John H. Riskind · Neil A. Rector

Looming Vulnerability

Theory, Research and Practice in Anxiety

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With contributions by Stephanie Cassin

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We dedicate this book to our wives and families. John Riskind dedicates this book to his wife Laura and his children Zachary and Ariel and Neil Rector dedicates it to his wife Deborah and daughter Zoe.

Preface

We are cognitive-behavioral researchers and practitioners who specialize in the understanding, assessment, and treatment of anxiety disorders and other emotional disorders. We also believe that theory and effective assessment and intervention develop and advance by successive approximation. Every theory in science is an oversimplification of reality. Indeed, sometimes perspectives that would seem to be logical opposites and incompatible can both have truth and account for aspects of reality in superior ways. Perhaps the most apt and familiar example of this is in the domain of physics where views of light as a wave form and as discrete particles both have sway.

The looming vulnerability model (or LVM) of anxiety and threat appraisal is not logically incompatible with other currently prevailing cognitive perspectives today. Far from it, it offers an expansion and refinement of key aspects of such perspectives. It sheds light on how threat- and anxiety-related cognition comes about, both in evolutionary phylogenetic terms and in terms of the ontogeny and growth from infancy of an individual's appraisal systems and ways of thinking about the world as it is lived in.

This book is for researchers and practitioners and other readers who are interested in new ideas, who believe that progress does not simply derive from holding firmly onto good ideas that are proven to work but also from extending and building on these. It is for readers who want to question basic premises and ask "why" questions because they believe that a deeper understanding of familiar phenomena can lead to additional ways to approach and develop innovative treatment targets.

Our goal in this book is to introduce the LVM to those who don't know it and extend it to those who are familiar with it and suggest that it captures aspects of threat not captured by other models. Such models have a needlessly narrow and restrictive focus on judgments and appraisals of static quantities or features of threats such as their proximity or probability. In contrast, the LVM emphasizes the perception of the dynamism and growth rate of and evaluation of threat as changing and increasing in the moment (looming vulnerability to threat). Moreover, we will contend that such perceptions of dynamic growing are a crucial intrinsic component of what is meant by personal vulnerability to threat and that this reflects a

phylogenetically ancient and evolutionarily implanted defense mechanism found in virtually all the entire animal kingdom. This model has important ramifications for improving our understanding of anxiety, fear, and worry—including the information processing and cognitive biases associated with them, the cognitive vulnerabilities that put a person at risk for these, and the possible clinical interventions that can enhance their treatment. It can be noted that, in many ways, writing this book has been a process of discovery that has led to significant clarifications and modifications of the LVM.

We hope that this book will stimulate attention to this essential but neglected aspect of cognitive biases and emotional processing in anxiety, bring together a variety of bodies of literature that have not be recognized as bearing on the same issues into a more integrated whole, and prompt further research.

Fairfax, VI, USA — John H. Riskind
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Outline of Book

Goals and Organization of the Present Book

The present book is divided into three main sections. In the first section, we provide background in the first five chapters on the phylogenetic, ecological and ontogenetic (cognitive developmental), and ecological and evolutionary context for the impact of dynamic perceptions of change in the moment for threat, cognitive appraisal, and emotions. We also present basic tenets of the LVM as a model of threat response and basic processes involved in anxiety, fear, behavioral urgency, information processing, and defensive reactions. In the second section of the book, encompassing Chaps. 6 and 7, we present evidence from experimental studies bearing on the priority and impact of dynamic changes and physical movement for attention and memory and fear and emotional reactions to negative stimuli.

The third section turns to the application of the looming vulnerability to the anxiety disorders. Chapter 8 introduces the concept of *looming cognitive style* as an individual difference factor that creates vulnerability to anxiety, describes the development of the LMSQ, and summarizes evidence for the measure. Next, Chap. 9 presents evidence on the developmental antecedents of the looming cognitive style, cognitive-vulnerability stress interaction, and disorder-specificity to anxiety. Chapter 10 provides a conceptual overview and research regarding the consequences of looming cognitive vulnerability for etiological processes involved in anxiety disorders. Following this, Chaps. 11 through 14 will present in more detail how the LVM helps to understand a range of anxiety disorders and disorders formerly considered to be anxiety disorders such as OCD and PTSD.

The fourth section includes a cluster of chapters that consider clinical treatment applications of the LVM, including cognitive-behavioral procedures for reducing "looming vulnerability" distortions (Chap. 15), new directions for research (Chap. 16), and a final synthesis and conclusions (Chap. 17). We hope that the ideas in this book and the wealth of material that we have brought together help to provide a useful framework for understanding and studying the role of dynamic parameters of threat in anxiety and anxiety disorders.

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Chapter 1
Introduction

"The evidence is overwhelming … that men and women of today live in an 'age of anxiety.' If one penetrates below the surface of political, economic, business, professional, or domestic crises to discover their psychological causes, or if one seeks to understand modern art or poetry or philosophy or religion, one runs athwart the problem of anxiety at almost every turn."

—Rollo May, 1950, p. v., (italics added)

Anxiety touches all our lives and, as most of us are aware, anxiety disorders are a great public health problem (Kessler, Walters, & Wittchen, 2004). In recent years, anxiety disorders have become recognized as one of the most debilitating forms of mental illness in Western Society (Kessler, Mickelson, Barber, & Wang, 2001; Rovner, 1993) and affect as many as 46 million individuals in the United States alone (Kessler et al., 1994). Indeed, they are among the most common and prevalent types of psychological maladies in the United States (Shepherd, Cooper, Brown, & Kalton, 1996). Certainly, approximately 32% of the population develop anxiety disorders at some point in their lives, and in any given 12 months almost 19% have anxiety disorders (Kessler et al., 2012). Such disorders tend to produce significant impairment in occupational, social, and family functioning (Kessler & Greenberg, 2002; Kessler & Wittchen, 2002) and cost billions of dollars each year, making them among the most expensive of all mental health problems (Greenberg, Sisitsky, Kessler, et al., 1999; Kessler & Greenberg, 2002; Rovner, 1993). Also, such disorders can also lead to other severe mental and physical disorders, such as depression, alcoholism, and heart disease (Kessler et al., 2001; Kessler et al., 2004).

Exacerbating the problems, in addition to individuals who meet the full criteria for anxiety disorders, there are countless more individuals who suffer from anxiety symptoms that are below the threshold for current criteria. Such persons suffer from limitations similar to those with full anxiety disorders on important measures of disability and dysfunction (Kessler et al., 2005; Ruscio et al., 2005).

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Also making the matter worse, serious anxiety problems also seem to be on the increase. In a series of ingenious studies, Twenge (2000) examined trends in scores of common psychological tests of anxiety and other characteristics over four decades. She found that Americans have shifted toward substantially higher levels of anxiety during recent decades (p. 1007). Both college student (adult) and child samples reported greater anxiety levels between 1952 and 1993. These findings were so striking that "the average American child in the 1980s reported more anxiety than child psychiatric patients in the 1950s." Twenge's findings are corroborated by epidemiological findings of the World Health Organization (2000). They found in a study of six countries—Canada, Mexico, Turkey, Netherlands, and the United States—that anxiety and stress disorders are becoming increasingly prevalent over time (Kessler, Petukhova, Sampson, Zaslavsky, & Wittchen, 2012).

Anxiety and Fear

Most psychological theories of anxiety are built on the assumption that it is a response to the perception or anticipation of a potentially threatening or injurious situation or event. Anxiety can be seen as an extension of the basic emotion of fear which is also a response to the perception that a situation or event represents a source of danger. Anxiety is a form of fear that is usually characterized by physiological symptoms such as autonomic reactions, increased heart rate, and tension.

Anxiety and fear are believed to be emotions. As Hofmann (2016) has recently stated, an emotion such as anxiety or fear is a multidimensional rather than unidimensional experience. Put another way, an emotion is not simply a particular cognitive appraisal or thought but includes physical sensations, motivational tendencies, a conscious experience, and feelings. Frijda, the emotions theorist, put a similar idea in this way: "Emotions are, or can be matters of the body; of flesh, brain, and the veins" (Frijda, 1986, p. 5).

Coupled with this, anxiety and fear can be manifested in diverse ways in different circumstances (e.g., freezing, fighting, flight). Frijda (1986) illustrated this idea with the example of fear in rats. He suggested that the specific manifestations of fear that are present depend on what makes sense for the organism under the circumstances. For example, *freezing* is more likely in the open field, which might allow the animal to avoid notice by a predator, *running* is more likely when the animal perceives clear exits or paths of escape, and *fighting* when there are other rats around. The implication is that different forms of anxiety and anxiety disorder (e.g., panic, generalized anxiety, phobias) can be seen as representing different manifestations of fear.

Although normal anxiety and fear is dependent on the specifics of the surrounding circumstances, anxiety disorders are associated with disproportionate reactions. Disordered cognitive processes likely play a role in anxiety disorders and emotions. Frijda (1986) suggested that when emotions such as fear, anger, sadness, or love are at lower to moderate levels of intensity, individuals still have varying degrees of ability to inhibit, regulate or influence the emotional reactions or their expression,

and calibrate the expression to the situation. However, very intense emotional reactions can reach a "point of no return" in which they are let loose of control and inhibitory restraint. As Frijda aptly put it, "Violent anger, violent fear, and violent desire are blind." By this, he meant that when fear or anger intensity reach a point of no return, as in panic attacks, there is a weakness in the process of stimulus control, and individuals lose all control of the emotions or their ability to terminate the emotional reactions or calibrate them to be appropriate, as in panic or rage attacks.

A somewhat similar idea was expressed by Clark and Beck (2010) in their distinction between normal and abnormal anxiety. In normal anxiety, individuals are more balanced in the attunement to positive and negative stimuli, while abnormal anxiety is characterized by disproportionate sensitivity to negative stimuli and exaggerated perceptions of threat. Moreover, similar to Frijda (1986), Clark and Beck pointed to a role of lack of controlled cognitive processes when anxiety is abnormal.

Cognitive Models of Anxiety

Cognitive models of emotion (e.g., Frijda, 1986; Lazarus, 1991; Moors, Ellsworth, & Scherer, 2013; Ortony, Clore, & Collins, 1988; Roseman, 2013; Scherer, 2001, 2005) and anxiety (Beck, Emery, & Greenberg, 2005; Clark & Beck, 2010; Clark & Purdon, 1993; Clark & Wells, 1995; Ehlers & Clark, 2000; Heimberg, Brozovich, & Rapee, 2010; Rachman, 1997; Salkovskis, 1985; Wells, 2000) assume that cognitive appraisals and interpretations of events are central to these disorders. Lazarus (e.g., Lazarus, 1966, 1991; Lazarus & Folkman, 1984) distinguished between primary appraisals (e.g., of the harm potential of a stimulus) and secondary appraisals (of one's options and resources for averting or escaping the harm). This distinction was incorporated into Beck et al.,'s (2005) cognitive model and subsequent revisions of Beck's model (e.g., Clark & Beck, 2010). Building on Lazarus's seminal model, Beck, Emery, and Greenberg proposed that anxiety is associated with a tendency to (1) overestimate threat or danger (i.e., primary appraisal) and (2) underestimate their degree of control or effectiveness in coping with this threat (i.e., secondary appraisal).

Recently, Clark and Beck (2010) stated, much like other CBT models (Carr, 1974; Foa & Kozak, 1986; Rapee & Heimberg, 1997), that cognitive appraisals that overestimate the temporal/physical *proximity*, the *probability of occurrence*, and the *severity* (or cost) of outcomes are the crucial core components of threat appraisals in anxiety. Although such factors are important, we shall presently argue that perceptions of the dynamic experience of threats, that they are that growing and approaching ("looming vulnerability"), captures critical aspects of cognitive factors in anxiety that the other factors don't. The extent to which something is threatening is not just proximity- or probability-dependent, but dependent on whether it appears to be making rapid dynamic gains in these values. Moreover, we will contend that the LVM addresses an evolutionary-based but inflated cognitive bias in anxiety that other models have overlooked.

Dysfunctional Danger Schemas

In Clark and Beck's (2010) model of anxiety and earlier formulations of Beck's model, danger schemas are knowledge structures or cognitive frameworks for evaluating potential threat stimuli and processing threat-related information. Danger schemas are individual's enduring personal frameworks that provide mental lens for understanding and appraising threats and are a product of their past experiences. When encountering a potential source of threat (e.g., of rejection), the individuals' immediate cognitive appraisals and automatic thoughts are a product of how the stimuli are interpreted in the context of the person's danger schemas.

Cognitive Vulnerabilities

Danger schemas are a source of cognitive vulnerability and are underlying mechanisms for anxiety (Beck, 1976; Beck et al., 2005; Clark & Beck, 2010). Danger schemas are thought to influence tendencies to allocate selective attention to some stimuli as opposed to others, guide the priority given to some stimuli as opposed to others in memory, and influence recall. They also lead to differences in interpreting the same ambiguous situations, forming expectations and generating mental simulations of the potential future. Some individuals, more than others, are predisposed to develop anxiety or other emotional disorders because of cognitive vulnerabilities. Often, these are conceptualized as dysfunctional attitudes or faulty beliefs (Clark & Beck, 2010). Some concrete examples are provided by work on anxiety sensitivity (beliefs about the harmful consequences of anxiety) (Reiss & McNally, 1985; Taylor, 1999) and intolerance of uncertainty (beliefs about the harmful consequences of uncertainty; e.g., Dugas & Ladouceur, 2000). In addition, cognitive vulnerabilities can be represented by negative cognitive styles, the nature of which leads to systematic dysfunctional patterns of interpreting events and drawing inferences from such events. An example is the depressive inferential style that has received extensive support in the depression literature (Alloy, Abramson, Safford, & Gibb, 2006; Alloy et al., 2000).

Automatic and Strategic (Controlled) Processes

The cognitive activities that underlie anxiety involve both automatic and controlled processes (Clark & Beck, 2010; Mathews & MacLeod, 1994). The distinction between these is important because they differ in the degree to which specific cognitive activities are conscious, purposeful, and effortful or to which they occur effortlessly on their own and cannot be intentionally terminated.

Automatic processes run on their own and occur without conscious awareness. They are rapid and cannot be terminated by intention. Controlled processes, on the other hand, are purposeful, resource demanding, and effortful. One can see automatic thoughts as the cognitive products of automatic processes, while the anxious person's attempts to control or deal with these thoughts reflect the activity of strategic or controlled processes. To give examples, a fear response is likely to be evoked by an automatic process. Once fear is evoked, an individual might use worry or thought suppression as a strategic process for curtailing or avoiding the fear.

Cognitive Underpinnings of Normal and Abnormal Anxiety

Clark and Beck (2010) have also drawn a distinction between normal and abnormal anxiety. Abnormal anxiety is associated with a disproportionate sensitivity to negative stimuli, while normal anxiety is associated with a balanced sensitivity to positive and negative stimuli. Abnormal anxiety is associated with more exaggerated and unbalanced danger appraisals, threat cognitions, and cognitive biases in threat processing, as well as more automatic, inhibitory self-protective behaviors. In their view, abnormal anxiety is also associated with a greater focus on weakness and low self-efficacy and expectations of negative outcomes as well as poor processing of safety cues. As a result, there is less accessibility to a "constructive mode" of thinking as well as more uncontrollable worry in abnormal anxiety. In contrast, in normal anxiety, danger appraisals are less "likely to be exaggerated and more appropriate to the situation at hand."

Clark and Beck (2010) suggest that the greatest differences between abnormal and normal anxiety occur at a stage when strategic controlled processes take place. For individuals with abnormal or clinical anxiety, these processes result in persistent and even escalated anxiety, whereas the same strategic or controlled processes result in reduction and possible termination of anxiety for nonclinical individuals. Abnormal and clinical anxiety is also associated with the persistence of maladaptive compensatory and self-protective mechanisms such as pathological worry.

Cognitive Theory and Therapy: In Ongoing Development

Cognitive therapy (or cognitive-behavior therapy, as it is often now known) represents a rigorous and systematic perspective for conceptualizing anxiety disorders and other disorders, identifying and assessing potential treatment targets, and generating appropriate interventions. As the reader no doubt knows, cognitive therapy has been very successful and is often regarded as the current "Gold Standard" in treating many anxiety disorders. Yet, despite its proven efficacy (Hofmann & Smits, 2008), there is

still ample room for improvement. Many anxious patients do not fully respond and for some disorders such as GAD response rates are only 50% so far (Nathan & Gorman, 2002). Given this, there has been growing interest in developing new ideas and approaches within the general theoretical umbrella of CBT (Dugas & Koerner, 2005; Borkovec, Newman, & Castonguay, 2003; Wells, 2000). Examples of these new lines of inquiry include work on meta-cognitive processes by Adrian Wells (2000), worry by Borkovec and others (Borkovec, Alcaine, & Behar, 2004; Newman, Llera, Erickson, & Przeworski, 2014), intolerance of uncertainty by Dugas and colleagues (Dugas & Koerner, 2005; Dugas & Robichaud, 2007), experiential avoidance (Hayes, Strosahl, & Wilson, 1999), OCD beliefs and cognitions (Clark & Purdon, 1993; OCCWG, 2001, 2003; Rachman, 1997; Salkovskis, 1985), anxiety sensitivity (Reiss & McNally, 1985), mental imagery (Hirsch & Holmes, 2007; Holmes & Matthews, 2010), and transdiagnostic processes (Harvey, Watkins, Mansell, & Shafran, 2004; Paulus, Talkovsky, Heggeness, & Norton, 2015).

The LVM represents another new line of such nuanced inquiry that presents new ideas that may further refine cognitive conceptualizations and assessments of mechanisms in anxiety as well as identify novel targets for possible intervention. There is a strong link between new ideas and the continued progress of cognitive-behavior therapy (Wells, 2000).

Brief Sketch of the Looming Vulnerability Model

Cognitive models have identified cognitive appraisals involving the overestimation of threat or danger as key factors that contribute to the development and maintenance of anxiety disorders. As we stated earlier, such models have focused on threat appraisals of the probability, proximity of threats and the costs of their negative consequences should they occur. However, while such judgments can contribute to anxiety, we submit that perceptions of the dynamism and growth rates of threats are also independently important in their own right. As Beck (1976) has stated, anxiety is a response to a negative event that "could happen—but *hasn't* happened yet." Thus, the LVM submits that threats must make *dynamic gains* in their probabilities, proximities, or other threat values for them to happen. In contrast to other models, then, the LVM underscores the important role of perceptions and simulations of dynamic growing threat in anxiety. As we will see, two threats may be of equal magnitude in terms of proximity, probability cost, and so forth, but the one that is perceived as showing rapid dynamic gains will create greater anxiety, over and above the absolute levels of these judgments in a given time frame.

As Cosmides and Tooby (2013) and other evolutionary psychologists have argued, the mechanism behind many kinds of psychopathology has had evolutionary value (Buss, 1991; Confer et al., 2010; Gilbert, 1998; Hoffman, Moscovitch, & Heinrichs, 2004; Marks & Nesse, 1994). We will attempt to show that animals (and humans) must be sensitive to movement and change—for these cues provide information about whether threat—locomoting predators, flying branches,

wildfires—are dynamically growing or getting closer (i.e., looming). Thus, throughout evolution, a sensitivity to approach movement and looming stimuli has been essential to our survival. Further, the brain and perceptual systems were designed to detect change (Cacioppo & Fredberg, 2012).

A tenet of the LVM is that when someone makes threat appraisals that they want to know whether the threatening situation is dynamically growing, escalating, and moving toward them, and if so, how quickly—or whether the danger is static or even dissipating. As a preliminary definition, the construct of *looming vulnerability* refers to a person's perceptions that threats are dynamically growing, approaching and making rapid gains. We contend that such perceptions are a fundamental component in the experience of anxiety. The early detection of the "approach movement" of dynamic growing threats allows an individual to prepare for the harmful stimuli and to engage in compensatory or self-protective behaviors.

Brief Overview of Convergent Literature

The LVM (Riskind, 1997; Riskind, Rector, & Taylor, 2012; Riskind & Williams, 2006; Riskind, Williams, Gessner, Chrosniak, & Cortina, 2000; Riskind, Williams, & Joiner, 2006) is supported by an enormous and diverse literature that includes work on fear and defensive behavioral reactions in animals (Ball & Tronick, 1971; Eilam, 2005; Gill, Sutherland, & Watkinson, 1996; Stankowick & Blumstein, 2005; Stankowich & Coss, 2006), as well as by neurobiological (e.g., Anderson, 2010; Bach, Neuhoff, Perrig, & Seifritz, 2009; Billington, Wilkie, Field, & Wann, 2011; Coker-Appiah, White, Clanton, Yang, Martin, & Blair, 2013) and perceptual studies (Freyd and Rinke 1984) of human adults and their young (Ball & Tronick, 1971; Kayed & Van der Meer, 2007). Also included are experimental studies on the effects of approach movement/movement on attention (Franconeri & Simons, 2003; Judd, Sim, Cho, von Muhlenen, & Lleras, 2004; Lin, Murray, & Boynton, 2009) and memory (DeLucia & Maldia, 2006; Matthews, Benjamin, & Osbourne, 2007; Matthews, Buratto, & Lamberts, 2010; Pilz, Vuong, Bülthoff, &Thornton, 2011). There is work on social cognition (Aspinwall & Taylor, 1997; Hsee & Abelson, 1990; Hsee, Tu, Lu, & Ruan, 2014) and emotional reactions (Davis, Gross, & Ochsner, 2011; Mühlberger, Neumann, Wieser, & Pauli, 2008), as well as work on relevant evolutionary theory (Dixon, 1998; Fanselow & Lester, 1988; Haselton & Buss, 2000; Haselton & Nettle, 2006; Gilbert, 2001; Marks & Nesse, 1994; Nesse, 2001), as well as work emotions theory (Baumeister & Bratslavsky, 1999; Lazarus, 1991; Ortony et al., 1988; Scherer, 2001), embodied cognition (Niedenthal, Barsalou, Winkielman, Krauth-Gruber, & Ric, 2005; Williams, Huang, & Bargh, 2009) and metaphor (Lakoff & Johnson, 1980; Landau, Meier, & Keefer, 2010). Insofar as cognitive models of anxiety are concerned, these diverse lines of research have been separately siloed and disconnected from each other into separate lines of research and neglected. We argue that this dissociation of factors that should properly be linked has precluded a more integrated and unified understanding of anxiety and threat and their evolved cognitive mechanisms.

Links to Cognitive, Behavioral, and Emotion Processing Models

Cognitive Models

The LVM is strongly rooted in cognitive-behavioral theoretical perspectives such as Beck's (Beck, 1976; Clark, 1988; Clark & Beck, 2010) and others (e.g., Clark & Wells, 1995; Ehlers & Clark, 2000; Heimberg et al., 2010; Rachman, 1997). It is unique from such models, however, in the major emphasis it places on the crucial role of perceptions of dynamic gains and approaching movement by threats. At the same time, we will see that a handful of cognitive clinical models and related theories have some recognizable points of correspondence with the postulated importance of perceptions of dynamic gains in threat values, over and above their absolute levels, to anxiety and fear (for discussion, see Chap. 4). Among these models are Llera and Newman's "emotion contrast" model of worry in GAD (Llera & Newman, 2010; Newman & Llera, 2011; Newman et al., 2014), Mineka and Kihlstrom's (1978) account of experimental neurosis, and Gray's (1982, 1987) and Gray and McNaughton's (2000) models of anxiety. Also, it will be seen that some cognitive theories of emotion in the wider literature (e.g., Lazarus, 1991; Scherer, 2001; Scherer, 2005) have points of correspondence that make them compatible with the LVM's emphasis on dynamic cues in threat appraisal. Also, the LVM has direct implications for research on threat processing in terms of memory, interpretative biases, and cognitive vulnerability.

Behavioral Conditioning

Cognitive-behavioral models have also ignored the role of dynamic parameters of to-be-conditioned stimuli in the learning and unlearning of fear. As we will see, individuals likely acquire and *sustain* anxiety and fear longer for stimuli that are displaying dynamism, movement, or change than if they are having entirely static stimulus properties (See discussion in Chaps. 4 and 6). The greater the perceived or simulated potential for approach movement, the more readily a neutral stimulus can be fear-conditioned. Or, to put this differently, the dynamism of stimuli may be a fundamental feature that makes them biologically prepared for fear (Ohman & Mineka, 2001; Ohman & Wiens, 2004; Seligman, 1971).

Emotion Processing Models

It will also be seen that the LVM also has implications for understanding aspects of emotion regulation (e.g., Gross, 1998a, 1998b; Mennin, Heimberg, Turk, & Fresco, 2005; Mennin, Fresco, O'Toole, & Heimberg, 2018; Roemer & Orsillo, 2007;

Roemer, Salters, Raffa, & Orsillo, 2005). Gross has distinguished between antecedent and response-focused emotion regulation. Antecedent emotion regulation involves cognitive strategies such as cognitive reappraisal, that manipulate the input to the emotion system, while response-focused emotion regulation, in contrast, deals with strategies such as emotion suppression that target the output. We will suggest that antecedent and response-focused strategies are not purely separate and independent. For example, exaggerated perceptions of approach movement and threat escalation may elicit more intense emotion and fears of loss of emotional control and thereby lead to selection of different response-focused strategies than other (Riskind & Kleiman, 2012). For example, such dynamic perceptions can help drive elevated fears of loss of emotional control and experiential avoidance, as well as intensify and prolong worry episodes and fears of loss of self-control.

Implications for Vulnerability and Treatment of Anxiety and Anxiety Disorders

Ultimately, our aim in this book is to demonstrate that dynamic perceptions of growing threat and the LVM have important ramifications for improving our understanding of anxiety, fear, and worry—including the information processing and cognitive biases associated with them, the cognitive vulnerabilities that put a person at risk for these, and possible remediation of these in treatment. As we will see, the LVM has implications for conceptualizing and understanding cognitive mechanisms, assessing cognitive mediators and vulnerabilities, and developing innovative strategies for designing novel treatment targets.

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Chapter 2
Evolutionary and Ecological Functions of Dynamic Perceptions of Looming Danger

"The capacity for anxiety, like other normal defenses, has been shaped by natural selection."

Isaac M. Marks and Randolph M. Nesse, 1994

A useful analogy may help to understand the evolutionary selection pressures that have shaped how humans detect and respond to threats. A rare genetic anomaly on the V chromosome has been found that results in a "movement blindness" in the form of an inability to perceive visual movement (Zeki, 1991; Zihl & von Cramon, 1983). If an individual were to have this genetic defect, the person would only be able to perceive object movement that occurs in the surrounding environment as series of snapshots of static objects rather than as a fluid sequence of dynamic objects that are approaching. Consider how could this inability to perceive the dynamism of visual objects could affect their chances of surviving an encounter with a predator or a car that was careening toward them while they were crossing the street? Similarly, imagine that there were two hypothetical human ancestors, one of whom had our ability to rapidly detect and respond to dynamism and movement of potential predators and one who didn't. Which one of these potential ancestors are we more likely to be descended from?

As we will attempt to demonstrate in this chapter, a threat-related defensive response to approach movement has an evolutionarily ancient origin. After reading the chapter, we believe it should be obvious that the ability to rapidly detect and respond to approach movement, and dynamic change, has been an important target of selection pressure in our species and other animal species. We will attempt to show in this volume that innate defensive mechanisms, which are ubiquitous observed across the animal kingdom, have been conserved and constitute a part of the basis for human threat processing and anxiety.

This chapter contains three main sections. In the first section, we will begin with a broad discussion of how evolution has shaped the ancient phylogenetic scaffolding

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of humans' (and other animals') defense systems. In the second, we will examine concepts of defense repertoires, predatory imminence, and protective space and margins of safety. Then, in the third section, we will review considerable research that has demonstrated the effects of looming stimuli and approach movement in triggering defensive reactions across the whole animal kingdom. The evidence that we present in this chapter implies that the way in which we respond to threats is deeply rooted in our adaptations to evolutionary recurrent threats of predation and other threats in a dynamic world, one in which objects move around and toward us and can cause us harm.

Evolutionary Psychology and Evolutionary Continuity and Change

As Buss (1991) and other evolutionary psychologists (Barrett, 2005; Confer et al., 2010) have noted, the need to escape from predators and other dangers may be the most behaviorally urgent threat to any animal's reproductive success. The need to find solutions to the threat of rapidly approaching dangers is essentially one of the most fundamental and ancient adaptive challenges faced by all animal species. Indeed, even the most primitive multicellular organisms have some kind of biological defense systems for detecting and responding to the dynamic movement of looming threats.

Evolutionary Continuity and Change

How did the human species evolve to what it is today? We should recognize that evolution doesn't proceed by just inventing utterly innovative designs and nervous systems for new animals from out of the blue. To the contrary, evolution can generally only elaborate, modify, or "tinker with what is already there" (Gilbert, 1998). Simply put, earlier design-features are the starting points for continued evolution and tend to be conserved as organisms continue to evolve, even though they may be extended or repurposed for other functions. This conservation of earlier design creates a continuity between the organism's more ancient phylogenetic past and its present. Gilbert (1998, p. 355) used the design of the human spine as an example that aptly illustrates this phenomenon:

> "It originated in the sea to act as a 'coat hanger' for the internal organs. Subsequently, it was adapted for walking on four limbs and then later for walking upright. But it does not really work that well for walking on two limbs and bipedalism is responsible for our innumerable back problems. It has also caused serious problems for women. The evolution of larger brain infants and the conflict of this with the size of the birth canal has resulted in billions of females dying in childbirth."

More relevant to our concerns with emotion, a similar conservation mechanism may help to explain the likely evolutionary origins of another presumptively universal and basic emotion—disgust. According to Darwin (1872), the original function of disgust was to prompt animals to physically avoid spoiled or contaminated food, and to expel it—if consumed—by means of spitting or vomiting. Today, however, the function appears to have been *coopted* and expanded to apply to distastful, repugnant values, ideas, and behaviors that are observed in oneself or others (e.g., child abuse). For example, there is evidence that the same facial expressions and subjective phenomenology that are associated with physical disgust may be implicated in at least some forms or subtypes of moral disgust (Chapman, Kim, Susskind, & Anderson, 2009; LaRosa & Mir, 2013), although not necessarily all (David & Olatunji, 2011).

Another striking illustration of the same conservation phenomenon concerns the molecular mechanisms implicated in the human fear response that humans have to aversive stimuli. As LeDoux (2003) has described, the same molecules that mediate aversive conditioning in snails and fruit flies also mediate fear conditioning, and thus anxiety, in humans and other animals. This striking observation exemplifies the fact that there has even been continuity and conservation of design in anxiety and fear at the molecular level.

Relatedly, Anderson has proposed that "neural reuse" is a basic organizing principle of the brain (Anderson, 2010, 2014). It is normal for an animal's evolving brain to coopt or reuse neural circuitry that evolved for earlier functions for different purposes. In this chapter, we will demonstrate that even infants, and most, if not all, animals—even invertebrates—respond more negatively with defensive reactions and alarm to perceptions of the dynamism of growing threat and approach movement than to static or to receding physical objects. Accordingly, we will contend that the same phylogenetic mechanisms that are involved in defensive responses of other animals—to dynamic growing threat and approach movement—have been conserved and extended to problems and worries faced in human society today. As a result, ancient biological adaptations have a profound effect on the cognitive processes involved in how we detect and respond to threats today.

Anxiety and Fear as Evolved Defense Systems

Gilbert (1993, 1998) and other scholars including Dixon (1998) and Marks and Nesse (1994) have noted that anxiety and fear are grounded in evolutionarily ancient defense systems. More specifically, according to Gilbert's (e.g., 1993, 1998, 2001) biosocial model, the human (or animal's) brain has evolved as a "decision-making organ" for threat assessment. As such, the brain includes stimulus detection systems that are concerned with appraising whether a stimulus is a potential source of "threat/harm, or whether it is neutral, or even a source of reward/benefit." Paired with this threat assessment system, the brain also has response systems involving species-specific menus of possible options for dealing with the stimuli that have

been detected and coded. Gilbert has proposed that animals select defensive responses from their menus of options that have proven most adaptive in similar circumstances over evolutionary history.

Theorists such as Gilbert (1993, 1998, 2001), Dixon (1998), Marks and Nesse (1994), and others have suggested that the general defensive options for responding to threats that animals can use include escape, aggression, freezing, and submission. According to Dixon (1998, p. 421), escape behavior, which can involve flight, is an emergency response that not only takes precedence over other ongoing activities but encompasses "activities that when performed by an animal serve to remove it from a source of danger or harm." The simplest form of flight, of course, is escape behavior which serves to physically separate the animal from the source of harm. But as we will see, there are also others such as covert mental strategies.

A second major alternative defensive option is avoidance behavior. The avoidance option has the function of avoiding getting too close to that which threatens. As is true of all defensive behaviors, avoidance and flight have potentially significant tradeoffs and costs (Gilbert, 1998). In many cases, the same situations that threaten an animal, such as social relationships, can also offer potentially significant opportunities (e.g., mates, alliances). Among the tradeoffs and costs of fleeing or avoiding danger is that such behaviors can limit an animal's abilities to meet other basic needs such as foraging or obtaining food (Nesse, 2001; Ydenberg & Dill, 1986).

Another defense option is aggressive behavior—which represents an "attack-first" strategy that an animal can use when facing threats (Gilbert, 2001). Aggressive behaviors such as bullying, intimidation, or actual attack against others can be an option that could be used in certain circumstances. Obviously, such aggressive strategies are unlikely to be effective for a person who faces others who are far bigger, stronger, faster, or have more lethal weapons for attack. Other options may be preferable in such circumstances.

As Gilbert suggests, another option that is perhaps better in such circumstances is help seeking—seeking protection and alliances from conspecifics and potential allies. One can often best succeed in getting help by making oneself attractive to others as opposed to bullying. By developing friendships or allies, even if by servile submission, one can make threats either less likely or more surmountable. Within this general category of defenses, Marks and Nesse (1994) have identified passivity and subordination as particularly used as a defensive response in the context of social threats.

Dixon (1998) has suggested that the various types of defensive behaviors above can take an altered form when responses are blocked or arrested. "Arrested defenses" occur in several types of circumstances in which primary options are blocked. For example, Dixon suggested (p. 423) that active escape or flight can be prevented by "physical barriers (e.g., confinement, or social constraints), as when the escape route is blocked by a predator or more dominant animal." A specific example of an arrested defense is "arrested flight" (Gilbert & Allan, 1998) which occurs when an individual is strongly motivated to escape but is blocked, as in the familiar learned helplessness paradigm for understanding depression (e.g., Abramson, Seligman, & Teasdale, 1978; Hiroto & Seligman, 1975; Seligman, 1975). Dixon (1998) sug-

gested that having to stay in an aversive environment while having a "strong desires to escape from it, but feeling unable to" is associated with depression. In other cases, individuals may be strongly motivated to engage in specific defense behaviors, such as aggression or help seeking, but are not able to do so because these behaviors are under inhibitory control. For example, arrested aggression is a defensive pattern which may occur in circumstances in which individuals are frightened of retaliation, or perhaps of potential damage to their alliances. For another example, arrested help seeking occurs when an individual's desire to seek help or comfort from supportive relationships is stopped because the costs of closeness and support seem to outweigh the benefits. Arrested help seeking can occur if it requires a person to self-disclose things that are personally shameful or where there is strong distrust of others.

When threatened animals cannot reduce the input of an adversary's disturbing stimuli by escaping, they may resort to defensive "cut-off" actions and postures (Chance, 1962) which serve an analogous function and partially substitute for the actual escape. For instance, the simplest cut-off escape behavior is to physically avert the head away from the source of threat or close or cover the eyes, which reduces the perception of the disturbing stimuli that the adversary represents. The gaze aversion is theoretically adaptive because it reduces the individual's level of arousal and enhances the person's chances of switching to a more appropriate behavior when the need arises. Chance states that escape cut-offs such as gaze aversion or perhaps certain forms of postural tension are an cindication of incipient flight and their manifestation also implies the presence of perceived danger (p. 423)."

It should be noted that similar arrested defenses can be observed among human beings. For example, some individuals close their eyes (e.g., when watching particularly scary scenes in a horror movie) to reduce arousal produced by threat even when the danger situation is known to be a purely imaginary one. Other arrested defenses take the form of "mental cut-off" strategies such as cognitive avoidance mechanisms or even "ego defense-mechanisms" such as denial and suppression (e.g., Dixon, 1998). From this perspective, worry (Borkovec, Ray, & Stoeber, 1998; Sibrava & Borkovec, 2006) and experiential avoidance (Roemer & Orsillo, 2010) can be reasonably conceptualized as reflecting forms of mental cut-off strategies.

Temporal-Spatial Factors in Defensive Responses: Predatory Imminence Continuum

Theoretical work and research on animal behavior have suggested that spatial-temporal parameters are key determinants of defensive responses. As an example, Fanselow and Lester (1988) proposed the "predatory imminence continuum" hypothesis, which holds that the physical proximity of a predator determines the defensive responses selected by a potential prey animal, such as a rat, in a sequence of predictable phases. Before the potential prey animal encounters a predator, it is

typically engaged in other activities such as exploring surroundings or foraging. When it senses that a predator is near, the animal exhibits freezing or other species-specific defensive reactions that are intended to hinder detection and may facilitate vigilance and threat assessment. Then, once the predator is clearly encountered the animal enters the circa-strike phase and defensive responses such as flight or attack become more optimal strategies.

Similarly, some scholars have suggested that there is a "distance-dependent defense hierarchy" (Gallup, 1974; Ranter, 1977). In this hierarchy, animals freeze when they detect a distant predator, whereas they flee a predator that is nearby, and may engage in a defensive attack when the predator is closer and flight is no longer available as an option.

It should be noted that distance isn't the only spatial-temporal parameter of threat that triggers defensive behavior, but its dynamism, movement, and changing distance are also important. For example, Eilam (2005) described results of a study showing that not only proximity but approach movement predicts defensive behavior. An owl in a birdcage was moved closer toward rodents (voles) on a runway from four meters away. This research revealed that defensive responses of the voles were movement-dependent, not distant-dependent and triggered by the perceived approach movement of the owl, not its proximity.

Approach movement and proximity are distinct although related constructs. They should be distinguished because an animal such as a vole can perceive a threat such as an owl as distant but rapidly approaching, and by the same token, it can perceive the owl as close by but not dynamic or coming any closer. As we shall describe elsewhere (see Chaps. 5 through 7), approaching objects (looming dangers) elicit cognitive, affective, and psychophysiological reactions that are not explained by their physical or temporal proximity alone.

The Margin of Safety and Flight Initiation in Response to the Approach of Threat

The defensive reactions that animals deploy when approached by predators are partly a function of their perceived margins of safety. The related concepts of margin of safety, "buffer zone (Knight & Knight, 1984; Rodgers & Smith, 1995, 1997; Rodgers & Schwikert, 2002), flight zone" (Hediger, 1964), and "flight initiation distance" (Blumstein, 2003; Blumstein, Anthony, Harcourt, & Ross, 2003; Cooper, 1997; Smith, 1997) are similar and refer to the distance that animals require around themselves to feel comfortable and safe around other animals that are in proximity to them (especially predators). These concepts are also related, in human beings, to the concept of personal space that people require to feel comfortable around others (Hall, 1963, 1966).

Generally, animals will tolerate the presence of threats up to a certain point because of the tradeoffs and costs of taking flight. For example, a predator at a distance, and particularly one that is not approaching does not automatically initiate

flight because it would cause the potential prey animal to give up foraging or grazing (Ydenberg & Dill, 1986). However, as the predator gets closer to the flight zone or flight initiation distance (the nature of which may extend either/or both horizontally or vertically from animals) the animals become increasingly vigilant and wary even when they are continuing to eat or graze. Moreover, once the predator reaches their flight initiation zone, they take flight.

Several specific factors determine the size of the margin of safety. For example, the protective space that animals in the wild require around their bodies is greater than the space that domestic animals require. Furthermore, the attributes of the predator, including its dynamism, speed and approach movement, as well as the closeness of a perceived place of safety and refuge, influence the margin of safety and flight initiation distance (Cooper, 1997; Helfman, 1989; Smith, 1997; Stankowich & Blumstein, 2005; Stankowich & Coss, 2006; Ydenberg & Dill, 1986). Thus, animals tend to require a wider margin of safety when they are further away from a place of refuge and when predators are faster moving.

Researchers have found that the distance at which animals begin to actually flee from potential approaching predators, referred to as its "flight initiation distance," (Blumstein, 2003; Blumstein et al., 2003) can be objectively measured and is associated with other aspects of defensive behavior such as "alert distance," the distance at which an animal becomes alert to an approaching threat (Fernández-Juricic, Jimenez, & Lucas, 2001, 2002; Fernández-Juricic, Vernier, Renison, & Blumstein, 2005; Rodgers & Smith, 1995, 1997). Moreover, this distance is related to amount of time that the animal spends assessing the movement of the potential threat (assessment time) (Stankowich & Coss, 2006). Notably, researchers use the objectively measured flight initiation distance as an objective behavioral indicator of threat perceptions by nonhuman animals (Gill, Sutherland, & Watkinson, 1996; Stankowich & Coss, 2006). For instance, when prey animals initiate flight more in some circumstances than others after exposure to predators, they are assumed to have greater threat perceptions. Animals also have distinct alert postures when they are attending to approaching threat. Researchers have used this as a measure of the time spent the animal spends on attending to the approaching threat, or elapsed time between alert posture and flight, which is referred to as "assessment time" (Stankowich & Coss, 2006).

In one study that provides a telling example, Stankowich and Coss (2006) examined the "perception of risk" in deer and other animals by the distance at which the deer exhibited defensive behaviors ranging from alertness to actual flight. Several different variables were found to be important determinants of flight distance—including distance from refuge, size, etc.—and the velocity or speed with which the potential predator was one of the important determinants. Deer that perceived a potential predator as rapidly approaching their safety zone responded with greater speed—assumed to represent greater risk perception—than potential predators that moved more slowly toward them or not at all. The latter findings indicated that deer evaluate risk with a variety of different variables—including distance from refuge and rapidly of approach a flight zone—before choosing which of several possible defensive responses that can be deployed (alertness, flight, etc.). Much the same

kinds of findings have been reported for other animals (Cooper, 1997; Fernández-Juricic et al., 2006; Stankowich & Blumstein, 2005; Blumstein, 2006; Ydenberg & Dill, 1986).

As we will now attempt to show, evolutionarily recurrent threats to survival from predators have led all animals to evolve specialized adaptations (Bracha, 2004; Confer et al., 2010). These functional adaptations are specialized to protect animals from rapid gains by dynamically approaching threats approach of threats.

Empirical Evidence of Defensive Looming Responses to Approach Movement in Nonhuman Animals

A wide range of research indicates that all animals have found it necessary to develop specialized survival mechanisms for facilitating the rapid detection and selection of appropriate defensive responses to rapidly approaching, potentially threatening, objects.

Research has found remarkably consistent evidence for the effects of approaching, looming objects in triggering defensive behavioral reaction across the animal kingdom. Some of the earliest evidence for this "looming effect" was presented by Schiff, Caviness, and Gibson (1962), who tested the notion that the changing flow of a visual or optical array (see Gibson, 1979) provided cues that would inform animals about their exposure to danger: the potential approach of dangerous objects and triggered defensive responses. The rapid symmetrical expansion of the visual or optical array signaled the rapid approach of danger and triggered defensive responses, whereas the asymmetrical expansion would signal a near miss, and a shrinking optical display would indicate that the object was receding. In short, an expanding visual optical array presented animals with crucial cues of the approach of danger and elicited subsequent avoidance and defensive responses.

The evidence for the looming effect has been remarkably consistent for both invertebrate and vertebrate animals. For example, defensive responses to the approach movement of looming stimuli have been observed in locusts (Hassenstein & Huster, 1999), flies (Jabłonski & Strausfeld, 2000), fruit flies (Card & Dickenson, 2008; Tammero & Dickinson, 2002), locusts (Santer, simmons, & Rind, 2005; Santer, Rind, Stafford, & Simmons, 2006), cockroaches (Camhi & Tom, 1978; Kramer & Bonenfant, 1997), wood crickets (Casas, Body, & Lazzari, 2011), barnacles (Gwilliam, 1963), crayfish (Glantz, 1974), and crabs (Ball & Tronick, 1971; Hemmi, 2005a, 2005b; Jennions, Backwell, Murai, & Christy, 2003; Oliva, Medan, & Tomsic, 2007). Additionally, they have been observed in vertebrates such as fish (Helfman, 1989; Millot, Bégout, & Chatain, 2009), lizards (Carlile, Peters, & Evans, 2006; Cooper, Martin, & Lopez, 2003) and frogs (Kang & Nakagawa, 2006; Yamamoto, Nakata, & Nakagawa, 2003), birds such as chickens (Jones, Duncan, & Hughes, 1981; Evans et al., 1993), eagles (Knight & Knight, 1984), pigeons (Wang & Frost, 1962; Wu et al., 2005), ducks (Schaller & Emlen, 1962; Schiff, 1965; Hassenstein & Huster, 1999), and gannets (Lee & Reddish, 1981). They have also,

of course, observed in mammals such as mice (Yilmaz & Markus, 2013), woodchucks (Kramer & Bonenfant, 1997), kangeroos (Wolf & Croft, 2001), black-tailed deer (Stankowich & Coss, 2006), and various primates—including rhesus monkeys (Maier & Ghazanfar, 2007; Maier, Neuhoff, Logothetis, & Ghazanfar, 2004; King & Cowey, 1992).

These animals exhibit a variety of responses to the visual or auditory approach movement and dynamism of looming stimuli, the nature of which may be both species-specific and exhibit context-sensitivity. For example, chicken's crouch (Jones et al., 1981), and as previously noted, black-tailed deer have been found to exhibit defensive responses that are tailored to the speed of the approach movement, closeness to refuge, and size of the potential predator or enemy (Stankowich & Blumstein, 2005; Stankowich & Coss, 2006) Such context-sensitivity of defensive behaviors is also observed in many invertebrates. For example, as mentioned, barnacles close their shells (Gwilliam, 1963). On the other hand, locusts make evasive responses in which jumps are determined by the angle of the approaching threat (Card & Dickenson, 2008; Gray, Lee, & Robertson, 2001). As further examples of the specificity of defensive reactions to species, some crabs (Neohelice) raise their claws aggressively when approached (Scarano and Tomsic, 2014), whereas fiddler crabs hide (Hemmi, 2005a; Hemmi, 2005b; Jennions, Backwell, Murai, & Christy, 2003). In this regard, fiddler crabs run correspondingly faster to an available refuge when a dummy predator approaches them quickly rather than slowly (Hemmi, 2005b).

Defensive Looming Responses to Approach Movement in Primates and Humans

As should be expected, human beings and other primates exhibit defensive behaviors in respond to looming stimuli. For example, monkeys have been found to respond defensively to both visually looming and auditory looming stimuli (Ghazanfar & Maier, 2009; Maier & Ghazanfar, 2007; Maier, Neuhoff, Logothetis, & Ghazanfar, 2004; King & Cowey, 1992; Schiff, Caviness, & Gibson, 1962). Likewise, research has documented similar looming effects in human adults (King, Dykeman, Redgrave, & Dean, 1992; Regan & Hamstra, 1993) and their young (Kayed & Van der Meer, 2007; Schmuckler, Collimore, & Dannemiller, 2007). For example, King et al. (1992) found that human adults ducked their heads when presented with looming visual objects. Similarly, developmental psychologists studying stranger anxiety have found that children respond with greater anxiety to a stranger who approaches rapidly rather than slowly (Reingold & Eckerman, 1973; Trause, 1977). A recent study by Schmuckler, Collimore, and Dannemiller (2007) compared the eye blink responses of 4- to 5-month-old infants who were shown stimulus objects that were looming on either collision or near-miss trajectories. Their findings showed that infants showed a greater number of eye blink responses to objects on a collision course than did those on non-collision trajectories. This not

only suggests that infants can discriminate subtle differences in motion direction, but this ability has an innate basis. Indeed, a study by Jouen (1990) (see also Jouen, Lepecq, Gapenne, & Bertenthal, 2000) showed that 3-day-old neonates seemed to orient to looming flow motion patterns by tilting their heads backward. Also noteworthy is that the extent to which these neonates tilted their heads was positively related to the optic flow velocity of the looming stimuli.

Such looming effects have been demonstrated in an auditory as well as a visual modality. Research has demonstrated that behavioral reactions are elicited in human adults by the dynamism of auditory looming sounds (sounds that move closer) that create a sense of looming or receding movement (Bach, Neuhoff, Perig, & Seifritz, 2009; Bach et al., 2008; Neuhoff, 1998, 2001). Similar results have been found in human infants as young as 4–6 months of age, who exhibit avoidance responses to looming sounds but not to other equivalent sounds (Freiberg, Tually, & Crassini, 2001) and discriminate looming sounds better than receding sounds (Morrongiello, Hewitt, & Gotowiec, 1991). In their study, Freiberg et al. tested 4-month-old infants in complete darkness and presented them with auditory stimuli to create the illusion with sound pressure level that a sound source was approaching or receding. They also manipulated the rate at which the auditory stimuli underwent unidirectional changes in the rate at that sound pressure level during trials (fast vs. slow). The researchers assessed the avoidance behavior of the infants by the amount of backward body pressure they exerted in response to the different auditory stimulus presentations. This research showed that avoidance behavior (backward body movement) was associated with sound pressure level increases (i.e., illusory approach) but not sound pressure decreases (i.e., illusory recede) conditions. Moreover, it found that infants engaged in more defensive leaning back in fast change trials compared to slow change trials. Thus, the latter finding indicated that under certain conditions infants can "detect information for changing object distance" just based on auditory looming stimuli.

To conclude, research has thus demonstrated defensive behavioral reactions to looming, approaching stimuli in both nonhuman primates and humans, including human infants, with both visual and auditory stimuli. As will be seen later, looming effects in humans have been studied in relation to attentional and memory processes (see Chap. 6), and approach movement has been shown to have a powerful influence on affective reactions such as fear (Chaps. 5 and 7).

Summary and Conclusions

This chapter has presented extensive evidence that innate survival systems for defending against looming, rapidly approaching threats are ubiquitous across the animal kingdom. Powerful selection pressures due to living in a dynamic environment have apparently led all animals including humans to develop specialized adaptive systems for responding to looming or rapidly approaching threats. As conservation of design is an essential feature of the evolutionary process, we should

hardly be surprised that our human adaptive systems (cognition, emotions, behavior, and physiology) are tightly geared to process information about the dynamism of threats and defend against the approach of threats.

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Chapter 3
Dynamic Information Is Integral to Perception, Cognition, and Emotion

The human brain and its sensory systems are evolutionarily designed to be sensitive to movement and change and dynamic stimuli (Cacioppo & Freberg, 2016). Moreover, our higher-order perceptions of the world and thinking abilities appear to have their roots in perceptual systems that are sensitive to dynamic information (Fodor, 1972; Freyd, 1987; Shepard, 1981; Shepard & Podgorny, 1978). People, like most other animals, use dynamic information to increase their odds of survival in an often-dangerous environment.

Notably, however, psychologists have long tended to neglect the importance of dynamic information. As Freyd, Panzer, and Chang (1988, p. 395) have observed:

> "Much of what people encounter in everyday life is static from their point of reference: Cups rest on desks, chairs sit on floors, and books stand on shelves. Perhaps it is the very pervasiveness of static objects and still scenes that has been responsible for psychology's historical focus on the perception of static qualities of the world: shape and form perception, pattern recognition, picture perception, and object recognition. In apparent contrast to this [static] focus, there has been an increasingly popular emphasis on the perception of events, or patterns of change in the world."

As we will attempt to show in this chapter, people use dynamic information about moving objects and change to comprehend happenings in our own lives and experiences. In this chapter, we will present converging evidence from multiple lines of research to demonstrate that dynamic information is fundamental to human cognition and its construction of its understanding of the environment. This evidence includes: (1) theoretical and empirical work on representational momentum; (2) episodic memory, personal identity, stories and narrative; (3) the semantic differential; and (4) embodied cognition, metaphor, and emotions.

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Dynamic Information in Perception

As Freyd et al. (1988) pointed out, studies that have used the point light technique illustrate the ability of people to make use of dynamic perceptual information (Johansson, 1973). These studies have presented evidence that viewers can identify a person in the dark solely from his or her distinctive patterns of physical movement if the person has a small number of lights attached to his body as he or she moves (Cutting & Kozlowski, 1977).

Freyd and colleagues, as well as many other investigators have presented extensive evidences in numerous studies that people exhibit a representational momentum bias, a systematic bias, or dynamic memory distortion for moving objects. When viewing a sequence of static frozen-action photographs of simple dynamic scenes (e.g., a boy throwing a ball), for example, individuals tend to incorrectly remember seeing images that are displaced forward on an object's implied path of motion than what they had seen (for a review, see Freyd, 1987; Hubbard, 2005). Thus, memory of an object may incorporate its anticipated movement. Moreover, this magnitude of the forward displacement of the object depends on both its apparent velocity and acceleration and other apparent characteristics of its motion (Doerrfeld & Shiffrar, 2011; Hubbard, 1995, 1997, 2005). Hence, a person's higher-order perceptions and mental representations of simple dynamic scenes incorporate dynamic motion (i.e., representational momentum).

Dynamic Information in Autobiographical Memory, Mental Time Travel, and Narratives

People also use dynamic information when they think about past events or experiences they might have in the future. First, Tulving (2005) posited that episodic, autobiographical memory, as well as the ability to imagine possible futures, involves an autonoetic ability to be self-aware and to mentally "time travel." For example, when a person wants to remember past life experiences, the person must engage in a kind of mental time travel to go back in time and to reexperience events as if they were unfolding in the present. Similarly, the person must engage in a form of time traveling by projecting himself or herself forward and ahead into imagined futures when imaging possible futures. An idea that is similar, at least in part, has been proposed by theorists who have proposed that individuals engage in mental simulations of possible futures when anticipating their possible outcomes (Taylor, Pham, Rivkin, & Armor 1998; Tversky & Kahneman 1974).

Next, people use dynamic information when thinking about (constructing) their own personal life stories and identities. As Bruner (1991), McAdams and colleagues (e.g., Adler et al., 2015) and others have stated these stories and identities are narrative accounts of connected actions and events in experiences. In a more general sense, all stories, myths, and even excuses that people create for their behavior or

that of others are narrative accounts. All such narrative accounts are presentations of how past situations and events have led to present situations through a series of connected dynamic actions and events.

Semantic Differential

As mentioned, people use dynamic information when attempting to navigate throughout the physical and social world. They use dynamic information to organize and comprehend happenings in their lives. This idea is a basic assumption of Osgood, Suci, and Tannenbaum's (1957) semantic differential theory of linguistic meaning. In their theory, the linguistic meaning of all concepts and things can be represented by relative ratings on basic structural dimensions of judgments that include "activity" (e.g., the fast and slow of things), evaluation (the good and bad of things), and potency (the strong and weak of things). Interestingly, the following passage of Osgood (1969) seems to have anticipated the emphasis of the looming vulnerability model (LVM) on the role of dynamic information in the comprehension of threat:

> "Organisms without other specialized adaptive mechanisms (e.g., armor, coloration, poisons, etc.) which were unable to represent for themselves the good versus bad implications of the signs of things (antelope versus saber-toothed tiger), the strong versus weak of things (saber-toothed tiger versus mosquito) and the *quick* versus *slow of things* (saber-toothed tiger versus quicksand) would have *little chance of survival*" (Osgood, 1969, p. 195). (Italics added by the present authors).

Piaget's Model of Cognitive Development

In Piaget's (2007) cognitive developmental theory, dynamic information is integral to human thought because experiences with dynamic events such as changes and transformations provide the impetus for the development and change in schemas. Namely, we are compelled to develop and change our schemas to accommodate new elements that challenge prior expectations. Moreover, Piaget viewed the knowledge people obtained from such dynamic experiences (what he termed "operative" knowledge) to be far more important to their cognitive development than information regarding the static properties of things.

Dynamic Information Referenced and Conveyed by Nonverbal CUES

Evidence supporting the essential role of information about the dynamism of events to human thought also comes from research on nonverbal communication. From an evolutionary perspective, Edwards (1998) hypothesized that nonverbal

informational cues conveyed by individuals' facial expression would play a critical role in helping others to determine the time course of potential threats and the best actions to take in fight-flight situations. As predicted, her data revealed that participants could distinguish between impending and dissipating threats simply using nonverbal cues in facial expression as they were presented on displays. In addition, they were particularly sensitive to nonverbal cues conveyed in the early stages of facial expressions, which probably would be the stages of the events in which the informational value of facial expressions in conveying temporal cues would be of greatest adaptive value.

Embodied Cognition

According to conceptual models of embodied cognition, the dynamic information that is embodied in nonverbal cues such as facial expressions can also affect a person's own thoughts and appraisals. These models have posted that much of human thought is grounded in sensorimotor states such as patterns of perception and action. In other words, whenever a person thinks about given concepts (e.g., weight or height) or objects, the person experiences a corresponding activation of stored sensorimotor patterns that are closely associated with them. For example, when thinking about another individual who is tall, the person will tend to look up—while when thinking of someone who is short, he/she will tend to look down. Because of the strong associations, the opposite is also true. Whenever a person experiences the stored sensorimotor patterns that are associated with concepts, this can in turn help activate the person's thoughts or concepts that they reference. In short, a person's thinking about the world involves visual and sensorimotor processing (Barsalou, 2002, 2003a, 2003b; Briñol & Petty, 2008; Wilson, 2002).

In this vein, Glenberg (1997; Glenberg, Witt, & Metcalfe, 2013) has postulated an embodied cognition model that states that bodily states can be viewed as providing "action-based" meanings for human thought. Evidence for Glenberg's theory has been presented by a study by Tucker and Ellis (1998). Their participants were given the task of detecting whether a cup was right-side up or upside down. Supporting Glenberg's model, the participants were faster to identify whether the cup was right-side up or upside down when the cup's handle was on the same side of the display as the hand they used to respond. If the cup handle was on the right (or left) side, they responded faster with the right (or left) hand than when the handle was on the opposite side.

As another example, Reed and Farah (1995) gave participants the task of judging whether two visually presented human figures shown on a display depicted the same posture. The human figures in each case were the same except with regard to their precise relation to the orientation of the participant's own arms and legs. Supporting Glenberg's (1997) model, when participants were asked to move their arms they were better at detecting changes in the arm position of the figures, whereas when they were asked to move their legs, the pattern was reversed, and they were better at

detecting changes in the position of the leg of the figures. Reed and Farah's findings were extended in a neuroimaging study by Chao and Martin (2000). Participants were asked to view manipulable objects while lying passively in an fMRI scanner. The brain imaging results showed when participants viewed objects that they could manipulate, this activated grasping circuits.

Many more studies also support embodied cognition models. For example, Cacioppo, Priester, and Bernston (1993) showed that participants evaluated novel Chinese ideographs more favorably when bringing their arms closer (physical movement that is typically associated with approach tendencies) than when they were presented while extending or pushing their arms away (movement that is typically associated with avoidance). For another example, Wells and Petty (1980) examined attitude change while participants were instructed to either nod or shake their heads for a different ostensible task. Their results showed that participants agreed more with the attitude message when they nodded their heads while listening to these than when they shook their heads. Likewise, research by Laird and colleagues (Duclos et al., 1989; Laird, 1974) and Riskind and colleagues (Riskind, 1983, 1984; Riskind & Gotay, 1982) and others (Strack, Martin, & Stepper, 1988) has revealed that changes in facial expressions and physical postures can influence emotional states and judgments, as would be expected if such sensorimotor cues carry information that can significantly affect human thought. Note that some findings on posture effects not reviewed here have been difficult to replicate (Carney, Cuddy, & Yap 2010).

Embodied Metaphors

Nagle, a philosopher of science, aptly observed the role of metaphor in human thought when discussing how people develop and grasp new scientific concepts:

> "The widespread use of metaphors, whether they are dead or alive, testifies to a pervasive human talent for finding resemblances between new experiences and familiar facts, so that what is novel is in consequence mastered by subsuming it under established distinctions. (p. 107–108. Nagle, 1961)."

Nagle's suggestions foreshadow a great deal of subsequent theoretical and empirical work on the phenomenon of metaphor-based thinking. A vibrant body of work has proposed and tested the idea that a person's sensorimotor states and prior experiences with the world provide the person's mind with basic analogies or metaphors for thinking and understanding (Lakoff & Johnson, 1980; Landau, Meier, & Keefer, 2010). Lakoff (2015), one of the most influential thinkers regarding the role of metaphors in human thought, expressed these ideas in this way in a talk on "How the Brain Thinks: The Embodiment Hypothesis." As he stated, "Everyone living on earth" has experienced the world, "we have all experienced gravitation." Furthermore, Lakoff argues that these primal physical experiences with the world provide the "superstructure for all the conceptual systems that people develop thereafter."

Williams, Huang, and Bargh (2009) have proposed a similar "scaffolding" model of cognition. They propose that early preverbal sensorimotor experiences with the environment provide all people with simple concepts (e.g., warmth/coldness and heaviness/lightsness) that serve as analogies when people develop more complex concepts. For example, a person's sensorimotor experiences of weight would provide the person with a simpler, concrete concept that is used as an analogy and building block for more abstract concepts such as "importance."

Evidence supporting such suppositions has emerged in numerous studies. For example, Jostmann, Lakens, and Schubert (2009) asked participants to hold a clipboard while judging the importance of an issue. Participants who held a heavy clipboard were found to judge an issue as more important than did those who held a light clipboard. In another study, Kang, Williams, Clark, Gray, and Bargh (2011) found that participants who were primed by briefly touching a cold pack were less interpersonally trustful of other people than those who touched a warm pack, as indicated by the amount they invested in an anonymous partner on an economic trust game. Some studies by Slepian, Wesbuch, Rule, and Ambady (2012) manipulated the participants' tactile/proprioceptive sensations of toughness (e.g., squeezing a rough versus a soft ball) while asking them to categorize ambiguous faces as "male" or "female." Squeezing a rough ball was found to lead participants to be more likely to categorize the ambiguous faces as male. In other studies, Briñol, Petty, and Wagner (2009) showed that body postures can influence confidence in thoughts. When participants were placed into a confident posture (sitting with an erect back while pushing their chest out), this increased confidence in thoughts more as compared to when they were placed into a doubtful posture (their back curved).

The importance of dynamic information in human thought comes from a recent study by Miles, Nind, and Macrae (2010). They examined the relationship between thinking about the past as opposed to the future and body lean. In particular, they assessed participants' body movements while giving them instructions to either imagine a future scenario or to recall events from the past. When participants were instructed to imagine a future scenario, they tended to lean slightly forward, whereas when they were instructed to recall events from the past, they tended to lean slightly backward.

Thus, these findings imply that people understand the idea of events that may occur in the future by means of the analogy of objects that are ahead and coming closer. In contrast, they understand the idea of events in the past with the analogy of objects that are receding and behind us in physical space.

In sum, dynamic information is integral to our perceptual representations, autobiographic memories, and personal narratives. It is a basic dimension for linguistic meaning (Osgood et al., 1957). We can read subtle dynamic cues about unfolding events from the facial expressions of others. Moreover, dynamic information from sensorimotor states provides a grounding for the superstructure of our conceptual systems.

Dynamic Information and Emotional Experience

The idea that dynamic information is indispensable to how people think is also supported by work that suggests that the dynamism of emotion-eliciting stimuli plays an integral role in emotions. For one example, Lazarus's (1991) theory of emotion posited that emotions are elicited by cognitive appraisals of the changing "relational meaning" of changes in the environment (for a more detailed discussion, see Chap. 5 of the role of approach movement in cognitive appraisals). Relational meaning refers to the idea that people continually evaluate the continually changing implications of their transactions with an environment that can continually "change over time and circumstances."

In a similar manner, Baumeister and Bratslavsky (1999) and Ortony, Clore, and Collins (1988), as well as other emotions theories, have posited that emotional experiences are triggered by *changes* in stimuli (or events) rather than the stimuli themselves. As Baumeister and Bratslavsky (1999) put this:

> "Clearly, emotions generally involve strong, rapid, and temporary responses by the organism. They are transitory states marked by physiological arousal, and as such they seem poorly suited to recognize stable, enduring circumstances—but very well suited to response to important changes. Emotions should therefore be plentiful in times of change, but, once the situation stabilizes, they will taper off (p. 53)."

Along similar lines, the self-regulatory model of Carver and Scheier's (1990) proposed that emotional reactions depend on the extent that people perceive a rapid dynamic rate of change in their progress toward positive goals or away from negative goals. More specifically, a person experiences more intense feeling of positive emotion when rapid progress is being made *toward* positive goals, and more intense feelings of negative emotion when a slow rate of progress is being made *away* from negative goals. Interestingly, one makes slower progress away from negative goals when a threat is rapidly approaching. Thus, Carver and Scheier's model is consistent with the LVM.

Hsee and Abelson (1991) proposed and showed that the extent that people report satisfaction or dissatisfaction with outcomes depends on the rate of change with which these outcomes have improved or worsened. For example, when a person achieves a high standing in an undergraduate class, the person experiences greater satisfaction when their class standing has rapidly improved than when it has improved more slowly or when it was always high. Indeed, they showed that a small but rapid rise in class standing or other positive outcomes produced more satisfaction than a larger but slower rise. Similarly, experiencing a rapid drop in outcomes such as class standing produces more dissatisfaction than a slower drop or outcomes that have constantly been low.

Along similar lines, Aronson and Linder (1965) tested a "gain-loss model" of interpersonal attraction that was stimulated by Spinoza's (1996) philosophical analysis of emotion. Their research suggested that people tend to like a person far more who's liking for them has grown over time than a person who has always liked

them. Likewise, they tend to dislike a person far more who comes to dislike them after initially liking them, as compared to a person who has always disliked them.

According to Helson's (1964) adaptation level model, a person's judgments of intensity are made with reference to an implicit benchmark (or psychological neutral point) called the adaptation level. Exposure to an unchanging stimulus causes the stimulus to lose intensity as the adaptation level changes. For example, if a person were to place his or her hands in cold water, the water eventually begins to feel less cold as they adapt to it. If the person were subsequently to place his or her hands in water that was actually just warm, it might then feel hot. Likewise, if the person were to place his or her hands in hot water, the person's hands would adapt to it, and if the person then placed his or her hands in warm water it would feel cold.

Thus, Helson's (1964) theory can be related to the ideas of Baumeister and Bratslavsky (1999) and other emotion theorists that protracted exposure to static unchanging stimuli results in emotion that is short-lived and that tapers off as adaptation occurs. One implication of these ideas for anxiety is that when threat stimuli are static or unchanging they would theoretically have diminishing emotional impact as adaptation occurs. On the other hand, when threats are dynamically intensifying (i.e., looming), this can maintain and even intensify emotion.

Helson's (1964) model also helped to inspire a "hedonic treadmill" theory of happiness and subjective well-being proposed by Brickman and Campbell (1971). Their theory predicts that even major life-changing events have a short-lived impact on a person's happiness because adaptation takes place. Consistent with this idea, Brickman, Coates, and Janoff-Bulman (1978) presented evidence that the effects of events such as winning a lottery or becoming totally disabled on happiness had relatively temporary effects on happiness.

Kahneman and Tversky's (e.g., 1979) prospect theory of economic choice behavior also emphasizes the importance of prior psychological neutral points or benchmarks. The theory states that people don't only judge the attractiveness of choice alternatives by their absolute values, but by comparing these absolute values with their prior neutral points or benchmarks. For example, a person who expects to pay $200 for a product and finds one on sale for $150 will find that very attractive; however, if the person will not feel that way if the person has expected to pay $100 for same item that is on sale for $150. Kahneman and Tversky suggested that it isn't absolute values but the differences between present values and prior benchmarks that are the actual "carriers of value" that most strongly influence choice behaviors.

Synthesis and Conclusions

In short, information about the dynamism of events is fundamental to human cognition and to the warp-and-weave of its construction of its understanding of the environment. People navigate their paths through the physical and social world using dynamic information. In addition, the emotional impact of stimuli appears to depend

on their dynamism and on changes that occur in them rather than the stimuli alone. Emotional reactions to static (constant) stimuli tend to taper off and be short-lived since one's psychological neutral point tends to adapt to them.

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Chapter 4
Basic Postulates of the Looming Vulnerability Model

As we saw, across the entirety of the animal kingdom, dynamic approaching objects evoke defensive behavioral reactions. Birds flutter, crouch, or try to fly away. Monkeys crouch or put their arms up protectively, even barnacles close their shells when they sense objects approaching them. Human adults, too, react defensively to rapidly approaching objects, and young children exhibit stranger anxiety to the rapid approach of an unfamiliar adult. People become more anxious as deadlines approach. It would seem obvious that these different observations are connected to anxiety and threat somehow, but how?

The looming vulnerability model (LVM) emphasizes the continuity of reactions to the approaching movement of threats across the animal kingdom with human fear responses. Perceptions of the dynamism of looming threats and their approach movement are crucial to the threat reactions of humans (as with other animals) because they are relevant to our evolutionary-based strategies for responding to and evading threats.

Our goal in this chapter is to focus on basic postulates of the model regarding potential determinants (or antecedents) and consequences of perceived dynamic growing threat for anxiety.

The purpose of this chapter is to provide a broad overview of the looming vulnerability model. More specifically, we will begin to discuss the looming vulnerability model by addressing these basic questions: (1) In what ways do we conceptually and operationally define the perception of looming vulnerability to dynamic growing threat? (2) What types of determinants or inputs contribute to the perception of looming threat? (3) What consequences do these perceptions of looming vulnerability have for how individuals react to and cope with threats? (4) Finally, what points of correspondence or connections does the looming vulnerability model have with other contemporary CT/CBT models?

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Conceptual and Operational Definition of the Perception of Looming Vulnerability

How do we define the perception of looming vulnerability? In simple terms, the perception (or sense) of looming vulnerability refers to one's subjective perception that one may be defenseless to the dynamism of rapidly growing threats unless one can respond in time. This construct implies that individuals become anxious in large part because they perceive rapid dynamic gains occurring in threats that are developing and advancing faster than they can respond. By dynamic gains, we mean that they perceive threat as rapidly increasing and approaching over the previous levels of their proximity, probability, urgency, and intensity or other parameters. Accordingly, a person's anxiety derives in part from a perception of rapidly rising risk and a general feeling of dreaded events moving rapidly toward collision with them.

Why look at these perceptions of looming vulnerability to dynamic growing threat? Why don't appraisals of static parameters or judgments of probability, proximity, and the like, suffice? There are four important reasons to focus on perceptions of looming vulnerability dynamic growing threat and rapid dynamic gains when conceptualizing features of threat. First, the assumed significance of such perceptions connects more closely than current more static models to the abundant demonstrations that humans and other animals respond to the dynamism and patterns of change of rapidly approaching objects (looming stimuli). Second, a focus on perceptions of dynamic growing threat helps to bridge these lines of investigation with theoretical and empirical work on cognitive appraisal and defense systems in anxiety as well as with work on emotions, attention, memory, and other aspects of information processing of threatening material. Third, perceptions of looming vulnerability involve more visual and sensory-motor processing than other constructs related to threat cognition. And, fourth, a focus on perceptions of dynamic gains in growing threat may afford new ways to understand cognitive mechanisms and vulnerabilities in anxiety disorders as well as suggest opportunities for novel treatment strategies. Note also that the emphasis on such perceptions is in closer accord with the fact that the human brain is sensitive to change (Cacioppo & Freberg, 2012).

As we saw, animals in the wild often continue to forage even after they detect predators. There is a tradeoff to committing to flight or defensive behaviors, and so they only take flight or engage in such extremes when they see dynamic gains in threat as the predators move (or prepare to move) closer. Likewise, individuals today don't generally take physical flight automatically when they simply see parked cars in the street; rather, they only do so when they perceive the threats to be rapidly approaching and the cars to be making dynamic gains. It should be obvious no one could function well if they immediately ran away every time they detected a threat. Thus, individuals whether threats are dynamically growing and approaching dynamic growth of threats when estimating the tradeoffs when selecting

among options for responding to the threats. As we will attempt to show, anxiety disorders develop when individuals begin to indiscriminately perceive their feared threats as rapidly growing and looming.

When individuals encounter possible threats and dangers, they generally want to know whether possible threats are dynamically growing (progressing or escalating) in a given time frame, and, if so, how quickly they are doing so. When threats are static or dissipating in a time scale, they tend to perceive that they are less urgent and assume that they can put off dealing with such threats and their anxiety tends to taper off. Furthermore, the judgments that individuals make about threats aren't just static judgments preserved in amber. Threat is a dynamic experience, They don't just judge the proximity or probability of a threat at a static point-in-time, but also judge how quickly the risk is rising for them in the instant. For example, they judge whether the threat of a health condition, car accident, or being unprepared for a deadline is making dynamic gains because the threats are rapidly bearing down on them.

For these reasons, individuals don't just assess the possible danger of being rejected and hurt by others as a fixed numerical probability during a given time frame. They don't just appraise threats as fixed probabilities or proximities, but also attempt to assess the dynamism of threats and to anticipate and simulate their dynamic growth rates. Thus, they attempt to perceive and simulate whether the risk of a looming threat is rapidly escalating and how quickly a danger can reach them.

Their perceptions of dynamically growing threat can be also assessed with questions that are tailored to be quite fear- or disorder-specific (e.g., OCD, spider phobia, social anxiety). For example, they don't just assess the possible danger from germs and contaminants in terms of the probability of contamination or the distance from them during a time scale but imagine whether the germs and contamination are quickly spreading and can reach them. For another example, the perception of looming vulnerability for spider fears is operationalized by perceptions that spiders are moving and/or rapidly reproducing and approaching.

It is assumed that the parameters of individuals' perceptions of the dynamic nature of possible threats can be likened to those of physical bodies in motion (Riskind, 1997). For example, the greater the perceived velocity of the approach movement and change of a growing threat (i.e., its speed toward the self), the greater the extent would be to which one will experience anxiety and fear. A rapidly changing and fast-moving dynamic threat produces more anxiety for a person than a static or slowly moving threat. Another factor that has impact is the perceived acceleration of the approach movement of a potential threat (i.e., the extent that the velocity itself is perceived as increasing in the moment). Furthermore, a person's perceived looming vulnerability is greater to the extent that the dynamic threat object is perceived to be increasing in intensity or magnitude and gathering momentum to the point it can be difficult to stop or evade.

Perceptions of Looming Vulnerability Are Embodied

It is further proposed that individuals' perceptions of looming vulnerability to threats are embodied (Barsalou, 2002, 2003a; Niedenthal, Barsalou, Winkielman, Krauth-Gruber, & Ric, 2005) in visual and sensory processing as well as imagination. That is, their perceptions of dynamic growing threats cannot be reduced to static "stuck-in-amber" judgments of probability, proximity, or cost. The following example of a cognitive fear script, which Lang (1984) offered when presenting his network formulation of fear structure, provides a useful way to illustrate the embodiment of looming threats in visual and sensory processing and imagination:

> I am in a wooded area when I see a large snake. It appears to be moving toward me. There's a diamond pattern on its back. It could be a dangerous snake. My eyes jump in my head following a quick, sinuous movement. (from Lang, 1984, p. 197).

More generally, perceptions of looming threat are embodied even when threats are not so specific and concrete as in phobic stimuli like spiders. As Lakoff (2015) has stated, "Everyone living on earth" has experienced gravitation, movement of objects toward the self, etc., and these experiences provide the "superstructure for all the conceptual systems we develop thereafter." A similar view has been suggested by the scaffolding theory of Williams, Huang, and Bargh (2009), which assumes that early preverbal sensorimotor experiences with the physical environment provide basic building blocks and conceptual analogies for understanding other aspects of the social and physical world. Thus, ultimately, all our perceptions of looming threat are grounded in past visual and sensory experiences with dynamism and change in the world, even if these have simply provided a "superstructure" of metaphors or conceptual analogies that enable us to comprehend the features of objects and events that cause them to be dangerous.

Perceptions of Approach Movement Occur in a Dynamic and Relative Reference Frame

It is assumed that people perceive the dynamism of threats (and their dynamic gains or losses) in the context of a dynamic relative reference frame. For example, an individual can experience a sense of looming vulnerability to rapidly growing threat regardless of whether it is the threat—such as a spider or deadline—that is approaching or whether the individual is the one approaching the threat—such as the edge of a tall building. Another factor that influences perceptions of dynamic growing threat in this dynamic relative reference frame is the perception of self-efficacy and control. A perception of self-efficacy and control can benefit the individual by attenuating the impact of the approaching threat. At the same time, the benefit that an individual receives from perceiving self-efficacy and control is much lower when threats aren't perceived to be approaching than when they are (Riskind & Maddux, 1993).

What Are the Antecedent Factors and Conditions That Contribute to the Perception of Looming Vulnerability?

Determinants of Perceptions of Dynamically Growing Threat

Perceptual and Cognitive Factors

Perceptions of looming vulnerability derive from a combination of several types of inputs. They can be constructed in part based on perceptual cues (e.g., from incoming visual or auditory information) and perceived physical properties of threat stimuli. For example, perceptions of objects that are suddenly approaching closer can increase the sense of looming threat. Even minimal or barely noticeable cues of dynamism and movement can also sometimes heighten an individual's sense of looming vulnerability to threat. Imagine, for example, that a person sees that a nearby wasp or stinging insect on a wall seems to be just slightly moving and/or flexing its legs. This minimal cue provides the person with warning signals that a threat is dynamic and growing.

Note that many animal species interpret preparatory but stationary dynamic postures, such as aggressive postures, as "intention movements" that signal impending action by another animal or predator (Hinde, 1970; Krebs & Dawkins, 1984). In short, static or stationary postures (e.g., a coiled cobra that is poised to strike) can sometimes carry significant dynamic information of dynamic growing threat.

Cognitive Biases

Several cognitive biases can contribute to perceptions of looming vulnerability (for more, see Chap. 14). For example, individuals appear to have a "self-centered" cognitive bias to perceive directionally ambiguous movement as approaching them (Lewis & McBeath, 2004). More broadly, they may sometimes perceive any ambiguous dynamic activity or changes in potential threats as growing threats that are making dynamic gains. From an evolutionary perspective, this self-centered bias would seem to make sense under conditions of uncertainty about the possibility of looming danger. That is, human ancestors in a world with potential predators would have had better chances of surviving if they were biased toward overestimating dynamic growing threat ("better safe than sorry") than if they were biased to underestimate it (see "error management" theory; Haselton & Buss, 2000; Haselton & Nettle, & Andrews, 2005). Furthermore, in more extreme instances, this tendency may even occur when threats are receding because their movement can make it more salient to the fearful person that they have dynamism and can approach. Anxiety may only taper off when it is indisputably clear that the receding threats have reached an apparent point of no return (Riskind, Kelly, Harman, Moore, & Gaines, 1992).

As detailed in Chap. 14, a tendency to perceive dynamism and movement in threats can also simply result from focusing on the threats. Focusing on a threat can create an illusion of movement even when it is static. Moreover, this illusory movement can particularly emerge when someone engages in mental simulation of its potential to approach.

Synthesis in Information Processing

The LVM assumes that people process bits and pieces of information from many possible inputs and sources to formulate their perceptions and appraisals of potential dynamic growing threat. We posit that much of this activity occurs automatically and nonreflectively and involves the integration of incoming information with memories, attitudes, beliefs, and cognitive styles.

Cognitive Vulnerability as a Determinant of Perceptions of Looming Vulnerability to Rapid Dynamic Gains in Threat

Some individuals more than others also acquire a distinct and characteristic negative cognitive style—the looming cognitive style—that systematically biases their processing of threat and puts them at greater risk for anxiety (see Chaps. 8, 9, and 10). Someone with this cognitive style is therefore more likely to interpret and simulate ambiguous threats as dynamic, growing, and approaching and rapidly rising in risk (Riskind et al., 2000).

Consequences of Perceived Approach Movement for the Output of Threat Processing and Responses

The looming vulnerability construct posits that perceptions that threats are dynamically growing and advancing are important theoretical features of threat that can profoundly affect anxiety and fear in several ways (Riskind, 1997; Riskind and Williams, 2006; Riskind, Williams, & Joiner, 2006). As just one example, as we will show in Chap. 5, the dynamic features of threat have significant impact on threat appraisal. For another example, as we will show in Chap. 6, perceptions of dynamic movement, and change in potential threat have a significant impact on attentional and memory processes as well as the interpretation and appraisal of threat. As we will see in Chap. 6, looming stimuli have been repeatedly shown to have priority in attentional capture. In addition, moving and looming stimuli and images are better recognized and remembered. Likewise, we will argue in Chap. 6 that individuals are

more readily conditioned to become afraid of dynamic (e.g., moving spiders) than static ones. Perceptions that threats are rapidly approaching (looming) can also produce more intense emotional reactions and physiological responses. The salience of looming threats, as well as their perceived immediacy and urgency, causes individuals to have more intense anxiety and fear and even anger reactions. As we will see, this can also lead them to have greater fear of losing control over their emotions.

Effects on Physiological Reactions to Perceptions of Looming Stimuli

It has been shown that perceptions of dynamic growing threat can activate basic neural defense systems. For example, Coker-Appiah et al. (2013) showed participants images that were either threatening or neutral and which were displayed as either approaching (looming) or receding from them. As well, the images were either animate (animals) or inanimate (objects). Using fMRI brain imaging, Coker-Appia et al. showed that the amygdala was responsive to the threatening nature of the images, as well as their animacy, and whether they loomed. The amygdala was particularly responsive to looming threats and looming animate stimuli. They also found that the periaqueductal gray was also sensitive to emotional information and particularly responsive to looming threats. Other studies have found comparable findings with both visual (Mobbs et al., 2007) and auditory (Bach, Neuhoff, Perrig, & Seifritz, 2009) looming stimuli.

Effects on Defensive and Self-Protective Reactions

An individual's perceptions of dynamic growing threat also have significant effects on anxiety by affecting the person's ensuing motivational, and behavioral reactions to threats. We will cover this material in more depth than other topics in this chapter because we don't deal with it as much in later chapters.

Schreij and Olivers (2015) presented evidence on the relationship between looming movement and behavioral urgency. While playing on a computer task, participants performed a visual search task in a computer game that required them to respond to shape changes of a target stimulus on a screen that contained an avatar of themselves. When the target stimulus was a moving object on a collision course with their avatar on the screen, the participants responded more quickly on the visual search task than when the target was moving away from their avatar. In short, perceptions of approaching (looming) threats appeared to increase the participants' feelings of behavioral urgency. As will be seen, further evidence for this assumption about behavioral urgency is presented in Chap. 6 on attentional processes.

An individual's perceptions of dynamic growing threat can also trigger freezing reactions. Freezing represents an initial orienting response that is often exhibited in terms of an immobile posture or postural tension, slowing reaction times, and reduced heart rate (bradycardia). It is thought that when individuals freeze, they can become more hypervigilant for cues that help in assessing the degree of clear and

present danger and in selecting the most useful coping responses (Hagenaars, Oitzl, & Roelofs, 2014; Mobbs, Hagan, Dalgleish, Silston, & Prévost, 2015).

Sagliano, Cappuccio, Trojano, and Conson (2014) recently designed a study to examine whether normal human participants have freezing responses to dynamic, approaching threats. The procedure involved asking participants to make judgments about whether images of animals or other stimuli were "living" or "nonliving." Slower reaction times (RTs) on this lexical decision task for approaching threatening animals (e.g., spiders or crocodiles)—compared to those for receding animals or to nonthreatening animals—are indicative of freeze-like reactions. Sagliano and colleagues found that individuals evinced more freeze-like reactions to the approaching images of dangerous animals than they did to the receding images of the same animals. The approaching images of dangerous animals also elicited faster and more pronounced freeze-like reactions than the neutral animals regardless of whether they were approaching or receding.

Freezing reactions can generally cease to have any significant adaptive benefit for individuals when they become rigid and occur in inappropriate situations (e.g., when it is obvious that no threat exists or that the threat has receded). Indeed, it appears that inappropriate freezing reactions along with other defensive reactions are prominent features of anxiety disorders and other psychopathologies (see Chap. 9). For example, they have been observed in social anxiety (Buss, Davidson, Kalin, & Goldsmith, 2004) and PTSD (Hagenaars, Van Minnen, Holmes, Brewin, & Hoogduin, 2008; Rizvi, Kaysen, Gutner, Griffin, & Resick, 2008). Thus, Sagliano et al.'s study implies that exaggerated perceptions of dynamic growing threat may contribute to freezing reactions in anxiety disorders.

An individual's perceptions of looming threats can have significant effects on defensive responses at the most rudimentary and innate automatic level as well as more complex cognitive-affective responses. As an example of the former, a recent study examined the effects of tactile perceptions of looming stimuli moving toward the face on automatic defensive reactions (Clery, Guipponi, Odouard, Wardak, & Hamed, 2015). The object movement that approached the face (on a collision course or a near miss) seemed to automatically provide participants with predictive cues affecting their expectations about the timing and location of the expected impact of the objects.

On a different front, when individuals see no immediate way in which they can avoid threatening objects or stimuli, we saw in Chap. 2 that they sometimes use covert mental "cut-off" strategies (see Chap. 2) to modulate the impact of threats. In this vein, there is considerable evidence that the looming cognitive style has significant impact on whether individuals engage in defenses such as thought suppression, worry, experiential avoidance, and affect avoidance.

In short, a central tenet of the LVM is that perceptions and simulations of looming threat affect a range of core processes involved in the evaluation and emotional, physiological and behavioral response to threat. The LVM is unique from other models in its focus on the role that perceptions of dynamic growing and approaching threat play as a core mechanism in anxiety.

What Points of Correspondence Are There Between the Looming Vulnerability and Other Contemporary CT/CBT Models?

As we will now see, despite the differences between the looming vulnerability model and other CT/CBT models, the looming vulnerability model also has points of correspondence with several other models of anxiety. Moreover, as already described in Chap. 3, the looming vulnerability model also connects with cognitive models and research in the more general emotions literature that share the idea that emotion is a response to appraisals of dynamic changes in stimuli, not merely their mere presence (Baumeister and Bratslavsky, 1999; Lazarus, 1991; Ortony, Clore, & Collins, 1990).

What models in the clinical literature on anxiety does the looming vulnerability model connect with? First, it connects with the recent affective contrast theory of generalized anxiety disorder (GAD) that has been proposed by Llera and Newman (Llera and Newman, 2014; Neuman and Llera, 2011; Newman, Llera, Erickson, & Przeworski, 2014). The central premise of their model is that individuals with GAD are more threatened by the experience of negative affect shifts—or, in our terms, dynamic gains in negative affect—than they are by the experience of negative states themselves. This, in turn, paradoxically motivates individuals with GAD to engage in a worry state that buffers them from feeling sudden, acute increases in negative affect (negative affect shifts).

More generally, we presently expect that somewhat analogous "affective contrast" mechanisms also operate in anxiety disorders. For example, we have observed that OCD patients appear to have inflated fears of negative affect shifts that could lead to rapid loss of emotional control. Some patients are even afraid of experiencing positive affect shifts. As one patient put it, he believed that "the higher the rise I get in feeling a positive mood, the harder my fall will be." In effect, his fears of dynamic shifts in both positive and negative affect were associated with perceptions of looming vulnerability to negative affect shifts that could lead to uncontrollable anxiety and depression.

Despite some of their similarities and emphasis on the role of dynamic increases in negative states, the affective contrast model and looming vulnerability model differ in at least one salient respect. That is, the affective contrast model primarily focuses on *internal* cues that threat negative affect shifts, whereas the looming vulnerability model focuses on both internal and external cues more broadly. Individuals have a sense of looming vulnerability to threats such as automobile accidents, cancers, and social rejections, but also have a sense of looming vulnerability to panic attacks, obsessional thinking, or a loss of control over negative affect states.

Next, the looming vulnerability model can also be related to Gross's emotion process model (Gross, 1998a, 1998b) and several other emotion regulation or related models including Borkovec's model of worry (Borkovec, Alcaine, & Behar 2004, Borkovec, Ray, & Stoeber, 1998), Roemer & Orsillo's model of experiential avoidance (Roemer & Orsillo, 2007; Roemer, Salters, Raffa, & Orsillo, 2005), and

Mennin and Fresco's emotion regulation model of GAD (Mennin & Fresco, 2013; Mennin et al., 2018). In his model, Gross distinguishes between *antecedent* emotion regulation processes that are involved in generating emotional responses (e.g., events and cognitive appraisals) and *response-focused* processes that are involved in strategies such as emotion suppression that target the output. As noted above, perceptions of looming vulnerability (an antecedent process) are thought to lead more intense emotional responses. As such, perceptions of looming vulnerability can influence the subsequent response-focused self-regulation processes. A study by Riskind and Kleiman (2012) found that the looming cognitive style had significant positive relationships to experiential avoidance and fears of loss of emotional control. Riskind and Kleiman (2012) suggested that antecedent perceptions of rapid dynamic gains in threatening events can evoke intense emotion and fears of loss of emotional control. These exaggerated fears, in turn, can cause individuals to select more response-focused emotion regulation strategies such as suppression, worry, and experiential avoidance that are important in many emotion regulation models. For example, Mennin and Fresco's model states that individuals with GAD have exaggerated fears of intense emotions and of losing control over their emotions (Mennin & Fresco, 2013; Mennin et al., 2018).

Third, the looming vulnerability model can also be related to an analysis by Mineka and Kihlstrom (1978) several decades ago of experimental neurosis in discrimination learning. Like the looming vulnerability model, Mineka and Kihlstrom spotlighted the importance of perceptions of dynamic gains and losses. Contrary to the common psychological assumption that experimental neurosis resulted from lack of predictability and control, they stated that experimental neurosis results from a *loss* of predictability and control by someone that once had these.

The looming vulnerability model can also be related to the cognitive formulation of anxiety that Beck and his collaborators (e.g., Beck, 1976; Beck, Emery, & Greenberg, 1985; Clark & Beck, 2010) have proposed and revised. For example, in the first stage of Clark and Beck's reformulated cognitive model, the stimulus activates an innate early warning detection system (or "Orienting Mode") for threat. Simultaneously with the orienting mode, a "Primal Threat Mode" is activated that is associated with a variety of threat schemas. The perception of looming vulnerability would be expected to trigger this step of Clark and Beck's model because, as we saw, perceptions of physical approach movement are an ecologically fundamental warning signal that has been repeatedly demonstrated on a species-wide basis in humans and other animals (see Chap. 2).

Consequently, perceptions of the dynamism of approaching, growing threats would be expected to activate the primal threat mode and all its attendant threat schemas. More specifically, such perceptions would activate danger schemas that would lead individuals to experience increases in (1) threatening automatic thoughts and images, and (2) cognitive processing errors that exaggerate the imminence, probability, and severity of potential threats. Likewise, taking the theoretical logic of Clark and Beck's (2011) model into account, perceptions of dynamic growing threat would also activate the person's self-protective responses such as fight or

flight, freezing, or fainting, as well as ineffective defensive responses such as worry and thought suppression.

Notably, a meta-analysis that was conducted by Robert Beck and Perkins (2001) failed to support Beck's core cognitive specificity formulation. Contrary to the cognitive specificity formulation, their analysis indicated that threat cognitions were no more linked to anxiety than depression. As will be seen later (Chaps. 5 and 9), incorporating dynamic components to threat might help to enhance cognitive specificity to anxiety as well as improve knowledge of cognitive vulnerability. In addition, while Clark and Beck emphasized the role of fixed (static) beliefs about threat in enduring danger schemas, incorporating cognitions relating to perceptions of the dynamism and rapid dynamic gains of threats may help to pinpoint significant facets of cognitive vulnerability not captured by other cognitive constructs.

Finally, the looming vulnerability model also has points of correspondence with Gray's bio-behavioral model (Gray, 1982, 1987; Gray and McNaughton, 2000). Grey stated that lower anxiety occurs when individuals have stable "working models" of their expectations about the environment. Anxiety results when it is difficult to maintain these stable working models. The main idea is that in a dynamic environment where stimuli are changing, it is harder to maintain stable models of expectations than in one where stimuli are static. Furthermore, Gray's model states that novel stimuli, which are unfamiliar and unpredictable, activate the behavioral inhibition system in anxiety. Because rapid dynamic gains and movement make it harder for a person to maintain stable working models of expectations, such factors should increase the perceived novelty and unpredictability of the environment. Within the internal logic of Gray's model, we could expect that this would make habituation to threatening stimuli more difficult (see also Riskind, 1997).

Summary and Conclusions

As we have shown, the looming vulnerability model postulates that perceptions and simulations of the dynamism of rapidly growing threat play a prime role in the core processes in anxiety. These core processes include threat processing in attention, memory, and appraisal, as well as in neural defense systems and physiological responses, emotional response, and defensive behavioral reactions to threat.

In the next chapter, we will look much more closely at the implications of this new perspective for understanding the threat appraisal process.

We further suggest that the perception or expectation that threat is dynamically growing and advancing is a key factor determining its consequent repercussions. If a potentially emergent threat is perceived as unchanging, unmoving and static, and unlikely to further advance, it becomes less relevant. Thus, it becomes less likely to be prioritized in information processing, less likely to produce intense physiological and emotional response and less likely to set off defensive behaviors.

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Chapter 5
Dynamic Gains in Growing Threat and Threat Appraisal

Cognitive models suggest that faulty threat appraisal leads to threat overestimation that elicits and maintains anxiety. The prevailing paradigm thus emphasizes threat overestimation in the etiology, maintenance, and treat of anxiety, and particularly credits the overestimation of probability and cost in a given slice of time. In contrast, the looming vulnerability model (LVM) proposes that it isn't just this kind of threat overestimation, but also the overestimation of higher-order attributes of threat such as patterns of change and intensification over time that is also important. Thus, the LVM is concerned with dynamic features of perceived threats that other cognitive models have been neglected.

The dynamic rate at which such threat values are rapidly gaining or increasing is different and separable from the absolute level of the threat's probability or proximity. For example, a probability or proximity of a negative outcome at a given time point can be high but constant or it can be lower but "fast" and rapidly increasing and rising in risk. The "fast" threat that is rapidly growing and gaining is likely to elicit more anxiety, as well as habituate more slowly, than the "slow" threat that is slow or increasing slowly, if not receding and moving further away.

The purpose of this chapter is to present reasons that perceptions of rapid gains by dynamic growing threat are important to cognitive appraisal. In addition to this general goal, the chapter will cover several other related issues. These include: (1) evidence that perceptions of dynamism and dynamic gains provide additional information beyond static threat, (2) static point-in-time appraisals of probability and proximity may have more modest effects than contemporary CT/CBT models assume, (3) the impact that perceptions of rapid gains have on specific types of threats appraisals, (4) direct and indirect pathways through which perceptions of rapid dynamic growing threat influence anxiety, (5) evidence that perceptions of rapid dynamic gains involve perceptual biases and distortions, and (6) theoretical reasons that such perceptions can help to discriminate anxiety from depression.

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Theoretical Reasons That We Expect That Rapid Gains in Dynamic Growing Threat Have an Impact on Threat Appraisal

1. *Effects on threat extrapolation*. When dynamic gains in potential threats (such as rapid increases in proximity and probability) are perceived, we contend that it is easier to extrapolate that a negative outcome will occur. The expectation is supported by a perceived trend. When possible threats are static or unchanging, or when the trend is for threats to be receding, it is much harder for someone to imagine the outcome will occur or will have to be reckoned with.
2. *Dynamic growing threats are more vivid and memorable.* In their work on the role of cognitive heuristics in judgments of risk, Tversky and Kahneman (1973) stated that judgments of risk are often disproportionately influenced by the availability or vividness of relevant information. This is because such information comes to mind more easily and is more memorable. We expect that when individuals perceive or imagine that patterns of gains are occurring in dynamic growing threats (as with rapidly spreading contaminants or disease or moving spiders), these dynamic perceptions are more vivid and memorable and thereby have more impact than static judgments of probability.

   In the passage below, Kahneman (2011) seems to allude to the enhanced power of imagining or mentally simulating dynamic growing threats on judgments. He implies that individuals often better understand risk when it is expressed in terms of a dynamic story or mental simulation of negative scenarios that can occur. Kahneman also alludes to the modest effects of static judgments of probability and the appraisal of risk:

   > Every parent who has stayed up waiting for a teenage daughter who is late from a party will recognize the feeling. You may know that there is really (almost) nothing to worry about, but you cannot help images of disaster from coming to mind. As Slovic has argued, the amount of concern is not adequately sensitive to the probability of harm; you are imagining the numerator—the tragic story you saw on the news—and not thinking about the denominator. Sunstein has coined the phrase "probability neglect" to describe the pattern (p. 144).

3. *Dynamic growing threats preserve their vividness and impact better*. We suggest that when potential threats are perceived to be making dynamic gains or approaching, this can maintain and increase their perceptual salience to individuals. In contrast, if they don't increase over prior levels individuals tend to habituate to them (Helson, 1964). The key point is that by making dynamic gains, threats engage or reengage individual's attention and their emotional impact. Emotion theorists suggest that emotions are not a response to stimuli but *changes* in stimuli. The emotional impact of stimuli that don't change is short-lived (Baumeister & Bratslavsky, 1999).

Evidence That Perceptions of Rapid Gains in Dynamic Growing Threat Provide Additional Incremental Information to Threat Appraisal

It is theoretically expected that a perception of rapid gains can independently have an impact on affect and appraisals above and beyond the effects of absolute levels of threats at the point in time. It is also expected that the effects of static absolute threat values can sometimes be far more modest than current CT/CBT models expect (e.g., Beck, 1976; Carr, 1974; Clark & Beck, 2010; Foa & Kozak, 1986; Rapee & Heimberg, 1997). This expectation is based on the theoretical reasons we have described as well as on research.

Eight studies conducted by Hsee, Tu, Lu, and Ruan (2014) recently tested and supported an "approach aversion" hypothesis that can be conceptually aligned with the expectations of the LVM. Hsee et al.'s studies demonstrated that individuals have an apparently general tendendcy to feel less positively (or more negatively) about a stimulus if they perceive it to be approaching rather than receding or static. Moreover, their data indicated that the approach aversion effect emerges whether the stimulus is initially negative or nonnegative and whether it moves closer in space, time, or probability (i.e., closer to certainty).

Several of Hsee et al.'s (2014) studies showed that stimuli (e.g., letters from the alphabet, emoticons) that appeared to move physically closer elicited more negative feelings than the same stimuli that moved further away or were already close to the participants in space. In one of the studies, the participants were asked to imagine that a distant cousin living in a different city expressed a desire to stay with them for a week visit, depending on the availability of airline tickets. The availability of the tickets was set up to vary from moment to moment. In the approaching condition, the expected time of the visit/of the cousin began at 12 days away, but during a 2-min booking it grew closer and closer until it was 3 days away. In contrast, in the receding condition, the expected time of the cousin's visit was 3 days away but grew to 12 days. As expected by Hsee et al.'s (2014) approach aversion hypothesis, participants expressed more negative feelings about the cousin's visit in the approaching condition than in conditions in which her proposed visit moved farther away. Importantly, their reactions were also more negative than if the visit was already near in time (static proximity) or when it was more distant in time (static distant).

In another of their series of studies, Hsee et al. (2014) replaced the expected time of the cousin's visit with the *probability* of her visit. While the cousin said she might visit on the following day for a week's stay, she said that the chances depended on whether she could get a good price on an airline ticket. If the probability of her finding a ticket appeared to be increasing (i.e., approaching certainty), participants felt more far negatively about her visit than if the probability she would get a ticket was either statically low or high. In short, Hsee et al.'s studies indicated that approach aversion appeared to be a general tendency.

Similar evidence of the additional incremental impact of perceptions of rapid gains in dynamic growing threat comes from a brain imaging study by

Mobbs et al. (2010). The participants viewed a monitor that showed prerecorded videos of a tarantula that they believed was in the same apparatus in which their own feet had been placed. Under this pretext, they viewed a tarantula that appeared to be moving either (1) closer or further away from their feet and that was (2) starting out at a distance that closer or further away in proximity. The critical fMRI and self-report data of this study indicated that dynamic gains in proximity had significant effects over and above those of sheer proximity of the tarantula. We would note in passing, however, that even a tarantula whose limbs are moving about while it is stationary (versus a "quiet" tarantula) might be expected to increase its unpredictability and provide some dynamic information.

Unlike perceptions of the dynamism and dynamic gains by threats, fixed or static "point-in-time" threat values may have more modest effects than theorized by current models (e.g., Beck, 1976; Carr, 1974; Clark & Beck, 2010; Foa & Kozak, 1986; Rapee & Heimberg, 1997). As regards physical proximity for example. Rachman's (1994) work on the overprediction of fear indicated that individuals with anxiety disorders overestimate the amount of fear they will experience in their feared situations. Other studies by Andrews and colleagues have presented evidence that individuals with social anxiety, agoraphobia, or claustrophobia rated the likelihood of feared events as higher prior to ever entering their feared situations than when in the actual situations or after (Andrews, Freed, & Teeson, 1994; Poulton & Andrews, 1994). For instance, Poulton and Andrews's study showed that socially phobic individuals rated an upcoming speech as more threatening when anticipating it than when giving the speech.

In recent research, Riskind, Calvete, and Black (2017) showed that college students who were assigned to give a speech in 3 weeks in a speech communications course had their greatest anxiety when the speech was announced. Anxiety subsequently showed a decline up the actual time of the speech for all students except for students who were high in the looming cognitive style. These students showed a rebound of anxiety just before the speech, which could perhaps reflect their tendencies to perceive the threats as dynamically growing.

In an analogous way, research indicates that when individuals don't perceive salient rapid gains in growing threat in terms of probability—or what Hsee et al. (2014) referred to as "approach aversion"—the mere probability levels of negative outcomes may also have minimal effects. Supporting this idea, considerable research has been amassed on the phenomenon of "probability neglect." Contrary to common expectations, individuals don't tend to respond differently to different probabilities. To the contrary, they tend to respond in an "all-or-none" manner to probabilities, and especially when possible outcomes have significant emotion-evoking consequences such as getting a disease or winning a lottery. Thus, rather than a sensitivity to probability people tend to show a sensitivity to the *merest possibility that* negative outcomes will occur (Loewenstein, Weber, Hsee, & Welch, 2001; Loewenstein & Lerner, 2003; Sunstein, 2002; Sunstein & Zeckhauser, 2010). Given this research, Sunstein and others (Slovic, 2000; Slovic & Peters, 2006) have concluded that people don't naturally have an inherent intuitive grasp of probability and aren't inclined to use probabilities when estimating risk.

Other studies indicate that if participants expect to receive painful electric shocks at an expected time but had an uncertain probability of whether the shock would occur (i.e., 5, 50, or 100%), they exhibit little difference in "sensitivity to the probability of the shock—unless this probability was zero" (e.g., Bankhart & Elliott, 1974; Monat, 1976; Monat, Averill, & Lazarus, 1972). Thus, this work, too, supports the conclusion that people lack a good intuitive grasp of probability (probability neglect).

Similarly, Slovic, Monahan, and MacGregor (2000) asked forensic psychologists and psychiatrists to make judgments concerning the degree of risk that a mental health patient would commit a violent act, such as killing someone, within 6 months of discharge from their hospital. These participants were given another purported expert's assessment of the risk of violence that was expressed either in the form of relative frequency or probability. When risk was expressed in terms of relative frequency they were told that "10 out of every 100 patients like Mr. Jones are estimated to commit an act of violence to others." On the other hand, when given equivalent information phrased as a probability they were told that "10% of patients like Mr. Jones are estimated to commit an act of violence to others." If risk was expressed in terms of relative frequency, these forensic experts and psychiatrists judged the mental patient as more dangerous than when risk was expressed in terms of probability. Once again, then, it appears that people lack a good intuitive understanding of the meaning of probability.

In sum, there is evidence that dynamic gains in probability and proximity have powerful effects. *Increases* over prior levels appear to be more salient and the LVM expects that they create more of a sense of behavioral urgency. By contrast, static point-in-time judgments of probabilities and proximities in the absence of salient dynamic gains over prior levels have been found to have more modest effects than existing CT/CBT models have expected. Further, when people have vivid images and mental simulations of dynamic gains in threats, these may serve as powerful judgmental heuristics that influence threat estimation more strongly than probability or proximity information.

Perceptions of Rapid Gains in Dynamic Growing Threats Provide a Source of Data for More Specific Appraisals

Next, consider the hypothetical scenario of two people who are evaluating the same threat (e.g., contracting a disease or being rejected). If one of these individuals were to imagine the threat as increasing and the other were to imagine it as static or receding, we would expect that they would differ in multiple ways in the appraisals they make. Namely, the individual who imagines rapid dynamic gains to be occurring in the threat would be likely to estimate the *behavioral urgency* and *probability* of negative consequences as higher, as well as estimate the *proximity* in time and space of the threat to be closer. Thus, the LVM assumes that the person's perceptions of rapid dynamic gains can provide a major source of data for more specific threat appraisals.

In addition to the foregoing types of appraisals, the person's perceptions that threat is increasing and making rapid dynamic gain could also affect his or her threat appraisals that involve estimates of the *severity* of the negative consequences of *costs*. The reason is that anyone would tend to perceive that more may be at personal stake if a potential threat is perceived as making rapid dynamic gains. To put this another way, they would tend to perceive the downside risks associated with the potential outcomes as greater than they would if they perceived the threat as slowly gaining, static, or even receding.

Rapidly gaining dynamic threats, relative to static ones, should also increase the person's *perceptions of uncertainty and perceptions of unpredictability.* A key reason for assuming this is that rapid changes would make more difficult for a person to form and maintain stable expectations of the threats. As we previously saw (Chap. 4), Gray's model (Gray, 1982, 1987; Gray & McNaughton, 2000) postulates that novel, unfamiliar and more unpredictable stimuli activate a person's behavioral inhibition system and create anxiety. Thus, perceiving rapid dynamic gains and change should violate the person's expectancies and hinder him or her from maintaining stable working models of expectations, which would increase the unpredictability. Another reason that rapid dynamic gains by approaching threats could also increase unpredictability is that they are likely to be perceived by the person as affording fewer opportunities for mitigating measures to counter the threats. Given this, greater uncertainty and unpredictability would result because it exposes one to a wider range of potential better or worse outcomes of different severities.

As anticipated by the preceding paragraph, the person's perceptions of rapid gains in dynamic growing threats should often also diminish the person's judgments (or secondary appraisals) of possibilities of coping options for *contro*l. Compared to potential threats that aren't dynamically gaining, those that are rapidly gaining would be more difficult for the person to mitigate. The reason is that they tend to afford a person less time to select or locate coping responses. The LVM assumes that the perception of having sufficient time to select or find appropriate responses is one of the most important coping resources that anyone could possess.

Support for many of the foregoing theoretical predictions was found in two studies that were conducted by Riskind, Kelly, Moore, Harman, and Gaines (1992) and Riskind and Maddux (1993). Brief video clips were presented of tarantulas moving toward participants or moving further away or as static. As expected, participants rated the tarantulas as being more likely to cause harm, as well as being more unpredictable and uncontrollable, and near, when the tarantulas were shown with forward movement rather than as stationary or moving further away. Another study which explored the "auditory looming" phenomena (judging a sound source as coming faster than it is) can be viewed as supporting the same expectations, Bach, Neuhoff, Perrig, and Seifritz (2009) showed that participants rated their expectations as higher that adverse outcomes would follow after approaching sounds than receding sounds. For another example, Dorfan and Woody (2006) tested the effects of mental imagery on habituation responses and found that imagery that involved visualizing a drop of urine placed on their hands as spreading was associated with an increase in threat cognitions.

In another line of research, many studies have shown that individuals attribute mental states or intentions to moving geometric objects (Heider & Simmel, 1944; Kuhlmeier, Wynn, & Bloom, 2003; Michotte, 1962) and other nonhuman stimuli. This *anthropomorphic* tendency to attribute properties of human mental states to objects or toys seems to be heightened when they exhibit dynamic movement (Morewedge, Preston, & Wegner, 2007). Furthermore, children as young as 4 years of age have been shown to use movement cues to distinguish between harmful and harmless intentions of others, such as chasing, fighting, courting, or playing (Barrett, Todd, Miller, & Blythe, 2005).

Of more direct bearing to the link between anxiety and threat estimation, a study by Riskind, Moore, and Bowley (1995) presented evidence that individuals high in spider fear not only imagined spiders on photographs as rapidly approaching, but also attributed human mental states and ill-intentions to the spiders. More recently, a study by Riskind and Richards (2017) reported even more remarkable evidence of a link between OCD-related contamination fears and anthropomorphic attributions to micro-organisms. In one experimental condition, the participants were shown a brief film clip of magnified images of moving micro-organisms, whereas in the other condition, they were shown a static image from the same film clip. Results showed that participants tended to attribute significantly more negative intentions and mental states such as angry emotion to germs if they were presented as moving than if they were presented in a static format. In addition, these anthropomorphic attributions were stronger in participants who had higher OCD-contamination fear than in those with lower fear.

We suggest that such findings might be understood in evolutionary terms. Natural selection pressures would have likely favored human ancestors who tended to interpret movement cues as potential warning signals of rapid gains by predators or other dynamic growing threats. In a context of uncertainty about danger, individuals may be naturally predisposed to at least initially attribute ill-intentions and hostile mental states to dynamic approaching objects.

Causal Mediation of the Effects of Perceptions of Rapid Gains of Dynamic Growing Threats

The LVM assumes that a person's perceptions of dynamism and rapid gains by threats can be theoretically expected to influence anxiety and fear through direct and indirect pathways (Riskind, 1997). As depicted by Fig. 5.1, such perceptions can influence fear through a direct pathway by heightening the person's sense of behavioral urgency because they have a dynamic experience of threat as intensifying. For example, a person standing in front of a charging elephant intuitively recognizes the danger and need for urgent action. In addition, perceptions of gains in rapid growing threat can have an indirect effect that is mediated by static time-point judgments such as the perceived probabilities and proximities in the moment. Past studies presented evidence that the effects of mental images and mental simulations of

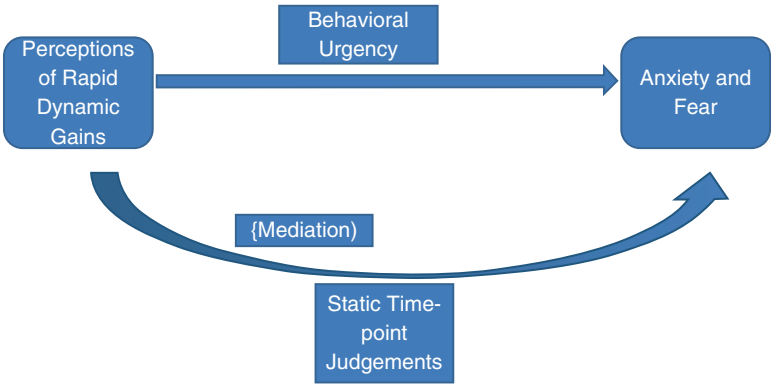

Fig. 5.1 Direct and indirect effects of dynamic growing threat

looming vulnerability to spiders or germs on fears for these stimuli are partially mediated by these static judgments (see Riskind, 1997 for a review).

Nonetheless, two caveats must be mentioned. First, we expect that the relative weight of these two pathways can depend on contextual features. In particular, the more that a person has a lifelike, embodied perception, image or mental simulation of rapidly growing danger, the more relatively important the direct pathway is and the greater the likely perceived behavioral urgency. However, the less lifelike the perceived situation is, the more the person will rely on other information to judge the danger. For example, if the person is simply given a long list of animals and asked to rate their relative danger, the person may simply rely on the common knowledge that lions are more dangerous than rabbits.

Second, such common knowledge or static judgments of probability or proximity will mainly be linked to anxiety when it is believed that threats can make further dynamic gains. For example, a threat that is just a close distance away but that a person believes will absolutely *never* ever get closer should normally elicit little anxiety.

Perceptions of Dynamic Gains Involve Perceptual Distortions

We view the perception of looming vulnerability to rapid gains by dynamic growing threats as generally involving visual and sensory processing (see Chap. 4). Moreover, when perceptions of looming vulnerability are inflated, they can normally be associated with perceptual biases and distortions. Supporting these ideas, individuals who fear spiders have been found to overestimate the frequency with which spiders are jumping in their direction (Rachman & Cuk, 1992) and the speed with which spiders are rapidly moving toward them (Riskind et al., 1992). This has been confirmed in both lab-based judgment paradigms (Basanovic, Dean, Riskind, & MacLeod, 2018; Vagnoni, Lourenco, & Longo, 2012) as well as self-report studies. In the

Vagnoni et al. (2012) study, participants tended to overestimate the time of contact of threatening images of spiders and snakes more than that of nonthreatening images and participants who were high in fear did this more than did those with lower levels of fear.

Similarly, college students with OCD symptoms (Dorfan & Woody, 2006; Elwood, Riskind, & Olatunji, 2011; Riskind, Abreu, Strauss, & Holt, 1997) and clinical patients (Riskind & Rector, 2007; Tolin, Worhunsky, & Maltby, 2004) who have been diagnosed with OCD tend to spontaneously imagine germs and contaminants as rapidly spreading and approaching. As an aside, it is noteworthy that the threatening (or fear-eliciting as opposed to disgusting) content of contaminants appears to be behind such effects (Cole, Balcetis, & Dunning, 2013; Riskind & Richards, 2017).

In a related vein, studies of the auditory looming phenomenon have demonstrated that individuals tend to overestimate the closeness and speed of an approaching sound source (Bach et al., 2009; Neuhoff, 2001). Moreover, this particularly occurs when they are anxious about approaching physical threats (Labos & Neuhoff, 2014; Riskind, Kleiman, Seifritz, & Neuhoff, 2014).

On another front, there is also research indicating that perceptions of rapid gains in dynamic looming threats can be associated with subtle distortions in individuals' temporal judgments concerning the speed with which time is going by. These distortions involve "time dilation," a tendency to overestimate the duration of objective units of time (e.g., estimating that 5 min has passed when it has only been 2 min). For example, Langer, Wapner, and Werner (1961) found greater time dilation when participants walked blindfolded toward the edge of a precipice on a state than when they walked to the end of a stage with no dangerous drop. Another study by Watts and Sharrock (1984) found that participants with spider phobia estimated the length of a brief time interval spent in the presence of a spider than non-phobic controls. Inducing a sense of threat through goal conflict also leads individuals to feel more pressed for time and to judge that their time for achieving goals is inadequate (Aker, Etkin, & Evangelidis, 2015). Such time dilation effects have also repeatedly been observed when individuals simply look at threatening images as compared to positive or neutral ones (Angrilli, Cherubini, Pavese, & Manfredini, 1997; Doi & Shinohara, 2009; Droit-Volet, Brunot, & Niedenthal, 2004).

There are times, however, when individuals face imminent impending disasters such as collisions that they can't do anything about that they report experiencing events as if they were unfolding in slow motion. They report that it is almost as if time were slowing down. Because this distortion differs substantially from the above examples, it warrants more discussion. In the preceding cases of time dilation, the person may not recognize that they are having an abnormal experience of time (i.e., experiencing time as passing faster than it is). In contrast, in these latter cases where events appear to be unfolding in slow motion, the person consciously reports that their experience of time is abnormal and has been strangely altered.

A possible but speculative explanation for this difference can be offered. Namely, when the person feels that there is still *action that can be taken* to avoid harm, it is activating and thus functional to perceptually exaggerate the speed of the approaching

threat. The reason is that the person is less likely to "take his or her time" when responding if he/she experiences time as moving faster than it is. However, we would expect that the activating functions of such perceptual biases disappear when the person perceives that nothing more can be done (such as when facing an impending car crash). When the person clearly perceives that no action can be taken, their inner quickened time-keeping may cause outside events seem to move slower. That is, if the person still privately overestimates the amount of time that is going by (e.g., 5 s feels like 20 s), events that normally should move a given degree in 5 s would appear to be taking four times as long (i.e., moving in slow motion).

We expect that a person's perceptions of rapid gains in dynamic growing threat can also produce fearful perceptual distortions of the proximity of threats. For example, Langer, Werner, and Wapner (1965) put blindfolds on participants and asked them to walk toward the edge of a theater stage. In one of the conditions, the edge of the stage was a dangerous precipice, while in another condition, there was no dangerous drop. The blindfolded participants who were walking toward the dangerous precipice judged the proximity of the end of the stage as much nearer to them than the blindfolded participants who had walked toward the edge of the stage with no drop. In a previously mentioned study by Cole et al. (2013), participants were exposed to threatening stimuli (e.g., a tarantula or a belligerent confederate) and neutral stimuli or disgusting stimuli (e.g., a disgusting confederate). Participants who were exposed to threatening stimuli judged them to be closer than they did neutral stimuli, while those exposed to disgusting stimuli did not show this effect. These findings parallel Riskind and Richards's (2017) findings on disgust. They found that it was the "fearful" rather than the "disgusting" aspect of contamination that was most closely associated with perceptions that germs were rapidly approaching.

As mentioned, spider fearful individuals tend to visualize spiders as jumping, moving, or approaching them (Rachman & Cuk, 1992; Riskind et al., 1992, 1995). Given the fact that objects normally appear physically larger to us as they get closer, perceptions of spiders as jumping and approaching could account for findings that fears of spiders are associated with size overestimation (Shiban et al., 2016; Vasey et al., 2012).

We suggest that such perceptual biases to overestimate the rapid, dynamic gains of threat could have evolved due to natural selection pressures. As Haselton's (Haselton, Nettle, & Andrews, 2005) error management theory states, it would have been more costly for human ancestors to have "false positives" when judging threats (e.g., overestimating their growth and approach) than false negatives (underestimating these). Indirect evidence for this reasoning comes from studies of accident rates in young children and senior adults. Young children have been shown to have a low ability to distinguish between different rates of approach speed of cars and have also been found to be more likely to be struck by them than adolescents and adults (Wann, Poulter, & Purcell, 2011). Recent evidence suggests that children rely overly much on static distance cues and do not sufficiently take the speed of the vehicles into account (Morrongiello, Corbett, Milanovic, & Beer, 2016). On the other hand, older drivers have higher accident rates compared to younger mature adults because

they appear to be impaired in their ability to distinguish between different rates of approach speed of cars (Poulter & Wann, 2013).

In short, the LVM posits that a person's perceptions of rapid gains by dynamic growing threat involve biases and distortions in visual and sensory processing. As such, it addresses dynamic spatial and temporal parameters of threat perception that other existing models have overlooked.

Perceptions of Rapid Gains in Dynamic Growing Threat Help to Distinguish Anxiety from Depression

The LVM proposes that perceptions of the dynamism and rapid gains in threats can also help in distinguishing the cognitive appraisals associated with anxiety from the appraisals associated with depression. It is, of course, widely recognized by now that symptoms and cognitions in anxiety and depression overlap and that the disorders are highly comorbid (Brown, Campbell, Lehman, et al., 2001; Kessler, Birnbaum, Shahly, et al., 2010). However, the cognitive specificity hypothesis in Beck's cognitive formulation states that each emotional disorder has its own unique or distinct cognitive content that differentiates it from other emotional disorders (Beck, 1976). Beck stated that anxiety is a response to uncertain negative events that may happen but haven't yet happened or struck. In contrast, depression is the response to negative events that have already struck or are thought to be absolutely certain to happen.

Although the difference that Beck proposes between anxiety and depression might seem clear in principle, the cognitive overlap between them is far more pronounced than his model expects. For example, individuals who are anxious as well as those who are depressed are both biased to predict that threatening negative future events will befall them (Beck, Wenzel, Riskind, Brown, & Steer, 2006; Butler & Mathews, 1983; MacLeod & Byrne, 1996; Miranda, Fontes, & Marroquín, 2008). For another example, the previously cited meta-analysis by Beck and Perkins (2001) found that self-report measures of threat-related cognitions (as well as of negative anticipations and worry) were as strongly associated with depression as anxiety.

Taking account of the role of individuals' perceptions of rapid dynamic gains helps to elucidate the distinct and overlapping cognitive features of anxiety and depression (Riskind, 1997; Riskind et al., 2000). These perceptions may serve as an adaptive mechanism in anxiety to motivate and prepare the person to escape from the threat before it arrives but would have less of a psychological function in the person's depression. Theoretical models have typically seen depression as a response to past losses that have struck or to hopelessnes about the certainty of future losses (Abramson, Metalsky, & Alloy, 1989; Clark & Beck, 2010).

We can cite some initial evidence here that has amassed that is broadly consistent with the contours of this conceptual analysis. For example, a study of the narrative structure of young children's stories about their emotional experiences that made them feel fear was associated with rising or escalating action. This was less true of

their stories about emotional experiences that made them feel sad (low in happiness) or angry (Hudson, Gebelt, Haviland, & Bentivegna, 1992). In another study, a group of researchers used fMRI neuroimaging to compare patterns of brain activation associated with viewing of facial displays that were either static or dynamically changing (LaBar, Crupain, Voyvodic, & McCarthy, 2003). Brain regions involved in processing facial affect, including the amygdala and fusiform gyrus, were found to show greater responses to dynamic emotional expressions than to static ones, and this was particularly true for emotional expressions of fear.

Studies using the semantic differential technique of Osgood, Suci, and Tannenbaum (1957) also presented evidence that at least suggests that perceptions of dynamism and kinetic activity are more closely related to anxiety than to depression. These studies have found that anxious individuals tend to make higher ratings of activity (e.g., on dimensions such as "fast" vs "slow") for target concepts (e.g., test or book) than less anxious individuals, while depressed individuals either show no such effects or even make lower ratings of activity than individuals who are less depressed (Costello & Comrey, 1967; Galassi, Frierson, Ross, & Sharar, 1981; Karoly & Ruehlman, 1983; Ruehlman, 1985). Along similar lines, it has been found that anxious individuals tend to frequently report perceiving animate and inanimate movement in Rorschach inkblots, as compared to less anxious individuals, but depressed individuals show no such tendencies (Exner, 1993).

Riskind (1997) reported an analogue study that was designed to test the importance of perceptions of rapid dynamic gains in distinguishing anxiety and depression. College students were asked to rate how well a list of attributes were characterized or were typical of specific events they had experienced that they had reported as having evoked either anxiety or depression. Confirming these predictions, the study participants rated dynamic action and approaching movement (e.g., "involves fast action and speed") as more typical (or prototypical) of events associated with anxiety than events associated with depression. Conversely, they rated events associated with depression as higher on static attributes such as "slow" and as having "occurred in the past."

Nonetheless, as we discuss in Chap. 8, perceptions of dynamic growing threat can secondarily be associated with depression. In particular, they can be associated with anxiety-depression comorbidity (Chap. 8; Tzur-Bitan, Meiran, Steinberg, & Shahar, 2012) when mental depletion from coping with recurrent threats or hopelessness about evading future negative events occurs.

Summary and Conclusions

The LVM model acknowledges that anxiety can result in part because individuals overestimate factors such as the probability, or proximity of threats. However, individuals also estimate whether there are dynamic gains in these parameters, and it is expected that a person's perceptions, imaginings and simulations of dynamic growing threat may be at least as important as their estimates at any one moment of

probabilities and proximities. At each point at which a salient increase in threat occurs, the perceived threat re-engages a person's attention and reconfirms that the given threat must be reckoned with. Dynamic gains increase the salience of threats salience and heighten their behavioral urgency. Moreover, we expect that dynamic gains may often be more important than static threats because of the habituation factor. Accordingly, we expect that a fundamental part of a person's threat appraisals is comprised of his or her perceptions, mental images, and mental simulations of the degree that threats are dynamically growing and gaining in probability and proximity and not their static judgments alone.

Viewed differently, there are two parts to this issue of whether appraisals of probability, proximity, cost, and the like are important to anxiety. The first concerns whether the underlying appraisal dimensions are key to anxiety. We should be clear that we do not dispute that the *appraisal dimensions* are important. The second and more critical issue concerns efforts to define threat in terms of static judgments on these dimensions. As we have argued, the *patterns of dynamic change* on the appraisal dimensions (i.e., looming vulnerability) are the defining attributes of threat appraisal, not the static judgments on the dimensions alone.

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Chapter 6
Effects of Moving and Looming Stimuli on Attention, Memory, and Fear Conditioning

Cognitive models of emotion assume that individuals continually scan their environments for stimuli that might influence their goals (Lazarus, 1991; Russell, 2003; Scherer, 2005). Similarly, Clark and Beck (2010) refer to an "Orienting Mode" of threat processing that precedes the activation of other cognitive processes. In short, an individual's appraisals of threat are connected to other cognitive processes. As we will see in this chapter, the LVM posits that people prioritize their attention and memory for stimuli that are dynamic and that may represent rapidly growing threats. In addition, perceptions of the dynamism and movement may be a key factor in the fear conditioning process that lead a person to perceive previously neutral stimuli as threatening.

The Prioritization of Looming Stimuli in Attentional Capture

Attentional Capture in the Visual Domain

Williams James (1950/1890) was one of the first modern theorists to cite the power of visual movement in attentional processes. More specifically, he suggested that "moving things" attract a person's attention (cited in Abrams & Christ, 2003). Since James, numerous studies of movement and attention have been carried out over the last 20 years. Research by Jonides and Yantis found evidence of attentional capture by new visual objects that abruptly appear during the time that a person is doing a different, irrelevant task (Jonides & Yantis, 1988; Yantis & Jonides, 1984, 1990). Subsequent studies carried out by Franconceri and Simons (2003) extended these findings by showing that other dynamic movement in addition to abruptly appearing objects captures attention. They concluded that attentional capture is elicited by moving objects and particularly by looming (*i.e., approaching) objects, but not by receding objects.

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According to Franconceri and Simons' (2003) "behavioral urgency" hypothesis, dynamic stimuli, and particularly looming stimuli, capture attention because they could signal the presence of a source of threat, such as a predator or a flying branch, that requires immediate action to prevent injury or harm. By contrast, receding objects would not have the same motivational significance because they don't tend to require immediate action.

Nonetheless, in a context of potential danger, even receding motion may create an increased sense of behavioral urgency. It can be recalled that a study by Lewis and McBeath (2004) indicates that people appear to have a perceptual bias to "egocentrically" judge directionally ambiguous or even irrelevant motion as approaching (rather than receding). In accord with our present line of reasoning, Skarratt, Cole, and Gellatly (2009) used a visual search task to compare reaction time performance in response to looming and receding objects. Skarratt et al. found that detection times for looming objects were faster than those for both receding and static objects but the detection times for receding objects were still faster than for static objects. Skarratt and colleagues suggested that while both types of motion might have an alerting function, but looming motion appears to benefit from additional attentional prioritization and processing enhancement beyond the effects of motion alone.

Research consistent with a theoretical link between looming stimuli, behavioral urgency, and attention (or hypervigilance) has been reported by many other investigators. For example, in one study, Judd, Sim, Cho, von Muhlenen, and Lleras (2004) created an illusion for participants of looming or receding motion by manipulating how dots on a visual display started moving. Namely, they manipulated whether the dots moved as a coherent group with "looming motion" or "receding motion" coherent group in relation to a core reference location. Judd et al. proposed and found evidence for a "looming cueing effect" on detection times. Reaction times were faster when a target stimulus was to be detected that appeared at the center of dots that started moving as a group with looming motion (i.e., a "looming cueing effect"), as compared to dots that started moving with receding motion. Notably, the effects of looming stimuli on hypervigilance and attentional capture are typically assumed to function at an automatic level of processing. In support of this idea, Judd and colleagues found that the looming cuing effects appeared to influence reaction times of participants with automaticity, independently of conscious awareness.

Automatic processes are widely assumed to operate in a "capacity-free" manner so they are expected to place no demands on a person's limited cognitive resources. A study by Kahan, Colligan, and Wiedman (2011) was carried out to examine these assumptions. They asked participants to view looming or receding stimuli that would serve as orienting cues to signal which of two alternative experimental tasks they would perform. The cognitive load that was put on participants' attentional capacity was manipulated by varying whether the orienting cues were viewed *before* they performed the experimental task or *simultaneously* with the task so as to increase cognitive load by creating multiple attentional demands. The looming cues produced better performance on the experimental task irrespective of when they were presented and thus the results supported the automaticity of the attentional

priority of looming stimuli. In other words, the looming stimuli had an automatic capacity-free advantage over the receding stimuli, regardless of other demands on attentional capacity.

Evidence of the automaticity of the attentional priority of looming stimuli over receding stimuli was also presented in a study by von Mühlenen and Llera (2007). They asked their participants to detect the presence of simple target probes that were placed in dynamic visual arrays of randomly moving dot patterns. At this point, the patterns gradually transformed into either a looming pattern, a receding pattern or stayed the same. The results of the study showed that detection of target probes was faster when they were placed in the middle of the looming arrays but not the receding arrays. Moreover, further results indicated that this attentional advantage was found even when the discrimination task became quite difficult and demanding.

In another study, Doi and Shinohara (2012) manipulated the movement of point light figures to examine attentional capture. Florescent dots were placed on the body of target persons or figures who are videotaped in the dark as they moved. The findings of these researchers aligned well with a behavioral urgency hypothesis for they showed that the human walking movement of an approaching figure was detected faster than receding walking movement. In a more sophisticated test of the importance of motivational significance to the perceiver, the researchers manipulated whether the figures were shown rightside up or upside down. When the figures were shown upside down, there was no detection advantage of the approaching figures over the receding figures.

Additional evidence that aligns well with the behavioral urgency of looming objects comes from another study by Lin, Murray, and Boynton (2009). Their study used a visual search paradigm to compare the effects of objects looming in the direction of the observer (which would signal an impending collision) with looming stimuli on a near-miss path. Results showed that looming stimuli on a near-miss trajectory had quite different effects. While the looming stimuli on a collision path with the observers captured their attention, the looming stimuli on a near-miss path did not. Moreover, just as in the Judd et al. (2004) and other studies, the effects seemed to occur without the participants' perceptual awareness. Lin and collaborators suggested that the visual system is innately set up to be hypervigilant for looming objects. In addition, it is set up to automatically categorize looming threats as threat stimuli and approaching stimuli on a near-miss course as safe.

Evidence consistent with such conclusions was also presented by Parker and Alais (2006) using a binocular rivalry paradigm. In particular, Parker and Alais compared looming and receding stimuli by simultaneously presenting them as separate images to each eye. As expected, the looming stimuli rather than receding stimuli were the dominant image when these were presented as separate images to each eye. Much like the other researchers we have mentioned (e.g., Franconceri, & Simons, 2003; Franconceri, Hollingsworth, & Simons, 2005), Parker and Alais (2006) suggested that stimuli that are expanding and apparently approaching the observer are often prioritized in attention because they are more likely to require immediate action.

As previously noted, an objects' dynamic motion can facilitate attentional capture even if it is not visibly looming (albeit it may do this less than a looming object). In addition, the effects of the object's dynamic kinetic motion on drawing attention may be enhanced when it also has other additional negative features. Bearing on this idea, Ceccarini and Caudek (2013) conducted a study showing that dynamic motion influences the processing advantage for detecting an angry as compared to a happy face in the crowd (the "anger superiority effect" or ASE). Other research using static images of faces had previously yielded equivocal results. Their study showed in five experiments that the ASE is obtained when using dynamic images of realistic human faces, but not when using static faces. Thus, they showed a processing advantage for detecting a dynamic threatening social stimulus but not one that is identical but static.

Also bearing on this idea, Carretié et al. (2009) showed participants negative (spiders and cockroaches) or neutral (butterflies or ladybugs) distractor stimuli while they performed on a digit categorization task (judging whether the second and fourth digits were the same or different in 4-digit displays). The distractors were either static or moved across a computer screen. As they predicted, Carretié et al. found that the moving negative distractors not only produced the longest reaction times in the digit categorization task, but also elicited the highest amplitudes in the P1 component of the ERPs which are closely associated with attentional capture. The results of this research suggested that motion supplies additional salience to threatening information that facilitates attentional capture.

In a study that in some ways parallels that of Carretié et al. (2009), Simons, Detenber, Roedema, and Reiss (1999) examined heart rate response to kinetic, moving as opposed to static images of emotion-arousing pictures. A pattern of decelerator heart rate response was found to the moving images, indicating that the moving images engaged sustained attention. In discussing their results, Simons et al. cited the results of a study by Reeves et al. (1985), who found that motion on a filmed screen is associated with higher levels of cortical arousal as assessed by alpha frequency on EEG recordings. In explaining their findings, Simons et al. (1999) emphasized an important idea that might account for the effects of motion on attention. Specifically, they stated that "motion continually presents new information to viewers, and thereby may hold their attention once it has been captured."

In another study, Basanovic, Dean, Riskind, and MacLeod (2017) attempted to specifically examine the effects of looming, approach movement on fear-linked attentional vigilance to spider stimuli. Attentional vigilance was assessed by showing the participants spiders and butterflies that displayed either approaching movement toward the viewer or receding movement from the viewer. The study found a fear-linked attentional vigilance to spider stimuli, but this only emerged only under receding stimulus movement conditions. When spider images displayed receding movement, the spider fearful participants displayed more heightened attentional vigilance than the lower spider fearful participants. However, no difference emerged in the approaching stimulus conditions.

We would expect that most individuals have a tendency to become more hypervigilant to spiders moving toward them. However, spider fearful individuals are

more generally primed than less spider fearful individuals to expect spiders to approach. This can lead to a more general tendency toward hypervigilance for any spider movement than individuals with lower spider fears.

Taken together, there is considerable evidence that the visual system prioritizes moving and especially approaching stimuli for attention. Moreover, the visual system is obviously one of the most import sensory systems for detecting rapid dynamic gains in potential threats.

Auditory and Tactile Looming Perception

In addition to the visual system, individuals can also detect the dynamism and rapid dynamic gains by potential looming threats by using the auditory and tactile systems. Despite a dearth of relevant studies in these modalities, their results support the enhanced attentional capture and behavioral urgency associated with looming stimuli. In one study, McCarthy and Olsen (2017) used an auditory spatial localization task and found that looming sounds that rose continuously in intensity were localized faster and more accurately than receding sounds that decreased in intensity. Thus, looming sounds captured attention more quickly than the receding sounds. While not directly examining attentional capture, another study by Bach et al. (2008) also supports the behavioral urgency of rapid dynamic gains in the intensity of auditory stimuli. As we saw previously, Bach et al. found that rapid dynamic gains in sound intensity have warning properties at both the implicit psychophysiological level and the explicit level in terms of listener's reported arousal and emotions.

For another example, Meng, Gray, Ho, Ahtamad, and Spence (2015) examined the effects of looming stimuli in the tactile modality. In particular, they used a simulated "car-following task" in order to examine whether vibrotactile warning signals that move toward the body have promise for the design of future car-collision-warning systems. Reaction times for breaking on the simulated car on this task were found to be significantly faster for toward torso as compared to away from torso cues.

In another study in the tactile modality, Cabe (2011) blindfolded participants in an experimental task and then examined their responses to tactile sensations of looming. Sensations of looming stimuli were created by varying the forces on a weighted string held taut by the participant's finger or a handheld rod or ring. As expected, the participants used haptic information in inferences about relative spatial position and object movement.

The key point is that empirical evidence on multiple sensory modalities has convincingly corroborated that moving and looming stimuli are prioritized by the attentional system. Furthermore, this evidence strongly indicates that looming stimuli represent warning signals and are automatically prioritized because of their greater motivational significance and behavioral urgency.

Dynamic Movement and Memory

The LVM theoretically expects that dynamic, moving, and looming stimuli have priority in memory over static stimuli. One reason for their priority is that they may require behaviorally urgent action. Coupled with this, the dynamism of moving and looming stimuli makes them more vivid and apt to capture attention. A memory advantage should thus be expected for dynamic stimuli because information tends to be better remembered when it has been attended more intensely (Anderson et al., 2000).

Consistent with these theoretical expectations, ample evidence has been found that movement serves to enhance memory. In one early study, Lewis (1975) showed participants footage from video clips of motion pictures of real-world scenes or animated cartoons as compared to pictures from the same real-world scenes or animated cartoons that were unmoving and still, during 15-s exposure periods. Participants had greater recall for both types of moving stimuli, as well as for large stimuli, than for unmoving or small stimuli. In another study, Goldstein, Chance, Hoisington, and Buescher (1982) asked participants to study film clips or still-images taken from those clips and administered a recognition memory test a few minutes later. Recognition memory was significantly better if the pictures were presented in a dynamic mode and then seen later in a dynamic mode in a recognition task.

Two subsequent studies by Matthews, Benjamin, and Osbourne (2007) extended the foregoing findings by examining whether these effects are temporary or might be longer enduring. They presented participants with moving and static scenes of equal duration drawn from a wide variety of sources. After this, they tested recognition memory at intervals ranging from 3 days to 1 month. Rather strikingly, the advantages of moving scenes over static scenes were evident over the whole 1-month period of the study. Furthermore, this recognition memory advantage was independent of psychophysical characteristics such as the color of the stimuli (or their chromaticity).

It should be noted that Matthews et al. (2007) also compared recognition memory for moving scenes with memory in a "multistatic" condition which presented single static frames drawn from regular intervals in the moving clips in succession. This condition was included to rule out the possibility that the moving scenes were better recognized simply because they offered more static views and not because they were dynamic. Importantly, the results indicated that the advantage for the moving scenes was not wholly due to there being more static views in the dynamic scenes. Memory for the multistatic stimuli was the same as for single static images. Hence, as in other research (Pike, Kemp, Towell, & Phillips, 1997), their findings indicated that the dynamism and *fluid motion* in the images seems to be critical to the memory advantages of moving stimuli; it is not just that moving images simply contain more static information.

In another experiment, Buratto, Matthews, and Lamberts (2009) examined recognition memory by crossing the mode of presentation in the initial study phase

(static, multistatic, moving) with the mode of presentation of the stimuli at a subsequent test phase (static, multistatic, moving). They found that the overall recognition rates were higher for scenes that had been presented as moving rather than static or multistatic in the study phase. However, movement at the time of recognition seemed to have less effect on the memory advantage for moving scenes.

Research on the effects of image movement on memory for human faces has presented similar evidence for the advantages of dynamic stimuli. In this regard, Lander, Christie, and Bruce (1999, p. 974) noted that prior research on facial recognition had primarily relied on static stimuli and had given little consideration to the role of movement. Nonetheless, as they stated: "Faces in the real world tend to be viewed in motion." Lander et al. (1999) designed their study to examine whether moving images of famous people were remembered better than static images of the sample people on a recognition memory task. To this end, Landers and colleagues presented images of moving and static faces to participants under several different conditions. In addition to moving images of faces, they presented some images as (1) photographic negatives (as in a film negative), (2) inverted (upside down), or (3) as out of their order in a sequence. Their findings supported that moving faces were better recognized than static ones under all conditions.

Like other investigators, Landers and colleagues suggested that the recognition memory advantages of moving faces could not be explained by the possibility that they contained more static information (more different views and face expressions than a single static view of the face). Their results indicated that the dynamic motion of the faces seemed to increase recognition of the faces, even when the amount of static information was equated in moving and static faces. The key point, they suggested, was that the "dynamics of the motion" provided unique additional information that facilitated face recognition. Of further note, these findings were obtained even when participants did not necessarily remember where the target persons were seen or what they were doing.

In another study, Weyers, Mühlberger, Hefele, and Pauli (2006) examined recognition memory for an avatar's static and dynamic morphs (e.g., a face developing from neutral to happy or angry) that were presented for 1 s each. Consistent with other studies we have described, Weyers et al. showed that dynamic expressions led to better recognition rates. Furthermore, the dynamic expression rates were rated by participants as more intense and realistic.

Other data demonstrating the importance of the dynamism of stimuli on recognition memory has found in studies using the "point light" technique (Johansson, 1973). As previously described, these studies use a procedure in which florescent dots are placed on the face or body of target persons who are videotaped in the dark as they move. These studies have provided evidence that people can discriminate the resulting points of light as faces, and distinguish between facial expressions and gender, as well as better identify the specific actor in different clips.

In one such study, Schiff, Banka, and de Bordes Galdi (1986) examined recognition memory for stimulus persons who had been seen in a dynamic video of a holdup at a liquor store, or static shots from the same video. Participants were better in recognizing individuals that had been seen in the dynamic videotape, rather than

static shots from the videotape. Similarly, Roark, O'Toole, Abdi, and Barrett (2006) found that observers were better at recognizing individuals in whole body videos when they had been seen in videos showing dynamic facial speech rather than static shots from the scene videos.

Other research indicates that infants as well as adults prioritize dynamic information in memory. For example, a study by Otsuka et al. (2009) found evidence that 3–4-month-old infants exhibited better recognition memory of previously unfamiliar faces that they learned in a moving condition than in a static condition. Indeed, the infants in the moving condition could successfully recognize moving faces in one-third of the time (30 s vs. 90 s) that they required when viewing the same images of faces learned in a static condition. Moreover, just as in studies with adults, a multistatic condition did not provide the same benefit as moving images.

Of note, research has also begun to examine the specific effects of the looming or approaching movement of objects on memory processes. In a set of experiments, Pilz, Vuong, Bülthoff, and Thornton (2011) investigated whether approach movement leads to better recognition memory of faces than does receding movement. To examine whether this type of motion enhances face processing, Pilz et al. placed a number of different 3-dimensional models of heads on identical 3-dimensional body models. These models were animated to approach the perceiver, recede (walk away), or remain still. Consistent with theoretical expectations regarding greater motivational significance of approaching stimuli, the participants were faster in recognizing faces when they had been learned in the context of approaching motion than receding motion. In subsequent experiments, similar evidence was found when participants were shown moving or static avatars and then asked to search for target faces in the midst of static arrays. Echoing the explanations of researchers studying attentional processes, Pilz and collaborators (2011) suggested that the visual system may have special mechanisms that facilitate the encoding of dynamic, approaching objects that are highly behaviorally relevant.

Using a representational momentum paradigm, Greenstein, Franklin, Martins, Sewack, and Meier (2016) recently examined memory for dynamic scenes which were either threatening or nonthreatening. They presented participants with visually neutral dynamic stimuli (e.g., ambiguous scenes from video surveillance) and manipulated threat conceptually with verbal descriptions of the scenes. For example, in one scenario, a visually neutral scene of a person carrying a frying pan was described as a person bringing the frying pan to a friend, or as approaching another person to do harm. Participants in both the threatening and nonthreatening descriptions remembered the final scenes as displaced forward ahead of the final scenes they had actually seen. However, this representational momentum effect was stronger for the scenarios in the threat conditions. Greenstein et al. suggested that the increased representational momentum effects for threat could serve the function of increasing people's "ability to predict, and thereby evade, a moving threat" (p. 663).

In research on a closely related topic, Nairne, Vanarsdall, Pandeirada, Cogdill, and Lebreton (2013) examined the impact of animacy on memory. As was seen, dynamism and object movement appear to be critical cues for animacy (see Chap. 5). Nairne et al. tested the hypothesis that animacy is an important mneumonic dimension because of the fact that "distinguishing between living (animate) and

nonliving things is essential for survival and successful reproduction." Results of Nairne et al.'s two studies showed that words that are high in animacy are better remembered. Moreover, the memory advantage of animate words remained even when they were equated with inanimate words along other mnemonically relevant dimensions (e.g., imageability).

In sum, a compelling body of evidence has accumulated that has indicated that dynamically moving and looming stimuli are advantaged in memory, just like they are in attentional capture. Moreover, these attentional and memory advantages appear to be innate because they are found in infants as well as adults.

Moving and Looming Stimuli and Fear Acquisition

In this final section, we present evidence that the advantages of dynamic stimuli on attention and memory also extend to the phenomenon of fear conditioning. The LVM theorizes that the dynamism and movement of stimuli should affect the readiness with which they can be conditioned to fear (Riskind, 1997). It can be noted that Carr (1969) suggested more than three decades ago that the animate nature of fear-relevant stimuli such as spiders or snakes distinguished them from other stimuli and is a "controlling variable" that mediates the importance of these stimuli in phobias. In a similar vein, Thorndike suggested even earlier than this that infants are more predisposed to manifest fear to objects that wiggle and contort themselves than to objects that are motionless stimuli (Thorndike, as cited in Seligman, 1971, p. 410). In a similar vein, McNally and Steketee (1985) reported evidence from retrospective interviews with animal phobics that fear-stimulus movement often played a role in fear acquisition. Such observations should hardly come as a surprise, given the presumed evolutionary function of fear conditioning is to increase the chances of survival against dynamic enemies and predators. The LVM posits that due to the association between movement and predation risk, the fear conditioning process is mediated, at least in part, by the perceived (or imagined) movement of the to-be-conditioned stimuli. To loosely paraphrase what James said, the LVM expects that "moving things" are more readily fear conditioned.

Somewhat surprisingly, there has been a dearth of attention to the effects of movement and the dynamic attributes of stimuli on conditioning. In our search of the literature, we found that the only study to even approach this question was done on aversive conditioning in minnows. Consistent with what we would expect, Wisenden and Harter (2001) hypothesized that object motion is a "particularly reliable indicator of predator identity that would be likely to affect aversive conditioning." They offered the explanation that object motion might be one of the few stimulus properties that a minnow might discern in the immediate environment that would be likely to indicate predation risk.

In Wisenden and Harter's (2001) study, a procedure was used in which chemical alarm signals were introduced into water tanks containing fathead minnows, who were exposed to one of two stimulus objects. One of the objects was a rod that resembled a natural predator of the minnows (a pike), and the other was a black

disk. Critically, for some of the minnows, the rod or the disk was moving, while the remaining minnows the objects were static and stationary.

As Wisenden and Harter (2001) reported: "After a single conditioning trial, in which chemical alarm cues were paired with the stimulus objects, minnows associated risk (as indicated by defensive antipredator responses) significantly more with the previously moving object than the previously stationary object." In a dramatic contrast, the shape of the object (a disk as opposed to a natural predator), as opposed to the objects' movement, had no significant effect on aversive conditioning.

Wisenden and Harter's (2001) interpretations of their findings fit well with the LVM:

> "To eat, predators must approach, grasp, handle and swallow prey. Even predators that remain stationary while in ambush must engage in motion during a predation event. Motion, and not shape per se, is thus a predictable and reliable component of predation and may serve as an immediate releaser of learned risk association" (p. 363).

To our best knowledge, no other animal or human research seems to have examined the impact of object movement or the dynamism of objects in fear conditioning. However, a study by Arntz, Van Eck, and de Jong (1992) is germane to this topic. Arntz and colleagues examined the effects of unpredictable, sudden increases in painful stimulation on levels of acquired fear to a warning signal (or UCS). To this end, they test this, the administered 17 moderately painful shocks to participants, which alternated with three stronger unpredictable, sudden shocks to the warning signal. By contrast, the participants in a control condition received shocks of constant (or unchanging) and predictable intensity. The participants receiving trials with dynamic increases in intensity exhibited higher levels of conditioned subjective fear ratings, skin conductance responses, as well as heart rate acceleration and respiration to the warning signal, relative to participants who received shocks of constant (or unchanging) intensity.

The LVM would expect that sudden *increases* in shock intensity are easier to extrapolate to the expectation that severe harm will occur than static levels of shock. However, a limitation of the study for testing this is that the Arntz et al. study (1992) did not include a constant-high intensity shock condition.

Despite the paucity of evidence regarding the role of dynamic attributes such as object motion on fear conditioning, further research seems warranted. Dynamic stimuli are more lifelike and ecologically relevant. Thus, future research on conditioning with dynamic stimuli would likely benefit the advancement of understanding of fear conditioning processes.

The Impact of Approach Movement and Dynamic Change on Habituation

Riskind (1997) further postulated that static stimuli are easier to habituate, and that movement and other dynamic parameters should often impede habituation and the unlearning of fear. For example, it could be expected that a spider phobic would

habituate more readily to a static slide of a spider than to a video clip of a moving spider—and particularly to a spider that is moving physically closer (or looming) to the viewer.

Research on psychological stress lends support to this idea because it has indicated that the anxiety responses that individuals have to threats that seem unvarying (static and constant) tend to habituate and diminish with time (Lazarus & Folkman, 1984; for a review, see Paterson & Neufeld, 1987). Moreover, the ease that a person might have in habituating to static threats would also be consistent with expectations derived from Helson's (1964) adaptation level model (see Chaps. 3 and 5), which assumes that individuals tend to quickly become accustomed to stimuli unless they change and intensify. From a different theoretical vantage point, individuals would be likely to find it easier to find ways to cope with threats that do not vary or are slow to change.

With just one notable exception, researchers studying desensitization and exposure have devoted surprisingly little attention to the role of stimulus movement. A study by Dorfan and Woody was designed to explicitly test these predictions of the LVM. In their study drops of sterilized urine were placed on the arms of college student participants who were assigned to one of three kinds of mental imagery conditions. Specifically, the participants were instructed to visualize germs as moving and spreading (moving around on their bodies), as static (i.e., they visualized urine drops as motionless on the original site of contamination), or as safe (i.e., it contains no harmful germs). Results indicated that the use of the moving imagery sensitized distress during a 30-min exposure, whereas the static and safety imagery reduced distress. In other words, exposure failed to reduce distress for the participants in the moving harm condition and they actually became more sensitized to the urine drops.

Several important implications are suggested by Dorfan and Woody's (2006) dramatic findings. In accord with Riskind's (1997) predictions, moving dynamic threats may often impede habituation. If so, using mental imagery instructions or other means (see "looming reduction strategies" in Chap. 15) to reduce the perceived or imagined dynamism of threats might potentially help to expedite habituation. A caveat, however, is that habituation to a static stimulus (such as a static spider image) may not protect a person from a return of fear when a dynamic stimulus (e.g., a moving spider) is encountered in real life. Thus, it may be necessary to augment initial habituation to a static threat stimulus with exposure to more dynamic versions of the threat stimulus to promote generalization and reduce a return of fear.

Overall Summary and Conclusions

The evidence presented in this chapter demonstrates that the dynamism of moving objects—and particularly looming objects—is prioritized in attentional capture and recognition memory. Moreover, this prioritization is apparently both automatic and innate and has been repeatedly demonstrated in infants as well as adults using a variety of methodologies. A great deal more research is needed to ascertain the role of dynamism and movement of objects in fear conditioning and desensitization.

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Chapter 7
Experimental Studies Confirming the Emotional Impact of Dynamic Movement and Looming Manipulations

The looming vulnerability model (LVM) expects that a person's perceptions and simulations of rapid gains by dynamic growing threats have powerful effects on affective responses. It isn't only the potential threat stimulus that influences affect but the dynamics of the motion of the threat and its rapid gains that also profoundly affects how the person emotionally responds. We presented a small amount of this evidence from studies using experimental designs in Chap. 5. We will now present a much more extensive body of literature that supports these expectations of the LVM. This evidence includes two broad classes of studies. These include: (1) a few studies in which the dynamism and movement of stimuli was varied in ways that did not directly menace or approach the perceiver and (2) studies that have manipulated such perceptions in ways that could directly menace or approach the perceiver.

Ambiguous Dynamic Motion Amplifies Perceived Threat

As we saw, Lewis and McBeath (2004) demonstrated that individuals have a general perceptual bias to judge directionally ambiguous motion as approaching rather than receding. Thus, any perceived dynamic change or movement can potentially increase threat because people have a self-centered bias to perceive ambiguous movement as approach movement.

Clinical Analogue Studies

In one of the earliest set of studies to compare the effects of moving versus static stimuli on danger appraisal and anxiety, Riskind and Wahl (1992) asked college students to read hypothetical vignettes about target persons (or characters) who were either psychiatrically ill strangers "on leave from the hospital" or

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nonthreatening target characters (e.g., an ordinary person in Study 1, and a professional clown in Study 2). They used a procedure in which participants were instructed to imagine encountering the target persons in public places such as standing in lines ahead of them at fast food restaurants or while waiting in line to buy tickets at the cinema. As they pointed out, it has been previously found that "active" is one of the most common descriptors applicable to mentally ill characters in prime-time television (Wahl & Roth, 1982), along with "threatening" and "dangerous" (Gerbner, 1980; Wahl & Roth, 1982). Moreover, when others are portrayed as mentally ill, they are not only widely feared as physically dangerous but often artistically depicted in active poses with muscular tension (implying high potential for movement), so that activity and movement are characteristic elements of classical depictions of madness (Gilman, 1982).

In the "Active" condition in Riskind and Wahl's (1992) studies, the target person's movement was varied in a way that did not obviously directly threaten a perceiver. For example, the person in a fast food restaurant was described as "tapping her fingers on the table and moving her legs around energetically under the table" while she ate. In the "Inactive" condition, "her hands and fingers are resting on the table and her mouth barely moves as she eats. Her legs are inactive and motionless under the table." Consistent with predictions, Riskind and Wahl's (1992) results indicated that the psychiatrically ill patients in the vignettes were rated as far more threatening and fear-provoking to the extent that they exhibited cues of dynamic activity and rapid movement. In addition, the more active characters were generally more feared than inactive ones overall, but the fear inducing effects of movement were far stronger when the target persons were psychiatrically ill patients rather than nonthreatening target characters.

A related study reported by Riskind (1997) asked college students to read hypothetical vignettes in which potential threats were described as either exhibiting dynamism and kinetic activity or movement or were described in static terms. In one dynamically described situation, for example, germs were described as moving around on a microscope slide; as another example, a wasp on the inside-and-on the back window of one's car (while one was driving) was described as wiggling its wings; in another vignette, a somewhat frightening stranger in an elevator late at night was shifting around on his feet. These dynamic scenarios were compared to matched static control situations in which the germs, wasp, and stranger in the elevator were motionless. As expected, results indicated that the participants' danger appraisals (e.g., estimated probability of harm, unpredictability, personal lack of control, behavioral urgency, and need for vigilance) and their reported anxiety were greatest after they read the dynamic as compared to the static versions of the vignettes.

Another study conducted by Courtney, Dawson, Schell, Iyer, and Parsons (2010) collected data from self-report as well as physiological measures to compare the effects of computer-generated kinetically moving as opposed to static images of snakes and spiders. A further aspect of their study was that they examined participants who feared snakes but not spiders or vice versa. Their study found that the fear-relevant stimuli and particularly those that were moving in videos elicited greater physiological reactions (heart rate acceleration, skin conductance, and star-

tle eyeblink responses) indicative of anxiety and self-protective responding as well as self-reports of arousal. As would be expected, high fear individuals also had stronger physiological reactions than low fear individuals when presented with static images of fear-relevant stimuli, but these effects were smaller than those for moving images.

Other Studies of Affect

Simons and Detenber and colleagues have presented somewhat similar evidence on the effects of kinetic image motion on affect response to emotion-arousing pictures (Detenber, Simons, & Bennett Jr., 1998; Simons, Detenber, Reiss, & Shults, 2000; Simons, Detenber, Roedema, & Reiss, 1999). Their studies have shown that emotion-arousing pictures that move horizontally or vertically on a screen have emotionally arousing effects that are more intense than the same pictures that remain static. For example, in one study, Simons and his colleagues used images selected from the International Affective Picture System (Center for the Study of Emotion and Attention, 1997) to represent a range of categories of emotion and arousal ratings. They showed that moving pictures produce more arousal than static pictures assessed by self-report and with physiological indices such as skin conductance responses. More precisely, when the images contained motion, this was found to make the participants' responses to negative images (e.g., a crying face, a body) more negative as well as arousing, and their responses to positive images (e.g., nature scenes, a smiling baby) more positive and arousing.

Studies Manipulating Perceived Approach Movement

A considerable number of experimental studies have also examined the emotional impact of a person's perceptions that negative (or positive) stimuli are making rapid gains and approaching. These studies more directly address the impact of perceptions of rapid dynamic gains by approaching threat, since they manipulated the movement direction of threats or affective stimuli (toward or away from the perceiver). First, we examine clinical analogue studies, then examine other studies of approach movement and affect.

Spider and Social Phobia Analogue Studies

In one early study, Riskind, Kelly, Harman, Moore, and Gaines (1992) asked participants to view footage from a series of film clips of different animals with different types of motion and then rate their feelings of anxiety and perceptions of threat

when they viewed these. Each of the film clips they were shown contained an animal (either a tarantula or a rabbit) that was either approaching, motionless, or moving away. As theoretically expected, the film clips of the approaching tarantulas were rated as far more anxiety-provoking and threatening by participants than those of controlled-movement static tarantulas or those that were moving away. Consistent with the predictions, if the tarantulas showed any movement at all—even receding movement—they were more threatening than if they were still and motionless. No such differences for the movement manipulation were found for the rabbits. In support of another important prediction, it was found that all of the preceding findings were significantly stronger for individuals who had the highest levels of spider fear than for those with lower spider fear.

In a subsequent follow-up study, Riskind and Maddux (1993) presented participants with the same film clips of tarantulas, but not of rabbits. Aside from this difference, the chief new element of the study is that the film clips were presented under two different self-efficacy conditions. In both conditions, the participants were asked to imagine themselves sitting in a chair while in the room with the tarantulas they were viewing on the film clips. However, the participants were then randomly assigned to the self-efficacy conditions. In a *high self-efficacy* condition, they were asked to imagine that the door to the room was open while they were sitting in the chair with a rolled-up newspaper in their laps; in the *low self-efficacy* condition, they were asked to imagine that the door was closed while they were sitting in the chair with no newspaper. Just as predicted, the high self-efficacy and movement manipulations interacted and moderated each other's effects: the high self-efficacy instructions had a significant effect in decreasing the participants' anxiety ratings, but this only emerged when film clips showed tarantulas with approaching movement. However, the self-efficacy instructions had minimal impact on anxiety ratings when film clips showed tarantulas that were stationary or moving away. Thus, the findings indicated that self-efficacy expectations will primarily be helpful in reducing a person's anxiety when he/she perceives a threat as dynamically growing. Conversely, self-efficacy expectations are not that useful when an approaching threat is not salient to the person.

Viewed from a different perspective, Riskind and Maddux's (1993) data showed that participants who viewed the footage of approaching tarantulas only reported more anxiety than those who viewed the footage of the stationary or receding tarantulas when they received low self-efficacy instructions. However, the approach movement in the video clips had no effect on anxiety in the high self-efficacy condition. Thus, these findings support the idea (see Chap. 4) that when individuals have a strong sense of control, this can mitigate the impact of approach movement on their anxiety.

As we saw in Chap. 5, a person's perceptions of the dynamics of the motion and rapid dynamic gains threat (i.e., its approach movement) contribute additional incremental variance to the prediction of his or her anxiety. That is, they predict anxiety beyond the effects explained by the absolute levels of proximity or probability of encountering the threat at any given moment. In their fMRI study, Mobbs et al. (2010) instructed participants to put their feet into a covered apparatus or

"imminence box" that was said to contain a live tarantula that they could see on a monitor screen facing them. By means of this ruse, they were able to show the participants prerecorded film clips of tarantulas that appeared to be (1) moving toward or away from their own feet and (2) placed at closer or more distant relative positions to their feet. Mobbs et al.'s (2010) findings on a self-report measure of fear were consistent with the Riskind studies (Riskind et al., 1992; Riskind & Maddux, 1993) and indicated that approaching tarantulas induced greater fear than ones that were receding. Importantly, they demonstrated that manipulated tarantula movement toward the viewers elicited different fMRI responses than movement away from the viewers, even when controlling for the apparent proximity of the tarantulas to the participants' feet.

Thus, Mobbs et al.'s (2010) findings demonstrated that a person's perceptions of rapid dynamic gains and approach movement in threat make unique contributions to fear and neural defense systems that are distinct from those of mere proximity alone.

In another phobia analogue study, Haikal and Hong (2010) examined the effects of a manipulation of "temporal looming" on social anxiety. In this case, all participants were told they had a short time to prepare for a videotaped speech they would give about themselves. Meanwhile, some of the participants were assigned to a temporal looming condition (where a "count-down" clock was prominently displayed showing the time that remained before their videotape), whereas the other participants had no such clock. The temporal looming condition, in which the count-down clock was shown, was found to heighten two social anxiety-related illusions. Namely, the temporal looming condition heightened the "illusion of transparency" (that one's internal sensations are transparent to other people) and the "spotlight effect" (that others notice and remember one's behaviors when they don't).

Spread of Contamination Analogue Studies

A cluster of analogue studies that pertain to contamination fear also support the impact of perceptions of rapid gains by potential threats. Riskind, Wheeler, and Picerno (1997) examined whether mental imagery to "freeze" or slow down the rate at which threats can advance can reduce fears of contamination and avoidance behavior among individuals with subclinical obsessional symptoms. Male college student participants were shown a film clip of a men's room in a campus building which was made by the experimenters to look dirty and contaminated (e.g., dirty paper towels were on the floor). Participants who were in a "freeze" condition were asked to imagine that contaminants were "frozen" in place and unable to move, whereas those in a "loom" condition were instructed to imagine the contamination as moving and spreading. The effects of this manipulation were assessed with both verbal reports and unobtrusive measures (e.g., did the participants take cookies placed near a garbage can after the study). The findings of this study suggested that the "freeze" imagery appeared to reduce fear and avoidance for the participants who had higher scores

on the Padua fear of contamination scale, and particularly for the participants with relatively higher levels of imagination. Somewhat paradoxically, however, the freeze imagery appeared to increase the fear of participants with low scores on the Padua fear of contamination scale. The explanation offered for these findings were interpreted as suggesting that participants with low contamination fears don't tend to spontaneously imagine dynamic experiences with germs and contaminants. Thus, the "freeze" imagery may have been sensitized them to the possibility of the germs the dynamism which didn't normally even occur to them.

As we previously saw, Dorfin and Woody (2006) also used guided mental imagery instructions in another more involved analogue study to test the LVM. College student participants had a drop of sterilized urine placed on the bodies, and then given one of three different sets of experimental imagery instructions. In the "Spread" condition, they were asked to imagine that the urine was spreading and moving on their bodies to produce increasing levels of bodily contact with the urine. In the "Static" condition, they were asked to imagine that the urine drops were dangerous but motionless. Finally, in the "Safety" condition, they were asked to imagine that the sterilized urine drops were entirely safe. In line with the LVM, the "spreading contamination" imagery was found to elicit significantly higher ratings of distress and fear as well as appraisals of danger in danger cognitions than did the other imagery conditions. Moreover, as previously noted, the spreading contamination imagery impeded habituation to the presence of the urine during a 30-min exposure period.

Other Studies of Affect: Approach Aversion Effects

In their eight studies on the approach aversion effect (see Chap. 5), Hsee, Tu, Lu, and Ruan (2014) demonstrated that there appears to be a general tendency for individuals to respond with more negative feelings to a variety of social stimuli (e.g., letters of the alphabet, emoticons, the possible visit of a distant relative) when these are approaching rather than static or moving further away. For example, in one typical study, the participants rated their feelings about emoticons (icons of faces) that were either negative, neutral or positive. The results showed that feelings about the emoticons were more negative when they were approaching, and this was irrespective of whether the emoticons expressed negative, neutral, or positive emotions. Crucially, when the social stimuli were approaching (moving closer in time, space, or probability), they elicited more negative feelings than they did if they were statically near (constant in proximity). Thus, the effects of perceiving dynamic gains in potential threats weren't limited to physical movement in space but were seen for movement in time and probabilities.

In another study, Hsee et al. (2014) asked participants to imagine that a distant cousin living a different city was going to visit their city for a week for personal business and had asked if she could stay with them and that they had consented without giving it much thought. In a "neutral" condition, participants were asked to imagine that they overall had neutral feelings about the cousin and her stay. In a

positive condition, participants were asked to imagine that they had mixed feelings, but that they overall liked the cousin and looked forward to her stay. In a negative condition, they were asked to imagine that they had mixed feelings but that overall they disliked the cousin and dreaded her visit.

Participants were then told that the cousin might visit on the next day and stay with them for a week, but that the chances she would come depended on whether she could get airline tickets. The results revealed that when the likelihood of the visit loomed closer (the probability of her finding a ticket increased), the participants felt more negatively than those in a static-near condition (in which the likelihood was always high), and those in the static-far condition (in which the likelihood was always low). Thus, the findings of the study indicated that what produced the "probabilistic approach aversion effect" was not static probability but rather the "movement in probability" that a social event would arrive.

The "approach aversion" hypothesis of Hsee et al.'s (2014) studies and their findings suggest that the approach of even positive stimuli can elicit more negative (or less positive) feelings. Nevertheless, even ambiguous or unfamiliar positive social stimuli can have potential risks. We suggest that the approach of threats (ambiguous or not) is more likely to produce negative feelings than unambiguously positive and familiar social stimuli or events.

Effects of Perceived and Imagined Approach Movement on Reactions to Affectively Charged Pictures

Other studies have demonstrated that individuals react differently to affective stimuli from the International Affect Picture System (Center for the Study of Emotion and Attention, 1997) depending on whether they are presented as moving toward or away from them. In one set of studies, Mühlberger, Neumann, Wieser, and Pauli (2008) manipulated the movement direction of pictures with different content (pleasant, neutral, or unpleasant) by changing their pixel size, creating the illusion that the pictures were approaching, receding, or resting constant size. The participants rated their emotional reactions to the stimuli after they were presented. The results of these studies generally fit with those of the other studies we have reviewed. They found that participants reacted more negatively to unpleasant pictures that were presented as moving toward them than they did to the same pictures when they were presented as moving further away or as static. In contrast, the movement direction of neutral or pleasant stimuli had no significant effects. Thus, these findings resembled those of Riskind et al. (1992) who showed that approach movement did not produce a more negative reaction to non-negative or innocuous stimuli (i.e., a rabbit, as opposed to a tarantula in the Riskind et al. study).

In one of the studies, Mühlberger et al. (2008) examined how the movement of pictures toward the participants affected their startle responses. Negative affect states such as fear have been found to potentiate startle reactions to suddenly appearing negative stimuli (Bradley, Codispoti, Cuthbert, & Lang, 2001). In line with

expectations, when negative pictures moved toward the observers this enhanced their startle reactions as compared to when the negative pictures moved away from the observers or were static. No such enhancement of startle responses by approach movement was found for positive and neutral pictures.

Significant effects of perceived rapid gains and approach movement on emotional reactions have also emerged when participants are simply instructed to imagine affective stimuli as moving closer or moving further away. Davis, Gross, and Ochsner (2011) gave participants practice using their imagination to manipulate the movement direction (movement-toward or movement-away) of the same kinds of pictures as in Mühlberger et al. (2008) by simply using their minds rather than actually moving the pictures. Participants rated their reactions to unpleasant pictures (e.g., a dead body) as far more negative when asked to mentally visualize the negative pictures as moving closer and becoming larger as compared to when they were asked to visualize them as static (staying constant) or as moving away from them.

Auditory Looming

Consistent with the prior work we have just presented, another line of studies of auditory looming effects on affective reactions have also produced results that are in line with the LVM. In one set of studies, Tajadura-Jiménez, Väljamäe, Asutay, and Västfjäll (2010) examined the impact of auditory looming cues on reactions to unpleasant versus pleasant and neutral pictures. Participants heard tones that rose or fell in intensity level to test the prediction that the participants would automatically code approaching sound sources as potentially threatening events. In line with the LVM, the results of these experiments showed that an approaching as compared to a receding sound direction produced faster reaction times, and this effect was far stronger for unpleasant stimuli than for pleasant or neutral pictures. Tajadura-Jiménez explained the asymmetry in these effects by suggesting that the perception of approaching sound sources might be closely linked to the activation of defensive behaviors, consistent with our premise that approaching stimuli are often seen as more behaviorally urgent and even inherently threatening.

In other studies of auditory looming, Bach, Neuhoff, Perrig, and Seifritz (2009) found a variety of evidence confirming that acoustic cues that rise in intensity have strong emotional impact and apparently serve as implicit warning signals. Participants were asked to listen on headphones to approaching sounds that were rising in intensity and receding sounds that were falling in intensity. Bach and his collaborators found that approaching sounds elicited more negative reactions on both explicit self-report and implicit physiological measures. Specifically, participants rated the approaching sounds as more unpleasant, strong, intense, and arousing than the receding sounds. In addition, they rated the subjective probability that an approaching sound signaled a forthcoming threat as far higher they did for a receding sound. Additional data from the more implicit psychophysiological measures confirmed that the approaching as opposed to the receding sounds elicited

more pronounced skin conductance responses, phasic alertness, and ratings of loudness change.

Overall Summary and Conclusions

To conclude, research has provided abundant support for the hypothesis that anxiety and negative emotional reactions are higher to negative or threatening stimuli that are perceived as dynamically and rapidly gaining and approaching, as compared to those same stimuli when they are seen as static (constant) or moving further away (or receding). Indeed, under conditions of uncertainty, even ostensibly positive stimuli (e.g., smiling emoticons) can produce more aversive reactions. These findings provide ample evidence for the assumption that the state elicitations of perceptions of looming vulnerability by objective experimental manipulations dramatically affect emotional reactions.

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Chapter 8
Introduction to Looming Cognitive Style: Construct and Measurement

Now I moved like a man pursued—pursued by the clock, by the ghastly advance of numbers. The earth turned, inexorably, the hour was approaching.

—Umberto Eco (1989), Foucault's Pendulum

The above passage from Umberto Eco's novel appears to aptly capture the anxious person's phenomenological sense of behavioral urgency and looming vulnerability to threat(s). The person's anxiety derives from the gains and increases in approaching threat and not the level of threat values alone. The person perceives and imagines rapid gains by a dynamically growing threat that he/she believes are leading to a behaviorally urgent collision.

The looming cognitive style (or LCS; Riskind, Williams, Gessner, Chrosniak, & Cortina, 2000) has been introduced to understand individual differences in the extent to which people are cognitive vulnerable to anxiety. Some individuals more than others tend to interpret, simulate, and imagine ambiguous threats as rapidly and dynamically growing. This chapter addresses the theoretical basis of the LCS and the development of the instrument by which it is measured, the "Looming Maladaptive Styles Questionnaire" (or LMSQ). We will show how the LCS is related to the concept of mental simulation. In addition, it is based on the common basic assumptions of other cognitive vulnerability models such as the distinction between distal and proximal causes, cognitive vulnerability–stress interaction, and cognitive specificity.

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Differences Between the LCS and Other Cognitive Vulnerability Factors

The LCS is concerned with an important theoretical feature of anticipated negative events that has been previously unexplored by other cognitive vulnerability models. It differs from the negative cognitive style for depression (Abramson, Metalsky, & Alloy, 1989; Alloy et al., 2000) in that it is concerned with the person's dynamic expectations and mental simulations of the rapid growth and development of threats before the "blow" has landed or they have struck. The depressive cognitive style is concerned with the retrospective explanation of the causes of negative events after they have struck and their future implications (e.g., hopelessness). By the same token, most cognitive vulnerability factors for anxiety are concerned with domain-specific negative beliefs about the meaning of symptoms or specific types of events. For example, anxiety sensitivity is concerned with negative beliefs that lead to the catastrophic misinterpretation of anxiety symptoms (e.g., heart attacks); intolerance of uncertainty is concerned with faulty beliefs about the implications of feeling undecided or uncertain. The LCS, in contrast, is concerned with the extent to which a person perceives and imagines rapid gains by a dynamically growing threat that he/she believes are leading to these or other behaviorally urgent outcomes.

As such, the LCS thus theoretically complements familiar constructs such as anxiety sensitivity (Taylor, 1999) and intolerance of uncertainty (Dugas et al., 2001; Dugas & Ladouceur, 2000), and other belief-based constructs, by attending to the dynamism and rapid pace of the growing danger. Moreover, while the LCS is thought to be causally implicated in instigating catastrophizing and worry, it is conceptually distinct from these. The LCS acts as a cognitive vulnerability that leads individuals to catastrophize (Riskind et al., 2000; Riskind & Williams, 2006) and generate worry scenarios. It captures a feature of a person's threat perceptions that involves the imagination and simulation of their rapid development and progression. Catastrophizing and worry don't deal with these features of threat and emphasize inflated expectations about the probabilities and costs of possible outcomes. As will be seen, the LCS has been found to be empirically distinct from anxiety sensitivity and intolerance of uncertainty, as well as worry and catastrophizing (Riskind et al., 2000; Riskind & Williams, 1999).

Mental Simulation and Time Travel in the LCS

According to social cognition theorists, mental simulation is a primary way that individuals attempt to estimate future risk and engage in proactive coping. As Taylor and colleagues have proposed, if individuals solely used a static representation of an emerging threat, instead of a dynamic mental simulation, they would not have a sufficient basis for proactive coping (Aspinwall & Taylor, 1997; Taylor & Pham, 1996; Taylor, Pham, Rivkin, & Armor, 1998). With mental simulation, individuals

manipulate a starting point to create "windows" into possible futures and possible ways to affect outcomes (Taylor et al., 1998, p. 498).

Riskind et al. proposed that individuals who are predisposed to anxiety have a maladaptive looming cognitive style, the LCS, which leads them to engage in dysfunctional attempts at mental simulation and proactive coping with potential emerging threats. When individuals anticipate a potential emerging threat, they simulate the threat by manipulating a starting point and attempting to estimate how quickly the threat might be developing and advance. Individuals who have the LCS manipulate the same starting points and exaggerate the speed at which the threats are gaining and approaching. Their faulty mental simulations lead to them to judge that threats may be approaching faster than they can respond or find help by other means, causing them to fear blows that in actuality may never arrive or that they still have time to discover appropriate ways to cope.

General Assumptions About LCS as a Cognitive Vulnerability to Anxiety

The LCS is assumed to be a cognitive liability to anxiety that is acquired in large part from developmental antecedents such as attachment patterns and peer relationships. Once established, the LCS operates as a danger schema for processing threat information and increases the sensitivity of individuals to stressful events.

Preliminary Considerations

Cognitive Vulnerability Theory

Theoretical work on cognitive vulnerability theory is thought to provide a theoretical foundation for understanding these general assumptions about the looming cognitive style. Thus, we will now present a brief overview of several key relevant general assumptions from work on cognitive vulnerability theory before we turn to their implications for the LCS and risk of anxiety.

Distal vs. Proximal Factors in Cognitive Vulnerability Theory/ Conceptualization

Theoretical work on cognitive vulnerability has drawn a vital distinction between distal and proximal factors in the etiology and descriptive phenomenology of emotional disorders. On the one hand, cognitive vulnerability factors are said to be *distal* etiological factors that have been established and set the stage for future symptoms

and/or disorders long before they first arise (e.g., Alloy, Abramson, Raniere, & Dyller, 1999; Riskind & Alloy, 2006). Cognitive vulnerability factors that have been cited include underlying negative cognitive styles, dysfunctional beliefs, and enduring danger schemas (Abramson et al., 1989; Beck, Emery, & Greenberg, 2005; Clark & Beck, 2010; Rachman, 1997; Rapee & Heimberg, 1997; Riskind, 1997; Riskind & Alloy, 2006). On the other hand, proximal factors are conceptualized as the products of the activation of these underlying cognitive vulnerabilities (e.g., a person's passing automatic thoughts in a mood). Importantly, individuals who differ from others in their levels of cognitive vulnerability can have similar cognitions (e.g., thoughts such as "I'm going to have a heart attack"; "I'm going to be humiliated"). The difference is that the proximal cognitions of individuals who are cognitively vulnerable can be triggered even when there is negligible objective reason to justify them.

Another feature of cognitive vulnerability theory is that a person's liability to anxiety is associated with distorted danger schemas that can cause them to engage in systematic schematic processing biases when interpreting or remembering threat (see Clark & Beck, 2010). Thus, negative cognitive styles and maladaptive beliefs are thought to function as danger schemas that bias the processing of threat information. In Clark and Beck's (2010) model, danger schemas are associated with the "Primal Threat" Mode. The Primal Threat Mode includes a variety of threat schemas related to information processing biases (attentional appraisal, memory), as well as with emotional, behavioral, physical, and defensive compensatory responses (for more on its effects on etiological chains, see Chap. 9).

Developmental vs. Genetic Antecedents

Cognitive models assume that cognitive vulnerabilities are acquired at least in part from prior negative life experiences. As we will see in Chap. 9, parental anxiety, faulty parental modeling or parenting behaviors, and faulty attachments can lead to the development of cognitive vulnerability factors. Developmental learning histories of parental or peer abuse, as well as childhood injuries, illnesses, or traumas may also be likely to contribute.

In combination with developmental antecedents, cognitive vulnerability factors are also probably influenced by genetic factors (Riskind & Alloy, 2006) via several possible pathways. In one hypothetical pathway, the total magnitude of risk from cognitive and genetic vulnerabilities could be additively cumulative such that both make independent (main effect) contributions to a person's liability to emotional disorders. In another possible pathway, the cumulative risk from cognitive and genetic vulnerability factors could be synergistic, such that the degree of risk would depend on interaction effects between these factors. For example, the likelihood that a person could develop an anxiety or another emotional disorder due to a given genetic vulnerability factor could hinge, at least in part, on whether the person also has a given cognitive vulnerability, and vice versa (Riskind & Alloy, 2006). It is further possible that even if individuals were to have the same genetic vulnerabilities,

they could potentially develop different disorders (e.g., major depression versus generalized anxiety disorder) depending on whether they differ in their cognitive vulnerabilities. In this vein, Barlow's (2002) integrated "triple vulnerability" model proposes that vulnerability to anxiety depends on a generalized, heritable genetic vulnerability, combined with (1) a generalized psychological vulnerability based on early experiences that contribute to a sense of lack of control over significant events and (2) a more specific psychological vulnerability resulting from learning experiences that lead to specific beliefs that make the person vulnerable to specific anxiety disorders.

Hankin and Abramson (2001) proposed another pathway whereby there may be genetic predispositions toward certain cognitive vulnerabilities. That is, genetic factors may operate as distal risk factors for the development of cognitive vulnerabilities. It could also be speculated that the same genetic factors may potentially lead a person to develop different cognitive vulnerabilities (e.g., the depressive cognitive style or the looming cognitive style) depending on life experiences.

In addition, other factors may potentially enhance or mitigate the effects of cognitive vulnerabilities once they are established. For example, protective and resiliency factors—such as social support networks, effective coping skills, and character strengths—can also potentially affect the etiology and maintenance of disorders (Riskind & Alloy, 2006).

Cognitive Vulnerability–Stress Paradigm

Many cognitive vulnerability models assume that anxiety or depression or other disorders can be triggered by stressful events for some people, but the specific nature, extent, and even direction of the response can differ enormously from one person to another (e.g., see Alloy et al., 1999; Riskind & Alloy, 2006). According to this cognitive vulnerability–stress paradigm, some individuals are highly resilient and do not develop anxiety disorders or other pathology after experiencing negative life events, while other individuals are highly sensitive to stressful events (even minor events) and develop disorders of different kinds.

Cognitive vulnerability models assume that the specific disorder that a person develops after they experience stressful life events, depends on their cognitive vulnerability. Thus, such models have been advanced to help explain not only *who* is vulnerable to developing emotional disorder (e.g., individuals with a particular cognitive style), and *when* (e.g., after a stress), but to *which* disorders they are vulnerable (e.g., depression, eating disorder). This "disorder-specificity" tenet of cognitive models helps to account for findings that negative life events seem to play a *nonspecific* role in triggering psychopathology. Indeed, negative life events play a role in depression (Brown & Harris, 1978; Paykel, 1982), bipolar disorder and mania (Alloy, Reilly-Harrington, Fresco, & Flannery-Schroeder, 2006; Johnson & Roberts, 1995), anxiety disorders (Last, Barlow, & O'Brian, 1984; Roy-Byrne, Geraci, & Uhde, 1986; Tweed, Schoenbach, George, & Blazer, 1989), and schizophrenia (Zuckerman, 1999).

Disorder-Specific and Transdiagnostic Vulnerability Factors

Many cognitive vulnerability models have adopted the assumption that anxiety and other disorders have their own disorder-specific content. From a cognitive vulnerability perspective, it is important to identify disorder-specific factors that differentiate anxiety from depression, since nonspecific (or transdiagnostic) factors are unable to explain how disorders differ or why and how individuals develop one disorder as opposed to another. For example, Beck (1976) stated that anxiety derives from the appraisal of future threat while depression derives from hopelessness and the appraisal of loss.

As previously noted, a meta-analysis found that self-report measures of cognitions that were presumed to be threat-related and specific to anxiety were just as related to depression as to anxiety (Beck & Perkins, 2001). Moreover, anxiety and depression are both positively associated with greater expectations of probable future negative outcomes (Beck, Wenzel, Riskind, Brown, & Steer, 2006; Butler & Mathews, 1983; MacLeod & Byrne, 1996; Miranda, Fontes, & Marroquín, 2008). Other cognitive factors that have been postulated to be disorder-specific also appear to be transdiagnostic across anxiety and depression. For example, perseverative negative thinking and rumination appear to cross diagnostic lines and are associated with both disorders and syndromes (Ehring & Watkins, 2008; McEvoy, Watson, Watkins, & Nathan, 2013; McLaughlin & Nolen-Hoeksema, 2011; Muris, Roelofs, Rassin, Franken, & Mayer, 2005). Likewise, factors such as anxiety sensitivity (Cox, Borger, Taylor, Fuentes, & Ross, 1999; Naragon-Gainey, 2010; Reardon & Williams, 2007; Schmidt, Zvolensky, & Maner, 2006) and intolerance of uncertainty (Dugas, Gosselin, & Ladouceur, 2001; Hong & Cheung, 2014; Paulus, Talkovsky, Heggeness, & Norton, 2015) were both posited as disorder-specific factors for anxiety, but have also been found to be shared with depression. For example, Schmidt, Zvolensky, and Maner presented evidence from a longitudinal study that anxiety sensitivity predicted several Axis 1 disorders including depression as well as anxiety disorders.

To the extent that the LCS or other cognitive factors evince greater specificity to anxiety than depression, this can potentially increase understanding of their specific etiological cognitive pathways, as well as the nature of their interrelationships. As such, advances in knowledge of cognitive specificity to anxiety could plausibly benefit the conceptualization, assessment, and treatment of these disorders.

Implications of the Preceding Considerations for the Looming Cognitive Style

In this theoretical context, the LCS is viewed as a cognitive vulnerability factor that is activated by precipitating negative events. Further, it is expected that when activated by negative events, LCS operates as a danger schema (see Chap. 10). The LCS and perception of looming vulnerability are also posited to be primarily relevant to anxiety. Anxiety derives from dynamic expectations and simulations of dynamically

growing threat. The adaptive function of anxiety is to motivate and prepare the individual to avoid or avert the threat before it strikes. In contrast, the adaptive function of depression is to inspire the individual to "give up" and to accommodate to negative conditions that have already struck and cannot be changed or overcome (Riskind et al., 1997; Riskind et al., 2000).

As noted in Chap. 5, perceptions of dynamic growing threat can contribute to higher feelings of uncertainty and unpredictability. If, however, people become certain in their conviction that rapidly approaching threats will strike, and that they cannot avert or escape them, the perception of dynamic growing threat can contribute to a secondary depression. Further secondary depression can result from unrelenting perceptions of rapid growing and approaching threats that produce feelings of mental depletion and a sense of cognitive overload (see Chap. 10). Comorbid anxiety and depression can result.

Overview of the Psychometric Development and Validation of the Measure of the Looming Cognitive Style: The Looming Maladaptive Style Questionnaire (LMSQ)

To test these and other theoretical predictions about the roles of the LCS in the etiology and maintenance of anxiety (see Chap. 9), Riskind et al. developed and validated a brief and easy-to-administer self-report measure called the "Looming Maladaptive Style Questionnaire" (LMSQ; also known as the LMSQ-R). Our goal now is to present a brief overview of the psychometric development and properties of the measure, and its empirical associations with measures of anxiety and depression and related constructs. We will then conclude the chapter with evidence that addresses the hypothesized developmental antecedents of the looming cognitive style, its putative role in creating liability to anxiety, and cognitive specificity.

Development and Scoring

The LMSQ built on an earlier measure developed by Riskind, Kelly, Harman, Moore, and Gaines (1992). Respondents who complete the scale are asked to read six brief vignettes pertaining to social or physical threats and to imagine scenario as vividly as possible (see Appendix A). The *looming social threat* vignettes include: (1) the possibility of a romantic relationship breaking up; (2) inviting a very popular person to a party in front of a group of people; and (3) speaking in front of a large audience of strangers. The *looming physical threat* vignettes include: (1) hearing a strange engine noise while driving on the expressway in rush hour traffic; (2) developing heart palpitations while speaking with someone about a financial problem; and (3) the risk of getting into a car accident. Respondents are asked to respond to four questions for each vignette on a Likert scale: (1) How worried or anxious does imagining this scene make you feel ("not at all" to "very much")? (2) In this scene,

do the chances of you having difficulty seem to be decreasing or increasing and expanding with each moment ("chances are decreasing with time" to "chances are expanding with time")? (3) Is the level of threat staying fairly constant *or* growing rapidly larger with each passing moment ("threat is staying fairly constant" to "threat is growing rapidly larger")? (4) How much do you visualize the threat as progressively worsening ("not at all" to "very much")?

A total LMSQ score is calculated by aggregating responses to the final three questions across the six vignettes. Subscale scores for LCS-Physical and for LCS-Social are computed by aggregating responses to the three items within the three vignettes that fall within those two given domains. [Other subscales have been developed for specific anxiety subtype symptoms (e.g., contamination fear or panic disorder), but they will be described in later chapters.]

Psychometric Evidence

Riskind et al. (2000) provided evidence for the predictive, convergent, and discriminant validity of the measure, as well as its internal consistency (coefficient alpha = 0.91), and 1-week test-retest stability (r = 0.88). Sica, Caudek, Chiri, Ghisi, and Marchetti (2012) found a test-retest reliability of 0.83 in an Italian sample for 6 months and 0.64 for a year. Acceptable to good internal consistencies for the total LMSQ score and the subscales have been found in Canadian, Croatian, Italian, Japanese, Nepalese, Serbian, Spanish, Italian, Singaporean, Turkish, and USA/American samples (Hong et al., 2017; Riskind, Tzur, Williams, Mann, & Shahar, 2007).

Construct Validity

To test the central premise that the LCS is concerned with perceptions and mental simulations of rapid gains in dynamic growing threats, Riskind et al. (2000) assessed the extent to which respondents rated their imagined scenarios on the LMSQ as more like rolling videotapes as compared to static snapshots. Corroborating this key premise, the participants' tendencies to rate their imagined scenarios as more like rolling videotapes than like static snapshots were strongly correlated with their LMSQ scores (r = 0.78).

Convergent and Discriminant Validity

Research has repeatedly found evidence for the convergent validity of the LMSQ. Studies have shown with remarkable consistency that the LMSQ is related to higher levels of anxiety as measured on the Beck Anxiety Inventory and the

Spielberger trait and state anxiety scales, and Costello-Comrey scale (*r*'s range from 0.39 to 0.49). LMSQ is also related to OCD symptoms, social anxiety, fear of negative evaluation, social threat cognitions, PTSD symptoms, and worry (Brown & Stopa, 2008; Elwood, Riskind, & Olatunji, 2011; Reardon & Williams, 2007; Riskind et al., 2007; Williams & Riskind, 2004; Williams, Shahar, Riskind, & Joiner, 2004). In addition, studies have also found correlations with correlates of anxiety such as catastrophizing, trait thought suppression, scores on the Fear Survey Schedule, attachment anxiety, rejection sensitivity, romantic attachment anxiety, early maladaptive schemas, attachment style, fears of emotion and loss of emotional control, and experiential avoidance (Brown & Stopa, 2008; Elwood et al., 2011; Reardon & Williams, 2007; Riskind et al., 2000, 2007, 2013; Riskind & Kleiman, 2012; Riskind & Williams, 1999; Williams et al., 2004). The LMSQ has thus been shown to correlate with a wide variety of measures of anxiety and related constructs. Moreover, Riskind et al. (2000) demonstrated with structural equation modeling that while the LMSQ and anxiety are correlated, their measurement properties clearly distinguish between them.

By contrast, research has verified that the LMSQ is also empirically (not just conceptually) distinct from anxiety sensitivity, intolerance for uncertainty, catastrophizing, dysfunctional attitudes, and attributional style (González-Díez, Calvete, Riskind, & Orue, 2015; Hong & Lee, 2015; Hughes & Alloy, 2008; Reardon & Williams, 2007; Riskind et al., 2007). For example, Reardon and Williams reported a correlation between LMSQ and anxiety sensitivity of 0.32 and Hong and Lee reported a correlation between the LMSQ and the 18-item intolerance of uncertainty scale of 0.38, as compared to a correlation between anxiety sensitivity and intolerance of uncertainty of 0.54. Evidence for the *discriminant* validity of the LMSQ also comes from studies showing that it has only small to nonsignificant correlations with negative affectivity (Elwood et al., 2011) and neuroticism (Hong & Lee, 2015). Hughes and Alloy found that the LMSQ was correlated with worry but not with rumination, when the other response style was controlled.

Incremental Validity

There is also substantial evidence that the LMSQ and the perception of dynamic growing and approaching threat independently predict and contribute to additional, significant unique variance in anxiety symptoms. The LCS has been found to predict anxiety, even when cognitive appraisals of unpredictability, uncontrollability, likelihood, or imminence of threat are controlled (e.g., Riskind et al., 2000). Equivalent findings have been obtained in other studies that have provided evidence that indicates that looming vulnerability perceptions account for unique variance in fear of spider symptoms (Riskind et al., 1992; Riskind, Moore, & Bowley, 1995), contamination fear symptoms, and fear of HIV (Riskind & Maddux, 1994) beyond the variance accounted for by judgments of probability, control, or the imminence of the feared outcomes. Similarly, Riskind and Williams (2005) found that the LMSQ differentiated GAD in a community sample from unipolar depression and

nonpsychopatholgy controls, but probability judgments for the same frightening scenarios in the LMSQ did not differentiate the groups. Moreover, Riskind, Rector, and Cassin (2011) found that perceptions of looming vulnerability themes related to panic disorder distinguished the disorder from OCD, social anxiety, and GAD even when controlling to probability judgments for the same panic outcomes. However, probability judgments did not distinguish panic disorder from the other disorders when looming vulnerability perceptions were controlled.

Likewise, studies have shown that even when the LMSQ is correlated with measures of anxiety sensitivity, intolerance of uncertainty, neuroticism, negative affect, and negative life events, it can clearly be distinguished from these variables, and that the LMSQ predicts distinct variance in anxiety over and above that predicted by these measures (Elwood et al., 2011; Riskind et al., 2000, 2007); Reardon & Williams, 2007). It also predicts unique variance after controlling for depressive explanatory style and dysfunctional attitudes (Kleiman & Riskind, 2012; Reardon & Williams, 2007). Similarly, it predicts OCD symptoms beyond the variance explained by OCD beliefs and interpretations of intrusions (Riskind & Rector, 2007), as well as "not just right experiences" (Sica et al., 2012).

Factor Structure and Structural Invariance

There is also evidence for the proposed factor structure of the LMSQ as assessing two broad domains, physical threat and social threat. Using a large sample of Spanish young adults (N = 471), a recent study by González-Díez et al. (2015) found evidence from factor analyses confirming two second-order factors (for social and physical threat). As anticipated, items loaded on appropriate social and physical looming scales. Equally important, a multiple-group analysis indicated the measurement invariance of the model, for men and women and for groups that displayed clinically significant generalized social anxiety and those that did not. Another multi-national study reported by Hong et al. (2017) with 4000 participants from 10 countries (Canada, Croatia, Italy, Japan, Nepal, Serbia, Singapore, Spain, the United States, and Turkey) largely replicated these findings for the measurement invariance of the LMSQ across countries as well as gender.

Differences Between Women and Men in LCS

In addition to the largely invariant measurement models for women and men, both González-Díez et al. (2015) and Hong et al. (2017) found an interesting gender difference. Namely, women also had significantly higher scores on the LMSQ than men, consistent with the higher rates of several anxiety disorders among women

(McLean, Asnaani, Litz, & Hofmann, 2011; McLean & Hope, 2010). Similar gender differences in LMSQ were found in a study of Italian college students and their parents (Riskind, Sica, Bottesi, Ghisi, & Kashdan, 2017). An intriguing implication of these findings is that gender differences in LMSQ may help to explain why females are likelier than males to develop anxiety disorders (McLean et al., 2011). A caveat, however, is that the gender differences found by Hong et al. (2017) were smaller than those found by González-Díez et al. and by Riskind et al. (2017), suggesting that they may be of greater importance in some populations than others. It could be beneficial in future research to determine how important these differences are to understanding gender differences in the anxiety disorders.

Further intriguing clues about gender differences in looming cognitive styles also come from other areas of research. It has been found that, as compared to men, women are more prone to overestimate the closeness of approaching sounds that may signal that a threatening stimulus is rapidly escalating or moving closer to the person in space or time (i.e., "anticipatory auditory looming bias") (Neuhoff, Planisek, & Seifritz, 2009). It has also been found that compared to men who are physically stronger, those who are lower in fitness also have a stronger anticipatory auditory looming response (Neuhoff, Long, & Worthington, 2012). Likewise, an imposed mental load that could create feelings of greater weakness and vulnerability also strengthens the anticipatory auditory looming bias (McGuire, Gillath, & Vitevitch, 2016). Neuhoff, Long, and Worthington have suggested that the anticipatory auditory looming bias may be an evolved compensatory response to perceptions of being vulnerable to danger.

In other research, described in Chap. 3, it was found that women were more sensitive than men to subtle dynamic temporal cues conveyed in facial expressions (Edwards, 1998). Thus, several findings from different areas of research suggest that women are more sensitive to looming cues and dynamic information, and it is interesting to speculate that this may be related to why they are also at more risk for many anxiety disorders.

Nonverbal Tests of LCS

Preliminary validation of the LCS with nonverbal measures has been provided by several researchers. A team of Swiss researchers at the University of Geneva (Glauser, Visch, Grandjean, & Scherer, 2008) found that the LMSQ-R predicted responses on a nonverbal measure of "looming sensitivity" for neutral, looming geometric stimuli. Participants performed on a detection task on which physical properties of looming stimuli (velocity, acceleration, and distance) were varied and the impact of these properties was assessed. Looming sensitivity was operationalized as a sensitivity in response times to the variations in those physical properties. It was found that the nonverbal measure of looming sensitivity was unrelated to anxiety and depression measures, and it was significantly associated with the LMSQ-R.

A few studies described in more detail in Chap. 10 also support the LCS with measures of looming sensitivity in the auditory and visual modalities.

LCS Is Unique from Other Vulnerability Factors

Not Correlated with Anxiety Sensitivity, Intolerance, Neuroticism

Research has documented that there are significant positive relationships between neuroticism and anxiety. As a result, to demonstrate the incremental heuristic value of cognitive vulnerability factors, it is necessary to show that they contribute to the prediction of variance in anxiety symptoms over and above the effects of neuroticism (e.g., Hankin, Lakdawalla, Carter, Abela, & Adams, 2007; Zinbarg et al., 2010). To give a concrete example of the need for this, anxiety sensitivity (Cox et al., 1999; Lilienfeld & Penna, 2001; Norton, Cox, Hewitt, & McLeod, 1997) and intolerance of uncertainty (Hong & Lee, 2015; McEvoy & Mahoney, 2012) are significantly related to neuroticism. Accordingly, critics of cognitive vulnerability variables could argue that they simply reflect the effects of underlying neuroticism. In this context, it is reassuring that some research with large subject samples suggests that the LCS is not strongly related to neuroticism (Hong & Lee, 2015). Furthermore, there is evidence that the LCS also has relatively moderate relationships to anxiety sensitivity ($r = 0.32$, $p < 0.001$, Reardon & Williams, 2007) and intolerance of uncertainty ($r = 0.38$, $p < 0.001$, Hong & Lee, 2015).

LCS and Comorbidity of Anxiety and Depression

The LCS was originally advanced as being primarily disorder-specific to anxiety. Consistent with this, earlier studies indicated that LCS was more closely associated with anxiety than depression (e.g., Reardon & Williams, 2007; Riskind et al., 2000; Williams et al., 2004). Thus, the significant correlation between the LMS and anxiety was found to remain highly significant when the variance due to depression is statistically controlled, whereas the correlation between LMSQ and depression is reduced to nonsignificance when the variance due to anxiety is controlled (Riskind, Williams, & Joiner, 2006). However, other research has been more mixed. For example, in a study of a sample of patients with terminal leukemia, higher LCS scores were associated with higher depression as well as higher anxiety (Levin, Li, & Riskind, 2007). Other studies have also found evidence that there are conditions in which LCS is associated with comorbid anxiety and depression (Hong et al., 2017; Tzur-Bitan, Meiran, Steinberg, & Shahar, 2012).

Kleiman and Riskind (2012) hypothesized that the LCS may predict depression when individuals perceive no way out from negative events because they also have the depressive cognitive style. This hypothesis was tested in a short-term prospec-

tive study with college students. As hypothesized, a significant interaction effect was found. Students who had high levels of both the depressive cognitive style and LCS tended to show the greatest increases in depression and anxiety symptoms over a 4-week prospective interval. Thus, Kleiman and Riskind's study indicated that those with co-occurring vulnerabilities experienced a more severe subsequent level of anxiety and depression symptoms.

To conclude, numerous studies have repeatedly supported the reliability and validity of the LCS, including its convergent and discriminant validity, and measurement invariance across ten countries. Crucially, numerous studies have found evidence that the LCS is a cognitive vulnerability that increases liability to anxiety.

Appendix

ID:_____ Gender M F (Circle One)

LV Questionnaire

Instructions

In these questions, we are interested in your immediate thoughts and reactions to a number of different scenes. Put down whatever comes to mind in response to each of these scenes immediately, rather than thinking about your answer for a long time.

After you read each scene, try to **vividly** imagine it. What comes to mind as you bring that scene to mind and think about it? Concentrate on it and imagine it in as much vivid detail as possible.

After you have finished concentrating on the scene, answer the questions about what you were imagining was happening. Please do not leave out any questions if possible.

To summarize;

1. Vividly imagine yourself in each scene.
2. Answer all the questions about your own immediate thoughts and feelings.

Suppose that you were to hear a strange engine noise from your car as you were driving on the expressway in heavy rush hour traffic. There are rushing cars and trucks on both sides of you and your car sounds as if it the engine could be cracking or the engine is developing a serious problem.

1. How worried or anxious does your imagining this scene make you feel?

   Not at all 1 2 3 4 5 Very Much

2. In this scene, are the chances of your having a difficulty with the car's engine decreasing, or increasing and expanding with each moment?

Chances are decreasing with time 1 2 3 4 5 Chances are expanding

3. Is the level of threat to you from the car's engine staying fairly constant, or is it growing rapidly larger with each passing moment?

   Threat is staying fairly constant 1 2 3 4 5 Threat is growing rapidly larger

4. How much do you visualize your car's engine as in the act of progressively worsening?

   Not at all 1 2 3 4 5 Very Much

Suppose that a person you have been romantically involved with is behaving oddly. They were late to meet you and there are long moments of silence when they don't speak and don't give you eye contact. It seems your relationship could be breaking up.

1. How worried or anxious does your imagining this scene make you feel?

   Not at all 1 2 3 4 5 Very Much

2. In this scene, are the chances of your having a difficulty with the relationship decreasing, or increasing and expanding with each moment?

   Chances are decreasing with time 1 2 3 4 5 Chances are expanding

3. Is the level of threat of losing your relationship staying fairly constant, or is it growing rapidly larger with each passing moment?

   Threat is staying fairly constant 1 2 3 4 5 Threat is growing rapidly larger

4. How much do you visualize your relationship as in the act of progressively breaking up?

   Not at all 1 2 3 4 5 Very Much

Suppose that you get odd heart palpitations while talking to someone about a financial problem. You have never had palpitations where your heart skipped around like this and you could be developing a heart murmur.

1. How worried or anxious does your imagining this scene make you feel?

   Not at all 1 2 3 4 5 Very Much

2. In this scene, are the chances of your having a difficulty with your heart seem to be decreasing, or increasing and expanding with each moment?

   Chances are decreasing with time 1 2 3 4 5 Chances are expanding

3. Is the level of threat of a heart condition staying fairly constant, or is it growing rapidly larger with each passing moment?

Threat is staying fairly constant 1 2 3 4 5 Threat is growing rapidly larger

4. How much do you visualize your heart problem as in the act of becoming progressively worse?

   Not at all 1 2 3 4 5 Very Much

Suppose you walk up to an extremely popular, self-centered person in a group of people. The person looks a little bored when first glancing at you and many of the people in the group are looking in your direction. You want to extend an invitation to a party to the person but the person could reject your invitation.

1. How worried or anxious does your imagining this scene make you feel?

   Not at all 1 2 3 4 5 Very Much

2. In this scene, are the chances of your having a difficulty decreasing, or increasing and expanding with each moment?

   Threat is decreasing with time 1 2 3 4 5 Threat is expanding

3. Is the level of threat of your being rejected staying fairly constant, or is it growing rapidly larger with each passing moment?

   Threat is staying fairly constant 1 2 3 4 5 Threat is growing rapidly larger

4. How much do you visualize the risk of being rejected as in the act of becoming progressively worse?

   Not at all 1 2 3 4 5 Very Much

Suppose that you are in front of a large audience of strangers. You are speaking about a topic on which you do not know a lot. Some of the people look bored or disinterested, while others look upset. It seems that you could get a very negative audience reaction.

1. How worried or anxious does your imagining this scene make you feel?

   Not at all 1 2 3 4 5 Very Much

2. In this scene, are the chances of your having a difficulty with the audience decreasing, or increasing and expanding with each moment?

   Threat is decreasing with time 1 2 3 4 5 Threat is expanding

3. Is the level of threat from the audience staying fairly constant, or is it growing rapidly larger with each passing moment?

   Threat is staying fairly constant 1 2 3 4 5 Threat is growing rapidly larger

4. How much do you visualize the audience reaction as in the act of becoming progressively worse?

   Not at all 1 2 3 4 5 Very Much

Suppose that it is 6:00 in the evening—the height of the rush hour and you are heading home on the expressway in your car. A red truck is speeding aggressively in and out of traffic behind you without seeming to notice your position. It seems that there is a definite risk of getting into an accident.

1. How worried or anxious does your imagining this scene make you feel?

   Not at all 1 2 3 4 5 Very Much

2. In this scene, are the chances of your having difficulty with the red truck decreasing, or increasing and expanding with each moment?

   Threat is getting smaller or decreasing with time 1 2 3 4 5 Threat is expanding

3. Is the level of threat of an accident staying fairly constant, or is it growing rapidly larger with each passing moment?

   Threat is staying fairly constant 1 2 3 4 5 Threat is growing rapidly larger

4. How much do you visualize the risk of an accident as in the act of becoming progressively worse?

   Not at all 1 2 3 4 5 Very Much

Looming cognitive style (LCS) assesses a person's exaggerated tendency to perceive threats as moving through time and space, rapidly increasing in proximity and rapidly escalating in risk and danger. The two subscales (Physical and Social Looming Threat) are often summed as they are highly correlated in many samples. However, with domain-specific threat material, the subscale that corresponds better provides a better measure of looming style for that material (e.g., Social looming for social threat information). Moreover, under some special circumstances, the two subscales can even have opposing effects. A recent study of auditory looming perception by Riskind, Kleiman, Neuhoff et al. (in press) has shown that anxiety in combination with looming style for physical threat produced an enhanced or stronger tendency to guess that an approaching auditory sound source is closer than it is (anticipatory auditory looming effect). Anxiety in combination with looming style for social threat produced a diminished or weaker anticipatory auditory looming bias.

Scoring Instructions for the LMSQ (Looming Maladaptive Style Questionnaire) to Looming Cognitive Style (LCS).

There are six scenarios or vignettes in the questionnaire. Half of the scenarios contain content related to *social rejection* or rejection by someone in a romantic relationship (**Loom-Social subscale**). These scenarios for the Looming-Social sub-

scale are scenarios the second, fourth, and fifth ones. These scenarios for the Looming subscale are:

Suppose that a person you have been romantically involved with is behaving oddly. They were late to meet you and there are long moments of silence…
Suppose you walk up to an extremely popular, self-centered person in a group of people. The person looks a little bored when first glancing at you…
Suppose that you are in front of a large audience of strangers. You are speaking about a topic on which you do not know a lot.

The remaining three scenarios contain content related to *physical threat* such as being in automobile accidents (**Loom-Physical subscale**). The scenarios for the Looming-Physical subscale are scenarios the first, third, and sixth ones. These scenarios for the Loom-Physical subscale are:

Suppose that you were to hear a strange engine noise from your car as you were driving on the expressway in heavy rush hour traffic.
Suppose that you get odd heart palpitations while talking to someone about a financial problem.
Suppose that it is 6:00 in the evening—the height of the rush hour and you are heading home on the expressway in your car. A red truck is speeding aggressively in and out of traffic.

Scoring Instructions

The questions for each scenario are the second, third, and fourth ones. [We don't use the scores for question 1, which are includes as primes]. Examples are:

2. In this scene, are the chances of your having a difficulty with the relationship decreasing, or increasing and expanding with each moment?
3. Is the level of threat of losing your relationship staying fairly constant, or is it growing rapidly larger with each passing moment?
4. How much do you visualize your relationship as in the act of progressively breaking up?

Each question is scored on a 1–6 point scale. Total scores for each scenario (e.g., romantic rejection) are the sum of scores for questionnaire items 2, 4, and 5. Thus, the total score for each scenario can range from 1 to 18.

For each **subscale—the Loom Social or Loom Physical subscale—the total scores for the three scenarios that make it up are added together. Thus, scores for each scale range from 3 to 54.**

For the total score for the LMSQ are computed by adding the scores for the Loom-Social and Loom-Physical subscales and can range from 6 to 108.

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Chapter 9
Developmental Antecedents of the LCS, the LCS as an Overarching Theme of Anxiety, and Cognitive Vulnerability–Stress Interaction

The looming vulnerability model (LVM) proposes that negative events and early developmental experiences in childhood can be critical to the formation of the LCS as a common cognitive liability to future anxiety disorders. From their learning histories and genetic predispositions, some individuals develop a characteristic cognitive style, the LCS, which is postulated to increase their sensitivity to threatening environmental stimuli and life events. The LVM differentiates between acute state elicitations of looming vulnerability (e.g., from an approaching train), a more generalized and enduring looming cognitive style for perceiving and interpreting threats and more disorder-specific looming vulnerability themes for specific anxiety disorders. For example, a person with spider phobia may be especially prone to perceive exaggerated simulations of rapidly growing threats of spiders suddenly moving toward them. For another, a person who has OCD may tend to play out and simulate mental scenarios of rapidly spreading contamination.

Despite the differences between anxiety and anxiety-related disorders, the sense of looming vulnerability to rapidly growing threat is a common feature that unifies them as an overarching theme. Furthermore, the LCS, which reflects a tendency to have such perceptions, is a cognitive vulnerability to anxiety that causes some individuals to be more sensitive to threatening environmental stimuli and events than others.

In this chapter, our goals include considering evidence that: (1) developmental factors contribute to the LCS; (2) the LCS and the sense of looming vulnerability are unifying and overarching theme across anxiety and anxiety-related disorders; (3) the LCS, once developed, serves as a cognitive vulnerability to anxiety.

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Antecedents of the Looming Cognitive Style

A person's cognitive vulnerabilities are typically assumed to be acquired at least in part from prior life experiences. With respect to this, several lines of research broadly suggest that developmental learning history plays a role in creating heightened vulnerability to anxiety. The first line of relevant research indicates that parental anxiety contributes to a vulnerability to anxiety, over and beyond the effects of genetic factors (e.g., Judd, 1965). It is likely that faulty parental modeling or parenting behaviors that involve excessive control, fear of uncertainty or danger, or that promote avoidance of anxiety-eliciting situations may lead to the development of the LCS or other cognitive vulnerabilities. A second line of relevant research suggests that behavioral inhibition and negative emotional reactivity may contribute to the development of later cognitive vulnerability to anxiety (e.g., Kagan, Reznick, & Snidman, 1987). A negative developmental trajectory may occur in which behaviorally inhibited, and emotionally reactive children may limit their exposure to anxiety-eliciting or novel situations, and consequently retain exaggerated beliefs about the magnitude and severity of environmental threat and underestimations of their own ability to cope with threat.

A third line of research indicates that negative life events of childhood, including parental and peer maltreatment/abuse (physical, sexual, or emotional), neglect, and poor grades could be tied to the development of cognitive vulnerability to anxiety and later risk of anxiety (e.g., Bernstein, Garfinkel, & Hoberman, 1989; Tweed, Schoenbach, George, & Blazer, 1989). Traumatic experiences with physical danger, either direct or vicarious, may also contribute to the development of cognitive vulnerabilities to anxiety. The occurrence of negative events or situations (e.g., faulty modeling, abuse, maltreatment, physical traumas, attachment disruptions) can have a profound effect on the child's developing cognitive styles and can profoundly influence the child's information processing including dysfunctional patterns of mental simulation. As suggested below, this can lead to the crystallization of an LCS.

Another line of relevant research suggests that faulty attachment relationships are likely to contribute to the development of a cognitive vulnerability to anxiety. According to Ainsworth's and colleagues' (Ainsworth, Blehar, Waters, & Wall, 1978) model of childhood attachment, an anxious/ambivalent attachment reflects the infant's perceptions of the caregiver as inconsistent in responding to his or her needs, particularly during times of distress.

Bowlby's initial developmental model (e.g., Bowlby, 1980, 1988) suggests that early attachment experiences are generalized and abstracted into relational schemas that influence adult relationships, as well as strategies for emotional regulation. Consequently, disruptions in early attachment, such as parental separation, loss, neglect, or abuse, are likely to result in the development of negative relational schemas of self and/or other, as well as deficits in effective emotion regulation. These negative self and other relational schemas and deficits in emotion regulation strategies may result in increased liability to later psychopathology. For instance, Bowlby

(1973) articulated several specific types of attachment experiences that may result in subsequent anxiety disorders, all of which involve parental overcontrol through either overprotection or rejection.

A few studies have examined parenting variables as possible predictors of the development of the LCS. This research is notable because there have been relatively few attempts to use cognitive theory to integrate the links between cognitive vulnerability to anxiety and attachment variables. Riskind et al. (2004) presented two studies that examined the links between the LCS and parental bonding (Study 1) and perceived parental attachment orientations during childhood (Study 2). In the first of the studies, low levels of maternal overprotection and high levels of paternal overprotection significantly predicted LCS scores, beyond the effects of current anxious and depressive symptoms. In the second study, college students who reported their mothers, but not their fathers, had exhibited greater attachment insecurity (before the students had been 16 years of age) had higher LCS scores as well as greater anxious and depressive symptoms, adult romantic attachment insecurity (namely, attachment anxiety indicative of a negative model of self), and potentially high-risk relationship behaviors. The results converged on those of Study 1 in highlighting the potential importance of a secure maternal attachment as a buffer against environmental stressors, psychological disorders, and cognitive vulnerability to anxiety. Moreover, they suggest that perceptions of an insecurely attached mother can be reflected in the development of dysfunctional cognitive styles, such as the LCS, that confer risk for later anxiety.

Altan-Atalay and Ayvaşık (2018) conducted a similar study in a large sample of Turkish university students. Their results found significant positive associations between the students' LCS scores and maternal overprotection and attachment anxiety. These associations indicated that students who had greater levels of anxiety of abandonment had higher levels of LCS. Unlike Riskind et al. (2004), Altan-Atalay and Ayvasık found no evidence of a relationship between paternal overprotection and students' LCS scores. In considering these differences, they suggested that this may reflect the fact that fathers play a limited role in caretaking in Turkish families.

Several studies have focused on the detrimental psychological effects of parents' emotional, physical, and sexual abuse for the development of children and adolescents (Fergusson, McLeod, & Horwood, 2013; Pollak, 2003). Emotional abuse can be less obvious than the other forms of maltreatment, but can have negative consequences that can be stronger than those of physical or sexual abuse. These can include low self-esteem (Iffland, Sansen, Catani, & Neuner, 2012; Kuo, Goldin, Werner, Heimberg, & Gross, 2011), poorer functioning, resilience, and quality of life (Simon et al., 2009), as well as the development of psychological problems such as anxiety and depression (Gibb, Chelminski, & Zimmerman, 2007; Knappe et al., 2009). In a similar vein, maltreatment by peers (peer victimization, exclusion, and aggression), particularly during adolescent years, can be another developmental antecedent of maladjustment (McCabe, Miller, Laugesen, Antony, & Young, 2010; Storch, Masia-Warner, Crisp, & Klein, 2005). Prior to work by González-Díez, Orue, and Calvete (2016) research had suggested that the depressive negative cognitive style might behave as a mediator between emotional abuse and depression onset

(Liu, Choi, Boland, Mastin, & Alloy, 2013). But less was known about the role of cognitive vulnerabilities in mediating its effect on social anxiety. To this end they conducted a three-wave longitudinal design study to examine the role of parental emotional abuse and peer victimization and LCS in the onset of social anxiety symptoms. In a sample of 550 adolescents (M_{age} = 16.97, 56% female), they found that parental emotional abuse and peer victimization were both related to social anxiety cross-sectionally. The longitudinal data, however, revealed that only parental emotional abuse behaved as a predictor of social anxiety and the LCS acted as a mediator. Combined, these findings suggest that while parental abuse can lead to both depression and social anxiety, the type of cognitive vulnerability factor is critical. That is, whereas the depressive cognitive style acts as a mediator for its effects on depression, the LCS-social threat scale acts as a mediator for its effects on social anxiety.

Another study by González-Díez, Calvete, Riskind, and Orue (2015) investigated whether early maladaptive schemas on the Young Schema Questionnaire (Schmidt, Joiner, Young, & Telch, 1995) would predict the increase of social anxiety over time and whether the social threat subscale of the LCS would act as a mediator between schema domains and social anxiety. Using a three-wave longitudinal design with a sample of Spanish adolescents and young adults aged between 16 and 25 years old (M_{age} = 17.81, SD_{age} = 3.19), they showed that the LCS for social threat acted as a mediator between the early maladaptive schema of "other-directedness" and social anxiety at T3.

Research has also begun to examine how parental cognitive styles can affect the intergenerational transmission of anxiety and cognitive vulnerability. In one of the first studies to examine this possible etiological pathway, Riskind, Sica, Bottesi, Ghisi, & Kashdan (2017) administered a battery of questionnaires that contained three cognitive vulnerability factors (the LMSQ, anxiety sensitivity, the Penn State Worry Questionnaire) and the Beck Anxiety and Depression scales to a sample of young adult college students (N = 382) and their parents. Moreover, the effects of the predictors were analyzed for fathers and mothers separately because of evidence suggesting the need to look at genders effects separately (Van der Bruggen, Stams, & Bögels, 2008).

As expected, parents who had higher levels of anxiety had college offspring who were more anxious. Likewise, the findings indicated that parental LCS of both fathers and mothers were predictive of their offspring's LCS scores. There was thus a link between the characteristic cognitive styles of the parents and those of their offspring. Next, Riskind et al. examined whether parents' LCS scores predicted the anxiety symptoms of their offspring. The analysis showed that only paternal LCS was significantly predictive of higher levels of anxiety in their college age children. No effects were found for parental anxiety sensitivity and worry. Crucially, fathers' LCS scores significantly predicted offspring anxiety, and this was obtained after controlling for parental anxiety sensitivity, worry, and anxiety and depression scores. Moreover, the findings were obtained for both sons and daughters, indicating that the effects were not simply genetically carried by the male Y chromosomes of fathers to sons. Notably, no effects were found for maternal LCS on offspring anxiety.

Riskind et al. suggested that paternal LCS may contribute to increased risk of offspring anxiety in part because of parental role expectations. Fathers are traditionally expected to behave as the protectors of their families (Bögels & Perotti, 2011). As a result, when fathers habitually perceive themselves as vulnerable to dynamic growing threats may predispose their offspring to be more anxious.

Parental LCS could contribute to the development of offspring vulnerabilities through social learning or modeling and also potentially affect offspring through a "contagion" effect. For example, work on depression has shown that college students tend to adopt or "catch" the depressive cognitive styles of their roommates and are more vulnerable to subsequent depression (Haeffel & Hames, 2014).

Evidence That LCS and the Sense of Looming Vulnerability Are a Unifying and Overarching Theme Across Anxiety Disorders

According to the LVM, the perception of growing and approaching threat represents a unifying transdiagnostic theme in anxiety and anxiety disorders. This perception of looming vulnerability can be reflected in higher scores on the subscales of the general LMSQ but can also be found in specific themes that can differ from one disorder to another. A considerable number of studies have supported these postulates.

Williams, Shahar, Riskind, and Joiner (2005) attempted to determine the extent to which exaggerated perceptions of dynamic, growing threat, as measured by LCS, underlie the common features of numerous anxiety disorder symptoms in a college student population. They hypothesized that controlling for depressive symptoms, the LCS would predict variability in scores for a latent factor comprised of indicators of five anxiety disorder symptoms: Obsessive Compulsive Disorder (OCD), Post-Traumatic Stress Disorder (PTSD), Generalized Anxiety Disorder (GAD), Social Phobia, or Fear of Negative Social Evaluation (FNE), and Specific Phobic Fears (SPF). To test this hypothesis, undergraduate students ($N = 123$) were administered a set of measures of the above mentioned anxiety and depressive symptoms and the LCS. The results of structural equation modeling analyses supported the hypothesis that perceptions of looming vulnerability are an overarching, unifying theme and a cognitive marker for anxiety. More specifically, Williams et al. constructed a latent anxiety disorder symptoms factor with the SEM that enabled them to partition the variance of the various anxiety symptom scales and to examine the effect of looming vulnerability on the variance associated with the latent factor vs. that associated with specific anxiety indicators. Consistent with Williams, et al. hypothesis, the LCS was strongly related to the latent anxiety disorder symptoms factor.

Reardon and Williams (2006) conducted a subsequent follow-up study that confirmed and extended these findings. SEM analyses were conducted to investigate the specificity of the LCS as well as anxiety sensitivity and depressive explanatory style in the prediction of latent anxiety disorder symptoms and latent depression

symptoms factors. They asked undergraduate students to complete a set of measures that included the LCS and other cognitive measures and symptom measures including those of obsessive compulsive symptoms (OCI, Foa et al., 2002), panic-related body symptoms, (BSQ; Chambless et al., 1984), generalized anxiety disorder symptoms (GAD-Q-IV: Newman et al., 2002), and PTSD symptoms (PPTS-R: Lauterbach & Vrana, 1996).

Consistent with the hypothesis that perceptions of rapidly growing and approaching threat are a core transdiagnostic theme in anxiety, the SEM modeling analysis on these data indicated that the LCS predicted the latent factor for anxiety disorder symptoms. It was also found that the LCS and two other cognitive vulnerability factors differed in terms of their specificity. Namely, the LCS demonstrated specificity whereas anxiety sensitivity and depressive explanatory style did not. The LCS predicted the latent factor for anxiety disorder symptoms but not the latent factor for depression symptoms. To the contrary, anxiety sensitivity and depressive explanatory style showed no specificity and predicted both anxiety disorder and mood disorder symptoms.

Further evidence was found in a longitudinal prospective study conducted by Riskind, Tzur, Williams, Mann, and Shahar (2007) with a 1-week follow-up period. College students were administered a packet of measures at both time points that included the LCS, intolerance of uncertainty, and measures of anxiety symptoms (worry, social anxiety, panic symptoms, and OCD). A composite symptom index (equivalent to the first factor obtained from a factor analysis) was constructed by averaging the standardized scores for each anxiety symptom measure. The analyses verified that the LCS predicted anxiety symptom changes on this composite symptom index as well as on separate analyses of Beck Anxiety Inventory scores-anxiety, Penn State Worry Questionnaire scores-worry scores, and Padua-OCD symptom scores. In addition, an interaction effect emerged between the LCS and the anxiety composite, indicating that LCS had its strongest predictive effects at higher levels on the anxiety index. Unlike the LCS, however, there were no significant main effect or interaction effects that emerged for intolerance of uncertainty on any anxiety measure.

Additional evidence comes from a study with college students that employed a retrospective research design. Black, Riskind, and Kleiman (2010) examined whether two cognitive factors, the LCS and anxiety sensitivity, were significant predictors of a composite measure of previous lifetime history of anxiety disorders (simple phobias, social phobias, generalized anxiety disorder, OCD, and PTSD). Participants for the study were all currently anxiety-disorder free. That is, they had no current anxiety disorder diagnoses or elevated levels of anxiety symptoms. Supporting the LCS, higher LCS scores, but not higher anxiety sensitivity scores, were significantly predictive of a higher incidence of prior anxiety disorders on the composite index in this currently asymptomatic student population. The study also indicated that a high cognitive risk group (based on selecting participants who were one SD above median on both LCS and anxiety sensitivity) had a significantly higher incidence of past anxiety disorders in their lifetimes than a low cognitive risk group (one SD below median on both measures).

Evidence for Subtype-Specific Looming Vulnerability Themes

Besides the evidence that looming vulnerability is a transdiagnostic theme in anxiety, considerable evidence has also amassed that the specific looming vulnerability themes can differ in their details from one disorder to another. For example, social anxiety (Brown & Stopa, 2008; González-Díez et al., 2015; Reardon & Williams, 2006; Williams, Shahar, Riskind, & Joiner, 2005) and social anxiety disorder (Riskind, Rector, & Cassin, 2011) have repeatedly been shown to be associated with a specific LCS for social threat such rejection or humiliation. Contamination fear is associated with an LCS that involves visualizing germs as quickly proliferating and spreading (Dorfan & Woody, 2006; Green & Teachman, 2013; Riskind, Abreu, Strauss, & Holt, 1997; Riskind & Richards, 2018; Riskind, Wheeler, & Picerno, 1997; Tolin, Worhunsky, & Maltby, 2004). Similarly, high fear of HIV and Auto-Immune Deficiency Syndrome is associated with a tendency to visualize the HIV virus as mobile and rapidly spreading (AIDS; Riskind & Maddux, 1994). Anxiety in cancer patients with leukemia is associated with an LCS that involves visualizing the cancer and its problems as rapidly progressing. Similarly, spider fear has been shown to be associated with an LCS that involves imagining spiders as rapidly approaching (Riskind et al., 1992; Riskind, Moore, & Bowley, 1995).

In a study that constitutes the most comprehensive investigation of subtype-specific themes to date, Riskind et al. (2011) simultaneously compared a sample of treatment-seeking patients with four different types of DSM-diagnosed anxiety disorders on different looming vulnerability themes. More specifically, they examined the specificity of looming vulnerability themes to social phobia, GAD, panic disorder with agoraphobia, and OCD. As expected, social anxiety disorder and GAD scored highest on the LCS subscale for social threat. Likewise, panic disorder with agoraphobia scored higher than the other anxiety disorders on looming vulnerability themes related to panic attacks, and OCD scored higher than the other anxiety disorders on looming vulnerability themes for the looming spread of contamination.

Thus, there is evidence that the LCS captures a core transdiagnosic theme in anxiety. In addition to this, subtype-specific looming vulnerability themes show relative specificity to their corresponding symptoms. Or, to put this differently, individuals who experience a specific fear-relevant form of looming vulnerability such as for spiders do not necessarily exhibit other fear-relevant forms of looming vulnerability such as for threats of social rejection or contamination (Riskind et al., 1992, 2011). Finally, it should be noted that although it is assumed that having the general LCS is likely to increase the likelihood of additional more specific styles, a person can have one or the other, but both.

Evidence for the LCS and Cognitive Vulnerability–Stress Interaction

Once the LCS has been established as a distal vulnerability factor, we postulate that it causes individuals to be more sensitive to negative environmental stimuli and events. To date, several studies have presented evidence for the theoretically expected stress–vulnerability interaction for the looming cognitive style. Adler and Strunk (2010) carried out a longitudinal prospective study to test this cognitive vulnerability–stress interaction for the looming cognitive style. They followed 72 college students for a month and found that for individuals who scored high on the LMSQ (+1 SD), threatening events were strongly related to subsequent changes in anxiety over a 4-week prospective interval. However, for individuals who scored low on the LMSQ (−1 SD) no relationship was found between negative events and anxiety. Next, Adler and Strunk (2010) examined whether the interaction between threatening events and was specific to anxiety or whether it also predicted changes in depression. Whereas the interaction between threatening events and the LCS continued to significantly predict anxiety, even when controlling for concurrent depression symptom changes, the opposite was not true, and it did not predict changes in depression symptoms when controlling for anxiety.

Next, Adler and Strunk (2010) also tested the interesting prediction that the LCS would moderate the impact of an index of *expected* (rather than actual) negative events (i.e., events that were anticipated by individuals to be likely in the future). The same interaction effect was found between LCS and the measure of expected negative events. Expected negative events were associated with increases in anxiety over time when individuals had high LCS but were not evident for individuals who were low in LCS. Moreover, there were no independent effects of LCS on changes in depression.

Confidence in Adler and Strunk's (2010) findings is further reinforced by the fact that they are consistent with those of an earlier but unpublished doctoral dissertation by Williams (2002). In a series of study, Williams demonstrated that the LCS interacted with negative life events to prospectively predict anxiety. Just as Adler and Strunk found, LCS did not interact with negative life events to predict future depression.

In another study, del Palacio-González and Clark (2015) investigated the interaction effects between a mood-induction procedure and two cognitive vulnerability factors, the LCS and anxiety sensitivity. In a parallel to the findings of Adler and Strunk (2010) and Williams (2002), they found that when negative mood was induced that the looming cognitive predicted the intensity of fear reactions but didn't predict sadness reactions. Of note, anxiety sensitivity predicted the intensity of both fear and sadness reactions to the mood-induction.

In other studies, measures of negative events were not assessed, but additional evidence has been found that confirms the incremental predictive validity of the LMSQ-R in predicting future anxiety. Numerous longitudinal studies (with follow-ups ranging from 1 to 4 weeks in duration) have shown that LCS significantly predicted residualized gains in anxiety and anxiety-relevant constructs when controlling

for baseline levels of anxiety (e.g., Riskind et al., 2007; Riskind & Williams, 1999; Riskind, Williams, Gessner, Chrosniak, & Cortina, 2000). Moreover, this found for numerous anxiety syndromes and symptoms including generalized symptoms, worry, social anxiety, and OCD symptoms.

Riskind et al. (2007) found that LCS interacted with initial levels of a composite anxiety measure (based on worry, panic symptoms, OCD symptoms, social anxiety) to predict levels of anxiety on the measure a week later. They found a main effect for LCS, and in addition to this, found that the effect was stronger for participants scoring higher (above median) on the anxiety composite (perhaps a proxy for higher recent stressful life events) than for those scoring lower on the composite measure. When specific anxiety symptoms were assessed, LCS predicted significant increases in worry and in OCD, and a near-significant strong trend for audience anxiety (a form of social anxiety). Of note, another cognitive vulnerability construct, intolerance of uncertainty did not predict changes in anxiety at the 1-week follow-up period.

Over a much more extended prospective time window, two studies have demonstrated that the LCS predicts social anxiety and OCD symptoms over two successive 6-month intervals. However, they did not explore changes in depression (Calvete, Riskind, Orue, & Gonzalez-Diez, 2016; Sica et al., 2012). More recently, Riskind et al. (2017) conducted a study to investigate the relationship between the LCS and changes in anxiety and depression symptoms over the course of a year's time. Investigating a sample of 187 Italian college students, they assessed LCS, as well as anxiety and depression symptoms at 3 time points (baseline and 6 and 12 months later). Consistent with the predictions of the LVM, the results showed that LCS predicted anxiety symptom changes over the two 6 month prospective intervals of the year-long study with relative specificity. The results indicated that after controlling for baseline anxiety symptoms, LCS (and the social, but not physical looming subscale) predicted changes in anxiety symptoms 6 months later, as well as the unique variance in anxiety not shared with depression. However, LCS scores did not predict changes in depression syptoms. It is also noteworthy that the study examined whether the LCS and anxiety exerted reciprocal influences over each other. The results did not support such reciprocal influence. Overall, these results strongly supported our cognitive specificity hypotheses.

As mentioned, a retrospective study by Black et al. (2010) selected college students who did not currently have anxiety or mood disorders at baseline and assessed their prior lifetime history of such disorders. Results confirmed that a "high cognitive risk" group (which was high in both LCS and anxiety sensitivity) reported a greater prevalence of past anxiety disorders than the low cognitive risk (which was low in both cognitive factors) group. When LCS and anxiety sensitivity were examined as risk factors separately using scores for the whole continuum of scores for each variable separately (Lewinsohn et al., 2001), they found that LCS but not anxiety sensitivity predicted past psychiatric diagnoses of anxiety disorder. Further, LCS only predicted lifetime prevalence of anxiety disorders but did not predict mood disorders.

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Chapter 10
Looming Cognitive Style Contributes to Etiological Processes in Anxiety Disorders

The looming vulnerability model (LVM) is concerned with theoretical features of cognitive vulnerability and threat that have been overlooked by other contemporary cognitive vulnerability models. Cognitive vulnerability is not viewed in the LVM as simply due to beliefs and appraisals that overestimate the probability or costs of potential threat stimuli. Other cognitive vulnerability factors such as anxiety sensitivity and intolerance of uncertainty can be viewed in those more static terms. The LVM, in contrast, emphasizes that perceptions of rapid dynamic patterns of change and increases on threat appraisal dimensions also critically contribute to anxiety. For example, if a person believes that there is a high probability of a physical or psychological symptom leading to a negative or catastrophic outcome, the outcomes will evoke less intense anxiety if it is expected to progress slowly or be static than if it is perceived as progressing quickly and suddenly. Notably, a threat is less likely to have an impact on etiological pathways if it is not perceived as dynamically growing. The looming cognitive style (LCS) is introduced to represent these theoretical features of cognitive vulnerability that other vulnerability factors such as anxiety sensitivity and intolerance of uncertainty don't capture.

According to the LVM, the LCS is presumed to remain relatively latent until activated by requisite stimuli (such as negative environment stimuli or negative events). It is activated by major negative life events. However, when the LCS has been recently primed or activated and is more cognitively accessible (e.g., Higgins, Rholes, & Jones, 1977; Riskind & Rholes, 1984), relatively minor events may activate the LCS to a higher level.

Notably, a person is viewed as often having little awareness of these effects. As Bargh and Williams (2006) have described, encounters with everyday situations can activate emotional and motivational tendencies and biases without the person's conscious awareness. Nonetheless, after it is activated, the LCS is hypothesized to have significant repercussions on multiple etiological processes that can reverberate throughout "the whole of the person's cognitive, affective, and behavioral systems" (Riskind & Williams, 2006).

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A Brief Sketch of Etiological Chains: How the Looming Cognitive Style Confers Cognitive Vulnerability

Once the LCS is activated, it is assumed to produce a schematic processing bias for threat information in individuals who are cognitively vulnerable. The LCS functions as a danger schema that actively affects the selection, interpretation, and memory of potential threat information (Riskind & Williams, 2006; Riskind, Williams, Gessner, Chrosniak, & Cortina, 2000). This activation of schematic processing biases creates the person's perceptions of looming vulnerability. This schematic processing sensitizes the person to threat movement and signs of intensifying danger in the environment (even when they aren't there), biases cognitive processing, and renders the anxiety to be more intense, persistent, and less likely to habituate (Riskind, 1997; Riskind et al., 2000). In this way, the schematic processing can lead to hypervigilant attention, memory bias for threat information, biased appraisals and threat overestimation, and can generate a continuing stream of inflated cognitions and images of threat. As a direct result, the cognitively vulnerable individuals can come to feel more intense anxiety and negative affect than others do in the same circumstances as well as fear their intense emotions. Another repercussion of this pernicious chain of events is that they can lead the cognitively vulnerable person to become mentally depleted and to rely on maladaptive coping reactions such as indiscriminate freezing responses and rigid avoidance coping. In addition, LCS can contribute to the onset, escalation, and maintenance of anxiety through reciprocal influence processes.

In the LVM, the sense of looming vulnerability to a potentially uncontrollable threat is viewed both as a *necessary cause* of the experience of anxiety (i.e., it must be above a minimal threshold for any anxiety to occur) and a *sufficient cause* for the experience of anxiety (i.e., its occurrence guarantees the anxiety → self-protective response sequence). In some cases, individuals may have a "stimulus-specific" form of looming vulnerability theme without developing the general LCS. For example, some persons with specific phobias may have a restricted, stimulus-specific looming style (e.g., for representing spiders or social rejections as rapidly approaching or rising in risk). Although a person can have one without the other (i.e., the general LCS and the specific looming vulnerability theme), it is postulated that the general predisposition or LCS biases the person to be more sensitive to the looming properties and threat potential of a variety of environmental stimuli.

Repercussions of Activation of the LCS: Cognitive Processing

As mentioned, the LCS can be viewed as having painful repercussions that reverberate throughout the whole of the individual's cognitive, affective, physiological, and behavioral systems. These repercussions can influence anxiety through a series of etiological chains. These include: (1) schematic processing biases in attention,

memory, and the interpretation of threat information; (2) more intense affective and physiological responses to threat; (3) greater behavioral urgency; (4) mental depletion and cognitive overload; (5) reliance on maladaptive, default coping responses. In addition, the LCS and its repercussions can interact through bidirectional or reciprocal feedback loops.

Attentional Processing Biases in Initial Processing

As we saw in Chap. 6, looming objects capture attention. This has been evolutionarily adaptive on larger scale, but in the case of a person who has the LCS, a general tendency to perceive simulations of dynamic looming threats has morphed to become disruptive and dysfunctional. Such a person may be hypervigilant and susceptible to attentional capture, as well as find it more difficult to disengage attention, because he/she sees growing threat even when there is no such threat present.

Although a conspicuous dearth of research exists on the effects of LCS and hypervigilance, a recent study by Basanovic, Dean, Riskind, and Macleod (2017) has indirectly taken a step in this direction. Their study focused on the nature of the relationship between spider fear and attentional vigilance. To this effect, they used a novel attentional vigilance task to present color images of spiders or butterflies, some of which were approaching and some of which were receding from participants. While no fear-linked difference was found in vigilance for spider images that displayed approach movement, a significant fear-linked difference emerged when spider images displayed a receding movement. Namely, the higher spider fear participants, as compared to the lower spider fear participants, demonstrated heightened vigilance to spider images when images displayed a receding movement.

As was described in Chap. 6, virtually anybody is likely to have their attention captured when they spot a spider suddenly moving toward them. The state-elicitation of looming vulnerability by a looming spider can nullify or minimize the effects of preexisting differences in chronic fear levels. In the absence of the state-elicitation, however, spider fearful individuals may maintain more hypervigilance even to receding movement because of their internal simulations of rapidly approaching spiders.

Perceptual Biases

We suggest that the LCS produces perceptual biases toward overestimating the speed, closeness, and time of arrival of approaching threat objects. Riskind, Kleiman, Seifritz, and Neuhoff (2014) examined the separate and conjoint effects of the LCS and anxiety on the anticipatory auditory looming bias (the tendency to overestimate the closeness and speed of an approaching sound source). One notable

finding was that although anxiety increased the anticipatory auditory looming bias, depression reduced it. This finding is consistent with the theoretical presupposition (see Riskind, 1997) that anxiety has the evolutionary adaptational function of increasing early detection and preparation for threats *before* they have already struck. Depression, on the other hand, lacks this function because it is an evolved adaptation for dealing with negative events (e.g., past losses) after the blow has already been struck.

The central purpose of the Riskind, Kleiman, Seifritz, and Neuhoff's (2014) study was to examine the interactive effects of LCS and anxiety. In specific, it was expected that facilitating effects of anxiety on the tendency to overestimate the speed and closeness of an approaching sound source would primarily occur under conditions in which the physical threat component of the LCS was high. In contrast, anxiety could divert a person's attention away from physical threat to ruminating about social rejection when the social threat component of the LCS was high. Anxious individuals who worried and ruminated about social threats would thus be less motivated to be vigilant to the rapid early detection of the approach of physical threats. Upholding these expectations, two significant interaction effects were found, which together accounted for an astounding 22% of the variance in anticipatory auditory looming. Notably, the interaction between anxiety and LCS-physical threat and anxiety and LCS-social were not due to suppression effects. Both were obtained when they were analyzed alone in separate regression models.

In a study designed to extend these above findings, Riskind, McDonald, Buzzell, and Beaver (under review) examined the effects of LCS and anxiety by using a visual expanding geometric object rather than an auditory looming paradigm. The participants were asked to perform in a novel task where they were shown a darkened circle that either expanded and approached (visual looming) or contracted and receded. They were asked over a series of trials to press a button to indicate when they believed the circle had reached its maximal distance in moving close when approaching or moving away when receding. Notably, the results revealed a significant main effect for LCS. The LCS for physical threat predicted a stronger tendency to overestimate the closeness of the expanding geometric object on this visual looming task. Unlike the auditory looming study of Riskind et al. (2014), no main effect or interaction for anxiety emerged. A methodological strength of this visual looming study was that the analyses controlled for the participants' tendencies to overestimate the distance of the object when it was receding. Thus, the study controlled for individual differences in impulsiveness.

Interestingly, additional findings of this study also revealed that the LCS for social threat also predicted participants' tendencies to overestimate the speed and closeness of the expanding visual object. As well, the effects of the LCS-physical and LCS-social components of the LCS were independently statistically significant. Riskind et al. suggested that the LCS-social factor may have increased physical threat because research has shown that there is a more general tendency for individuals to make anthropomorphic appraisals and attributions to moving visual objects (e.g., see Chap. 5; (Heider & Simmel, 1944; Kuhlmeier, Wynn, & Bloom, 2003; Michotte, 1962)).

Combined, these studies support that the LCS is related to overestimation of the closeness and time of arrival of both visual and auditory looming stimuli. Future studies could compare threatening and neutral stimuli rather than rely just on the neutral geometric object used by Riskind et al. on distance estimation. It would also be interesting to explore other biases such as perceptual biases in time duration during threat exposure. As previously seen, individuals have been found to overestimate the passing of time (time dilation) when in the presence of threat (see Chap. 5; Langer, Wapner, & Werner, 1961).

Influence of Perceptions of Looming Vulnerability on Appraisals and Inferences

In describing his emotions theory, Scherer (Scherer & Brosch, 2009) briefly cited the looming vulnerability model and impact that perceptions of dynamic spatial/temporal movement can have on cognitive appraisals. Scherer and Brosch stated that the LCS can be "considered an example of a dysfunctional appraisal bias" that affects many aspects of perception and judgment and that it "may facilitate the development of the actual anxiety disorder" (p. 275). In connection with Sherer's model and many other cognitive models of emotion (Ellsworth & Scherer, 2013), we could expect for similar reasons that an individual's perceptions of dynamic parameters should likely have significant effects on a range of appraisals such as novelty, intrinsic pleasantness, urgency, certainty/predictability, goal significance, and coping potential (see Chap. 5).

As previously described in Chap. 5, research suggests that when threat stimuli (e.g., images of tarantulas) are displayed as approaching, people tend to judge them as more threatening, more likely to produce harm, more difficult to control, etc., than when the images are displayed as stationary or moving further away (Riskind, Kelly, Harman, Moore, & Gaines, 1992; Riskind & Maddux, 1993). In addition to these state elicitions of looming vulnerability, the LCS, which biases people to perceive threats as growing and approaching, is also postulated to produce more negative threat appraisals. Consistent with these expectations, Riskind et al. (2000) found that scores on the LCS were highly correlated with other self-reports of appraisals of the probability including negative events in the LMSQ scenarios, as well as of their uncontrollability and unpredictability.

Another study by Riskind, Calvete, and Black (2017) employed a longitudinal prospective design which included a measure of thought tapping. Participants' in a public speaking course was asked to record their thoughts four times over the course of 3 weeks leading up to a public speech (at the announcement of the speech, a week later, 2 weeks later, and on the day of the speech). The LCS for social threats prospectively predicted the extent to which the participants exhibited threat ideation on the thought tapping measure over the course of the study. This finding is noteworthy because anxiety did not predict the course of their threat ideation.

Several studies have extended the foregoing sets of findings on the expected effects of the LCS with laboratory-based tasks. As will be discussed soon in somewhat more detail, a study by Riskind et al. (2000) demonstrated that college students with higher levels of the LCS were more likely than students with lower levels to interpret ambiguous verbal information on a homophone task in a threatening manner. Specifically, they tended to spell out ambiguous tape-recorded words (e.g., "die" versus "dye") with the more threatening spelling and meanings.

In another lab-based study, Pietri, Fazio, and Shook (2012) reported novel evidence that supports that the LCS can affect threat appraisals. They focused on a hypothesized "negative weighting bias" that occurs when individuals make negative attitude generalizations from prior events. The participants in their study performed on a computer game in which their task was to maximize points. They had to learn which presented stimuli (i.e., game beans) would win as opposed to lose them points. In the next phase, they were shown novel (never seen before) game beans that resembled prior beans that had either earned or lost them points. Pietri et al. observed that a stronger negative weighting bias was displayed by participants with higher levels of the LCS, as well as those with aversion to risk-taking and rejection sensitivity. Thus, their findings suggest that individuals with LCS tend to make more negative inferences in attitude generalization.

Memory Bias

To examine the links between the LCS and schematic processing bias, several studies have been conducted to investigate its effects on memory. A cluster of our studies have examined memory for lexical and visual threat-related stimuli on both explicit memory tasks (which make direct reference to study materials) and implicit memory tasks (which make no direct reference to such materials). First, as just mentioned, the results of the study that used a homophone task indicated that the LCS is significantly and uniquely related to the tendency to process and interpret ambiguous verbal information (e.g., "dye" versus "die") in a threatening manner (e.g., Riskind et al., 2000).

Viewed from a more detailed perceptive, the results indicated that the standardized coefficient representing the path between the LCS and the homophone measure was significant, whereas the coefficient representing the path between anxiety and the homophone measure was not. Further, elimination of the path between the LCS and the homophone measure resulted in a significant decrement in model fit, whereas elimination of the path from anxiety to the homophone variable did not. A second set of analyses conducted to distinguish the effects of the LCS from likelihood estimates and the latent anxiety variable on the prediction of homophone spelling revealed a similar outcome: only the path between the LCS and the homophone measure was significant, and it was only the elimination of this path that produced a significant decrement in model fit.

These results indicate that the LCS produces a schematic bias to interpret and implicitly remember ambiguous information that cannot be accounted for by static expectations of threatening situations (e.g., likelihood estimates). Consistent with a broader perspective that emphasizes the role of danger schemas in information processing, they suggest that anxiety may primarily exert effects on such interpretative and memory biases via the guiding influence of the LCS. Finally, it was noteworthy that these results were even replicated in a *low anxiety* subsample, based on a median split of the participants performed on the latent anxiety variable. Thus, these exciting results suggest that the LCS produces a schematic bias in implicit memory, even for individuals who are *demonstrably* not currently anxious. Despite the fact that they did not examine actual clinical anxiety, these data are especially provocative since they imply that in many cases anxiety may primarily exert an effect on schematic processing via the LCS. Moreover, they imply that inconsistent findings regarding the associations between anxiety and schematic memory biases may sometimes emerge because of failure to take the LCS into account.

In another experimental laboratory study, Riskind et al. (2000) investigated the effects of the LCS on memory for visual threat-related stimuli. Participants were presented with 45 neutral (e.g., fish), positive (e.g., flowers), or threatening visual images (e.g., a house fire or auto crash) and asked to rate the extent to which each image was threatening so as to ensure their attention to the stimuli. The study included two measures of explicit memory (a free recall task, a frequency estimation task), and a measure of implicit memory (a word-stem completion task). Structural equation modeling replicated the pattern of the preceding study. Again, the standardized coefficient representing the path between the LCS and the dependent variables was significant, whereas the coefficient representing the path between latent anxiety and these dependent variables was not. Further, omission of the path from the LCS to each of these dependent variables resulted in a significant decrease in model fit, whereas elimination of the path between anxiety and the dependent variables did not.

Using a false memory paradigm, Monds, Paterson, Kemp, and Bryant (2013) examined the relationships between the LCS and the Post-Traumatic Cognitions Inventory (PTCA; Foa et al., 1999) on false memory for trauma-related words. College students were presented with six lists of trauma-related words (e.g., cut, assault, beaten) and six more lists of neutral words (e.g., shoe, hill, and postman) on a computer screen (2 s for each word), and then administered a free recall questionnaire and a recognition questionnaire. False memory scores were assessed by computing scores for free recall and reported recognition of critical lures (e.g., injury, suffered) that were thematically related to the original sets of trauma words but had not been shown.

Neither of the cognitive predictors predicted false memory scores for trauma words on the free recall task. Monds et al. (2013) interpreted this as indicating that these did not affect false memory processes. Notwithstanding this conclusion, their findings did reveal that LCS had a significant positive association with an intrusion index of false memory. Individuals who were higher in the LCS exhibited a greater number of false intrusions (remembering having seen trauma words that were nei-

ther false lures or words on the original list). Such intrusions are also indicative of false memory. Thus, Monds et al.'s data provided interesting evidence suggesting that the LCS can contribute to false memory. In addition, they noted that stronger findings might have been obtained had participants been selected for having experienced traumas.

Another interesting finding of Monds et al. (2013) is that LCS and PTCI were both positively associated with higher rates of *accurate* recognition memory of words from all the previously seen word lists. They explained this finding by suggesting that greater hypervigilance to threat cues would have increased accuracy. This would explain why they would exhibit increased accuracy by reducing levels of incorrect identification of the critical lures in the previously seen word lists.

More recently, West, Riskind, and Chrosniak (2018) explored the impact of the LCS and anxiety on the generation of false memories for images of threatening or nonthreatening animals (e.g., spiders versus turtles). As compared to individuals who were low in one or both factors, those who combined high anxiety with high LCS for physical threats were significantly more likely to falsely remember images of threat animals as approaching than as receding. West et al. interpreted these findings as indicative of the greater behavioral urgency of highly anxious individuals who have the LCS. Namely, a greater sense of looming vulnerability and behavioral urgency could heighten the likelihood of their falsely remembering seeing images of threatening animals as approaching. Moreover, the behavioral urgency account is also consistent with the finding that those participants tended to have faster reaction times in the recognition task. Behavioral urgency has been shown to produce faster reaction (Landy, Rastegary, Thayer, & Colvin, 1991).

Repercussion of the Activation of the LCS for Emotion and Physiological Response, Behavioral Urgency, and Defensive Responding

Intense Emotion and Physiological Response

As compared to individuals who have lower levels of the LCS, those with higher levels of the LCS are expected to have more intense emotion and physiological distress in response to threatening environmental stimuli or events. In addition, they might have different patterns of neural activation during neural imaging studies. To date, there is a paucity of research that explores these issues. However, Franklin, Ruscio, and colleagues have reported preliminary evidence that individual differences in the LCS predict cognitive, emotional, and physiological responses to a stressor task (the Trier Social Stress Task; Kirschbaum, Pirke, & Hellhammer, 1993) among individuals with GAD, comorbid GAD, and comorbid major depressive disorder, or no lifetime psychopathology (Franklin, Forbes, Kennedy, Spandorfer, & Ruscio, 2018). As we will soon mention at a later point in this chapter, the LCS may also predict corresponding fears of intense emotions and loss of emotional control.

Behavioral Urgency and Self-Protective Responses

We suggest that the sense of rapidly rising risk from dynamic growing threat is also likely to naturally evoke a greater sense of behavioral urgency and distress and lead cognitively vulnerable individuals to engage in various *self-protective behaviors*. When direct action is possible, cognitively vulnerable individuals may engage in behavioral avoidance. When direct action is not possible or when there are no instrumental responses immediately available to prepare for the possibility of countering the prospect of harm, the person may engage in cognitive avoidance behaviors.

Freezing. As we saw in Chap. 4, human and nonhuman subjects alike exhibit a brief initial freezing response and immobility when encountering threats. These brief freezing responses have been typically interpreted as having an adaptive function for evaluating the magnitude of the threat and available coping resources. Although such freezing responses might have an evolved adaptive function, it is presently assumed that the LCS can lead to maladaptive and inappropriate freezing responses that interfere with effective coping.

In a study that they designed to examine the psychometric structure of the intolerance of uncertainty construct, Hong and Lee (2015) reported that the LCS was significantly correlated with the "Inhibitory" component of intolerance of uncertainty. This Inhibitory component assesses maladaptive tendencies to "freeze-up" (paralysis) under conditions of uncertainty, as well as delayed decision-making and perseverative thinking about possible threats (Dugas, Gosselin, & Ladouceur, 2001; Dugas and Robichaud, 2007). Thus, Hong and Lee's finding suggests that LCS is associated with a chronic tendency to freeze-up under conditions of uncertainty. Unlike the Inhibitory component, the "Prospective" component of intolerance of uncertainty was not significantly associated with scores on the LCS. The Prospective component represents a desire for predictability of future events and triggers engagement in strategies such as information seeking to reduce uncertainty.

A chronic freezing response that is expressed in inappropriate contexts becomes ineffective and dysfunctional because it hinders flexible responding. Individuals who are not able to show an adequate freezing response, in terms of both its duration and context, tend to remain immobile and vigilant irrespective of the presence of actual danger, which limits their ability to use adaptive coping strategies (Hagenaars et al., 2014). Researchers have speculated that immobilizing freezing responses may be etiologically related to several anxiety disorders including social anxiety (Buss, Davidson, Kalin, & Goldsmith, 2004) and PTSD (Hagenaars, Van Minnen, Holmes, Brewin, & Hoogduin, 2008; Rizvi, Kaysen, Gutner, Griffin, & Resick, 2008).

With respect to this possibility, a study by Riskind, Sagliano, Trojano, and Conson (2016) examined whether the LCS predicts freezing reactions. Participants were asked to make judgments about whether images of animals or other stimuli were "living" or "nonliving." Slower reaction times (RTs) on this lexical decision task for images of approaching threatening animals (e.g., spiders or snakes), as compared to those of receding animals or nonthreatening animals, have been interpreted as indicating freeze-like reactions (Sagliano, Cappuccio, Trojano, & Conson,

2014). The study tested the hypothesis that higher scores on the LCS for physical dangers would be associated with more inflexible and indiscriminate freeze-like reactions. As expected, higher scores for the physical threat component of LCS were associated with more generalized freeze-responses (slower RTs) to all animal images (threatening or neutral) without regard to their movement direction (approaching or receding).

Unlike the overgeneralized freezing response pattern of participants with higher scores on the LCS for physical dangers, those with lower scores tended to exhibit more selective and functional freezing. Namely, freeze-like responses only occurred to threatening animals with the approaching motion (not to neutral animals or any animals with receding motion).

Although the participants with higher LCS scores for physical danger showed slower reaction times to animal stimuli, they weren't generally slower than those with lower levels of LCS. Other data revealed that they were no slower than those with lower LCS scores for physical danger when rating furniture or other neutral stimuli on a control task. The specificity of the association was also supported by additional findings that examined the LCS for social threat. When statistically controlling for the LCS for social threat, the findings for the LCS for physical remained significant, but the opposite wasn't true. The LCS for social threat was not significantly associated with reaction times when the LCS for physical threat was controlled. Additional findings revealed that there were no significant relationships between anxiety and behavioral inhibition scores on the BIS/BAS and freezing responses.

Other Maladaptive Coping

Cognitive Overload and Maladaptive Coping. A chronic or prolonged activation of the LCS can lead to a sense of cognitive-affective overload (e.g., Wegner, 1994; Wegner, Erber, & Zanakos, 1993). We suggest that if individuals experience an unrelenting and cross-situational sense of behavioral urgency, this can deplete mental resources that they require for effective coping (Muraven, Tice, & Baumeister, 1998; Schmeichel & Baumeister, 2004; Vohs, Baumeister, & Ciarocco, 2005). Based on this reasoning, we expect that a person with LCS, and particularly when it is activated, can have fewer mental resources with which to engage in successful mood-regulation or to cope with potential threats (see Riskind & Williams, 2006).

In combination with the above, mental depletion of coping resources and cognitive overload could make it more difficult to step back from any inflated initial automatic negative appraisals and engage in "rational" re-evaluations of the magnitude of threats or of coping responses that remain available. On a similar note, Gilbert and Malone (1995) have proposed that the initial cognitive appraisals that individuals make of events are normally simplistic and impressionistic. Thus, to have more balanced appraisals, individuals must take a second step involving more effortful cognitive activity to adust their appraisals by taking account of additional information. However, individuals do not ordinarily take this extra step if

they are feeling threatened, stressed, fatigued, or distracted. This account aligns with the possibility that the cognitive overload and mental depletion resulting from the LCS can therefore impede individuals from adjusting initially extreme automatic judgments.

To the extent that they have a diminished capacity for mental control while having exaggerated threat ideation, individuals can come to rely on ineffective, inflexible, "default" coping strategies (Riskind & Williams, 2006). Although these would have the advantage that they can be rapidly deployed, they have the cost of often being exaggerated and unnecessary, as well as represent highly restricted avoidance coping strategies (Riskind & Williams, 2006).

In research related to the foregoing concerns, Williams (2002) developed a measure of coping flexibility (the ability to re-evaluate and apply multiple coping strategies in response to changes in the veridical conditions of threat). His studies with this measure confirmed that individuals with the LCSs tend to use rigid and inflexible avoidance coping styles. In addition, this link or association between LCS and avoidance coping was stronger than the link between anxiety and such avoidance coping.

As we described, activation of the LCS is assumed to lead to the generation of a stream of threat ideation in the individual's stream of consciousness. This threat ideation intensifies the person's perception of behavioral urgency due to threat as well as the person's feelings of fear. Evidence that the LCS can generate a stream of threat ideation comes from a short-term prospective study by Riskind, Calvete, and Black (2017), mentioned earlier, that used a thought tapping paradigm. In this study, we assessed threat ideation four times over the course of 3 weeks leading up to a public speech. The LCS for social threats prospectively predicted the extent to which the participants exhibited threat ideation on the thought tapping task over the course of the study. Anxiety, however, did not predict the course of their threat ideation.

Building on a body of research on the role of worry in pathological anxiety, we assume that worry can be characterized as another self-protective process (e.g., Borkovec & Hu, 1990; Borkovec & Inz, 1990; Borkovec, Ray, & Stoeber, 1998). In addition, we assume that the worry process can be generated by the LCS because it leads individuals to engage in imagining and simulating dynamic mental experiences of anticipated rapidly growing and escalating threats. Significant relationships between the LCS and worry have been found in college students (Riskind et al., 2000; Riskind, Tzur, Williams, Mann, & Shahar, 2007), community samples (Riskind & Williams, 2005), and even in psychotic inpatients (Clemente, Gleeson, & Lim, 2013). Moreover, Riskind et al. (2007) found that the LCS functions as a cognitive vulnerability that predicts future levels of worry on the Penn state worry questionnaire over a 1-week prospective interval. In contrast to the LCS, they found that intolerance of uncertainty did not predict worry changes.

As previously suggested, the cognitive overload and loss of coping flexibility associated with the LCS, as well as the more intense anxiety and physiological reactions that it can elicit, should be expected to make the challenge of controlling intense emotions seem more threatening and uncertain. Consistent with this hypothesis, Riskind and Kleiman (2012) showed that the LCS was significantly and positively associated with higher scores for experiential avoidance and maladaptive

beliefs that emotions are uncontrollable and threatening. In a second study, Riskind and Kleiman demonstrated that the LCS significantly predicted increased fears of intense emotions and loss of emotional control over a month's prospective interval. These effects were obtained when controlling for initial fears of intense emotion and loss of emotional control at baseline.

In short, the LCS is predictive of both worry and fears of intense emotion. Other findings reported by Riskind et al. (2000) documents that the LCS is significantly associated with higher scores for thought suppression on the White Bear Thought Suppression Inventory (Wegner, 1994).

Recursive and Bidirectional Feedback Loops Involving Looming Vulnerability Perceptions in Anxiety

Finally, we suggest that the etiological chains related to anxiety often involve bidirectional reciprocal feedback loops in which individuals' pathological anxiety, maladaptive avoidance, or neutralizing behavior helps to maintain their distorted perceptions of rapidly growing danger (i.e., the LCS). For example, the LCS can give rise to higher anxiety, which in turn can affect future LCS.

In one study, Calvete, Riskind, Orue, and Gonzalez-Diez (2016) employed a prospective longitudinal design to examine possible reciprocal relationships between the LCS and symptoms of social anxiety and depression over three time points (6 months apart from each other) over a year's time. Structural equations modeling was employed to determine whether the LCS-social looming scale predicted social anxiety and whether social anxiety predicted changes in the LCS-social looming scale in return. The findings strongly supported a reciprocal feedback loop between LCS and social anxiety. Individuals who were higher in the social looming scale of the LCS tended to become more socially anxious over the 12 months of the study and individuals who were higher in social anxiety also tended to exhibit higher scores on the social looming scale of the LCS. In contrast to social anxiety, the LCS did not predict depression and depression did not predict the LCS over the year of the study.

A second study by Riskind, Calvete, and Black (2017) has provided additional support for the feedback loop hypothesis. Riskind et al. assessed the LCS for social threat and symptoms of anxiety at four times over a 3-week period prior to an assigned speech: when the assignment was first announced (T1), 2 weeks (T2), and 1 week (T3) prior to the presentation, and on the day of the presentation (T4). Consistent with Calvete et al.'s study (2016), higher scores on the LCS for social threat were predictive of higher subsequent levels of anxiety over time than as compared to lower scores, and higher levels of anxiety were predictive of higher scores on the LCS for social threat. Together, the findings of the two studies suggest a *cascade or snowball model* (Masten & Cicchetti, 2010) for anxiety, analogous to that for depression (Calvete, Orue, & Hankin, 2013, 2015; Nolen-Hoeksema, Stice, Wade, & Bohon, 2007). Namely, the LCS and anxiety would seem to predict and intensify each other in a negative self-sustaining cycle.

Another reciprocal process in anxiety can involve the stress generation process (Hammen, 1991). A great deal of research has documented that depression, as well as cognitive vulnerabilities to depression, are associated with heightened tendencies for individuals to generate negative life events (Hammen, 1991; Liu & Alloy, 2010). Although the great bulk of this body of research has focused on depression, we have conducted a series of studies that have extended the work on stress generation to cognitive vulnerability to anxiety.

First, Riskind, Black, and Shahar (2010) examined whether LCS and anxiety sensitivity predicted elevated rates of stressful life events over a 4-month prospective interval. The rationale for the predictions in this study was that depletion of self-control resources can compromise a person's ability to solve problems, cope with stress, inhibit unwanted thoughts, and manage impressions (Gailliot, Schmeichel, & Baumeister, 2006; Schmeichel, Vohs, & Baumeister, 2003; Vohs et al., 2005). We hypothesized if individuals had the LCS this would deplete their coping resources by causing them to feel more anxious. In addition, we assumed that these depleting effects of anxiety would be synergistically compounded were the participants to have a co-occurring vulnerability to anxiety sensitivity since having this vulnerability would make the anxiety even more threatening. As expected, a significant interaction effect emerged between the LCS and anxiety sensitivity to predict stress generation, and this was found after controlling for the main effects of both cognitive vulnerability factors and for their baseline levels of stressful life events and anxiety and depression symptoms. The interaction effect indicated that individuals who were higher in both the LCS and anxiety sensitivity reported far higher rates of negative life events than others over the 4-month period than individuals who had only one or neither of these cognitive vulnerability factors. Those results were replicated in a follow-up study by Riskind, Kleiman, Weingarden, and Danvers (2013) that used a shorter 4-week (rather than 4 month) prospective interval.

In another study, Kleiman and Riskind (2013) demonstrated that the depressive cognitive style and looming cognitive style also significantly interacted to predict future stress generation. Extending previous studies of both the depressive cognitive style and the LCS, Kleiman and Riskind presented evidence that depressive cognitive style have a synergistically stronger stress generation effect if it co-occurs with the LCS than if it doesn't. They suggested that individuals who tend to explain negative events in mentally depleting ways with the depressive cognitive style may experience synergistically greater mental depletion if they also had the LCS and simulate negative events as making rapid gains and approaching.

Summary and Conclusions

In this chapter, we have suggested that the LCS confers greater cognitive vulnerability to anxiety via the impact it has on several central pathways and etiological processes (see also, Riskind & Williams, 2006). These include: (1) schematic processing (attention, appraisal and attention biases, and memory); (2) more intense anxiety

and physiological responses; (3) fears of intense emotion and loss of behavioral control; (4) behavioral urgency; (5) cognitive overload; (6) reliance on maladaptive protective responses such as inflexible avoidance coping and cognitive-affective avoidance. Perceptions of looming vulnerability represent a common core mechanism of anxiety and anxiety-related disorders but can also occur in the form of specific looming vulnerability themes that correspond to specific types of disorders. Finally, these effects of the LCS can be compounded by snowballing spirals that deepen and self-sustain anxiety and anxiety-related disorders.

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Chapter 11
Looming Vulnerability in Generalized Anxiety Disorder

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Generalized Anxiety Disorder: Description and Worry Domains

Generalized anxiety disorder (GAD) is characterized by chronic, excessive, and uncontrollable anxiety and worry about a variety of topics (American Psychiatric Association, 2013). According to the Diagnostic and Statistical Manual of Mental Disorders (APA, 2013), the worry occurs more days than not for a period of at least 6 months and causes significant distress and/or functional impairment (e.g., academic, occupational, social functioning). The focus of the anxiety and worry cannot be confined to symptoms of another disorder (e.g., fear of having panic attacks as in panic disorder, fear of embarrassing oneself in social situations as in social phobia, or fear of having a serious illness as in hypochondriasis). In addition to excessive anxiety and worry, GAD is also associated with at least three of the following symptoms over a 6-month period: feeling restless, keyed up or on edge, becoming easily fatigued, having difficulty concentrating or mind going blank, irritability, muscle tension, and sleep disturbance (APA, 2013).

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The content of worries reported by individuals with GAD are similar to those reported by the rest of the population (Dugas & Robichaud, 2007). For example, some of the most common worry themes include family, relationships, work, school, health, and finances. However, the worry reported by individuals with GAD differs in important ways from non-anxious individuals (Dugas & Robichaud, 2007). First, the focus of the worry in GAD often jumps from topic to topic within one worry episode. For example, an individual with GAD might think, "What if I lose my job? What if we can't pay the mortgage? What if we become homeless? What if my spouse leaves me? What if I am unable to see my children?" Second, the intensity, duration, and frequency of the anxiety and worry reported by individuals with GAD are highly disproportionate to the objective likelihood or impact of the feared event. Individuals with GAD tend to worry more about unlikely events or remote future events compared to non-anxious individuals (Dugas et al., 1998). For example, they might worry about a family member contracting a rare but lethal disease, or might start worrying at an early age about whether they will be able to save enough money for their retirement or for their infant's university tuition. Finally, individuals with GAD also worry about very trivial matters (Hoyer, Becker, & Roth, 2001), such as being late for an appointment or deciding what movie to go see or what groceries to purchase.

Approximately 4–7% of the population will experience GAD at some point in their lives. Large epidemiological studies indicate that women are twice as likely as men to be diagnosed with GAD, with approximately 4% of women and 2% of men meeting diagnostic criteria for GAD within a given 1-year period (Blazer, Hughes, George, Schwartz, & Boyer, 1991; Wittchen, Zhao, Kessler, & Eaton, 1994). Approximately two thirds of individuals with GAD begin developing symptoms prior to the age of 20 (Dugas & Robichaud, 2007), and although the symptoms can wax and wane over time in response to life stressors, GAD tends to be a chronic disorder that is unlikely to remit spontaneously (Wittchen & Hoyer, 2001; Yonkers, Warshaw, Massion, & Keller, 1996).

When GAD was first introduced in the DSM-III (APA, 1980), it was most frequently used as a residual diagnosis for individuals who did not meet criteria for another anxiety disorder, and the symptoms were not thought to cause significant impairment in daily living or quality of life (Dugas & Robichaud, 2007). There is now abundant evidence that GAD can be a highly disabling disorder associated with substantial direct and indirect societal costs. Of all the anxiety disorders, GAD is associated with one of the highest rates of health care utilization (Dugas & Robichaud, 2007). Individuals with GAD rarely seek help from mental health specialists (Hunt, Issakidis, & Andrews, 2002), and instead seek help from family physicians and medical specialists which results in unnecessary and costly medical tests. With respect to indirect costs, GAD is associated with work absenteeism (Hunt et al., 2002) and reduced productivity (Wittchen, Carter, Pfister, Montgomery, & Kessler, 2000).

Theoretical Models of Generalized Anxiety Disorder

Cognitive Appraisal Models of Anxiety

The premise underlying most cognitive theories of anxiety is that cognitive appraisals or judgments about a source of threat or danger are direct antecedents of anxiety and fear (Riskind, 1997). Lazarus' (1966) appraisal model of stress and anxiety proposes that two types of appraisal processes influence threat perception. The primary appraisal process involves the evaluation of a stimulus as threatening or benign, whereas the secondary appraisal process involves possible ways of coping with the threat. Primary appraisals that influence stress and anxiety include imminence (closeness of the threat in time), probability of harm, and duration of threat (Lazarus & Folkman, 1984).

The cognitive approach to anxiety outlined by Beck and colleagues (Beck & Emery, 1985) proposes that anxiety is associated with ideational themes of vulnerability to future danger. Each anxiety disorder is associated with unique specific cognitive content pertaining to the ideational theme of threat. Vulnerability to anxiety disorders including GAD hinges on the development of danger schemas that bias information processing (e.g., attention, interpretation, and memory for threat-related stimuli). Once the danger schemas are activated by actual or anticipated aversive life events, information is distorted in such a way that anxiety is triggered and/or intensified. Similar to Lazarus' (1966) model, Beck proposes that anxiety is evoked when an individual perceives excessive threat or danger to their survival (primary appraisal) and underestimates their degree of control or effectiveness in coping with the threat (secondary appraisal). Thus, anxious states arise when an individual forms exaggerated expectancies regarding the imminence, probability, and severity of threat (Beck, 1976) and underestimates the coping resources available for dealing with such a threat. Such faulty appraisals prompt the use of maladaptive self-protective responses (e.g., cognitive or emotional avoidance), which are effective in reducing anxiety in the short term, but maintain anxiety in the long term by blocking further processing of threat-related stimuli, and thus, the opportunity to learn that the threat is actually benign, diminishing, and manageable.

Avoidance Model of Worry and GAD

The "Avoidance Model" of worry and GAD (Borkovec, 1994; Borkovec, Alcaine, & Behar, 2004) proposes that worry is an ineffective cognitive attempt to problem-solve that is reinforced through both negative reinforcement and positive beliefs about worry. Worry functions as a cognitive avoidance response to threatening stimuli, such as fear-related mental imagery, negative emotions, or bodily sensations. According to this theory, worry is a verbal linguistic, thought-based activity (Borkovec & Inz, 1990) that inhibits vivid mental imagery and the associated

somatic and emotional activation. This attempt to problem-solve and remove a perceived threat is counterproductive because the inhibition of somatic and emotional arousal prevents the emotional processing of fear that is required for successful habituation and extinction of fear (Foa & Kozak, 1986). The catastrophic and vivid mental images are replaced with more abstract and less distressing verbal linguistic thought-based activity. By avoiding the aversive somatic and emotional experiences associated with the mental imagery, worry is negatively reinforced (Borkovec, 1994; Borkovec et al., 2004). Additionally, positive beliefs about worry (e.g., worry helps to motivate performance, problem-solve, and/or avoid negative outcomes) serve to maintain worry over time because the non-occurrence of negative outcomes is attributed to the positive beliefs about worry (e.g., "I was only able to pay my rent this month because the worry motivated me to find different ways to increase my income").

Intolerance of Uncertainty Model

The "Intolerance of Uncertainty" model (Dugas, Letarte, Rheaume, Freeston, & Ladouceur, 1995; Freeston, Rheaume, Letarte, Dugas, & Ladouceur, 1994) proposes that individuals with GAD experience chronic worry in response to uncertain or ambiguous situations. Similar to the avoidance perspective (Borkovec, 1994; Borkovec et al., 2004), the intolerance of uncertainty perspective assumes that individuals with GAD hold positive beliefs that worry helps them to cope more effectively with feared events or to prevent the events from occurring (Borkovec & Roemer, 1995). This worry and the associated anxiety lead to negative problem orientation, which is characterized by: (1) lacking confidence in problem-solving ability; (2) perceiving problems as threats; (3) becoming easily frustrated when dealing with problems; and (4) being pessimistic about the outcome of problem-solving efforts (Koerner & Dugas, 2006). This negative problem orientation only serves to intensify anxiety and worry. Individuals with GAD use cognitive avoidance strategies, such as thought suppression, thought substitution, and distraction, in an attempt to reduce the cognitive arousal and threatening mental imagery associated with worry (Dugas & Koerner, 2005).

Meta-Cognitive Model

The "Meta-cognitive" perspective (Wells, 1995, 2004, 2005) proposes that GAD is characterized by two different types of worry labeled "Type 1 worry" and "Type 2 worry". According to this model, positive beliefs about worry are activated when individuals with GAD encounter anxiety-provoking situations (e.g., "Worry helps me to problem-solve more effectively"). Type 1 worry refers to worry about non-cognitive events including physical symptoms or external situations (Wells, 2005).

If the problem that triggered Type 1 worry is not resolved, negative beliefs about worry become activated. During this process, referred to as Type 2 worry or "meta-worry," individuals with GAD begin to worry about their Type 1 worry, fearing that the worry is uncontrollable and/or inherently dangerous. The model asserts that it is the negative beliefs about worry and the associated Type 2 meta-worry that distinguishes individuals with GAD from non-clinical worriers (Wells, 2005).

Individuals with GAD attempt to avoid worry by engaging in a variety of cognitive and behavioral avoidance strategies including distraction, thought suppression, reassurance seeking, checking behavior, and avoidance of anxiety-provoking situations (Wells, 2004). Ultimately, these strategies are ineffective and actually serve to maintain worry because they prevent opportunities to disconfirm negative beliefs that worry is uncontrollable and dangerous. Further, strategies such as thought suppression can be counterproductive by creating a rebound effect whereby worrisome thoughts actually become more frequent, thus reinforcing the belief that worry is uncontrollable. Type 2 worry increases the intensity of anxiety symptoms, which is interpreted as evidence that worry is dangerous, and the worry cycle is maintained (Wells, 2005).

Emotion Dysregulation Model

Another perspective in pathological worry, the "Emotion Dysregulation" model (Mennin, Heimberg, Turk, & Fresco, 2002, 2005; Mennin, Turk, Heimberg, & Carmin, 2004), differs from the other models in that it focuses primarily on the role of emotions in the etiology and maintenance of GAD rather than the role of cognitions (Behar, DiMarco, Hekler, Mohlman, & Staples, 2009). This perspective proposes that GAD is a disorder characterized by poor understanding and regulation of emotions. According to this model, individuals with GAD experience emotional hyperarousal, such that they have a lower threshold for experiencing emotions, and they experience emotions more easily, quickly, and intensely than individuals without GAD. This model also proposes that individuals with GAD have a poorer understanding of emotions, including deficits in labeling and describing emotions and in effectively utilizing the information that emotions convey. As a result of their emotional hyperarousal and poor understanding of emotions, individuals with GAD become anxious and overwhelmed when strong emotions occur and they hold negative beliefs that emotions are threatening, thus creating a feedback loop. Maladaptive emotion regulation strategies such as excessive worry or emotional suppression are employed in an attempt to reduce or over-control escalating emotions, but they ultimately serve to intensify negative emotions.

Central to most theoretical models of GAD is the assumption that worry is an ineffective strategy that is employed in an attempt to prepare for threat (Beck & Emery, 1985) and to avoid aversive internal experiences (Behar et al., 2009), such as vivid imagery and somatic activation (Borkovec, 1994; Borkovec et al., 2004), uncertainty (Dugas et al., 1995; Freeston et al., 1994), and unpleasant emotions (Mennin et al., 2002, 2004, 2005).

Limitations of Models

Cognitive appraisal models have contributed significantly to our understanding of the cognitive antecedents of generalized anxiety and worry; however, these models have had difficulty identifying cognitive appraisals that are unique to anxiety and able to distinguish anxiety from depression. This is problematic because the diagnosis of GAD is often complicated by significant overlap with major depression (Brown, DiNardo, Lehman, & Campell, 2001).

Several studies have demonstrated that static threat appraisals (e.g., exaggerated estimates of the likelihood of future aversive events and the imminence of such events), threat-related automatic thoughts, and the phenomenon of worry are not unique to anxiety, and do not distinguish anxiety from depression (Beck & Perkins, 2001; Brown et al., 2001; Dobson, 1985; Lazarus & Folkman, 1984). One challenge for cognitive models of GAD is to identify specific cognitive content that is unique to anxiety and can distinguish anxiety from depression (Riskind, 2005).

Generalized Anxiety Disorder: Looming Vulnerability and Worry

Description of the Looming Vulnerability Model

A central goal of the LVM has been to specify the critical components of threat appraisal and danger schemas that discriminate anxiety from depression (Riskind & Williams, 2005). Existing cognitive theories of GAD have focused predominantly on static appraisals of threat at a particular point in time, which some argue do not adequately capture an anxious individual's phenomenological experience (Riskind, Williams, & Joiner Jr., 2006). The LVM extends cognitive appraisal models of anxiety by highlighting the role of perceived threat *movement*, even during single, moment-in-time appraisals (Riskind, Williams, Gessner, Chrosniak, & Cortina, 2000). According to this model, the perception of threat as rapidly approaching and making dynamic gains in time and space is a core characteristic of the phenomenology of anxiety that will distinguish it from depression (Riskind, 1997). Rather than perceiving a threat as one static image, the LVM assumes that the phenomenology of danger is dynamic, like a motion picture or a video image projected on to the mind (Riskind et al., 2006).

The sense of looming vulnerability is proposed as a hypothetical cognitive construct that can be attributed to perceptions of the *velocity* of threat, *acceleration* of threat (i.e., rate-of-increase of velocity), and *direction* of threat (i.e., the extent to which threat is coming toward the individual) (Riskind, 1997; Riskind & Williams, 1999). These appraisals are thought to occur automatically and nonreflectively, and they likely involve the integration of incoming information with memories, beliefs, and concepts developed from past experience (Riskind et al., 2000; Riskind & Williams, 1999).

According to the LVM, the perceived velocity with which threat is escalating and rapidly growing more dangerous has an independent role in producing anxiety above and beyond the perceived likelihood of the threat occurring or the perceived magnitude of the catastrophe (Riskind, 1997). The LVM places relatively less emphasis on these static threat appraisals (e.g., likelihood of threat, magnitude of catastrophic outcome), and more emphasis on the phenomenology, mental simulation, and mental fear imagery of the threat as quickly accelerating toward a catastrophic outcome (Riskind & Williams, 1999). The sense of looming vulnerability can be distinguished from other threat appraisals; however, these other threat appraisals are partially dependent on the sense of looming vulnerability, such that rapidly approaching threats will be perceived as being more probable, imminent, and uncontrollable (Riskind, 1997). Thus, a sense of looming vulnerability impacts anxiety directly, as well as indirectly by heightening static appraisals regarding the probability of threat and/or magnitude of catastrophe (Riskind, 1997). The sense of looming vulnerability is thought to better account for the mobilization and defensive or coping responses that characterize anxiety than do static appraisals of threat (Riskind, 1997; Riskind & Williams, 2005).

Humans have a unique "autonoetic" capacity to mentally project oneself into the past or future (Wheeler, Stuss, & Tulving, 1997). The implication of this capacity for GAD is that anxiety can develop in response to both externally derived stimuli (e.g., being fired from one's job, experiencing the death of one's child) and internally generated expectations or mental scenarios of real or hypothetical events (e.g., imagining being fired from one's job or the death of one's child in the future) (Riskind & Williams, 1999). When individuals with GAD become anxious when imagining that threats are racing toward them (e.g., going bankrupt), they are responding to an internally generated representation of the external condition that evokes an anxiety response. According to the LVM, this "autonoetic" capacity to project oneself into the future, in tandem with other cognitive and emotional vulnerabilities, distinguishes the anxiety experienced by individuals with GAD from fear of more imminent and realistic threats (Riskind et al., 2000).

Looming Maladaptive Style

The LVM differentiates between a lower-order and higher-order sense of looming vulnerability (Riskind & Williams, 1999). Individuals can experience a lower-order sense of looming vulnerability to threats in specific situations that involve potential catastrophes (e.g., individuals with a spider phobia will imagine spiders as bodies in forward motion). However, some individuals, particularly those with GAD, develop a more generalized and enduring "looming maladaptive style" for evaluating potentially catastrophic situations that is characterized by a tendency to construct mental scenarios of unfolding threat and increasing danger (Riskind & Williams, 2005). The looming maladaptive style operates across situations, whereas the lower-order looming vulnerability to potential catastrophes is situation-specific and confined to

one specific class of threats. However, the looming maladaptive style can also intensify situation-specific looming vulnerability.

The LVM assumes that each anxiety disorder is associated with a unique characteristic sense of looming vulnerability, in the same way that Beck's (Beck & Emery, 1985) cognitive model proposed that each anxiety disorder was associated with unique cognitive content pertaining to the ideational theme of threat. The looming cognitive style is hypothesized as an overarching distal cognitive factor that creates vulnerability for anxiety, and interacts with other factors (e.g., trauma, learning history) to create more proximal disorder-specific cognitive mechanisms central to each anxiety disorder (Riskind et al., 2006). For example, individuals with OCD will imagine harmful contaminants spreading in all directions, individuals with health anxiety will imagine diseases spreading throughout their bodies, and those with social phobia will experience a looming sense of rejection (Riskind, 1997).

In contrast to anxiety disorders associated with a specific focal threat stimulus (e.g., spiders, contamination), GAD is thought to arise when an individual has a tendency to experience a more generalized sense of looming vulnerability in relation to the typical worry domains, resulting in catastrophization and worry. For example, individuals with GAD might perceive their health as deteriorating, their personal investments and stocks as declining, their debt and new expenses as increasing, their job security as unraveling, and their romantic relationship as rapidly progressing toward dissolution.

Looming Cognitive Style as a Vulnerability and Maintenance Factor for GAD

The looming cognitive style is thought to confer vulnerability to GAD through several pathways (Riskind et al., 2006). First, the looming cognitive style will cause individuals with GAD to generate a continuing stream of threatening, catastrophic mental imagery of even relative mundane events. Second, the looming cognitive style will absorb the attentional resources required to cope with distressing thoughts, and these distressing thoughts serve as worry triggers. Third, the looming cognitive style enhances catastrophic imagery, which in turn mobilizes coping responses to manage the distress. As noted by the avoidance perspective (Borkovec, 1994; Borkovec et al., 2004), the catastrophic imagery will prompt individuals with GAD to engage in prolonged worry as a self-protective response to reduce the distress by converting the fear-inducing imagery into a more abstract verbal linguistic thought-based activity. Fourth, the schematic processing bias associated with the looming cognitive style will cause individuals with GAD to attend to and preferentially recall threat-related information, particularly if the threat is dynamic, thus maintaining the belief that threat is dynamically intensifying.

The looming cognitive style is considered a higher-order, global, abstract characteristic framework that functions as a danger schema (Riskind & Williams, 1999, 2005). It is a distal cognitive factor that temporally precedes the signs and symptoms of GAD and creates an enduring vulnerability for the disorder. As a result of

biasing information processing, the looming cognitive style also creates vulnerability for GAD by activating more proximal risk factors, such as negative automatic thoughts, which occur closer in time to symptom onset. The looming cognitive style predicts anxiety and worry over time (Riskind & Williams, 2005; Williams, Shahar, Riskind, & Joiner Jr., 2005), and has been implicated as a maintenance factor for GAD (Riskind & Williams, 1999, 2005). Thus, the looming cognitive style is thought to function as an enduring cognitive vulnerability that activates proximal risk factors for GAD and maintains the disorder over time.

The looming cognitive style is hypothesized to produce schematic biases in the selection, interpretation, and recall of potential threats (Riskind et al., 2000). As a result of this danger schema, individuals with GAD will be more likely than non-anxious individuals to overestimate the extent to which threats are accelerating to produce dreaded outcomes (Riskind, 1997). They perceive information through the mental lens of looming vulnerability, and as a result, become more vigilant to threat-related information including even slight occurrences of threat, particularly if the threat is moving forward (Riskind, 1997). In addition, they might experience even longstanding or constant threats as being acute, varying, accelerating, and uncontrollable. The biased processing of information through the looming vulnerability lens results in a confirmatory bias, such that individuals with GAD will be more attentive to information that is consistent with their expectancies, such as threats moving forward toward dreaded outcomes. This confirmatory processing bias serves to both justify and maintain the sense of looming vulnerability.

According to the LVM, anxiety will be sustained over a longer period if it is associated with a sense of looming vulnerability to threat objects (Riskind, 1997). The perceptual and nervous systems detect changes in the environment rather than static features of the environment; thus, individuals tend to habituate to stressors that are perceived as predictable and constant, resulting in lower levels of anxiety and less of a need for urgent defensive action (Lazarus & Folkman, 1984). In contrast, the perception of threat as accelerating in forward motion will elicit intense anxiety, and individuals will remain sensitized to these threats rather than habituating to the threats over time. Furthermore, individuals with a sense of looming vulnerability will feel urgently challenged to cope with the accelerating threat. Due to a perceived urgent need to take action in response to a looming threat, individuals with GAD are likely to select default self-protective responses, such as worry, that function to reduce distress but are unnecessary or even maladaptive (Riskind et al., 2006).

Operationalization and Assessment of Looming Vulnerability in Generalized Anxiety Disorder

The Looming Maladaptive Style Questionnaire (Riskind et al., 2000) was designed to assess the tendency to perceive potentially threatening situations as rapidly unfolding or accelerating toward catastrophic outcomes (e.g., the higher-order looming cognitive style). Respondents to the questionnaire are presented

with six brief vignettes describing two types of potentially stressful situations. The social threat or *social looming* vignettes include: (1) the possibility of a romantic relationship breaking up; (2) inviting a very popular person to a party in front of a group of people; and (3) speaking in front of a large audience of strangers. The physical threat or physical looming vignettes include: (1) hearing a strange engine noise while driving on the expressway in rush hour traffic; (2) developing heart palpitations while speaking with someone about a financial problem; and (3) the risk of getting into a car accident. Respondents are asked to read each vignette and then to imagine the scenario as vividly as possible. They are then asked to respond to four questions for each vignette on a five-point Likert scale. The first question asks how worried or anxious respondents become when imagining the scenario ('not at all' to 'very much'). The second question asks the extent to which the chances of having difficulty in the scenario are increasing or expanding with each moment ('chances are decreasing with time' to 'chances are expanding with time'). The third question asks the extent to which the threat is growing larger with each moment ('threat is staying fairly constant' to 'threat is growing rapidly larger'). The final question asks the extent to which the respondent visualizes the scenario as progressively worsening ('not at all' to 'very much'). A total Looming Cognitive Style score is calculated by aggregating responses to the final three questions across the six vignettes. Previous psychometric studies have documented that The Looming Maladaptive Style Questionnaire exhibits adequate psychometric properties, including predictive, convergent and discriminative validity, internal consistency, and test-retest reliability (Riskind et al., 2000).

Most studies examining looming vulnerability in GAD have used the Looming Maladaptive Style Questionnaire (Riskind et al., 2000), which was designed to measure the looming cognitive style as an underlying vulnerability to anxiety. This measure was later expanded to include some anxiety disorder-specific scenarios regarding social conflict, physical illness, panic attacks, and obsessive content (Riskind, Rector, & Cassin, 2011), which has enabled investigation of the cognitive specificity of particular looming themes.

The Looming and Catastrophizing Outcome Questionnaire (Riskind & Williams, 1999) was developed to assess the lower-order looming vulnerability to potential catastrophes. Respondents are provided with three common worry topics (i.e., losing the person you regard as most significant, personal finances, health concerns) and are asked to rate the level of looming vulnerability associated with a series of 18 potential consequences (e.g., being lonely, losing all your relationships) for each of the three worry topics. For example, for the scenario involving the loss of a significant other, respondents would be asked to rate the extent to which the threat of becoming lonely and the threat of losing all relationships are rapidly growing. Looming vulnerability to potential catastrophes is calculated by averaging each of these respective ratings across all possible consequences.

Empirical Data on Looming Vulnerability in Generalized Anxiety Disorder

Schematic Processing

The LVM proposes that the looming cognitive style operates as a danger schema that biases the processing of threat-related information (Riskind et al., 2000). The relationship between the looming cognitive style and cognitive processing was examined in a sample of undergraduate students (Riskind et al., 2000). Individuals who scored higher on the looming cognitive style selected more threatening spellings of homophones (e.g., die vs. dye) than individuals who scored lower on the looming cognitive style, providing evidence for an interpretation bias toward threatening words. Further, the looming cognitive style contributed to the prediction of homophone spelling bias above and beyond the contributions of anxiety, worry, and static threat appraisals such as probability estimates. In addition to biasing the processing of lexical material, the looming cognitive style was also significantly related to the number of threatening pictures recalled in a visual memory test, as well as estimates of the percentage of threatening pictures that were viewed, and these findings were not accounted for by level of anxiety. Collectively, these findings support the proposition of the LVM that the looming cognitive style serves as a danger schema that biases information processing of threatening stimuli.

Association with Trait Anxiety and Anxiety Correlates

Much research on GAD has examined trait anxiety and worry in analogue samples. Analogue studies are based on the assumption that anxiety and worry can be measured dimensionally, and that individuals who fall at the high end of the spectrum with respect to trait anxiety and worry would likely meet diagnostic criteria for GAD. The LVM proposes that the looming cognitive style is a cognitive vulnerability factor for anxiety, and as such, it will be associated with anxiety and anxiety correlates (Riskind, 1997). Several studies have demonstrated that the looming cognitive style is associated with higher levels of anxiety, as well as several correlates of anxiety relevant to GAD including worry, thought suppression, catastrophizing, impaired mental control, and fears of losing control over one's thought processes (Riskind et al., 2000; Riskind & Williams, 1999, 2005).

A study with an undergraduate sample demonstrated that looming cognitive style is correlated with anxiety, even after controlling for static threat appraisals such as the probability of catastrophic events and perceived ability to cope (Riskind et al., 2000). In contrast, the significant correlations between probability estimates, coping, and anxiety were lost after controlling for looming cognitive style.

Although the looming cognitive style is strongly associated with anxiety, trait anxiety, and worry, structural equation modeling has demonstrated that their

measurement properties differ, suggesting that the looming cognitive style is conceptually distinct and is not simply another measure or proxy of these other constructs (Riskind et al., 2000).

Specificity to Generalized Anxiety Disorder

The LVM posits that the sense of looming vulnerability is a core characteristic of the phenomenology of GAD that distinguishes it from depression (Riskind, 1997). Consistent with this hypothesis, a series of studies has demonstrated that the sense of looming vulnerability is correlated with measures of anxiety even after controlling for the effects of depression. In contrast, the sense of looming vulnerability is unrelated to depression after controlling for the effects of anxiety (Forbes & Ruscio, 2017; Riskind et al., 2000; Riskind, Kelly, Moore, Harman, & Gaines, 1992; Riskind & Williams, 2005). Similarly, studies using structural equation modeling have demonstrated that the looming cognitive style predicts anxiety symptoms, but not depressive symptoms (Reardon & Williams, 2007).

The specificity of the looming cognitive style to GAD was examined in a sample of undergraduates with a likely diagnosis of GAD (Riskind & Williams, 2005). The probable GAD group demonstrated significantly higher looming cognitive style scores than the non-GAD group, even after controlling for potential covariates such as level of anxiety and depressive symptoms. Further, the GAD group continued to have higher looming cognitive style scores than the non-GAD group when controlling for specific anxiety measures, such as fear of negative evaluation and specific phobia fears, and when controlling for mental process variables, such as thought suppression, impaired mental control, and fear of losing control. This study provides a conservative test of the link between the looming cognitive style and GAD and suggests that the looming cognitive style in GAD is not simply a function of general anxiety symptoms, specific anxiety symptoms, depressive symptoms, or impaired mental processes.

This study was replicated and extended in a clinical sample of patients diagnosed with GAD (Riskind & Williams, 2005). Individuals with GAD were compared to those with depression and nonpsychiatric controls. The GAD group had significantly greater looming cognitive style scores than both the depression and nonpsychiatric control groups, whereas the depression and nonpsychiatric control groups did not differ from one another. The GAD group also reported significantly greater worry than the other two groups. In contrast, the three groups did not differ with respect to static threat appraisals (i.e., a composite measure of the probability, imminence, unpredictability, and uncontrollability of threats). Thus, as hypothesized by the LVM, dynamic threat appraisals significantly improve the prediction of GAD beyond the effects of static threat appraisals.

A discriminant function analysis was performed to compare the relative contributions of anxious symptoms, depressive symptoms, worry, and the looming cognitive style in predicting membership to the GAD, depression, and nonpsychiatric control groups (Riskind & Williams, 2005). The anxiety and depression symptom

measures were accurate in distinguishing clinical participants from controls, but not in discriminating GAD from depression. In contrast, looming cognitive style was most effective in discriminating individuals with GAD from the other two groups. In another analysis, associations between looming cognitive style and depression severity declined to statistical nonsignificance once anxiety severity was controlled, suggesting that the association between looming and depression may be due, in part, to the presence of anxiety (Forbes & Ruscio, 2017).

These studies lend support for the pathways thought to confer vulnerability to GAD (Riskind & Williams, 2005). The first pathway assumes that the looming cognitive style leads to intense emotional experiences and difficulties regulating emotion. The looming cognitive style was, in fact, associated with more intense anxiety symptoms. The second pathway assumes that the looming cognitive style absorbs the attentional resources required for coping effectively with negative emotion. Looming cognitive style was associated with both impaired mental control and fears of losing control over one's thoughts and impulses. The third pathway assumes that the looming cognitive style motivates self-protective responses. Individuals with GAD had elevated scores on the looming cognitive style, and the looming cognitive style was associated with both worry and chronic thought suppression.

More recently, empirical research has examined whether GAD can be cognitively differentiated from other anxiety disorders based on unique looming themes (Riskind et al., 2011). Treatment-seeking individuals with GAD were compared to those with social phobia, obsessive compulsive disorder, and panic disorder with respect to looming vulnerability themes (i.e., social, physical, panic, and contamination-related looming themes). It was hypothesized that the looming cognitive style would be elevated to a similar extent across all diagnostic groups because the looming cognitive style is conceptualized as a common cognitive vulnerability factor for all anxiety disorders. It was also hypothesized that individuals with GAD would score lower than the OCD group on contamination-related looming themes, lower than the panic disorder group on panic-related looming themes, and similar to the social phobia group on social-related looming themes given that social acceptance concerns are prominent in GAD. The results supported these hypotheses, providing evidence for specific associations between anxiety disorders and corresponding looming vulnerability content. Although the GAD and social phobia groups had similar elevations on social-related looming themes, the authors speculated that individuals with GAD might feel a sense of looming interpersonal vulnerability in intimate relationships whereas those with SP might feel a sense of looming vulnerability with respect to public humiliation based on a post hoc content analysis of the social looming vignettes.

Catastrophizing

Previous studies have demonstrated that individuals who worry excessively engage in more catastrophic thinking than nonworriers (Hazlett-Stevens & Craske, 2003; Vasey & Borkovec, 1992). Specifically, they tend to generate more worry steps

(i.e., "What if?" questions) when catastrophizing, they consider these steps more likely to occur, and they imagine more severe feared outcomes. The relationship between lower-order looming vulnerability, higher-order looming cognitive style, and catastrophizing was examined in an undergraduate sample divided into groups of "chronic worriers" and "nonworriers" (Riskind & Williams, 1999). Participants were provided with three worry topics that are common among individuals with GAD (i.e., death of a loved one, personal finances, health concerns) and were asked to rate a series of 18 potential consequences for level of likelihood (i.e., "How likely is this to happen to you?") and level of looming vulnerability (i.e., "How much is this a rapidly growing threat?"). As expected, chronic worriers demonstrated higher levels of catastrophizing and greater likelihood estimates. As predicted by the LVM, chronic worriers also demonstrated higher levels of looming vulnerability to potential catastrophes and higher levels of the looming cognitive style.

Looming vulnerability to potential catastrophes and the looming cognitive style were strongly related to participants' level of catastrophizing, likelihood estimates, and general level of worry (Riskind & Williams, 1999). Looming vulnerability to potential catastrophes was highly correlated with catastrophizing even after controlling for general level of worry and likelihood estimates. In contrast, the significant correlations between general level of worry, likelihood estimates, and catastrophizing were lost after controlling for looming vulnerability to potential catastrophes. Thus, the extent to which catastrophes are appraised as rapidly accelerating in time and space appears to be an integral part of catastrophizing, and this effect is not accounted for by general level of worry or likelihood estimates of dreaded consequences.

A mediational model was tested to examine the prediction that the looming cognitive style contributes to catastrophizing directly, as well as indirectly by triggering or intensifying mental simulations of looming vulnerability to potential catastrophes in specific situations (Riskind & Williams, 1999). The looming cognitive style predicted looming vulnerability to potential catastrophes, which in turn predicted an individual's level of catastrophizing. However, the looming cognitive style did not contribute directly to catastrophizing. Thus, the effects of the looming cognitive style appear to be fully mediated by mental simulations of looming vulnerability to catastrophizing.

Prospective Tests

The LVM conceptualizes the looming cognitive style as an enduring cognitive vulnerability for anxiety that precedes the onset of anxiety symptoms and predicts the development of anxiety and anxiety correlates over time (Riskind, 1997). To examine the prediction that the looming cognitive style is a durable cognitive disposition that should be associated with catastrophizing over time, the relationship between the looming cognitive style at Time 1 and catastrophizing at Time 2 (1 week later) was examined, controlling for catastrophizing at Time 1 (Riskind & Williams,

1999). The looming cognitive style was associated with increased catastrophizing over time, suggesting that it is a cognitive vulnerability for future catastrophizing. A similar study with an undergraduate sample demonstrated that the looming cognitive style was associated with increased anxiety and worry over a 1-week time interval among individuals who were initially low in anxiety (Riskind et al., 2000). Collectively, these findings suggest that the looming cognitive style is a cognitive vulnerability for anxiety and worry rather than a consequence.

To provide a stringent test of the prediction that the looming cognitive style is a cognitive antecedent and moderator of anxiety symptoms and worry, short-term changes in anxiety were examined under very restrictive methodological conditions in an undergraduate sample (Riskind, Tzur, Williams, Mann, & Shahar, 2007). Looming cognitive style at Time 1 predicted increases in worry at Time 2 (1 week later). In contrast, worry at Time 1 did not predict increases in looming cognitive style at Time 2. The results lend further support that the looming cognitive style is a cognitive vulnerability for, and not a consequence of, worry. Intolerance of certainty was also included in the study as a potential cognitive antecedent and moderator of anxiety symptoms and worry. Intolerance of uncertainty was a strong correlate of worry, but in contrast to the looming cognitive style, it did not predict increases in worry at Time 2. The looming cognitive style contributed incrementally to the short-term prediction of worry, even after controlling for both intolerance of uncertainty and depression.

A recent study examined whether the looming cognitive style acts as a moderator of risk factors for anxiety (Adler & Strunk, 2010). The interaction between traditional risk factors for anxiety (e.g., experiencing threatening events, perceiving that threatening events are likely to occur) and the looming cognitive style in predicting changes in anxiety over a 1-month time interval was examined in an undergraduate sample. Participants were given a list of ten threat-relevant events (e.g., failing a test, being criticized by a close friend) and were asked at Time 1 to rate the probability of each event occurring to them over the next month. They also recorded whether any of the threatening events actually occurred over the 1-month period. Consistent with the LVM, the static appraisals regarding threat probability and experiencing threatening events were more predictive of increased anxiety for individuals with the looming cognitive style. The results suggest that the relationship between traditional risk factors and symptoms of anxiety are particularly strong in individuals who exhibit the looming cognitive style.

The looming cognitive style and another cognitive vulnerability to anxiety labeled anxiety sensitivity (i.e., the tendency to perceive anxiety symptoms as being potentially harmful) have been associated with avoidance coping (e.g., wanting aversive situations to go away), which in turn has been shown to predict stress generation (Holahan, Moos, Holahan, Brennan, & Schutte, 2005). The ability of the looming cognitive style and anxiety sensitivity to predict negative life events over a 4-month time interval was examined in a sample of undergraduate students (Riskind, Black, & Shahar, 2010). It was hypothesized that the looming cognitive style and anxiety sensitivity would deplete the self-regulatory resources required for effective coping (e.g., impression management, ability to exercise self-control), and thus lead

to the generation of more frequent negative life events. Further, it was hypothesized that each cognitive vulnerability factor would augment any impact of the other cognitive vulnerability factor in generating stress. Consistent with the hypotheses, the looming cognitive style predicted stressful events under high levels of anxiety sensitivity, but not under low levels of anxiety sensitivity. Similarly, anxiety sensitivity predicted stressful life events under high levels of the looming cognitive style, but not under low levels of the looming cognitive style. These findings suggest that individuals with the looming cognitive style might not only experience more anxiety following stressful events, but as a result of depleting the self-regulatory resources required for effective coping, they might actually generate or propagate stressful events over time.

Looming Vulnerability: Overlap with and Extension of Previous Theoretical Models

The cognitive factors considered important in GAD can include both distal factors (e.g., maladaptive cognitive styles), which temporally precede the onset of the disorder, and proximal factors (e.g., negative automatic thoughts), which occur close in time to symptom onset. Proximal cognitions are typically produced when an individual perceives a situation through the filter of the underlying maladaptive cognitive style. Research on the cognitive factors implicated in GAD has focused primarily on proximal factors (Williams et al., 2005). The LVM proposes that the looming cognitive style is a higher-order, trait-like danger schema that acts as a distal cognitive vulnerability factor and leads to more proximal and lower-order anxiety-related cognitive processes, such as worry, catastrophizing, and interpretive biases in specific situations (Riskind et al., 2006; Williams et al., 2005).

Beck's cognitive appraisal model of anxiety (Beck & Emery, 1985) proposed that faulty appraisals or cognitive distortions regarding threat (e.g., exaggerated probability of threat, lack of control over threat, magnitude of catastrophe) heighten anxiety and prompt the use of maladaptive self-protective responses such as cognitive or emotional avoidance. The LVM notes that the looming cognitive style is also associated with catastrophizing; however, it differs from catastrophizing in that it emphasizes the perceived velocity and rate of change of velocity involved in catastrophic cognitions (e.g., the speed with which the odds of negative outcomes are escalating) rather than simply the imagined negative outcomes (Williams et al., 2005). We propose that an "All at Once" bias is the paradigmatic cognitive distortion fuelling catastrophization in GAD. This term captures not only the catastrophic outcome, but also the dynamic nature of the catastrophe including the velocity and rate of change of velocity of the aversive event. For example, whereas catastrophizing may involve associating missing a deadline with being fired from one's job, the looming cognitive style involves overestimating the velocity and rate of change with which missing a deadline would lead to being fired from one's job. Similarly, whereas catastrophizing may involve associating one argument with a romantic partner with the breakup of the relationship, the looming cognitive style involves

perceiving the relationship as quickly deteriorating and rapidly accelerating toward a breakup. Individuals with GAD also have a tendency to perceive multiple threats rapidly escalating simultaneously (Rector, Kamkar, & Riskind, 2008). For example, an individual might perceive that their debt is quickly escalating while their expenses are rising, coupled with fears that they are going to lose their job and their marriage is going to end and they will no longer be able to share expenses. This "All at Once" bias heightens anxiety and engenders a sense of urgency in the individual to cope with the threat using maladaptive self-protective responses, such as behavioral or cognitive avoidance.

Several GAD models have conceptualized worry as a maladaptive cognitive avoidance strategy (Borkovec, 1994; Borkovec et al., 2004; Dugas & Koerner, 2005) or emotion regulation strategy (Mennin et al., 2002, 2004, 2005). The Avoidance Model of Worry (Borkovec, 1994; Borkovec et al., 2004) elucidated the mechanism by which worry provides short-term relief of anxiety. Specifically, this model highlighted the role of vivid mental imagery in heightening anxiety, and proposed that worry is a self-protective cognitive process that reduces the aversive impact of fear-inducing mental imagery by transforming it into a more physiologically detached lexical form.

The LVM extends Beck's model by emphasizing the role of dynamic rather than static threat appraisals. The looming cognitive style is conceptualized as a cognitive vulnerability for GAD that operates as a danger schema characterized by rapidly unfolding danger. The LVM speculates that the looming cognitive style enhances fear-inducing mental imagery, which in turn triggers worry. As conceptualized by Lazarus' (1966) appraisal model of stress and anxiety, the fear imagery corresponds to the primary appraisal of threat movement, whereas worry corresponds with the secondary appraisal of ways to cope with the threat and prevent a dreaded outcome (Riskind, 1997). According to the LVM, worry could be a self-protective response to images and perceptions of looming vulnerability. Cognitively vulnerable individuals first generate fear-inducing mental representations of rapidly accelerating threat, and then employ self-protective strategies, such as worry and other emotion regulation strategies (e.g., experiential avoidance) to distance themselves from the aversive imagery (Riskind, 2005; Williams et al., 2005). In sum, the LVM speculates that is not so much the static threat appraisals that trigger worry, but rather, the fear-inducing mental imagery associated with dynamic threat appraisals that instigate worry in order to transform the threatening mental images into a more abstract and less distressing lexical form.

Conceptual Issues and Future Research Directions

A growing body of empirical research has supported the role of the looming cognitive style as a vulnerability and maintenance factor for GAD. As reviewed above, the looming cognitive style has been shown to function as a danger schema that biases information processing of threatening stimuli (Riskind et al., 2000). It is associated with anxiety and several anxiety correlates such as catastrophization and

worry, both cross-sectionally (Riskind et al., 2000; Riskind & Williams, 1999, 2005) and prospectively (Adler & Strunk, 2010; Riskind et al., 2000, 2007; Riskind & Williams, 1999). The looming cognitive style distinguishes individuals with GAD from those with depression and healthy controls (Riskind & Williams, 2005). Further, the specific looming content in GAD differs from the looming themes seen in other anxiety disorders, such as obsessive compulsive disorder and panic disorder (Riskind et al., 2011).

The current body of research pertaining to looming vulnerability in GAD has relied heavily on self-report measures to assess both the higher-order looming cognitive style (i.e., Looming Maladaptive Style Questionnaire; Riskind et al., 2000) and lower-order looming vulnerability to potential catastrophes (i.e., Looming and Catastrophizing Outcome Questionnaire; Riskind & Williams, 1999). The Looming Maladaptive Style Questionnaire presents respondents with several potentially stressful scenarios and they are asked to rate the extent to which the threat is growing larger and accelerating quickly, and the extent to which they visualize the problem as becoming progressively worse. Responses on this questionnaire will likely depend on whether the particular scenario is a worry topic for the respondent; thus, it will be important for future research to capture the full range of potential looming scenarios that individuals with GAD might perceive as threatening. Notably, the Looming Maladaptive Style Questionnaire has recently been expanded to include a wider range of looming themes including social, physical, panic, and contamination-related threats (Riskind et al., 2011). In addition to expanding the looming scenarios included in the Looming Maladaptive Style Questionnaire, future research would benefit from employing multi-method assessment of looming vulnerability, including behavioral and experimental tasks to tap looming as a cognitive process.

Prospective research has demonstrated that the looming cognitive style predicts increases in catastrophizing (Riskind & Williams, 1999), anxiety (Adler & Strunk, 2010; Riskind et al., 2000), and worry (Riskind et al., 2000, 2007) among undergraduate students, even those who were initially low in anxiety (Riskind et al., 2000). It will be important to extend this line of research using behavioral high-risk prospective designs to elucidate the temporal sequence of the association between looming vulnerability and anxiety symptoms and correlates, as well as to examine the role of looming vulnerability in the etiology and/or exacerbation of DSM-5 diagnosed GAD.

With a few exceptions (Riskind et al., 2011; Riskind & Williams, 2005), much of the empirical research examining the role of looming vulnerability in generalized anxiety has utilized non-clinical undergraduate samples. This body of research has demonstrated that looming vulnerability is associated with, and predictive of, anxiety and anxiety correlates such as catastrophization and worry. In addition, analogue studies have demonstrated that "chronic worriers" with a likely diagnosis of GAD have an elevated sense of looming vulnerability compared to "nonworriers" (Riskind & Williams, 2005). However, additional research is required with DSM-5 diagnosed GAD samples since individuals with pathological worry might differ in important ways from those with heightened worry. For example, consistent with the meta-cognitive model, individuals with GAD have been shown to appraise worry as

being more dangerous as compared to non-clinical individuals with heightened worry (Wells, 1995, 2004, 2005). An interesting line of inquiry would be to examine whether looming vulnerability contributes to the perception of worry as being dangerous or uncontrollable (i.e., "meta-worry").

The LVM extends traditional cognitive models of anxiety, such as Lazarus' (1966) appraisal model of stress and anxiety and Beck's (Beck & Emery, 1985) cognitive appraisal model of anxiety, by emphasizing dynamic rather than static threat appraisals. The LVM proposes that the looming cognitive style enhances fear-inducing mental imagery and, similar to the Avoidance model (Borkovec, 1994; Borkovec et al., 2004), speculates that worry could be a self-protective response to fear-inducing images and perceptions of looming vulnerability. Much has been written on the integration of looming vulnerability with existing cognitive appraisal models of GAD, and the associations among looming vulnerability, static threat appraisals, and worry have been the subject of several empirical investigations (Adler & Strunk, 2010; Riskind et al., 2000, 2007; Riskind & Williams, 1999). In contrast, relatively little is known about the integration of looming vulnerability with theoretic models that focus primarily on the role of emotions rather than cognitions in the etiology and maintenance of GAD, such as the Emotion Dysregulation model (Mennin et al., 2002, 2004, 2005). It would be informative to examine whether looming vulnerability contributes to emotional hyperarousal in GAD. For example, an experimental paradigm could be used to examine whether individuals with GAD experience faster and more intense autonomic arousal when imagining scenarios involving looming threat compared to scenarios that do not involve looming threat and compared to individuals who do not have GAD.

The LVM proposes that the link between looming vulnerability and anxiety has an evolutionary basis, such that the sense of looming vulnerability first evolved as a mechanism to ensure survival by helping species to avoid approaching predators and other threats (Riskind, 1997). According to the LVM, appraisals of threats as rapidly growing and accelerating are thought to occur automatically and nonreflectively. If looming vulnerability does, in fact, operate automatically and nonreflectively at an evolutionary level, it will be important for future research to elucidate how it becomes integrated with the downstream repetitive thinking, reflective pondering, and deliberate decision-making that characterize GAD.

We proposed in this chapter that an "All at Once" bias is the paradigmatic cognitive distortion fuelling catastrophization in GAD. An important area of inquiry for future research would be to examine how this cognitive distortion initially develops and how it fits in with other noted vulnerability and risk factors for GAD. For example, empirical research could prospectively examine whether factors such as early adversity (particularly multiple adversities occurring close in time), threats to security, parental modeling, and anxious attachment styles are implicated in the development of the looming cognitive style and the "All at Once" cognitive bias. It would also be informative to extend research on the specificity of looming themes to particular anxiety disorders by examining why the specific looming content of GAD gets activated.

Ultimately, theoretical models of GAD are important to the extent that they advance our understanding of the vulnerability, risk, and maintenance factors for GAD. To this end, the knowledge gained from previous looming vulnerability studies should inform the development of early intervention programs with the aim of reducing the sense of looming vulnerability, as well as the development of clinical strategies that can be incorporated into empirically supported treatments for GAD to challenge dynamic threat appraisals such as the "All at Once" bias.

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Chapter 12
Looming Vulnerability in Panic Disorder and the Phobias

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The Diagnostic and Statistical Manual of Mental Disorders (DSM-5; American Psychiatric Association, 2013) includes all of the anxiety syndromes within a section on anxiety disorders. However, the observation that some anxiety disorders share common features and are highly comorbid with one another has led to the development of a hierarchical model of anxiety disorders (Watson, 2005). This model divides the anxiety disorders into distress disorders (i.e., generalized anxiety disorder) and fear disorders (i.e., panic disorder, agoraphobia, social phobia, specific phobia). Distress disorders are characterized by negative affectivity and pervasive subjective distress, whereas fear disorders are characterized by phobic reactions, autonomic arousal, and the fight-or-flight response. Panic disorder and the phobias are grouped together in this chapter given these similarities and accumulating support for this hierarchical model (see Watson, 2005).

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Panic Disorder and Phobias: Descriptions

Panic Disorder and Agoraphobia

A panic attack describes a discrete period in which an individual experiences an abrupt onset of intense fear, terror, and/or discomfort (APA, 2013). The panic attacks are accompanied by a variety of somatic and cognitive symptoms which peak within 10 min. Somatic symptoms include heart palpitations or accelerated heart rate, sweating, trembling, shortness of breath, feeling of choking, chest pain, nausea, dizziness, tingling sensations or numbness, and chills or hot flushes. Cognitive symptoms include derealization (feeling of unreality) or depersonalization (feeling detached from oneself), fear of going crazy or losing control, and fear of dying.

Panic attacks are classified as either unexpected (uncued), situationally bound (cued), or situationally predisposed (APA, 2013). Situationally bound panic attacks refer to those that consistently occur in anticipation of, or when exposed to, a particular trigger (e.g., a person with an animal phobia having a panic attack in the presence of a dog). Situationally predisposed panic attacks refer to those that are more likely to happen, but do not consistently occur, in particular situations (e.g., a person occasionally having panic attacks while driving). Panic attacks are experienced by approximately 23% of the population (Kessler et al., 2006) and are not considered a psychiatric disorder on their own.

According to the Diagnostic and Statistical Manual of Mental Disorders (APA, 2013), panic disorder (PD) is diagnosed if an individual experiences recurrent and unexpected panic attacks which are followed by a least 1 month of the following symptoms: (1) persistent concern of experiencing additional attacks; (2) worry about the potential consequences or implications of panic attacks; or (3) significant change in behavior attributed to panic attacks. Individuals with PD might worry that the panic attacks are due to an underlying heart or respiratory condition, or that the panic attacks signify that they are losing control or going crazy. Individuals who experience recurrent panic attacks might avoid engaging in physical exercise, climbing stairs, and drinking caffeinated beverages for fear that these activities might precipitate a panic attack. The panic attacks cannot be due to the direct physiological effects of a substance (i.e., prescription medication or substance of abuse) or to a medical condition (e.g., hyperthyroidism, seizure disorders, cardiac conditions), and cannot be better accounted for by another psychiatric disorder. For example, if panic attacks only occur when exposed to social situations or specific phobic stimuli, the diagnosis would be social phobia and specific phobia, respectively.

Approximately 33–50% of individuals diagnosed with PD in community samples also develop agoraphobia (APA, 2000). Individuals with agoraphobia feel anxious about being in places or situations in which it would be difficult to escape or seek help in the event of a panic attack or panic-like symptoms. This anxiety often leads to significant avoidance of public environments, such as public transit, movie

theaters, shopping malls, and concerts. If these situations are endured, individuals with agoraphobia prefer to be accompanied by a safety person (e.g., friend, spouse) who can offer help in the event of an emergency.

Social Phobia

Social phobia (SP) is characterized by a marked and persistent fear of one or more social interactions or performance situations in which an individual might be judged by others (APA, 2013). Individuals with SP are often concerned that their anxiety will be apparent to others and/or that others will evaluate them as being boring, incompetent, inarticulate, weak, or inferior. They might also worry that they will say or do something inappropriate or humiliating, or that their anxiety will make others uncomfortable (Rector, Kocovski, & Ryder, 2006). Individuals with SP become anxious when exposed to social and performance situations, and often experience significant anxiety in anticipation of upcoming events. For example, they might develop heart palpitations, shortness of breath, and sweating, and in some cases will experience situationally bound or situationally predisposed panic attacks. Individuals with SP often avoid social and performance situations in order to prevent anxiety, or else escape at the earliest opportunity if their anxiety begins to escalate.

The avoidance, anxious anticipation, and anxiety experienced in social or performance situations can lead to significant impairment in social and romantic relationships, academic and occupational functioning, and normal routine. Individuals with SP often feel anxious about attending parties, meeting new people, making small talk with strangers or acquaintances, eating or drinking in public, behaving assertively, and making eye contact. They might avoid going to places with unfamiliar people, taking classes that have a participation or presentation component, or accepting jobs that require interaction with others. In severe cases, individuals with SP might withdraw from school, avoid work, and remain in the home for extended periods. As with PD, the fear and avoidance cannot be directly attributed to the effects of a substance or medical condition (e.g., Parkinson's disease, Stuttering), and cannot be better accounted for by another psychiatric disorder. For example, if an individual was strictly concerned that others were making negative evaluations concerning an aspect of his or her appearance, then body dysmorphic disorder would be the more appropriate diagnosis.

Specific Phobia

A phobia is defined as an intense and persistent fear or anxiety that is cued by the presence or anticipation of a specific object or situation (APA, 2013). Exposure to the specific object or situation consistently provokes an immediate anxiety response

and might even provoke a situationally bound or situationally predisposed panic attack. The phobic object or situation might be endured with great distress, but is more typically associated with a strong avoidance tendency despite the knowledge that the fear is excessive or irrational. To be considered a phobia, the avoidance, anxious anticipation, or distress associated with the feared object or situation must be marked enough to cause significant interference in daily routine, occupational or academic functioning, social activities, or relationships. In addition, the anxiety cannot be better accounted for by another disorder. For example, if fear of embarrassment or fear of dirt provoked intense anxiety, the diagnoses would be social phobia and obsessive compulsive disorder, respectively.

The Diagnostic and Statistical Manual of Mental Disorders (APA, 2013) identifies five subtypes of specific phobias which are distinguished by the focus of the fear or avoidance. Animal subtype refers to fear that is cued by animals or insects (e.g., spiders, snakes, dogs, mice). Natural environment subtype refers to fear that is cued by objects in the natural environment (e.g., storms, heights, water). Blood-injection-injury subtype refers to fear that is cued by seeing blood or an injury, or by receiving an injection or an invasive medical procedure. Situational subtype refers to fear that is cued by a specific situation such as flying, driving, enclosed places, or elevators. Other subtype is a residual category reserved for fears that are not captured by the aforementioned subtypes and includes phobias of vomiting, choking, loud noises, and costumed characters.

Theoretical Models of Panic Disorder and the Phobias

Panic Disorder

According to the cognitive model of PD (Clark, 1986), panic attacks are thought to result from catastrophic misinterpretation of bodily sensations (e.g., increased heart rate, dizziness, shortness of breath). Individuals with panic disorder have elevated anxiety sensitivity, meaning that they fear sensations associated with anxiety (Peterson & Reiss, 1987). As such, they tend to perceive benign and ambiguous bodily symptoms (such as heart palpitations) as threatening and signifying immediate personal danger (Clark et al., 1997). For example, an individual with PD might assume that heart palpitations signify a pending heart attack. This belief leads to anxious apprehension and creates hypervigilance for changes in bodily symptoms, which in turn serves to exacerbate the somatic symptoms of anxiety. A vicious feedback cycle is created, such that the intensification of somatic symptoms is further misinterpreted as signifying imminent death, insanity, or loss of control, which in turn intensifies fear. Individuals who develop agoraphobia avoid an increasing number of situations that could potentially trigger somatic symptoms, and situations in which escape would be difficult in the event of a panic attack.

Social Phobia

According to cognitive models of SP (Clark & Wells, 1995; Rapee & Heimberg, 1997), social anxiety is thought to arise from a desire to make a positive impression on others, combined with the belief that one will behave in an incompetent and inappropriate way in the presence of others and will suffer catastrophic consequences as a result. For example, individuals with SP might worry that they will be rejected by peers and end up alone if they say something inappropriate, or that they will disgrace the company they work for and get fired if they are unable to answer a question during a presentation. Individuals with SP have cognitive biases that serve to maintain anxiety. For example, they tend to believe that others are critical and are likely to evaluate them negatively (Rapee & Heimberg, 1997), and they overestimate the probability and cost of negative social events (Foa, Franklin, Perry, & Herbert, 1996). They also believe that others have very high standards regarding their performance and assume that they will fall far short of others' expectations (Rapee & Heimberg, 1997).

As a result of these negative beliefs and assumptions, individuals with SP shift their attention to a detailed monitoring of their thoughts, emotions, and physiological symptoms when they fear negative evaluation by others. Not only does this internal focus serve to intensify anxiety, but this information is also used to construct an impression of themselves as they believe others perceive them ("the observer perspective") (Clark & Wells, 1995). They subsequently compare this mental representation of the self to the standard they believe others expect of them, and perceive that they are falling short of others' expectations (Rapee & Heimberg, 1997). This leads to the appraisal that others are evaluating them negatively, and furthermore, that negative evaluation has disastrous consequences. Not surprisingly, this appraisal results in intensified anxiety and, and in some cases, objective performance deficits, both of which feed back into the negative mental representation of the self.

Specific Phobia

Mowrer's influential Two Factor Model (1960) proposes that fears are acquired by classical conditioning and maintained through instrumental conditioning. During the process of classical conditioning, a conditioned stimulus (e.g., a dog) is paired with an unconditioned stimulus (e.g., pain) until the conditioned stimulus evokes a conditioned response, such as fear, even in the absence of the unconditioned stimulus. Extinction of the fear is thought to naturally occur when the conditioned stimulus (e.g., dog) is presented over successive trials without the unconditioned response (e.g., bite), until eventually the conditioned stimulus (e.g., dog) stops eliciting the conditioned response (e.g., fear). Individuals with phobias attempt to avoid or escape the conditioned stimulus, and these behaviors are reinforced because they

reduce fear in the short term. However, ultimately these behaviors impede fear reduction in the long term because the extinction process is reduced or prevented by actions that allow an escape or avoidance of the conditioned stimulus.

Rachman proposes that fears can be acquired by through three pathways, of which only one is based on traumatic conditioning. In addition to this, he argued that fears can be acquired by means of vicarious experience and modeling. The third path consists of information about threatening stimuli acquired in other ways, such as media, or parental verbalizations and behaviors.

Cognitive theories of phobia acquisition and maintenance elaborated upon the behavioral models by considering the role of cognitive mechanisms such as expectations and memory representations of the conditioned and unconditioned stimuli. According to cognitive theories, fear and avoidance behavior are determined by the expectation that a behavior will lead to an aversive consequence, regardless of whether an individual has had an aversive personal encounter with a feared stimulus (e.g., dog), and is maintained by confirmation of the expectation (e.g., watching media coverage of a pit bull attack, hearing about a friend who got bit by a dog). Moreover, the avoidance behavior prevents disconfirmation of the irrational expectations. According to cognitive theories, individuals with specific phobia exhibit cognitive biases that serve to maintain phobias. For example, they overestimate the probability of threats and consequences of threats, scan the environment for potential threats, and interpret ambiguous situations as likely leading to worst-case scenarios.

Evolutionary Perspectives in Cognitively Oriented Models

Evidence exists that certain fears such as fears of spiders and snakes are more readily conditioned and appear disproportionately prevalent in relation to the actual danger they represent to the population. Seligman (1971) advanced the hypothesis that evolutionary selection pressures make some stimuli easier to condition to fear than others. Seligman's "biological preparedness" model assumes that in human evolution, spiders and snakes, for example, represented dangers to survival. Survival advantages are conferred by the inherited ability to learn to fear such stimuli very rapidly—to be biologically prepared for conditioning. In line with a biological preparedness perspective, Mineka, Davidson, Cook, and Keir (1984) showed that laboratory-raised spider monkeys (who were previously unafraid of snakes) became quickly conditioned to fear snakes after exposure to a film clip of another monkey screaming in fear at the sight of a snake; however, they did not show rapid fear conditioning after exposure to a film clip of a monkey screaming in fear at a neutral stimulus that would not be biologically prepared. In this context, Poulton and Menzies (2002) have even argued that learning is unnecessary and that evolutionarily relevant phobias and fears can emerge at just first sight of the phobic stimulus.

Some research, using factor analysis, has suggested that there are different etiological processes involved in fears of large as opposed to small animals. In this view, fears of large animals are derived from a predator defense (fear-based) system which has the function of protecting the integrity of the body from biting or other acute life-threatening injuries by large cats, wolves, etc. Fears about small animals (e.g., spiders, caterpillars, roaches), instead, are primarily related to fear of contamination and disease. Further, it has been suggested that fears related to the contamination/disease component are actually driven by a disgust-based process that instigates to withdrawal from stimuli that may cause contamination. Yet, Muris, Merckelback, de Jong, and Ollendick (2002) have noted that it wasn't until almost the twentieth century that it was discovered that insects play a role in spreading disease. Thus, it seems that a disgust-based system is unlikely to be the sole mechanism in animal fears, but disgusting objects can potentially be life threatening. An animal, for instance, can choke to death or become sickened by spoiled or toxic foods—and this weakened state could also increase its risk of being attacked and fatally injured by predators. While fear and disgust may independently contribute to fears of small animals, a disgust-based system may itself be based on the underlying fear of contact with disgusting—and potentially harmful—objects.

Panic Disorder and the Phobias: Looming Vulnerability

According to the LVM, phobias are associated with exaggerated perceptions and dynamic mental simulations of escalating threat. Cognitive models of anxiety focus primarily on the static content of cognition, including negative beliefs, thoughts, and images, and probability judgments (Brown & Stopa, 2008). For example, cognitive theories of panic disorder and the phobias share the assumption that individuals with anxiety overestimate the probability and cost of threats, and underestimate their ability to cope with threatening situations. These estimates or appraisals are static—because of the fact that they are not dynamically time coded for whether threat values are escalating or decreasing. In these cognitive models, such static beliefs and threat appraisals that overestimate probability and underestimate coping are thought to contribute directly to the experience of anxiety. Although cognitive content—i.e., "what" people think, as in probability estimates—has been shown to be an important contributor to anxiety, the cognitive process—i.e., "how" people think, as in anticipatory mental simulation—is thought in the LVM to be a key factor in understanding the salience of negative thoughts and associated anxiety (Brown & Stopa, 2008).

The LVM (Riskind, 1997) extends such cognitive models by elucidating further aspects of the anticipatory cognitive process that gives rise to anxiety and fear. According to the LVM, individuals with anxiety disorders, including panic disorder and phobias, think about threats in terms of dynamic anticipatory mental simulations and representations of future threatening events. For example, individuals with spider phobia might spontaneously imagine spiders as jumping or crawling toward

them in the absence of actual movement; they also imagine spiders as capable of rapidly jumping or switching directions toward them, making them dynamic, looming threats. Those with social phobia might exaggerate the rapid speed of progression of social rejection and imagine being promptly alienated from their entire peer group if they accidentally say something inappropriate.

Individuals who experience panic attacks have anticipatory mental simulations in which they imagine themselves experiencing symptoms that rapidly escalate in speed to create a heart attack. Thus, they image themselves immediately dying in response to minor heart palpitations, or experiencing a stroke and losing control in response to light headedness as a result of such mental simulations. Individuals who experience panic attacks may not only catastrophize if they are experiencing bodily sensations, but also come to avoid circumstances where these may occur or where quick exit is not possible.

Further, the perception of looming danger with the experience of rapid increasing threat is also a significant determinant of individuals' other threat cognitions, including their static threat estimates, which are not time coded for patterns of increasing or decreasing threat, which in turn lead to anxiety and fear. That is, anxious individuals overestimate the probability and cost of threats, in part because they perceive threats as rapidly intensifying and progressing.

Looming threat can also often predict anxiety incrementally beyond the effects of static threat appraisals at any given time. One of the reasons for this is that an individual's estimates of the probability of an injurious outcome are based on the momentary circumstances when those static estimates are made and these can quickly change. In the case of an individual watching a car speeding toward him or her, the estimate of the probability of harm is updated by the perception that the individual has as it gets closer and its speed becomes even more salient. An individual who enters a shopping mall views prior and future probabilities of harm as rising as they become updated by getting deeper into the shopping mall.

The LVM proposes that individual differences in anxiety are related to variations in individual's tendencies to generate anticipatory mental simulations and typical mental scenarios (or "fear scripts") that individuals apply to anticipated experiences in the near or far-away future (Riskind, Kelly, Moore, Harman, & Gaines, 1992). For example, an individual with a spider phobia might mentally simulate and/or perceive that spiders are looming forward even when they are motionless. Moreover, the perception of any movement, whatever the direction, might increase the salience of spiders as potential looming threats because of their ability to switch directions, or perceived ability to jump. Thus, the perception of any spider movement can activate anticipatory mental representations and representation of spiders as moving forward and create more fear than perception of no movement in spiders (seeing them as motionless). According to the model, individuals who mentally simulate looming threats for particular phobic stimuli (e.g., spiders) would not necessarily perceive other dangers (e.g., rats, snakes, dogs) as looming forward; nor would they be as likely to perceive other dangers as looming to the same degree. In contrast to this specific or focal looming style, individuals with generalized anxiety are thought to apply dynamic mental simulation to a variety of common experiences, such as social rejection, finances, and health.

The looming cognitive style confers vulnerability for anxiety disorders by leading individuals to generate threatening and catastrophic dynamic mental scenarios of relatively mundane events and to become hypervigilant to potential incipient threats. They tend to regularly perceive the world as dynamically intensifying in danger and themselves as unable to cope effectively with threats that are so rapidly making their way. As predicted by the LVM, the more global looming cognitive style has been shown to predict shared variance in anxiety disorder symptoms (Reardon & Williams, 2007; Williams, Shahar, Riskind, & Joiner, 2005). However, the particular anxiety disorder an individual develops likely depends on the interaction between the looming cognitive style and other factors (e.g., traumas, specific learning histories, other personality or learned dispositions) that create more proximal disorder-specific cognitive vulnerabilities (Riskind, Williams, & Joiner, 2006). Ultimately, the specific anxiety disorder depends on the specific anticipatory mental simulations and looming themes associated with the disorder.

Thus, panic disorder might result from looming themes specific to panic. Individuals characterized by panic disorder tend to experience physical sensations such as heart palpitations or dizziness and mentally simulate the explosive acceleration of symptoms into catastrophic outcomes. Their focus is primarily on internal threat stimuli and they are likely to generate dynamic mental scenarios in which relatively benign physical sensations rapidly intensify in danger and lead to imminent catastrophes such as a heart attack, stroke, or even death (Riskind et al., 2006). Social phobia is particularly related to the social threat component of the looming cognitive style (Haikal & Hong, 2010; Riskind et al., 2006). This cognitive vulnerability leads the individual with social anxiety to create dynamic mental scenarios of the rapidly progressing and intensifying danger of being scrutinized and rejected by others. Social anxiety in adults could be related to a looming cognitive style for social threats, as well as factors such as attachment insecurity, anxious attachment relationships, or rejection sensitivity. González-Díez, Orue, and Calvete (2016) examined young adults' perceived parental emotional abuse and peer victimization in the onset of social anxiety symptoms through social looming. Longitudinally, social looming acted as a mediator in the relationship between parents' emotional abuse and social anxiety. In addition, early childhood experiences and maladaptive schemas regarding mistreatment and rejection by others can lead the individual to not only interpret experiences but to frequently anticipate and mentally simulate mistreatment and rejection experiences. In consequence, early childhood experiences and maladaptive schemas can be precursors that set the stage for the development and maintenance of looming cognitive style for social threats.

According to the LVM, it is also possible to develop a lower-order, stimulus-specific form of looming vulnerability in the absence of a higher-order, generalized looming maladaptive style that biases the processing of a range of potential dangers (Riskind et al., 2006). For example, an individual with a specific phobia might experience self-generated mental scenarios in which dogs are quickly approaching and becoming more dangerous, without experiencing a more diffuse or generalized sense of looming vulnerability to numerous potential threats such as social rejection, physical harm, or spreading contamination (Riskind, 1997). For example,

Riskind et al. (1992) found that individuals who were high in spider fear had significantly higher scores for perceptions of looming spiders, but did not necessarily have higher scores for a generalize looming cognitive style. All else being equal, however, individuals with a diffuse and generalized looming cognitive style are more likely than other individuals to convert specific aversive environmental experiences into lower-order anxiety-specific themes. For example, an individual with a more generalized looming cognitive style, and particularly the subcomponent of the generalized style for physical threats, would be expected to be more likely to develop spider fears and spider-specific looming themes and patterns of mental simulation. Likewise, an individual with a generalized style, and particularly for looming social threats, would be more likely to develop new social fears and patterns of mental simulation for particular kinds of social situations.

Operationalization and Assessment of Looming Vulnerability in Panic Disorder and the Phobias

The Looming Maladaptive Style Questionnaire (Riskind, Williams, Gessner, Chrosniak, & Cortina, 2000) assesses the tendency of individuals to generate dynamic anticipatory mental scenarios of potentially threatening situations as rapidly unfolding or accelerating toward catastrophic outcomes (e.g., a higher-order looming maladaptive style). As noted in Chap. 11, respondents are asked to read six brief vignettes pertaining to looming social threats or looming physical threats and to imagine scenario as vividly as possible. The *looming social threat* vignettes include: (1) the possibility of a romantic relationship breaking up; (2) inviting a very popular person to a party in front of a group of people; and (3) speaking in front of a large audience of strangers. The *looming physical threat* vignettes include: (1) hearing a strange engine noise while driving on the expressway in rush hour traffic; (2) developing heart palpitations while speaking with someone about a financial problem; and (3) the risk of getting into a car accident. Respondents are asked to respond to questions such as "Is the level of threat staying fairly constant *or* growing rapidly larger with each passing moment ('threat is staying fairly constant' to 'threat is growing rapidly larger')?", or "How much do you visualize the threat as progressively worsening ('not at all' to 'very much')?" Previous psychometric studies have documented that the Looming Maladaptive Style Questionnaire exhibits adequate psychometric properties, including predictive, convergent and discriminative validity, internal consistency, and test-retest reliability (González-Díez, Sola, Calvete, & Riskind, 2014; Riskind et al., 2000).

Most studies examining looming vulnerability in anxiety have used the standard LMSQ, but this measure was later expanded to include some anxiety disorder-specific scenarios regarding panic attacks and obsessive content (Riskind, Rector, & Cassin, 2011), which has enabled investigation of the cognitive specificity of particular looming themes. Relevant to this chapter, the Looming Maladaptive Style Questionnaire-Expanded Version (Riskind et al., 2011) includes four brief vignettes

pertaining to looming panic attack threats: (1) feeling disoriented and confused while walking in a shopping mall; (2) feeling an odd physical sensation while in a crowded public place; (3) feeling slightly dizzy while in a department store; and (4) having a strange physical sensation while on a bus or subway far from home. Respondents are asked to visualize each scenario and respond to four questions on a Likert scale: (1) Do you visualize your chances of having a deadly stroke or heart attack as low or high? (2) Do you visualize your chances of having a deadly stroke or heart attack as staying fairly constant or increasing rapidly with each moment? (3) Do you visualize your chances of losing control over your mind or actions as low or high? (4) Do you visualize your chances of losing control over your mind or actions as staying fairly constant or as increasing rapidly with each moment? The looming of panic attack threat subscale has been shown to have adequate internal consistency and convergent validity (Riskind et al., 2011).

The Modified Spider Looming Questionnaire (Riskind, Moore, & Bowley, 1995) was designed to assess looming, fear, and threat of spiders. Respondents to the questionnaire are presented with a photograph of a tarantula and are asked to imagine sharing a room with the spider and three other people, with the spider in the middle of the room and one person sitting in each corner. Respondents are first asked to indicate whether they imagined that the spider was moving. If they respond "yes," they are next asked to map the direction of the spider on a piece of paper and to indicate the final location of the spider. After completing the drawing, respondents are asked to respond to two items on a Likert scale assessing looming of spiders toward the self (i.e., how actively and energetically the spider is moving toward you, how slow or fast the spider is moving toward you) and two similar items assessing looming of spiders toward other individuals. In addition to these items assessing looming vulnerability, respondents are also asked to complete eight items assessing static threat cognitions (i.e., danger, probability of harm, uncontrollability) and two items assessing fear. Each of the subscales has been show to have high reliability (Riskind et al., 1995). It is important to note that similar scales can easily be developed for dogs, snakes, or any threatening animal. Moreover, looming vulnerability scenarios could be developed for situational phobias (e.g., a person with fear of heights imagines rapidly losing balance and falling, or a person with an elevator phobia imagines the elevator as falling or rapid depletion of oxygen).

Empirical Data on Looming Vulnerability in Panic Disorder and the Phobias

The LVM proposes that the generalized or diffuse looming cognitive style presents a cognitive vulnerability for anxiety (Riskind, 1997). Supporting this assertion, the Looming Maladaptive Style Questionnaire was found to predict shared variance in a latent factor comprised of indicators of five DSM-IV anxiety disorder symptoms (i.e., specific phobia, social phobia, obsessive compulsive disorder, post-traumatic stress disorder, generalized anxiety disorder) (Williams et al., 2005). These findings

were replicated in a subsequent study, in which the Looming Maladaptive Style Questionnaire was found to predict shared variance in a latent anxiety disorder factor comprised of different indicators of five DSM-IV anxiety disorder symptoms (i.e., panic disorder, social phobia, obsessive compulsive disorder, generalized anxiety disorder, post-traumatic stress disorder) (Reardon & Williams, 2007). In addition to the looming cognitive style posing a cognitive vulnerability, LVM also proposes that some individuals have domain-specific fears (Riskind et al., 2006).

Panic Disorder

One study examined whether different DSM-IV anxiety disorders can be distinguished by the specific content of looming vulnerability themes (Riskind et al., 2011). Individuals with panic disorder, social phobia, obsessive compulsive disorder, and generalized anxiety disorder completed the Looming Maladaptive Style Questionnaire-Expanded Version (Riskind, Black, & Shahar, 2010), which assesses looming style as a general underlying vulnerability to anxiety disorders and disorder-specific looming vulnerability themes (i.e., looming vulnerability with respect to panic attacks, social threats, physical threats, and contamination threats). As predicted, the anxiety disorder groups did not differ from one another with respect to scores on general looming cognitive style. As expected, the panic disorder group scored higher than *all* other diagnostic groups on the looming panic attack threat scale and the threat probability ratings (i.e., the probability of having a heart attack, having a stroke, losing control of oneself, or behaving in an embarrassing way). Lending support to the LVM, the looming panic attack threat scale continued to have a specific and independent relationship with panic disorder even after controlling for threat probability ratings. Interestingly, moreover, there was a nonsignificant between-group difference for threat probability ratings when controlling for looming panic attack threat. These results suggest, as predicted, that the looming panic attack threat variable represents a different cognitive process than the static appraisal of panic-related threat probabilities.

Social Phobia

The aforementioned study examining disorder-specific looming vulnerability themes also found that the social phobia group scored higher on the looming social threat scale than the panic disorder group and obsessive compulsive disorder group, but not the generalized anxiety disorder group (Riskind et al., 2010). The observation that the treatment-seeking social phobia and generalized anxiety disorder groups did not differ is not surprising given that both disorders are associated with salient social concerns (e.g., interpersonal vulnerability in relationships). A structural equation modeling study with college students found evidence for the

specificity of social looming by demonstrating a specific link between social looming and fear of negative evaluation (Williams et al., 2005). Social looming correlated more strongly with fear of negative evaluation than did physical looming. In contrast, there was not a specific link between physical looming and fear of negative evaluation. In both of these studies, in addition to a general link between the LMSQ and the common variance among indicators of the five anxiety disorder symptoms, there was also an additional specific significant link between the social threat component of the LMSQ and social anxiety symptoms. Thus, these studies pointed to a particularly close association between the LMSQ social threat subscale and social anxiety. It would appear that in addition to the looming maladaptive style posing a cognitive vulnerability for anxiety, the social threat component of the LMSQ leads some individuals to have a domain-specific fear of social threat outcomes.

In a subsequent study that followed up on Williams et al. (2005), Reardon and Williams (2007) administered a battery of measures to 478 undergraduates in order to examine the specificity of the looming cognitive style, anxiety sensitivity, and explanatory style, in the prediction of latent anxiety disorder symptoms and latent depression symptoms factors. Structural equation modeling analyses indicated that the looming cognitive style predicted only anxiety disorder symptoms whereas anxiety sensitivity and pessimistic explanatory style predicted both anxiety disorder and mood disorder symptoms. In addition, they too found that the social threat component of the LMSQ appears to lead some individuals to have a domain-specific fear of social threat outcomes.

Another study sought to extend this research by examining the association between the looming maladaptive style and multiple aspects of trait social anxiety in a sample of undergraduate women (Brown & Stopa, 2008). Partial correlation analyses indicated that social looming was significantly associated with all three aspects of trait social anxiety (i.e., fear of negative evaluation, social interaction anxiety, public scrutiny fears), even when controlling for depression and general anxiety. In contrast, social looming was not significantly associated with depression or generalized anxiety when controlling for social anxiety. Multiple regression analyses demonstrated that social looming uniquely predicted fear of negative evaluation, social interaction anxiety, and public scrutiny fears, accounting for an additional 3–7% of the variance after controlling for depression and generalized anxiety.

Riskind et al. (2013) extended prior studies by examining the prediction that the social threat component of the looming cognitive style could affect social anxiety through both a direct and an indirect route mediated by verbal social cognitions. Anticipatory mental simulations of social rejection could not only directly affect social anxiety through an imagery pathway, but also activate verbal appraisals and cognitions (e.g., "I won't know what to say") that account for social anxiety. These predictions were tested in a large sample of university students ($N = 547$). As predicted, the results indicated both direct and indirect links between looming cognitive style and social anxiety. In addition, similar but smaller effects of looming cognitive style were found on depression symptoms, and a small indirect effect of looming cognitive style was found to be hostility. The authors speculated that anticipatory mental simulations of the speed of threats and their escalation might be more

closely related to anxiety, but also trigger some depression and anger in individuals who are vulnerable. For example, looming threat could trigger depression and anger in individuals who had depressive cognitive styles and/or hostile attribution biases. Contrary to some previous studies, the results of this study demonstrated that the social and physical threat components of the looming cognitive style covaried so strongly that it served as a unitary factor and no specific link was found between the social threat component and social anxiety symptoms.

In a recent study, Riskind, Calvete, and Black (2017) assessed anxiety in college students who were assigned to give a speech in 3 weeks in a speech communications course. Among students who were low in the social threat component of the looming cognitive style, anxiety was greatest when the speech was announced and then subsequently declined up to the actual time of the speech. Among students who were higher in the social threat component of the LCS, however, anxiety didn't keep declining. These students showed a rebound of anxiety just before the speech, which could perhaps reflect their tendencies to perceive the threats as dynamically growing. Thus, the LCS social threat component was found to moderate participants' levels of anxiety as a public speech approached nearer in time.

Finally, a recent study by González-Díez, Calvete, Riskind, and Orue (2015) examined the role of the looming cognitive style in the context of past research on early maladaptive schemas and social anxiety, which Beck (1976), and Young, Klosko, and Weishaar (2003) have suggested are derived from early formative experiences such as rejection and mistreatment by family members and peers in childhood. González-Díez et al. conducted a longitudinal study to test the hypothesis that looming cognitive style (LCS) for social threat accounts for the predictive association between early maladaptive schema (EMS) domains and social anxiety. The hypothesis was derived from the idea that individuals with EMS, who have experienced past social mistreatment and rejection, may tend to learn to generate dynamic mental scenarios in anticipation of future social rejection. As a consequence, individuals having EMS may not only have schema-driven appraisals of ambiguous interactions that occur as mistreatment, but also routinely anticipate looming mistreatment and confrontations. As a result, they may proactively simulate and rehearse future anticipated mistreatment scenarios, which would then help to produce and maintain a looming cognitive style for social events. Testing these predictions, the authors used a longitudinal design using three waves spaced 6 months apart. The participants ($N = 471$, 56.95% women) were young adults from Basque Country (Spain) aged between 16 and 25 years old. The results showed that three schema domains (impaired autonomy and performance, impaired limits and other directedness) predicted the increase in social anxiety over time and that the looming cognitive style for social threat acts as a mediator and predicted changes in social anxiety 6 months later. Looming has also retrospectively predicted prior lifetime history of social anxiety disorders among currently non-symptomatic college students (Black, Riskind, & Kleiman, 2010).

Whereas the previously described studies have used correlational, prospective, and retrospective methodologies and/or structural equation modeling, a recent study used experimental methodology to examine the effects of a manipulation of loom-

ing perceptions on social anxiety. Specifically, Haikal and Hong (2010) examined the effects of situational demands—i.e., looming threat and social evaluation—on social anxiety symptoms and performance deficits among undergraduates who possess two cognitive vulnerabilities for social anxiety (i.e., looming cognitive style and fear of negative evaluation). After participants in the study were informed that they would be giving a 3–5 min speech titled, "Introducing Myself," they were randomly assigned to a 2 (temporal looming: low vs. high) × 2 (social evaluation: low vs. high) experimental design. In the high temporal looming condition, participants were informed that they would be given 2 min to prepare for the speech and a digital stopwatch was placed in front of them to make the time pressure salient. In the low temporal looming condition, participants were informed that they would be given some time to prepare for the speech and were not given a stopwatch. In the high social evaluation condition, participants were told that their video-recorded speech would be evaluated by a group of communication experts and they were shown a 15-s sample video with a zoomed in image of themselves. In the low social evaluation condition, participants were not told their video would be reviewed by communication experts and the sample video showed an image of themselves from a distance. In line with the LVM, increased anxiety was reported by participants during the speech task under conditions of high temporal looming and high social evaluation. In addition, their performance on the speech task was rated as lower by two independent judges under conditions of high looming, regardless of whether they were in the low or high social evaluation condition. In other words, despite having equal time to prepare for the 3–5 min talk, and regardless of the manipulation of the salience of social evaluation, the high temporal looming condition seem to interfere with their ability to prepare for and/or deliver the brief talk about themselves. In addition, significant interaction effects were found that suggested that individuals who possess the looming maladaptive style and a fear of negative evaluation experience the worst consequences (e.g., elevated anxiety and performance deficits) when faced with multiple situational demands.

Specific Phobia

The LVM proposes that individuals with a sense of looming vulnerability generate dynamic anticipatory mental scenarios in which threatening phobic stimuli are rapidly approaching in both space and time (Riskind, 1997). In two of the earliest studies, Riskind et al. (1992) tested the idea that individuals with a high fear of spiders, as compared with those with low fear, tend to generate anticipatory mental scenarios of spiders as rapidly moving closer. Supporting this idea, they found that college students who were in the high spider fear group, as assessed by *Watts and Sharrock Questionnaire* (1984), perceived significantly more looming of spiders when shown static pictures of a spider (i.e., a tarantula) than college students in the low spider fear group. Moreover, this finding continued to be significant even when controlling for trait anxiety. In contrast, the looming of spiders was not significantly associated

with trait anxiety when the fear of spiders was held constant, suggesting that this cognitive bias is specific to phobic stimuli. Similarly, the looming of dangers typical of generalized anxiety was not significantly associated with fear of spiders when trait anxiety was held constant. Riskind et al. also found that participants' dynamic anticipatory mental simulations of tarantulas moving closer predicted fear of spiders incrementally above and beyond the effects of other danger-related appraisals (e.g., probability of harm, unpredictability, uncontrollability, and imminence).

In another study that is directly relevant to the LVM, Rachman and Cuk (1992) examined perceptual distortions among undergraduate students with an extreme fear of spiders or snakes. Fearful and non-fearful individuals did not differ with respect to their appraisal of spider or snake size; however, they did differ with respect to their appraisal of spider or snake movement. In line with the LVM, fearful individuals perceived that the snake or spider was moving toward them to a greater extent than did non-fearful individuals. Further, fearful individuals also perceived that the snake or spider was coming out of the cage to a greater extent than did non-fearful individuals. Consistent with the LVM, the authors suggested that, from an evolutionary perspective, this perceptual bias might help to identify and accentuate sources of danger, which in turn promotes the avoidance of threats and the survival of organisms (Rachman & Cuk, 1992).

More recently, Vagnoni et al. (2012) examined participants' estimations of movement speed for approaching images of spiders, snakes, butterflies, and rabbits, in which the movement speed of these differing stimuli was matched. The participants were instructed to estimate when each of the stimuli would collide with them had it continued on their course rather than disappearing. Vagnoni et al. (2012) observed that greater fear of spiders and snakes was associated with a reduction in estimated time-to-collision for such stimuli, suggesting that higher fearful participants may have perceived these stimuli to have been approaching faster. In another study, Witt and Sugovic (2013) showed that spiders appeared to move with greater speed toward participants than nonthreatening objects (e.g., lady bugs). Some participants were given the ability to block the advance of the stimuli, whereas others were not. Relative to those who could block the advance of the spiders or nonthreatening objects, the participants who lacked an ability to block them viewed them as moving with greater speed.

The studies of Vagnoni et al. (2012) and Witt and Sugovic (2013) were limited because they did not examine the participants' estimates of the speed of movement of receding spiders. The LVM predicts that a spider fear-related bias would be greatest when participants estimate the speed of spiders exhibiting approaching movement. Basanovic, Dean, Riskind, and MacLeod (2018) tested this prediction generated by the LVM. Using an experimental cognitive task, they showed that high spider fearful individuals relative to low spider fearful individuals displayed a heightened tendency to perceive spider stimuli as moving faster than non-spider stimuli, when such stimuli are approaching but not when they are receding. The study controlled the movement speed of spider and non-spider stimuli and compared participants' relative perception of movement speed in approaching spider and non-spider stimuli with their relative perception of movement speed in such

stimuli when they were receding. Hence, Basanovic et al. confirmed the operation of this fear-linked perceptual bias under tightly controlled methodological conditions.

Several experimental studies have provided evidence that looming manipulations of the approach of phobic stimuli have a strong influence on fear. Riskind et al. (1992) demonstrated that participants, and particularly participants with high levels of spider fear, responded with greater fear and heightened danger appraisals (e.g., probability of harm) to video clips of tarantulas moving closer than to video clips of static tarantulas or tarantulas moving further away. Using the same video clips, Riskind and Maddux (1993) replicated these effects, under conditions in which participants had low self-efficacy expectations, but these effects were neutralized when participants had high levels of self-efficacy. Riskind and Maddux, however, did not assess or separate participants by spider fears.

In a separate study, undergraduate students with low or high spider fears were presented with a picture of a tarantula and were asked to imagine sharing a room with the spider and three other people (Riskind et al., 1995). They completed the Modified Spider Looming Questionnaire to assess static threat cognitions and looming vulnerability. As predicted by the LVM, high fear individuals rated the spider as moving more rapidly toward themselves and perceived the movement as deliberate and selectively in their direction. Moreover, this finding of an increased sense of looming vulnerability was observed across a self-report measure and a measure of perceptual-cognitive distortion. Specifically, the perceptual-cognitive assessment asked participants to draw a line with a pencil from the location of the spider to other parts of the room to represent the spider's direction of movement (if any). In addition, a discriminant classification analysis was performed to examine whether participants could be correctly classified into low and high fear groups based on their responses to the Modified Spider Looming Questionnaire. Ninety eight percent (98%) of participants were correctly classified, and the largest independent and unique contributor to the discriminant classification analysis was the extent to which participants perceived the spider as looming toward the self. The extent to which the participants drew the spider as singling out themselves relative to the three other people in the scenario also made a significant contribution. In contrast, the threat cognition index which is comprised of items assessing static threat appraisals (i.e., danger, probability of harm, uncontrollability) did not make a significant contribution to the discriminant function.

Evidence in line with the LVM also comes from studies by other investigators. For example, Mobbs et al. (2010) also showed that participants reported greater fear when shown video clips of experimenters placing tarantulas closer and closer to them than placing tarantulas getting further away. Likewise, Sagliano, Cappuccio, Trojano, and Conson (2014) showed that participants evaluated pictures of threatening animals more negatively when they were presented as approaching rather than as receding. It is important to note that Mobbs et al. also demonstrated that manipulated tarantula movement toward the viewers elicited different fMRI responses than movement away from the viewers, even when controlling for the apparent proximity of the tarantulas to the participants' feet.

In another study, Vrijsen, Fleurkens, Nieuwboer, and Rinck (2009) used a modified version of the dot probe task to explore attentional bias toward moving spiders in high spider fear individuals. Using this experimental paradigm, they found support for the idea that moving spiders capture the attention of spider fearful individuals. Their methodology also allowed them to compare the effects of unpredictable movement to those of predictable movement. They also found support that both spider fear and non-fearful individuals react faster to unpredictable movements, which can increase looming vulnerability relative to movement that is predictable. Predictable movement that is not directionally approaching, however, would probably be quite different than predictable approaching movement (e.g., a car speeding toward oneself, or a spider jumping toward oneself).

Other studies have also examined attentional processes and spider movement. Reinecke, Becker, and Rinck (2010) found that individuals fearful of spiders demonstrated greater vigilance and detection of changing spider-related stimuli. In another study, Rinck, Kwakkenbos, Dotsch, Wigboldus, and Becker (2010) presented participants task-irrelevant moving and non-moving spiders within an immersive virtual environment. They observed that spider fearful participants demonstrated equivalent attention toward static spiders and moving spiders. Rinck and colleagues proposed that spiders moving side to side or up and down may be no more threatening to fearful participants than static spiders and suggested that the movement of spider stimuli may moderate attention to a greater degree if the movement was clearly associated with changes in potential of danger.

While these studies examined attentional processing in response to moving spider stimuli, none directly examined how fear-linked differences in attentional vigilance to spider stimuli might vary under conditions where spider stimuli display approaching versus receding movements. In another study, Basanovic, Dean, Riskind, and MacLeod (2017) looked at the effect of approaching stimulus movement and receding stimulus movement on fear-linked attentional vigilance to spider stimuli. The study employed a novel task capable of measuring attentional vigilance to spider stimuli under conditions where spiders and butterflies displayed an approaching movement toward the viewer, or a receding movement from the viewer. As previously described in Chap. 6, the study found a fear-linked attentional vigilance to spider stimuli, but the difference for spider fear levels only emerged only when spider images displayed receding movement. Under receding stimulus movement conditions, the participants who were more spider fearful displayed more heightened attentional vigilance than participants who had lower spider fear. However, no fear-linked difference emerged in the approaching stimulus conditions.

As previously stated, most individuals will likely have a tendency to become more hypervigilant to spiders moving toward them. However, spider fearful individuals are more generally primed than less spider fearful individuals to expect spiders to approach. This can lead them to have a more general tendency toward hypervigilance for any spider movement.

Conceptual Issues and Future Research Directions

Looming vulnerability is a cognitive process characterized by dynamic perceptions of intensifying danger and rapidly escalating risk. To date, the concept of looming vulnerability has largely been discussed with respect to external stimuli (e.g., spiders approaching forward, contaminants spreading outward, financial crises rapidly escalating). This chapter extends the concept of looming vulnerability to internal states. Individuals with panic disorder do not perceive external threats as looming, but rather, perceive their own physical symptoms as rapidly becoming more intense and signifying imminent catastrophes (e.g., heart attack, stroke, death). Similarly, individuals with social phobia perceive their own anxious symptoms (e.g., sweating, blushing) as being apparent to others, and as rapidly causing discomfort in others and leading to social rejection.

Research supporting the role of looming vulnerability in the phobic disorders is beginning to accumulate. As reviewed above, the looming maladaptive style predicts shared variance in a latent anxiety disorder factor, including symptoms of panic disorder, social phobia, and specific phobia (Reardon & Williams, 2007; Williams et al., 2005). Panic disorder and social phobia can be distinguished from other anxiety disorders based on the content of their looming vulnerability themes (Riskind et al., 2010). Looming vulnerability is associated with panic symptoms (Riskind et al., 2010), social phobia symptoms (Brown & Stopa, 2008; Haikal & Hong, 2010), and specific phobia symptoms (Riskind et al., 1992, 1995; Riskind & Maddux, 1994). Moreover, many studies have demonstrated that the association between looming vulnerability and anxiety symptoms persist even when controlling for static threat appraisals (e.g., threat probability ratings) and depression (Brown & Stopa, 2008; Riskind et al., 1992, 1995, 2010; Riskind & Maddux, 1994).

With few exceptions, studies examining looming vulnerability in the fear disorders have relied on self-report questionnaires to assess looming vulnerability. Future research would benefit from including multi-method assessment of looming vulnerability. In addition, studies examining looming vulnerability in the fear disorders have been cross-sectional in nature, which precludes statements about the direction of causality. Past research has demonstrated that the LCS predicts changes in anxiety and anxiety correlates such as worry and catastrophization over time (Adler & Strunk, 2010; Riskind, Tzur, Williams, Mann, & Shahar, 2007; Riskind & Williams, 1999; Riskind et al., 2000). Prospective studies would help elucidate whether looming vulnerability predicts the onset of the fear disorders, as well as increases in panic disorder, social phobia, and specific phobia symptom severity over time.

The association between looming vulnerability and specific phobia has been replicated in several studies (Riskind et al., 1992, 1995; Riskind & Maddux, 1994). However, these studies have focused almost exclusively on animal phobias, specifically spider phobia and snake phobia. It will be important for future research to extend this line of inquiry and examine whether looming vulnerability is also an important contributor to natural environment, blood-injection-injury, and situational subtype phobias. For example, individuals with driving or flying phobias might

experience self-generated dynamic mental scenarios in which the vehicle suddenly loses control and leads to an imminent catastrophe (e.g., crash, death).

In light of evidence that looming vulnerability gives rise to static threat appraisals, which in turn contribute to anxiety and fear, it will be important for clinical research studies to explore ways of reducing the apparent looming of danger. For example, previous research in the OCD literature has demonstrated that fear can be reduced by using mental imagery to "freeze" the potential contaminant in one place and reduce the spread (Foa & Kozak, 1986). An interesting idea that lends itself to empirical investigation is whether fear and anxiety can be impacted by manipulating fear imagery, such that potential threats (e.g., snakes, spiders) are "frozen" in place.

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Chapter 13
Looming Vulnerability in Obsessive Compulsive Disorder

Stephanie E. Cassin, Neil A. Rector, and John H. Riskind

Obsessive Compulsive Disorder: Description and Subtypes

Obsessive compulsive disorder (OCD) is characterized by the presence of recurrent *obsessions* and/or *compulsions* that are time consuming (i.e., occupy more than 1 h per day) and cause marked distress and/or functional impairment (i.e., interfere with daily routine or academic, occupational, or social functioning). Obsessions are persistent thoughts, ideas, and/or images that are regarded by the person as intrusive and/or inappropriate. Common obsessions include thoughts or images regarding germs and contamination, thoughts or impulses that are sexual or aggressive in nature, concerns regarding symmetry or exactness, worries about throwing things away, and concerns over somatic and religious matters (Abramowitz, Franklin, Schwartz, & Furr, 2003). Compulsions are ritualistic behaviors or covert mental acts that are performed to neutralize the anxiety caused by obsessions or to prevent a feared event (American Psychiatric Association, 2013). Common compulsions include cleaning, washing, checking, repeating, ordering, hoarding, counting, and praying (Abramowitz et al., 2003). Reassurance seeking is another compulsion that is observed clinically, but under-researched. Compulsions are either not connected in a rational way with the obsession they are designed to neutralize or they are clearly excessive. For instance, an individual who is consistently worried about germs might shower for 2 h and wash his or her hands 50 times each day to

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eliminate potential contaminants. According to the Diagnostic and Statistical Manual of Mental Disorders (DSM-5; APA, 2013), the content of the obsessions or compulsions cannot be confined to symptoms of another disorder (e.g., an anxiety disorder such as GAD, preoccupation with food as in eating disorders, preoccupation with drugs as in substance use disorders, preoccupation with serious illness as in hypochondriasis, preoccupation with sexual urges or fantasies as in paraphilias, concern with appearance as in body dysmorphic disorder, or ruminative thinking as in major depressive disorder). The DSM-5 no longer characterizes OCD as an anxiety disorder, despite its significant anxiety features. However, epidemiologic surveys suggest that the majority of individuals with OCD also meet full diagnostic criteria for an additional psychological disorder at the time of their assessment, most commonly a comorbid anxiety disorder (76%) or a depressive or bipolar disorder (63%) (APA, 2013).

There has been growing empirical support for the presence of symptom subgroups within the umbrella diagnosis of OCD. Following from the early distinction between "washers" and "checkers" based on clinical observation (Lewis & Mapother, 1941), a number of studies have employed multivariate statistical strategies to establish subtypes on the basis of manifest symptoms. A number of studies have examined the structural characteristics of extensive collections of OCD symptoms. Although studies have reported three to seven factor solutions, a four-factor model is the most consistently identified (reviewed by Mataix-Cols et al., 2004) and supported by meta-analyses (e.g., Bloch, Landeros-Weisenberger, Rosario, Pittenger, & Leckman, 2008) resulting in the following factors: (1) contamination obsessions and cleaning compulsions; (2) repugnant/harm obsessions (i.e., sexual, religious, harm-related, somatic) and checking compulsions; (3) symmetry obsessions and repeating, counting, and ordering compulsions; and (4) hoarding obsessions and compulsions although the latter is now conceptualized as Hoarding Disorder (APA, 2013). This model applies across all OCD age groups (Stewart et al., 2008). These dimensions may be present in differing degrees and combinations in any one individual and appear to be relatively stable over time. Of these subtypes, fearful thoughts and images regarding contamination appear to be the most common obsessional theme across numerous cultures (Khanna & Channabasavanna, 1988), as well as the most widely researched (Ball, Baer, & Otto, 1996).

Obsessive compulsive disorder affects 1–3% of the population (Torres et al., 2006), and the prevalence is fairly similar across cultures (Weissman, Bland, Canino, & Greewald, 1994) and genders (APA, 2013). It can become a chronic and debilitating disorder associated with severe impairments in academic, occupational, social, and family functioning (Piacentini & Bergman, 2000). With respect to academic and occupational functioning, individuals with OCD tend to have lower rates of employment, earn lower wages, have higher absenteeism, have lower levels of educational attainment, and have greater reliance on welfare payments, relative to those with anxiety disorders and those without mental health disorders (Knapp, Henderson, & Patel, 2003).

Psychological Models of Obsessive Compulsive Disorder

Behavioral Models of OCD

The origins of behavioral models of OCD derive largely from Mowrer's two-stage model of fear and avoidance behavior (Mowrer, 1939, 1960). Mowrer suggested that fear of stimuli, such as thoughts, images, or objects, were acquired through a classical conditioning process. According to the first stage of Mowrer's model, neutral stimuli, such as thoughts and images, become conditioned stimuli through pairing with an unconditioned stimulus that naturally provokes fear. As theorized, a traumatic event should represent the catalyst for the activation of obsessive compulsive symptoms. For example, an individual might develop contamination obsessions following a serious illness or doubting obsessions following a house fire.

According to the second stage of Mowrer's (1960) model, fear is maintained though operant conditioning processes, notably escape and avoidance behaviors. Learning theory frameworks were extended to account for the range of compulsive rituals observed in OCD. Compulsions were conceptualized as active avoidance strategies that are negatively reinforced and become habitual given their success in reducing the fear caused by the arrival of the obsession and the prevention of extinction (Dollard & Miller, 1950). For example, an individual with contamination obsessions might engage in excessive hand washing compulsions, avoid using public restrooms, and exit a room if another person is observed coughing or sneezing in order to reduce the chance of contamination. An individual with doubting obsessions might check the door locks, stove, and other appliances several times before leaving the house to ensure safety. This hypothesized functional relationship between obsessions causing distress and compulsive, escape, and avoidance behaviors reducing obsessional distress is so widely accepted that it is built into the modern nosologic description of the disorder (APA, 2013).

Beyond classical overt compulsions (such as washing and checking), a broader range of operant conditioning factors have been implicated in the maintenance of OCD. For instance, "safety behaviors," a term referring to a variety of overt or covert strategies that are typically more subtle than compulsions, are often used to avoid or escape a feared outcome (Deacon & Maack, 2008; Salkovskis, 1991). Using a sleeve to open a restroom door or carrying anti-bacterial hand sanitizer are two examples of safety behaviors that might be used by an individual with contamination fears. Similar to compulsions, safety behaviors are negatively reinforced by effectively reducing anxiety in the short term. They have been implicated in the maintenance, and perhaps even exacerbation, of OCD symptoms because they focus attention on feared stimuli and may be used to justify the non-occurrence of a catastrophe (Deacon & Maack, 2008; Salkovskis, 1991). Much research supports the role of operant conditioning in the maintenance of OCD; however, behavioral models have been challenged because there is relatively little prospective evidence to support the role of traumatic conditioning in the onset of OCD (e.g., Emmelkamp, 1982; Mineka & Zinbarg, 2006).

Cognitive Models of OCD

A number of cognitive models have been proposed to explain why some people are more vulnerable than others to developing OCD. Obsessions are experienced by 84% of the population, yet only a small fraction of individuals who experience obsessions actually meet the diagnostic criteria for OCD (Rachman & de Silva, 1978). The content of obsessions experienced by non-clinical individuals is similar to those experienced by individuals with OCD (Rachman & de Silva, 1978; Salkovskis & Harrison, 1984). For example, non-clinical individuals experience obsessive impulses to jump or push someone in front of the subway, violently punish a person or animal, disrupt peace in a gathering, harm small children or the elderly, say inappropriate things, or crash their car when driving. They may also have unwanted thoughts about accidents occurring to loved ones or about something being wrong with their health. Those individuals who meet the diagnostic criteria for OCD tend to experience their obsessions as less acceptable and more difficult to dismiss (e.g., Rachman & de Silva, 1978).

Early cognitive appraisal theories of OCD emphasized the impact of static threat appraisals on anxiety, such as overestimating the probability and cost of potential harm (Carr, 1974). In addition to faulty primary threat appraisals, which involve overestimating the probability and consequences of threat, individuals with OCD were also thought to make faulty secondary appraisals in which they underestimate their ability to effectively cope with the threat (McFall & Wollersheim, 1979). These early models were criticized for failing to specify how the threat appraisals in OCD differed from the threat appraisals found in other anxiety disorders (Salkovskis, 1985). That is, although these early cognitive appraisal theories would suggest that individuals with OCD make distorted appraisals regarding the likelihood of occurrence of contamination, the imminence of contamination, and their lack of control over contamination, they did not explain why some individuals were more prone to making distorted appraisals than others (Beck & Emery, 1985; Carr, 1974).

The contemporary cognitive-behavioral models of OCD that followed assumed that distress is mainly influenced by the way an individual appraises obsessive thoughts, images, and/or impulses, as opposed to by the content of the obsessions (Clark, 2004; Clark & Beck, 2010; Frost & Steketee, 2002; Rachman, 1993; Salkovskis, 1999). However, the models differed from one another with respect to the specific cognitive constructs that were emphasized in the etiology of OCD.

Rachman's Misinterpretation of Significance Theory. Rachman (1971, 1997, 1998) noted that the content of many obsessions reflect immoral themes of aggression, sex, and blasphemy. He proposed that individuals with OCD tend to make catastrophic misinterpretations of their negative automatic thoughts. For instance, they might believe that the intrusive thoughts are personally meaningful and reveal one's true character, and that they provide warning that negative events are about to occur or that one is about to lose control. For example, individuals with OCD might believe that if they have a sexual thought about their child, then it must mean that they are sexually deviant, dangerous, and at risk of actually harming their child.

Rachman (1998) proposed that individuals vulnerable to OCD possess preexisting beliefs that having an unacceptable thought increases the likelihood of the negative event featured in the thought occurring, or that having a morally repulsive thought is the moral equivalent of committing the act featured in the thought. These cognitive biases have been labeled "thought-action fusion" (TAF).

Salkovskis' Inflated Responsibility Theory. Salkovskis' (1985, 1989) model assumes that individuals with OCD appraise obsessional thoughts negatively due to deeper level core beliefs regarding personal responsibility for preventing harm to oneself or others. In an attempt to avoid being responsible for aversive events, individuals with OCD engage in a variety of neutralizing activities including performing rituals designed to prevent harm, seeking reassurance that harm has not occurred, or diffusing responsibility by communicating the potential for harm to others. They also begin to avoid stimuli that activate these obsessive thoughts. This avoidance may also take the form of thought suppression whereby effortful strategies are employed to control obsessions. Neutralizing activities, avoidance, and thought suppression are negatively reinforced because they temporarily reduce anxiety. However, they also serve to perpetuate the obsessions over time.

Clark's Meta-Cognitive Model. In Clark's meta-cognitive model (Clark, 2004), it is assumed that individuals with intrusive thoughts arrive at OCD because of mistaken meta-beliefs that they should be able to control such thoughts. The greater the extent that such individuals attempt to exert such control, the greater sense of their failure and the more they exacerbate their problems because they respond with greater attempts at thought control.

Obsessive Compulsive Cognitions Working Group. The Obsessive Compulsive Cognitions Working Group (OCCWG) was assembled to identify distorted beliefs that are relevant to OCD. Elaborating on Salkovskis' inflated responsibility theory, the OCCWG identified five additional categories of beliefs that are particularly relevant to OCD, including exaggerated appraisals of threat, perfectionism, intolerance of uncertainty, over-importance of thoughts, and need to control thoughts (OCCWG, 1997, 2001, 2003, 2005). Individuals with OCD have been shown to score higher than community and student controls on all of these belief domains, as assessed by the Obsessive Beliefs Questionnaire, and higher than non-OCD anxious controls on all belief domains with the exception of perfectionism and intolerance of uncertainty (OCCWG, 2005).

Other Research on Cognitive Factors. Other studies have found evidence that OCD is characterized by perfectionism, self-ambivalence, and sensitive self-domains (Bhar & Kyrios, 2007). Bhar and Kyrios found evidence that self-ambivalence was related to OCD symptoms, perfectionistic beliefs, and beliefs about the need for thought control. The more perfectionistic that the individual's self-standards are, the greater the discrepancy will be when an odd or inappropriate thought occurs, and the less confidently one can dismiss negative self-inferences about the meaning of such discrepancies. In a study comparing how OCD patients and non-clinical individuals attempt to control unwanted thoughts, self-punishment was higher in patients and showed the largest between-group discrepancy of the strategies examined (Amir, Cashman, & Foa, 1997). These findings imply that

individuals with OCD may be particularly self-judgmental when faced with apparent threats to their self-perception of morality.

Cognitive models focusing on the role of obsessive beliefs and catastrophic misappraisals have led to important advances in the conceptualization and treatment of OCD. However, given the heterogeneous nature of OCD, it is unlikely that one particular category of obsessive beliefs will account for all OCD symptom subtypes. Rather, there is growing consensus that appraisals might differ substantially across OCD subtypes, and that different models might be needed to account for the etiology and phenomenology of different subtypes (Purdon, 2009). For example, erroneous appraisals regarding the probability and severity of adverse consequences (e.g., diseases) appear to be particularly relevant to contamination concerns (Dorfan & Woody, 2006). Furthermore, several studies have reported that approximately half of all individuals diagnosed with OCD do not endorse elevated obsessive beliefs (Calamari et al., 2006; Taylor et al., 2006), suggesting that examination of additional cognitive vulnerability factors is warranted to better account for the symptom, cognition, and behavioral aspects of OCD. Cognitive vulnerability factors that have been the focus of recent research include meta-cognition (Purdon & Clark, 1999; Wells, 1997), "not just right experiences" (Coles, Frost, Heimberg, & Rheaume, 2003: Sica, Caudel, Chiri, Ghisi, & Marchetti, 2012), distrust and fear of the self (Aardema, Moulding, Radomsky, Allamby, & Souki, 2013; Julien, O'Connor, & Aardema, 2007), and looming vulnerability. The remainder of this chapter will focus on the LVM of OCD.

With the above background, it can be highlighted that all of the models above implicitly assume some form of vulnerability to the approach of threat. The focus of the assumed threat varies across these different models—e.g., failure to control intrusive thoughts, the threat of irresponsibility, or threat of contamination—differs but a cognitive process of simulating the approaching occurrence of the threat would presumably be critical in all.

Obsessive Compulsive Disorder: Looming Vulnerability

Description of the LVM

Existing cognitive theories of OCD have focused predominantly on static cognitive content in a given moment, including OCD-relevant beliefs, and appraisals of the probability or imminence of threat, perceived control over the threat, and magnitude of catastrophe. As previously described, the LVM assumes a pattern of increasing probabilities or other threat values predicts more anxiety and fear than a pattern of static probabilities of threat values or of decreasing values (Hsee, Tu, Lu, & Ruan, 2014).

Moreover, even assuming that two different people perceive the same probability or proximity of an outcome in the same given moment, they can still differ markedly in whether they see that probability or proximity as continuing to rapidly rise, as

unchanging or constant, or rapidly decreasing. As described herein, research has indicated that threats that approach (or "loom") on a probability or proximity dimension produce more negative responses than those that have static values on these dimensions or that recede (Hsee et al., 2014).

The LVM also suggests that whereas a person tends to habituate to and find ways to cope with threats that are static or very slow to change, the person will tend to stay fearful of threats that are perceived or imagined to be continuously advancing and escalating in danger (Riskind, Abreu, Strauss, & Holt, 1997). In the case of OCD, for example, feared stimuli, such as germs, that are perceived as constant and predictable factors will evoke minimal fear, whereas germs and contaminants that are perceived or played out in the mind as rapidly spreading and growing will lead to heightened fear of potential contaminants and slower distress reduction (Dorfan & Woody, 2006; Riskind, 1997).

Dynamic perceptions of rapidly escalating threat also adversely impact an individual's ability to evaluate and select the most appropriate coping strategy. The net result is that the person selects maladaptive strategies, such as behavioral compulsions, mental rituals, and avoidant coping strategies that are often selected by individuals with OCD because they quickly and effectively reduce or prevent anxiety. As a result, a negative reinforcement pattern is established.

Importantly, the LVM assumes that each specific symptom subtype of OCD has its own specific looming themes. For example, the model posits that individuals with the contamination subtype of OCD mentally play out and generate dynamic expectations of potential contaminants as spreading and growing and escalating in danger, causing him to have a sense of looming vulnerability, and resulting in an excessive fear of contamination. The fear of spreading contamination in OCD has been previously described by Foa and Kozak (1986). While conducting exposure therapy with a client with a urine phobia, they noted that they were able to reduce the client's fear by having him imagine that he was able to "freeze" drops of urine that were placed on his arm in order to prevent their spread.

Individuals with contamination obsessions and cleaning compulsions often describe contaminated objects as disgusting more so than threatening (Tolin, Worhunsky, & Maltby, 2004). Contamination concerns are thought to represent a blend of emotions including both fear and disgust (Woody & Teachman, 2000). Referring to an evolutionary perspective, one can postulate that the function of disgust is to prevent contamination and disease (Izard, 1993; Rozin, Markwith, & Nemeroff, 1992). There is some evidence that individuals with contamination-related OCD have a general predisposition to disgust (i.e., "disgust sensitivity") (Woody & Tolin, 2002), and it has been hypothesized that this disgust sensitivity serves a disease-avoidant function (Tolin et al., 2004). Regardless of whether disgust is ultimately based on a fear mechanism, the LVM posits that it is related to a cognitive process of perceiving or imagining a dynamic pattern of rapidly approaching and escalating threat. As described below, disgust sensitivity has been shown to be related to corresponding perceptions of looming vulnerability to disgusting situations.

Some individuals with OCD hold implausible beliefs regarding the spread or transmission of contagion (termed "sympathetic magic"; Nemeroff & Rozin, 1994). For example, they might hold the belief that contaminated objects remain contagious indefinitely and are capable of transmitting contamination permanently (Tolin et al., 2004). This belief causes them to avoid not only potential contaminants, but also secondary objects that might have come into contact with contaminants due to the belief that they have the same contagious properties as the original contaminant. For example, a woman who fears potential contaminants might remove her clothes and put them in the laundry after returning from the hospital, but then worry that the other clothes in the laundry basket are also contaminated, as well as the floor that the laundry basket is placed on. This phenomenon has been described as the "chain of contagion" in OCD (Tolin et al., 2004), and it is thought to account for increased avoidance of a wider range of potential contaminants as OCD progresses. But it is not just a person's static, abstract beliefs that may produce the chain of contagion, and the cognitive process that produces a sense of looming vulnerability may also be crucial. Looming vulnerability has been proposed as a cognitive mechanism underlying the "chain of contagion" because it blocks the habituation process. That is, the "chain of contagion" is a manifestation of the tendency of the person with OCD to perceive a pattern of escalating danger. Contaminants that are appraised as rapidly approaching and spreading outward from object to object might also be perceived as being sustained across several degrees of removal from the original contaminant (Tolin et al., 2004). Tolin et al. found that when they controlled for perceptions of looming vulnerability to contamination, the chain of contagion effect statistically disappeared.

Operationalization and Assessment of Looming Vulnerability in Obsessive Compulsive Disorder

The Looming Maladaptive Style Questionnaire (Riskind, Williams, Gessner, Chrosniak, & Cortina, 2000) is a general measure of tendency to interpret and perceive ambiguous threats as rapidly approaching and intensifying in threat values (e.g., the higher-order looming cognitive style). It is not specific to obsessive concerns, such as contamination. The questionnaire is designed to assess a person's general tendency to perceive the chances of harm, the proximity of the harm, etc. in ambiguous threats as increasing, escalating, and becoming greater by the moment (or "looming"). Respondents are presented with six brief vignettes describing two types of ambiguous, potentially stressful situations and are asked to read each vignette and then to imagine the scenario as vividly as possible. The social threat or *social looming* vignettes include: (1) the possibility of a romantic relationship breaking up; (2) inviting a very popular person to a party in front of a group of people; and (3) speaking in front of a large audience of strangers. The physical threat or *physical looming* vignettes include: (1) hearing a strange engine noise

while driving on the expressway in rush hour traffic; (2) developing heart palpitations while speaking with someone about a financial problem; and (3) the risk of getting into a car accident. After imagining each scenario, they are asked to respond to four questions on a Likert scale. The first question asks how worried or anxious respondents become when imagining the scenario ("not at all" to "very much"). The second question asks the extent to which the chances of having difficulty in the scenario are increasing or expanding with each moment ("chances are decreasing with time" to "chances are expanding with time"). The third question asks the extent to which the threat is growing larger with each moment ("threat is staying fairly constant" to "threat is growing rapidly larger"). The final question asks the extent to which the respondent visualizes the scenario as progressively worsening ("not at all" to "very much"). Responses to the final three questions are aggregated across the six vignettes to compute a total Looming Cognitive Style score. The Looming Vulnerability Scale is an expanded version of the LMSQ which includes items pertaining to looming vulnerability to contamination threat and looming vulnerability to panic attacks in order to assess the specificity of looming themes (Riskind, Rector, & Cassin, 2011).

The Looming of Disgust Questionnaire (Williams, Olatunji, Elwood, Connolly, & Lohr, 2006) was designed to assess the tendency to view potentially disgusting situations as rapidly rising in threat value. Similar to other looming measures, respondents are instructed to read brief vignettes and to vividly imagine themselves in each scenario. The eight vignettes correspond to the disgust domains assessed by the Disgust Scale (Haidt, McCauley, & Rozin, 1994): (1) you feel maggots from a garbage pail crawling up your leg; (2) a stranger vomits on your feet at a party; (3) the ashes of a cremated body spill onto you at a funeral; (4) you help an injured person who has exposed intestines; (5) you take a few large drinks of spoiled milk; (6) you observe a chef sneezing on food and preparing food with soiled hands; (7) you are stuck in an elevator with a person with severe body odor; and (8) you observe your roommate stirring soup with a flyswatter. Respondents complete six questions for each vignette on a Likert scale. Five of the questions form a total score for cognitive vulnerability to disgust: (1) Looming of Disgust (LOD) threat: the extent to which the level of threat increases as the scene unfolds; (2) LOD sick: the extent to which the threat of becoming nauseous or sick increases; (3) LOD disgust: the extent to which the level of disgust increases; (4) LOD spread: the speed with which the disgust stimulus is approaching, spreading, or moving; and (5) LOD imagine: the extent to which you feel disgusted when imagining yourself in the scene. The final question assesses secondary appraisals of disgust (LOD cope) and asks respondents to rate the extent to which they imagine being able to cope with the situation. The Looming of Disgust Questionnaire has been shown to discriminate between obsessive participants with contamination-related concerns, socially anxious participants, and non-anxious controls. Psychometric studies have supported the internal consistency and validity of the LODQ (Williams, Shahar, Riskind, & Joiner, 2005).

The Contamination Scenario-Based Questionnaire (Elwood, Riskind, & Olatunji, 2011; Riskind et al., 2011) was designed to specifically assess looming of

contamination. Respondents are presented with a picture of an aversive contamination scene (e.g., trash) and are asked to rate their fear and disgust of contamination, the perceived harm potential of the contaminants, and the subjective sense of looming vulnerability to the contamination on a Likert scale (ranging from "not at all" to "very much"). The perceived likelihood of harm subscale is computed by summing scores on two items. The first item asks about the likelihood that the germs or bacteria will harm the respondent. The second item asks about the likelihood that the germs or bacteria will make the respondent sick. The looming of contamination subscale is computed by summing scores on four items. Two of the items assess perceived spreading of contamination (i.e., the extent to which the germs or bacteria are moving toward the respondent, and the extent to which the germs or bacteria are actively and energetically moving toward the respondent). The remaining two items assess perceived growing of contamination (i.e., the extent to which the level of germs or bacteria is rapidly increasing, and the extent to which the germs or bacteria increase over a 10-min period). The perceived spreading and perceived growing of contamination subscales are significantly correlated with one another and have good internal consistency (Elwood et al., 2011).

The Looming of Contamination Questionnaire (Riskind, Abreu, et al., 1997) was designed to assess the subjective sense of looming vulnerability to contamination. Respondents are presented with five brief vignettes: (1) going to a dirty bathroom in a gas station; (2) sitting on the subway next to a man in dirty clothes who smells of urine; (3) shopping for produce next to a man who is coughing on the produce one wants to select; (4) shaking hands with someone who has just emptied the trashcan; and (5) talking to someone at a party who spits when speaking. Respondents are asked to read each vignette and then to imagine the scenario as vividly as possible. They are then asked to respond to seven questions for each vignette on a Likert scale, three of which assess the respondent's sense of looming vulnerability. The first question asks the speed with which contamination is spreading. The second question asks the extent to which the contamination is approaching moment by moment. The third question asks the extent to which the threat is growing larger with each moment. The final four questions assess other cognitive appraisals of threats, including the perceived probability of occurrence of contamination, imminence of the contamination, perceived lack of control over the approach of the contamination, and degree of worry when in similar contamination situations. Psychometric studies have supported the internal consistency and validity of the Looming of Contamination Questionnaire (Riskind, Abreu, et al., 1997).

The OCD Looming Vulnerability Measure (Riskind & Rector, 2007) was designed to assess the subjective sense of looming vulnerability to a range of potentially threatening situations relevant to OCD (e.g., contamination, hoarding, doubting, ordering/symmetry, and pure obsessions). Thus, tendencies to play out corresponding dynamic scenarios of looming threat in ambiguous situations are specified for each focus of OCD symptoms. Respondents are presented with 22 brief vignettes covering a range of OCD themes. Sample items include: Contamination Looming (e.g., using a dirty bathroom at a gas station); Hoarding Looming (e.g., having to discard an item that has personal meaning and that you might need again

one day); Doubting Looming (e.g., passing a busy intersection having a thought or image of having just caused an accident); Ordering/Symmetry Looming (e.g., passing by a painting on the wall that has become significantly tilted); and Pure Obsession Looming (e.g., having an urge to strike a pedestrian while driving, or having an image of yourself in a sexual act with a child, or having an urge to deface a place of worship). Respondents are asked to read each vignette and then to imagine the scenario as vividly as possible. They are then asked to respond to three questions for each vignette on a Likert scale. The first question asks how worried or anxious the respondent feels when imagining the scenario ("not at all" to "very much"). The second question asks the extent to which the threat is growing larger with each moment ("threat is staying fairly constant" to "threat is growing rapidly larger"). The third question asks the extent to which the threat is progressively worsening or expanding ("not at all" to "very much"). The last two questions assess the respondent's sense of looming vulnerability. Each of the OCD looming subscales has demonstrated adequate internal consistency (Riskind & Rector, 2007).

All of these looming vulnerability measures share the common feature of having a mood-induction and mental simulation component—whereby respondents are asked to vividly imagine themselves in potentially threatening scenarios—and are asked to rate the extent to which the threat is looming forward, spreading out, and increasing in intensity and/or dangerousness. However, the measures differ with respect to the type of threat being assessed (e.g., higher-order looming cognitive style, looming of disgust, looming of contamination, or looming of other OCD-relevant threats).

Empirical Data on Looming Vulnerability in Obsessive Compulsive Disorder

Mediational Model

As previously described, the LVM proposes that an individual who mentally plays out and who has dynamic expectations that threats are escalating, and germs and contaminants as continuously growing and rapidly changing and spreading will experience greater fear of exposure to potential contaminants. Further, the LVM proposes that this dynamic cognitive process contributes to fear and anxiety directly, as well as indirectly, by heightening static threat appraisals.

To test these predictions, undergraduate students were asked to read two brief vignettes describing close contact with an individual who is HIV-positive (i.e., sitting beside the person on a bus or near the person in a restaurant) (Riskind & Maddux, 1994). For each vignette, they responded to four items to assess the sense of looming vulnerability (e.g., extent to which the HIV is actively and energetically approaching, speed with which the situation is becoming more dangerous, the speed with which the HIV could be transmitted, and whether the speed is constant or accelerating) and eight items to assess static threat appraisals (e.g., perceived danger, likelihood of

harm, unpredictability of HIV, and lack of control over harm from HIV). As predicted by cognitive appraisal theories of anxiety, individuals with high-HIV fears rated the vignettes as higher on the static threat appraisals. Lending support to the LVM, individuals with high-HIV fears mentally play out scenarios of increasing looming vulnerability to HIV, imagining the virus to be rapidly spreading from people and across surfaces, whereas individuals with low-HIV fears did not have a sense of looming vulnerability (Riskind & Maddux, 1994). This cognitive process of simulating looming vulnerability was found to have a large indirect effect on fear of HIV, such that looming vulnerability predicted static threat appraisals, which in turn, predicted fear of HIV. However, there was also evidence for a significant, albeit smaller, direct effect of looming vulnerability on fear of HIV.

Another study was conducted to examine whether a sense of looming vulnerability to spreading contamination was linked to subclinical OCD (Riskind, Abreu, et al., 1997). Undergraduate students read vignettes of situations involving potential exposure to dirt, germs, or contamination, as described above in the Looming of Contamination Questionnaire. As would be expected, undergraduates with subclinical obsessional fears perceived the contamination threat as more probable, imminent, and uncontrollable, and they also had a much greater sense of looming vulnerability to spreading contamination compared to a control group with low obsessional fears. The results showed that perceptions of the contamination as spreading made distinct and significant contributions to fear of contamination symptoms with the effects of static threat appraisals removed. In contrast, the static threat appraisals had no significant associations with fear of contamination symptoms that were independent of perceptions of looming vulnerability. These findings support the proposition that the cognitive process producing a sense of looming vulnerability is positively correlated with OCD symptoms and contributes to contamination fears both directly and indirectly by triggering or intensifying static threat appraisals. According to this mediational model, the indirect effects of looming vulnerability are transmitted by heightening static threat appraisals.

Green and Teachman (2013) conducted a structural equation modeling study with 56 undergraduates to examine the relationship between "explicit, cognitive appraisals" (looming perceptions, likelihood estimates), and implicit measures of threat (an IAT test), in predicting contamination fear and distress. Interestingly, a disassociation was found between the explicit and implicit measures of threat, such that explicit self-report measures predicted explicit subjective distress measures, while on the other hand, implicit appraisals predicted avoidance behaviors. Of further interest, inspection of their SEM figure suggests that the two measures of looming perception may have exhibited a stronger association with subjective distress measures then did likelihood estimation although the authors did not specifically test the statistical significance of this difference.

Another study with undergraduate college students by Dorfan and Woody (2011) examined the capacity of cognitive factors, including looming vulnerability, to predict emotional responses, avoidance, and cleaning behavior during a behavioral avoidance test. Those authors constructed a "Washroom Appraisal Questionnaire" which yielded three subscales in a factor analysis: danger appraisals (items concerning perceived vulnerability to germs, level of risk/danger, likelihood of something

bad happening, likelihood of disease, and seriousness of disease), "looming germs spread"(acceleration of spread, germs spread through the air toward you, speed of germ spread, level of spread to others), and responsibility appraisals (responsibility itself, responsibility to others). When all three appraisal dimensions were entered simultaneously in the same step of a regression model, after controlling for gender, the looming germs spread appraisal factor was the only one to approach significance in predicting anxiety about touching contaminants ($p < 0.06$). This near significant effect was lost, however, when neuroticism was entered in a step prior to the appraisal factors.

Although this study did not find evidence of incremental prediction for looming vulnerability, it had some limitations. The main problem is that it did not include items that assessed whether individuals perceived or imagined the contamination in the washroom as escalating in threat, as we now do in the new looming contamination measures. Moreover, it only included a measure of perceived germ *movement,* and did not tap into perceptions that germs were rapidly growing versus spreading, which have also been found to predict contamination fears (Elwood et al., 2011). Another limitation is that their measure of "other danger appraisals" included items such as "perceived vulnerability"—which would be expected to contain some of the variance that properly belongs to the measure of looming vulnerability.

Taking a different and unique approach, Knapton (2015) used qualitative, cognitive linguistic analysis methods to analyze the spoken narratives of individuals with OCD. Each of her 15 participants completed an audio-recorded, semi-structured interview with questions about their experiences of OCD, descriptions of their OCD episodes as they unfold, and the onset of their OCD. Her findings indicated that perceptions of threats fluctuate as OCD episodes unfold, and that it is the perceived movement (or not) of the threat that induces distress.

Looming Manipulations

Studies using looming manipulations have supported the hypothesis that perceptions of looming vulnerability are a powerful causal antecedent of contamination fears. As previously mentioned, an early case study reported that an individual with a urine phobia was able to reduce his fear during exposure therapy by imagining that drops of urine that were placed on his arm were "frozen" and unable to spread (Foa & Kozak, 1986). Following this case study, a larger empirical investigation had undergraduate students with subclinical obsessions observe two videos of contamination scenes (i.e., a dirty toilet in a public restroom and a dirty trashcan covered with wet paper towels and toilet paper) with different sets of instructions (Riskind, Wheeler, & Picerno, 1997). Those in the control condition simply observed the videos and were not given any additional instructions. Those in the freeze imagery condition were told to visualize the contaminants as toxic but unable to move forward or spread out, whereas those in the looming imagery condition were told to visualize the contaminants as airborne, mobile, and rapidly spreading. As predicted, participants in the freeze imagery condition reported lower anxiety than those in the control

group. This finding was particularly true for individuals who scored high in imagination. The results for two indirect measures of fear of contamination also converged with the self-report findings. For example, individuals with subclinical obsessions in the freeze imagery condition demonstrated a greater willingness to stand near a contamination site (i.e., a filthy toilet) and to take a cookie from a tray strategically placed next to a large trashcan. In contrast, those in the looming imagery condition reported increased worry and urges to wash compared to the control group. However, looming imagery did not have a significant impact on indirect measures of fear of contamination. The authors noted that individuals with subclinical obsessions in the looming imagery condition might have been less motivated to comply with the looming imagery instructions because the imagery would heighten anxiety.

In another related, but more involved, study, Dorfan and Woody (2006) examined the effects of three imagery conditions on the distress associated with a contaminating stimulus. Undergraduate students underwent a contaminant exposure, in which urine drops were placed on the fingertips and palm of their non-dominant hand. They were then randomly presented with one of three different imagery scripts. In the moving harm imagery condition, they were informed that germs are dangerous and were told to imagine that any germs and contamination from the urine are moving across the skin and spreading through the air as they evaporate. In the static harm imagery condition, they were informed that germs are dangerous and were told to imagine that any germs or contamination from the urine are contained within the area of the hand where the urine is sitting and unable to spread from the current location. In the safety imagery condition, they were told to imagine that the urine is a clean and sterile substance from a healthy individual and contains no harmful germs or contaminants.

Participants in the moving harm imagery condition reported an immediate increase in distress that was sustained over the 30-min exposure period. In contrast, those in the static harm imagery and safety imagery conditions reported an immediate decrease in distress. In addition, those in the moving harm imagery condition reported significantly greater threat appraisals (e.g., likelihood of getting sick) compared to the static threat imagery and safety imagery groups. Those in the moving harm imagery condition also reported significantly greater lingering distress following hand washing than did the other two groups. The results also lent support to the LVM by demonstrating that individuals who imagine contaminants as moving forward and spreading outwards are not only slower to habituate, but are actually sensitized and increase their distress when confronted with a potential contaminant.

Spread of Contagion

Looming vulnerability has been proposed as a cognitive mechanism underlying the "chain of contagion," whereby individuals with OCD avoid not only contaminants, but also secondary objects that have come into contact with the original contaminant (Tolin et al., 2004). To test this prediction, individuals with OCD were

compared to an anxious control group and a non-anxious control group on a "chain of contagion" task designed to assess the extent to which contagion is transferred between previously uncontaminated objects (Tolin et al., 2004). Each participant was asked to identify the most contaminated object in the building (e.g., toilet, garbage can), and then asked to get as close as possible to the contaminated object. Next, the experimenter opened up a new box of 12 pencils, removed one pencil (Pencil #1) from the box, and systematically wiped the pencil over the contaminated object. The experimenter and participant then left the room with the contaminated object, and when the object was out of site, the participant was asked to rate the degree of contamination on Pencil #1 on a scale from 0 to 100. Next, Pencil #2 was removed from the box and was systematically wiped on Pencil #1. Pencil #1 was then discarded, and the participant was asked to rate the degree of contamination on Pencil #2. This procedure was repeated until contamination ratings were obtained for all 12 pencils in the box, each contaminated by the previous pencil. The exact same procedure was followed for a nonthreatening object (i.e., a piece of candy) which served as a control condition.

Lending support to the sympathetic magic phenomenon in OCD, individuals with OCD perceived that contamination persisted across points of removal. Across the 12 pencils, the contamination ratings provided by individuals with OCD decreased by an average of 40%, whereas the contamination ratings provided by the anxious controls and non-anxious controls decreased by 98% and 100%, respectively. In contrast, there were no differences between groups in the non-threat (i.e., candy) control condition, suggesting that the "chain of contagion" observed in OCD is specific to OCD threat-related stimuli. Individuals with OCD had a greater sense of looming vulnerability (as assessed by an interview version of the Looming of Contamination Scale; Riskind, Abreu, et al., 1997), and looming vulnerability was found to fully mediate the relationship between the diagnostic group and chain of contagion. The results suggest that individuals with OCD who appraise contamination as approaching forward, spreading out, and increasing in threat are also prone to assume that the contamination is transmitted indefinitely and across several degrees of removal from the original contaminant without diminishing substantially.

Attributing Human-Like Mental Properties to Germs

Research has shown that humans and even human infants have appeared to have an innate tendency to attribute human mental characteristics—such as intentions, thoughts, and even feelings to nonhuman agents and even inanimate objects (see Chap. 5). Moreover, such anthropomorphic tendencies can be strengthened when objects exhibit movement or activity (Morewedge, Preston, & Wegner, 2007). Riskind and Richards (2018) carried out two studies to examine the relationship between movement, contamination, and anthropomorphism. Following an initial study that established that there were associations between imagined germ movement, contamination fear, and the attribution of malevolent intentions to germs, they

conducted a second study that experimentally manipulated germ movement with a brief film clip of magnified germs. The results of the second study showed that the experimental manipulation of germ movement increased attributions of malevolent intentions to germs and enhanced the tendencies of individuals with higher levels of contamination fear to attribute some general human characteristics to germs (i.e., intentions, feelings). The pattern of findings revealed that the manipulation of germ movement had a far stronger effect on the anthropomorphic attributions of participants who were high in OCD contamination fears than on those who were low. No such findings were obtained for disgust sensitivity.

These intriguing findings suggest the possibility that the attribution of malevolent intentions to germs may be a cognitive distortion that contributes to the maintenance of contamination fear and may afford a novel treatment target. Moreover, perceived or imagined germ movement may serve as an antecedent to the attribution of malevolent intentions to germs and thus exacerbate the tendency to make these attributions. Future research could examine whether such anthropomorphic attributions of ill-intentions to germs play a role as determinants of other phenomena such as the spread of contagion effects. One would guess that the spread of contagion would be heightened were a person to view contaminants as ill-intentioned and malevolently motivated.

Disgust Sensitivity

Looming vulnerability is thought to be a common cognitive vulnerability to both fear and disgust because both such states are predicated on the approaching occurrence of contact with a threat or noxious stimulus. According to Williams et al. (2006), individuals characterized by disgust sensitivity likely perceive potentially disgusting stimuli as rapidly escalating and increasing in threat severity. To examine this prediction, undergraduate students who endorsed clinical levels of OCD symptoms, undergraduate students who endorsed clinical levels of social phobia symptoms, and non-anxious controls completed the Looming of Disgust Questionnaire and a measure of disgust sensitivity (Williams et al., 2006). It was found that the OCD group had significantly higher scores on the looming of disgust subscale, and on an item subscale that assessed the perceived ability to cope with the discussed scenario, in comparison to the social phobic group or the non-anxious controls. Furthermore, a moderate positive correlation was found between Looming of Disgust scores and disgust sensitivity, suggesting that these were related but distinct constructs.

Specificity to OCD

Supporting the idea that the general looming cognitive style represents a cognitive vulnerability for anxiety, the Looming Maladaptive Style Questionnaire was found to predict shared variance in a latent factor comprised of indicators of five

DSM-IV anxiety disorder symptoms (i.e., obsessive compulsive disorder, post-traumatic stress disorder, generalized anxiety disorder, social phobia, specific phobia) (Williams et al., 2005). Moreover, several other studies have found that the looming cognitive style predicts OCD symptom changes ranging from a week to 6 months later (Riskind, Tzur, Williams, Mann, & Shahar, 2007; Sica et al., 2012). However, in addition to the looming maladaptive style posing a cognitive vulnerability for anxiety, the LVM also proposes that some individuals with OCD have domain-specific fears, such as specific obsessional themes. For instance, individuals who exhibit perceptions of looming vulnerability in specific threat domains (e.g., contamination for OCD) should be more likely to develop heightened and persistent anxiety in those domains compared to individuals who lack those domain-specific perceptions.

To test the specificity of OCD-related looming themes, Riskind et al. (2011) tested individuals with OCD, generalized anxiety disorder, social phobia, and panic disorder, who completed a version of the Looming Vulnerability Scale that assessed looming style as a general underlying vulnerability to anxiety disorders and disorder-specific looming vulnerability themes (i.e., looming vulnerability with respect to contamination, physical, panic, and social threats). As would be expected, the anxiety disorder groups did not differ from one another with respect to scores on general looming cognitive style, but the OCD group scored higher than all other diagnostic groups on the looming vulnerability to contamination subscale. In contrast, the OCD, group scored lower than the social phobia group on the looming vulnerability to social threat subscale and lower than the panic disorder group on the looming vulnerability to panic threat subscale.

Looming Vulnerability Compared to Other Established Vulnerability Factors for OCD

Another question that has been given attention is whether looming vulnerability adds to the prediction of OCD symptoms afforded by other established vulnerability factors. For example, a recent study examined the unique contribution of looming vulnerability in the prediction of contamination fears, beyond the effects of two established factors—anxiety sensitivity and negative affectivity (Elwood et al., 2011). Undergraduate students completed measures of general looming cognitive style (The Looming Maladaptive Style Questionnaire), looming of contamination, static threat appraisals (i.e., likelihood of harm), anxiety sensitivity, and negative affectivity. Fear of contamination was moderately correlated with general looming cognitive style, looming of contamination, and perceived likelihood of harm, and was modestly correlated with anxiety sensitivity and negative affectivity. Hierarchical regression analyses demonstrated that the general looming cognitive style was a significant predictor of contamination fears even while controlling for static threat appraisals, anxiety sensitivity, and negative affectivity. Supporting an OCD-specific LVM, looming of contamination was a significant predictor of contamination fears in the final step of the model (beyond the effect of general looming

cognitive style). The study also examined the contribution of specific components of looming vulnerability to the prediction of contamination fears, namely fears of spreading contamination and of growing contamination. Hierarchical regression analyses demonstrated that the combined looming contamination factor was a significant predictor of contamination fears, but neither the spreading nor the growing component was a unique significant predictor.

The LVM assumes that a person's perceptions of a pattern of rapid threat escalation account for distress above and beyond the role of ingrained and stable obsessive beliefs, such as those assessed by Obsessive Beliefs Questionnaire (OBQ; OCCWG, 1997). For example, an individual with OCD might have an inflated sense of responsibility for preventing threat (static appraisal), but also perceive or imagine that the threat they will be responsible for is rapidly escalating and thus, perceive their personal responsibility as quickly increasing. To test this prediction, Riskind and Rector (2007) asked clinical patients with OCD to complete measures of looming vulnerability (the OCD Looming Vulnerability Measure), dysfunctional obsessive beliefs on the OBQ, and interpretations of intrusive thoughts (III) and OCD symptom severity. A hierarchical regression analysis was conducted to examine how much incremental variance in OCD symptom severity could be explained by OCD looming vulnerability beyond the effects contributed by dysfunctional obsessive beliefs and interpretations of intrusive thoughts (i.e., perfectionism, intolerance of uncertainty, inflated responsibility, exaggerated threat, importance of thoughts, need to control thoughts). As would be expected by cognitive appraisal theories of OCD (OCCWG, 1997, 2001, 2003, 2005; Rachman, 1998; Salkovskis, 1999), dysfunctional obsessive beliefs and interpretations of intrusive thoughts accounted for a significant amount of variance (24%) in OCD severity. As Riskind and Rector predicted, the measures of OCD looming vulnerability also contributed substantial additional variance (52%) to the prediction of OCD severity beyond the contribution of OCD beliefs.

Significant predictors in the analysis in that study included the Looming Contamination subscale and Looming Hoarding subscale, which each predicted unique variance in OCD severity. In addition, the Looming Pure Obsessions subscale (e.g., harming and sexual) was also a significant predictor although it unexpectedly predicted in the opposite or inverse direction. Unexpectedly, this finding showed that the person who perceives threats of harming others, or of having sexual or blasphemous impulses findings of an inverse relationship—as rapidly escalating and looming actually has less severe OCD symptoms than the person who does not.

A possible explanation for the above surprising results might be suggested by Lee and Kwon's (2003, p. 12) classification of obsessions into two subtypes, "autogenous" and "reactive", based on the manner by which they arise. Autogenous obsessions in their classification are similar to pure obsessions (relating to sex, aggression, or blasphemy), and are experienced as occurring spontaneously as they are said to have very loose connections with internal stimuli or thought processes. According to Lee and Kwon, such obsessions are more likely to be dealt with by cognitive avoidance strategies than the reactive type of the obsessions (relating to doubt, contamination, disorder/dissymmetry, and loss) that occur with more clearly identifi-

able external triggering stimuli and, are dealt with using more proactive strategies such as overt (visible, physical) compulsions. Thus, it may be that looming vulnerability to the threatening content associated with autogenous obsessions is a triggering agent for more active cognitive avoidance. If so, this presumably explains why looming vulnerability for the content of autogenous obsessions (i.e., pure obsessional content) was found to be related to a lesser severity of OCD symptoms. [It is important to note here, moreover, that Purdon et al. also found that pure obsessions were inversely related to OCD symptom severity although they did not assess looming vulnerability.]

In another recent study, Sica et al. (2012) utilized a longitudinal design to examine predictors of changes in OCD symptom severity over two 6-month intervals. The predictors were a measure of "Not just right experiences" (NJREs), defined as the unsettled feeling that something isn't "just as it should be," and the looming cognitive style, which, along with measures of OCD symptoms, and general distress (anxiety and depression) were administered to 187 college students on two consecutive 6-month intervals over the course of a year. The study found that both NJREs and looming cognitive style each independently and significantly accounted for variation in OCD symptoms over the two intervals, even when controlling for each other and general distress although the different pattern of outcomes slightly differed. They found that NJREs accounted for significant variation in hoarding symptoms, whereas looming cognitive style did not. On the other hand, looming cognitive style was predictive of variation in washing and checking, which NJRE's did not.

In yet other research, Riskind et al. (2007) found support for the incremental value of the looming cognitive style in predicting OCD symptom changes over a weeks' time. Their study examined both the looming cognitive style, and intolerance of uncertainty as predictors of short-term changes in OCD symptoms, and found that only looming cognitive style predicted variation in OCD symptoms between the two time points. Besides this, they found a significant interaction effect, indicating that the looming cognitive style predicted increased OCD symptoms better for the participants who had the highest levels OCD symptoms at baseline. Thus, these findings of Riskind et al.'s prospective study, like those of cross-sectional studies with clinical patients (e.g., Riskind & Rector, 2007) suggest the applicability of the looming cognitive style to the development and maintenance of clinically significant OCD.

Conceptual Issues and Future Research Directions

As described above, there is substantial research evidence supporting the role of looming vulnerability in OCD, particularly with respect to the contamination symptom subtype. A number of studies have examined the role of the perception of looming vulnerability in OCD, in both non-clinical and clinical patient samples. Most of this work has supported the main tenets of the LVM that looming vulnerability makes distinct and significant contributions to fear of contamination and OCD

severity above and beyond the effects of other established vulnerability factors, such as threat appraisals with static content, negative affect, anxiety sensitivity, and obsessive beliefs, and NJREs (Elwood et al., 2011; Riskind, Abreu, et al., 1997; Riskind & Maddux, 1994; Riskind & Rector, 2007; Sica et al., 2012).

Cross-sectional studies have provided suggestive evidence that looming vulnerability contributes to fear of contamination directly, as well as indirectly by triggering or intensifying static threat appraisals (Riskind, Abreu, et al., 1997; Riskind & Maddux, 1994). Research employing experimental research designs has also shown that threat appraisals, distress, and compulsive urges can all be impacted by manipulating fear imagery (Dorfan & Woody, 2006; Riskind, Wheeler, & Picerno, 1997). Although the general looming cognitive style seems to operate as a general vulnerability factor for a variety of anxiety disorders and syndromes, the additional specific looming content in OCD differs from the looming themes that characterize anxiety disorders such as social phobia, panic disorder, and generalized anxiety disorder (Riskind et al., 2011). Looming vulnerability has also been found to mediate the "chain of contagion" or "sympathetic magic" phenomenon observed in individuals with OCD (Tolin et al., 2004).

Most of the studies examining looming vulnerability in OCD have relied on self-report measures to assess perceptions of looming vulnerability and their contribution to contamination fears and OCD severity. In addition, participant samples have primarily relied on unselected students or students with subclinical obsessions. Although several studies employed clinical samples of OCD patients (e.g., Riskind et al., 2011; Riskind & Rector, 2007; Tolin, Woods, & Abramowitz, 2003) more such studies are needed. Several prospective studies, assessing OCD symptom changes over periods ranging from a week to 6 months, have shown that the general LCS is predictive of future increases in OCD symptoms (Sica et al., 2012). Additional experimental studies and prospective examinations of high-risk samples would be informative to clarify the direction of causality between looming vulnerability and the development of clinically significant OCD. It would also be informative to have additional studies examining OCD patient samples using a variety of assessment methods including self-report measures, behavioral approach/avoidance tests, and experimental tasks involving "freezing" or "spreading" OCD-relevant threats.

The heterogeneity of OCD has posed a significant challenge for research into OCD, including the LVM. It has been argued that different etiological models are likely required to account for the heterogeneous nature of OCD symptoms (Purdon, 2009).

Given the heterogeneity of OCD symptoms, the OCD Looming Vulnerability Measure (Riskind & Rector, 2007) was developed to assess a wider range of potentially threatening situations relevant to OCD (e.g., contamination, hoarding, doubting, ordering/symmetry, pure obsessions). This measure has the potential to advance research on looming vulnerability in OCD beyond contamination fears. Riskind and Rector (2007) found that looming vulnerability themes specific to hoarding and fears of asymmetry predicted OCD symptoms in clinical patients, even when controlling for OCCWG measures of OCD-relevant beliefs and appraisals. However,

large clinical samples comprised of individuals with a variety of OCD symptom subtypes will be required to more thoroughly examine the role of looming vulnerability in OCD. This line of research would help elucidate whether looming vulnerability is a cognitive vulnerability factor across OCD subtypes or a specific cognitive vulnerability factor associated more strongly with some OCD subtypes (e.g., contamination, hoarding) than others.

Other questions concern the relative roles of the general looming cognitive style and more domain-specific types of looming cognitive style (e.g., contamination looming, hoarding, etc.) in contributing to the development and maintenance of OCD symptoms. Future research is also needed to study more precisely the mechanisms behind the unexpected inverse relationship between the Looming Pure Obsessions subscale and OCD symptoms. Studies would be informative that can examine whether individuals with the general looming cognitive style are more likely to develop OCD-relevant looming cognitive styles, or whether the established effects of the general looming cognitive style on OCD symptoms are moderated or mediated by domain-specific forms of looming cognitive style. A further important question relevant to actual clinical work concerns the efficacy of "looming reduction" methods discussed in Chap. 14, for helping to ameliorate or control OCD symptoms in actual patients.

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Chapter 14
Exploring Potential Links Between Looming Vulnerability and Post-traumatic Stress Disorder

Linda D. Chrosniak and John H. Riskind

Over us looms atrocious history
Jorge Luis Borges
In Memory of Angelica (1979, p. 177)
"You're standing in the middle of the street. You can feel the heat radiating in the soles of your boots, reflecting off of the cracked pavement in the scorching sun that hovers menacingly in the Iraq sky. Sweat pours down your face and drips onto the detached vehicle door in your hands. You and a fellow soldier are carrying the door to the side of the road to clear the street. The reverberating boom of a Blackhawk medical helicopter landing nearby fills your ears and the rancid smell of gasoline, blood, and charring flesh is still hanging in the air. There is a distant echo of voices shouting in the background; to your right, the remains of a deceased suicide bomber are smoking, a blackened car engine nearby—the vivid result of the hellish scene that occurred minutes earlier. Blinking a few times, you look around. There is no lifeless corpse of a suicide bomber; no burning engine; no landing helicopter. You're standing on the sidewalk waiting for the bus, safely home in any given city across the country. The hustle and vivacious pace of life of modern American society surrounds you as you stare towards the middle of the street. Physically, you're home. Psychologically, you're still standing in the streets of Iraq".

Anonymous Quote from a Young Soldier

The written narrative above is from a young soldier who deployed to Iraq more than once at a young age. He is personally known to one of the authors and this narrative is used with his permission. His experience may be typical of that associated with the extreme stress of continued combat and that of many individuals who are diagnosed with PTSD.

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With the continued military conflicts in Iraq and Afghanistan during the past decade and the frequent deployments of US military personnel, the risk of mental health difficulties in this population has increased in frequency and severity. Post-traumatic stress disorder (PTSD) is one of those disorders that may be likely to continue increasing in the coming years in military personnel.

PTSD represents a complex range of psychological and cognitive responses that arise following direct exposure to a traumatic situation. The definition of the disorder has had some controversy, perhaps due to diagnostic criteria set in the DSM-III (APA, 1980) and then the DSM-IV (APA, 1994), and finally in the DSM-V, which no longer identifies it as an anxiety disorder. These modifications to the diagnostic criteria for the DSM-5 are summarized below.

The DSM-5 (APA, 2013) sought to clarify some of the criteria associated with the diagnosis of PTSD. To this end, the changes to the criteria are as follows: Criterion A now includes a tighter distinction between trauma and distressing events. Criterion A requirements are that the person was directly exposed to trauma in the following ways: direct exposure to trauma (e.g., death, threatened death), witnessing the trauma (e.g., aftermath of combat, physical violence), learning that a relative/close friend was exposed to trauma and/or had indirect exposure to aversive details of the trauma (e.g., medics, first responders, combat). Criterion B has several required components. These criteria include: experiencing recurrent and involuntary intrusive thoughts, nightmares and flashbacks, emotional distress and/or physical reactivity after exposure to reminders of the trauma (e.g., hearing a click reminding one of a grenade pin and becoming hypervigilant). Criterion C is now solely used to assess avoidance of behaviors that serve as reminders of the traumatic events (e.g., avoiding open spaces). Criterion D addresses negative alterations in cognition and mood related to the traumatic event(s). It contains two new symptoms, (exaggerated blame of self or others for causing the trauma and overly negative thoughts and assumptions about oneself and/or the world). Criterion E, which was formerly D, focuses on increased arousal and reactivity that began or worsened after the trauma. Other criteria remain the same, such as duration of symptoms.

According to Bresleu and Kessler (2001) over 90% of adults in the USA have experienced one instance of a traumatic event in their lives. These include events such as natural disasters, combat, accidents, and other types of events that involved serious injury or actual death. Thus, exposure to trauma is quite high but the prevalence rates of PTSD are quite low in comparison. While many people initially experience symptoms of PTSD immediately following a traumatic event, most individuals will show a progressive reduction in symptoms over a period of several months (reference). However, an affected group of individuals will continue to experience considerable symptoms of PTSD in the following months or even years to come. For example, Schnurr, Lunney, Sengupta, and Waelde (2003) found that PTSD symptoms among a large majority of Vietnam veterans did not typically show remission.

Rates of PTSD in the USA may differ depending on the study and the type of trauma. Prevalence rates for individuals exposed to traumatic events may be about 8% in the general population with much higher rates for individuals who experience

the trauma of sexual assault or combat (Kessler, Sonnega, Bromet, Hughes, & Nelson, 1995). Prevalence rates for PTSD are generally reported to range between 12 and 65% in females who were victims of assault (e.g., Resnick, Kilpatrick, Dansky, Saunders, and Best (1993) and about 15% of Vietnam combat veterans (Kulka et al., 1990). Kessler et al. (1995) in the National Comorbidity Survey, found that in individuals between the ages 15 and 54, the prevalence rate for PTSD was 7.8%. However, rates for women (10.4%) were found to be more than twice that for men (5.0%).

An important risk factor for the development of PTSD is simply being female. Certainly, it is important to note that men typically have either equal or more frequent exposure to trauma (Breslau, Chilcoat, Kessler, & Davis, 1999), but women still show higher rates of PTSD even after controlling for the type of trauma that women are typically exposed to (i.e., sexual assault and domestic violence). Thus, understanding factors that relate to the higher prevalence rates in female risk for development of PTSD is an important part of this area of research. A study by Del'Osso, Carmassi, Massimetti, Daneluzzo, and Ross (2011) found significantly higher prevalence rates of PTSD in adolescent females 10 months after they had experienced the L'Aquila earthquake in 2009 (51.7% for females relative to 25.7% for males). Further, Lilly, Pole, Best, Metzler, and Marmar (2009) found in a sample of female police officers and civilians that female civilians reported more severe PTSD symptoms that was explained by more intense peritraumatic emotional distress and current somatization (e.g., headaches, nausea, or faintness). It should be noted, however, that the Breslau et al. (1999) study found that peritraumatic appraisals of threat did not account for the gender differences in prevalence rates although prevalence rates were greater for females. Of relevance to the current topic, there is a tendency of women to perceive more looming vulnerability (González-Díez, Calvete, Riskind, & Orue, 2015; Hong et al., 2017), suggesting a potential link between looming vulnerability, gender, and risk for PTSD. Females have also been shown to have a stronger anticipatory auditory looming response (Neuhoff, Planisek, & Seifritz, 2009). This suggests that greater sensitivity to the dynamic growth and approaching movement of potential threats plays a role in gender differences in the susceptibility to PTSD.

Research has indicated that a number of preexisting factors may put certain individuals at greater risk of developing PTSD in the face of a traumatic experience. These risk factors seem to center around three categories. These include elements involving background and experience, components of the traumatic event (e.g., peritraumatic dissociations) and events following the trauma (e.g., level of social support).

Preexisting or psychosocial factors that may serve as vulnerabilities for development of PTSD include a young age at the time of the trauma, being female, level of social support, lower level of education, lower intelligence, and lower socioeconomic status (Brewin, Andrews & Valentine, 2000). Two studies that conducted meta-analyses found that previous psychiatric history indicated a small degree of risk for the development of PTSD (Brewin et al., 2000; Ozer, Best, Lipsey, & Weiss, 2003). Further analyses in the Brewin et al. (2000) study determined that when prior

instances of depression were considered, the risk for developing PTSD significantly increased.

Another factor that is relevant to the development of PTSD is the severity of the trauma itself. This is not surprising as the more severe the trauma, the more likely an individual may be in showing lingering effects of the event. While this may be the case, severity remains difficult to define. Several studies have utilized substitutes for severity to relate those to the trauma. One such study by Tucker, Pfefferbaum, Nixon, and Dickerson (2000) considered severity of the victims' physical injuries sustained in the Oklahoma City bombing as significantly related to symptoms of PTSD that were experienced after a 6-month period. Thus, determining the cause and the specific risk factors for the development of PTSD is extremely complicated and draws upon many psychosocial and biological factors.

Cognitive Vulnerability–Stress Paradigm

While there are obvious genetic and biological vulnerabilities to emotional disorders, including PTSD as in twin studies (e.g., Koenen et al., 2007), much research has indicated that the expression of a disease or disorder is also related to other factors. These include cognitive vulnerabilities (e.g., Brewin, Dalgleish, & Joseph, 1996; Ehlers & Clark, 2000; Elwood, Hahn, Olatunji, & Williams, 2009), personality factors and coping strategies (See DiGangi et al., 2013 for a review), as well as psychosocial factors such as social support (See DiGangi et al., 2013 for a review).

Looming Vulnerability Model

Of all the anxiety disorders or former DSM-anxiety disorders, the relationship between PTSD and looming cognitive style has been the least studied. However, an LCS would be likely to increase susceptibility to PTSD for several reasons. First, individuals with the LCS would begin with higher levels of anxiety or stress, and even depression prior to exposure to a traumatic event. This could increase their susceptibility to developing PTSD. In addition, one's schematic processing and attentional biases should make the traumatic, threatening event more salient and memorable. Moreover, schematic processing with the LCS should magnify threat appraisals as well as increase threat cognitions and threat overestimation biases. Third, it should contribute to stress generation (see Chap. 9) that could exacerbate PTSD. Third, having the LCS should increase the psychological impact and anxiety produced by the negative event, consistent with prior work (e.g., Adler & Strunk, 2010). Adler and Strunk showed that negative events primarily elicited greater anxiety among those with higher levels of the LCS. Moreover, individuals with the LCS are more prone to fear intense emotions and loss of emotional control, which should then make them more likely to employ maladaptive defensive responses, which may

include peritraumatic dissociation. Fourth, individuals with the LCS may be more prone to experiencing cognitive and affective overload due to their greater tendency to perceive approaching, escalating threats in their environments. As suggested in Chap. 9, this could impair their ability to respond adaptively to particularly traumatic events when they undergo these (Riskind & Williams, 2006).

A fifth point is that recent studies have revealed a link between fear of emotion and PTSD. This idea suggests that an increased fear of an experience (e.g., traumatic) or having expressed emotions regarding the experience is related to severity of the PTSD symptoms (e.g., Farnsworth & Sewell, 2011). Also, as mentioned earlier, anxiety sensitivity has been linked to PTSD (See Elwood, Williams, Olatunji, & Lohr, 2007, for a review). In addition, as suggested in Chap. 9 in this text, a feeling of greater vulnerability due to experiencing cognitive overload and loss of coping flexibility should make the challenge of controlling intense emotions seem more threatening and uncertain. Consistent with this theoretical logic, Riskind and Kleiman (2012) used a college student sample and found that the LCS was significantly associated with a characteristic tendency to fear intense emotion and loss of emotional control. The LCS was found to predict significant increases in fears of intense emotion and loss of emotional control over a month's prospective interval, after controlling for initial fears of intense emotion and loss of control at baseline. Given that individuals with the LCS are more prone to fear intense emotions and loss of emotional control, we could plausibly expect them more likely to employ maladaptive defensive responses, which may include peritraumatic dissociation.

The looming cognitive style model distinguishes between the general LCS as a cognitive vulnerability and more specific forms of looming vulnerability themes associated with specific syndromes. As we have seen in Chap. 11, spider phobias are associated with tendencies to perceive approach movement from spiders, whereas panic disorder is associated with a tendency to interpret ambiguous physical sensations as rapidly escalating sources of catastrophe, and social anxiety is associated with tendencies to interpret ambiguous interpersonal threats as rapidly escalating. In this same way, the LVM postulates that PTSD and trauma reactions may also be associated with trauma-relevant looming styles (e.g., Neuhoff, 2001; Riskind, Kleiman, Seifritz, and Neuhoff (2014). The example from the young soldier quoted at the beginning of the chapter indicates a tendency to interpret perceptions and sounds as escalating and approaching threats of physical danger. Further, someone who has been traumatized in an automobile accident may have an LCS to interpret the ambiguous movements of oncoming cars as looming dangers and exaggerate their approach movement toward their own side of the lane. As a result, such individuals may also have perceptual distortions and illusions of approach movement even when it is not occurring, much as spider phobics imagine spiders as hopping toward them (Rachman & Cuk, 1992) or approaching or germs spreading (Dorfan & Woody, 2006; Elwood, Riskind, & Olatunji, 2011; Riskind, Abreu, Strauss, & Holt, 1997; Riskind, Rector, & Cassin, 2011; Tolin, Worhunsky, & Maltby, 2004), even when they are not approaching. In line with these ideas, individuals who suffer from trauma from motor vehicle accidents have been found to exhibit perceptual illusions of automobiles veering across the center lines toward them (Taylor, 2006),

and individuals who have suffered physical assault are sensitized to imagined movement by physical attackers (Elwood et al., 2007). Similarly, research by Halowell and Brewin (2002) has shown that the flashback memories of individuals with PTSD tend to incorporate more dynamic movement than their ordinary memories of their traumatic events.

In some ways, looming cognitive styles may be related to two different aspects of PTSD that we mentioned earlier, fear of re-victimization and re-traumatization. In the first case, the person becomes biased to interpret ambiguous possibilities of the approach movement of potential threats as rapidly rising in risk and escalating and approaching faster than the person can respond. Thus, the person undergoes the constant anticipation of being victimized by further traumatic events. In the second, the person becomes threatened by the aversive, internal subjective experiences of the traumatic event (the affect, the peritraumatic dissociation, flashback experiences, intrusive thoughts). In this way, the person can have an LCS for these internal threats, much as panic disorder is associated with fears of looming bodily sensations and OCD is associated with looming intrusive thoughts. In this way, LCSs could predict and influence persons' tendencies to appraise their intrusive thoughts or emotional responses in the aftermath of the traumatic event in a way that distorts and overestimates their danger. Such negative appraisals, as hypothesized by Ehlers and Clark (2000), are strong predictors of future PTSD symptoms.

Coping

Individuals manifest biases in their primary cognitive appraisals (a painful sense that perceived threats are rapidly approaching, changing, or escalating in risk), and in consequence, feel "pressed" to urgently cope with or neutralize the *looming* threat. The net result of their sense of behavioral urgency is that they often select maladaptive, rigid coping strategies (e.g., avoidance and escape) and underestimate their personal efficacy to effectively deal with the oncoming dynamic threats (i.e., biased secondary appraisal). Some of strategies mentioned above (e.g., cognitive-affective avoidance) reflect this (see Chap. 9; Riskind & Williams, 2006).

Interestingly, a potential protective factor that could be explored in the relationship of LCS and PTSD **is the role of self-efficacy.** Self-efficacy beliefs are crucial to an individual's attempt to cope with current stressful situations and past traumas. If an individual appraises the past trauma in a way such that subsequent memories of that situation have large-scale or overall global implications for his future, then he would be less likely to feel self-efficacious for managing future situations as all or many situations may be perceived as threatening. For example, following a traumatic event, a person might conclude that "Nowhere is safe." or "The next disaster will strike soon." (Ehlers & Clark, 2000, p. 322). If so, the individual's self-efficacy beliefs (i.e., one's confidence that he/she may be able to deal effectively with a threat) should guide future cognitive appraisals and ultimately the strategies a person uses to cope with trauma. These strategies may then determine whether the

symptoms of PTSD are maintained or reduced. If there is a consistent appraisal that "Nowhere is safe," then it is not surprising that coping is affected and in fact, is likely to be very ineffective, working to maintain symptoms. This type of thinking is consistent with what is seen in individuals high in the LCS. For example, Riskind and Maddux (1993) manipulated self-efficacy in a laboratory study with a tarantula moving forward, backward, or still. Participants viewed images of spiders on a video screen and were instructed to imagine a scene where they had high or low self-efficacy for handling the "threat." Results indicated that participants who imagined having high self-efficacy reported lower fear for forward moving spiders relative to those in the low self-efficacy situation but not when the motion was backward or non-moving. While the looming questionnaire had not yet been developed at this time, the assumption was that this fear was related to the perceived motion and increasing proximity of the threatening object (in this case, the spider). Thus, this link suggests that high self-efficacy could be an important factor in coping in PTSD.

A study of Israeli combat veterans examined the aspects of battlefield functioning as related to perceived self-efficacy and attributional style to long-term PTSD (Ginzburg, Solomon, Dekel & Neria, 2003). The study took place 20 years after the combat experience occurred and included veterans with combat stress reaction (CSR), veterans decorated for bravery and combat controls. Those veterans with combat stress reactions have the lowest scores on perceived self-efficacy, while the decorated combat veterans had the highest perceived self-efficacy. A higher proportion of the CSR veterans had fewer years of education, lower military ranks, and were more likely to originate from outside Israel. In contrast, the decorated veterans were more likely to be officers, have higher education, and originate from Israel. Analysis revealed that sociodemographic background, battlefield performance, self-efficacy, and attributional style together classified 73% and 81% of the veterans correctly into PTSD or non-PTSD groups, respectively. Thus, PTSD veterans reported lower self-efficacy suggesting an important role in coping with the disorder. These authors suggest that low self-efficacy increases vulnerability to combat stress, which in turn reduces self-efficacy.

In general, there is some consistency in the findings that higher self-efficacy for coping following deployment to a combat zone is related to lower levels of distress or symptoms of PTSD. Several studies Smith, Benight & Cieslak (2013) have found that higher post-deployment coping self-efficacy is related to lower severity of distress in combat veterans with PTSD symptoms. Importantly, in this study, enhanced social support in combat veterans promoted coping self-efficacy and resulted in reduced distress levels. Thus, it appears that several factors are directly related to self-efficacy in laboratory settings and in combat-induced PTSD. It appears from research findings that in individuals with lower coping self-efficacy, the symptoms of PTSD may persist. These findings are consistent with the Ehlers and Clark (2000) model indicating that continued negative appraisals used by people diagnosed with PTSD contributes to the maintenance of the symptoms of PTSD. On the other hand, higher self-efficacy beliefs seem to play an important role in reducing distress levels in the presence of combat-related PTSD and other traumatic situations as well. Thus, the link between PTSD, LCS, and self-efficacy could reveal more about cognitive vulnerabilities in both constructs.

Cognitive Vulnerability to PTSD

Certainly, many aspects of cognitive processing are at work in the development and maintenance of PTSD. One aspect of cognitive processing that has been studied is the role of cognitive style or to be more specific, maladaptive cognitive styles, that may lead an individual to be more vulnerable to the development of PTSD. There is some evidence that is consistent with the notion of cognitive vulnerability to PTSD. For example, a study by Bryant and Guthrie (2005) investigated maladaptive cognitions in student firefighters during and after training but prior to deployment. Catastrophic cognitions strongly predicted levels of PTSD symptoms approximately 20 months following training. This finding indicates that a preexisting cognitive style of catastrophizing may be a risk factor for development of PTSD. Other studies have confirmed relations between anxiety and catastrophizing (e.g., Davey & Levy, 1998). Also, research by Riskind and Williams (1999) showed that when individuals were found to be high in the LCS, it predicted residual gains in the extent to which they engaged in catastrophizing over a period time. Thus, it would stand to reason that other aspects of cognition or cognitive vulnerabilities would be related to or predictive of the development of PTSD, such as the LCS (Riskind & Williams, 2006).

The characteristics of trauma memories themselves suggest that they are unique in comparison to other types of autobiographical memories. Questions then may arise regarding the nature of trauma memories and whether they differ in quantity (e.g., occur more frequently or more intensely) or quality (underlying memory processes or representations). It is possible that trauma memories are consolidated differently than other autobiographical memories. For example, trauma memories may lack coherence or be more fragmented and this may be due to a failure to integrate components of the event at encoding. Ehlers and Clark (2000) have suggested that trauma memories may be inaccessible to conscious recollection because they were poorly integrated at encoding, which relies on declarative memory processes (i.e., more explicit or conscious memory processes) and utilizes different neural pathways. Thus, Ehlers and Clark suggest that trauma memories are preserved in the implicit (non-declarative) memory system as vivid perceptual and sensory experiences that are less accessible to conscious recollection from the explicit/declarative memory system. These ideas regarding implicit and explicit processes is related to findings from Riskind, Williams, Gessner, Chrosniak, and Cortina (2000) who found that individuals high in the LCS were more likely to show a processing bias for threatening pictures on both explicit (recall, frequency estimation) and implicit (word-stem completion) memory tests. In addition, as mentioned earlier, one interesting study by Hellawell and Brewin (2004) of flashback memories in PTSD patients found that the narratives written during "flashback" re-experience as compared to those of "ordinary" memories had more autonomic and motion references (e.g., "motoring towards me very very fast" p5) along with more sensory detail. Further, Hellawell and Brewin found that these memories tended to be re-experienced in the present tense and were associated more with horror, fear, and

helplessness. (These findings are consistent with the vivid sensory and perceptual recollections of the soldier quoted at the beginning of this chapter.)

Importantly, Hellawell and Brewin (2004) also found that the motion references in the narratives were significantly greater in flashback memories relative to ordinary memories (5.53 versus 1.82, respectively). Thus, these findings with PTSD patients directly relate to the construct of looming vulnerability in the sense that reported flashbacks in PTSD patients are seen as moving toward one at a rapid rate as the looming model predicts. Further, Riskind et al. (2000) found that individuals high in the LCS showed implicit memory biases for threat, which suggests that if trauma memories are preserved in the implicit/non-declarative system then looming vulnerability could be expected in individuals at risk for PTSD.

LCS and PTSD

Based on findings of cognitive differences in individuals who have acute stress disorder or PTSD, the main purpose of this chapter is to consider possible role of looming vulnerability (Riskind & Williams, 2006) in relation to increased risk for PTSD. While research linking looming cognitive style and PTSD is sparse, there are a number of factors that would indicate that the two are related.

As mentioned above, cognitive vulnerabilities have been linked to increased risk for PTSD (e.g., Bryant & Guthrie, 2005). In addition, numerous studies have linked cognitive vulnerabilities to other anxiety disorders (Alloy & Riskind, 2006). Most cognitive vulnerability models assume that outcomes are dependent on the cognitive styles of an individual and the influence of the environmental experiences. In other words, predisposing factors whether innate or based on experience interact with environmental factors and together determine an individual's responses (Riskind & Alloy, 2006). For example, events such as childhood trauma, poor parenting styles or serious physical injury may influence the type of cognition style that develops in an individual over time. According to Beck (1976), if an individual acquires a maladaptive knowledge structure (schema) then that style of thinking is likely to influence the way that person interprets the past, present, and future. Thus, a cognitive vulnerability approach conceptualizes cognitive style as a stable, more trait-like personality characteristic that interacts with major life stressors and may put one at risk for the expression of an emotional disorder (Riskind & Alloy, 2006).

The looming cognitive style model reflects a schema-driven thinking style that is hypothesized to increase risk for anxiety disorders but not for depression. It refers to the internal generation of expectations or mental scenarios that involve a rapidly rising risk of threat. Thus, the central idea is that individuals who display a looming vulnerability will perceive a threat or danger (real or imagined) as rapidly rising and dynamically intensifying in risk. These threats are seen by the individual as being subject to frequent change even when appraised in a moment-to-moment situation in relation to the self. Importantly, these perceptions are likely to occur automatically and without conscious thought in a reflexive manner. Further, current

perceptions of the incoming information are integrated with memories, attitudes, beliefs, and concepts developed from past experience (Riskind et al., 2000). Also, important to the looming construct is the human ability of autonoetic consciousness (Wheeler, Stuss, & Tulving, 1997) to generate mental representations of past, present, or future events. This, in turn, allows individuals to prepare for or avoid possible threats in the environment. This ability could be the basis of an adaptive response in the face of a real danger, such as a fleeing from a burning building or waiting to cross a busy street until the light turns. However, individuals who develop this looming cognitive style tend to see rising threat or danger in ambiguous or neutral stimuli and therefore their response becomes highly maladaptive.

As mentioned, an important difference with the looming cognitive style model from other cognitive approaches is that individuals view the danger as dynamic and not static. Research has supported this notion with different anxiety disorders including obsessive compulsive disorder, specific phobic fears and panic disorder (Williams, Shahar, Riskind, & Joiner, 2005). Importantly, Williams et al. also found a modest association between self-reported looming cognitive style and PTSD symptoms suggesting a looming vulnerability in PTSD.

One link between PTSD and looming vulnerability may be seen in studies of anxiety sensitivity. Anxiety sensitivity is generally described as stable and trait-like and refers to a fear of physiological arousal that typically emerges from beliefs that such sensations have harmful consequences in that they are believed to have somatic, social, or psychological consequences (Reiss & McNally, 1985; Taylor, 1999). Thus, when these individuals experience anxious symptoms, they will begin to focus on the symptoms and experience fear, which results in an increase in symptoms. Research has demonstrated that increased anxiety sensitivity is seen in individuals with obsessive compulsive disorder, social phobia, generalized anxiety disorder, and PTSD (Taylor, Koch, & McNally, 1992). Using structural equation modeling, Reardon and Williams (2006) demonstrated that the looming cognitive style model is selectively specific in predicting anxiety symptoms, whereas anxiety sensitivity is predictive of anxious and depressive symptoms.

Despite the differences in the constructs, Reardon and Williams (2006) also point out that anxiety sensitivity and looming vulnerability share several conceptual similarities. Both constructs indicate that biased cognitive appraisals are principal characteristics in the development of anxiety. In addition, both constructs are seen as stable and trait-like in vulnerable individuals. Finally, both looming vulnerability and anxiety sensitivity appear to arise prior to the onset of anxiety, suggesting that both may have causal links to the associated cognitive biases, catastrophizing or the worry present in anxiety disorders. It should be noted that dissimilarities are seen in some studies in the differential prediction of anxiety and depressive symptoms (Reardon & Williams, 2006). However, they may work in a synergistic manner and indicate a double vulnerability to anxiety.

Other evidence on stress generation (Riskind, Black, & Shahar, 2010; Riskind, Kleiman, Weingarden, & Danvers, 2013) also suggests that looming cognitive style and anxiety sensitivity may represent a potent combination (see Chap. 9). Thus, ties between looming vulnerability and anxiety sensitivity may suggest a potential rela-

tionship of looming vulnerability to PTSD, which was linked to anxiety sensitivity in a variety of studies mentioned earlier and in a study with motor vehicle accident victims (Fedoroff, Taylor, Asmundson, & Koch, 2000). In their study, anxiety sensitivity was found to be a significant cognitive risk factor for intensifying and maintaining symptoms of PTSD.

The same points may apply to LCS and depressive cognitive style as another potent combination in PTSD. Research has previously shown that depressive cognitive style is a predictor of PTSD (Elwood et al., 2009). With this, Kleiman and Riskind (2012) showed that the combination of LCS and the depressive cognitive style was a potent predictor of both depression and anxiety symptoms.

A crucial point in understanding the LCS is the idea of a perception of dynamic changes in threats. These threats are perceived as moving forward and rapidly rising. With individuals who have excessive anxiety, the "threat," whether real or imagined, may have surpassed the adaptive component of anxiety and become maladaptive. These exaggerated perceptions of the progression of the threat tend to provoke a sense of urgency to flee and may lead to hypervigilance in the presence of a perceived threat. Importantly, anxious individuals will generate perceptions of dynamic changes as opposed to static or motionless scenarios that ultimately increase anxiety. It is the dynamic component that could be related to risk for PTSD or to the cognitions associated with PTSD.

Support for this notion of fear and anxiety relative to moving stimuli was shown in a study by Courtney, Dawson, Schell, Iyer, and Parsons (2010) who investigated the effect of computer-generated moving and static images (snakes and spiders) with individuals who scored high or low with regard to fear of one but not both of these. They also measured heart rate acceleration, skin conductance responses, and startle eyeblink responses while people viewed static or dynamic images or videos. Their results indicated that in the high fear individuals the fear stimuli and particularly the moving fear stimuli elicited greater physiological reactions. Skin conductance responses and startle eyeblink were higher relative to low fear control participants. As would be expected, high fear individuals also scored higher when presented with static fear images but lower than with moving images. Heart rate acceleration occurred in response to feared stimuli, but deceleration occurred in response to negative (but not feared) stimuli, but only occurred with moving stimuli. These findings do support the idea that the dynamic nature of moving stimuli is strongly related to fear and is consistent in the work of Riskind and colleagues, who found that film clips of moving spiders produced greater anxiety and fear (Riskind, Kelly, Moore, Harman & Gaines, 1992: Riskind & Maddux, 1993). It is not too surprising then, that some of the behaviors seen in PTSD, such as hypervigilance or an exaggerated startle reflex (Grillon, Morgan, Davis, & Southwick, 1998), and in individuals with an LCS are consistent with the concept of a dynamic component associated with perceived fear.

Also, of relevance here are other findings showing that individuals who suffer a trauma from motor vehicle accidents exhibit perceptual illusions of automobiles veering across the center lines toward them (Taylor, 2006). Other research (Elwood et al., 2007) indicated that victims of interpersonal trauma (e.g., physical abuse

sexual abuse or robbery) rated film clips of ambiguous social situations as increasing in risk and as more predictable than non-victims. Elwood et al. suggest that the ratings of increasing risk indicate that the "threat" perceived by these individuals, even in ambiguous situations, is consistent with the LVM. Further, the victims who viewed ostensibly positive situations as rapidly increasing in risk reported the highest levels of PTSD symptoms (Elwood et al., 2007). This surprising finding is interesting in that it is possible that these individuals may have become systematically biased in their interpretations of situations, both positive and negative, as dynamic and rapidly rising in risk, and this "cognitive style" makes them more vulnerable to anxiety or even PTSD.

One common theme in understanding cognitive vulnerability to anxiety disorders is the fact that it results in distorted interpretations of stimuli. This is also seen in PTSD patients, as mentioned earlier. The extreme stress during a traumatic event, such as combat, may affect the way the event is encoded. As mentioned, one line of research suggests that memories are more fragmented in individuals with PTSD than in individuals who have experienced trauma but do not have PTSD (Amir, Stafford, Freshman, & Foa, 1998). However, other studies do not show the same fragmentation of memories (e.g., Megias, Ryan, Vaquero, & Frese, 2007). The findings by Hellawell and Brewin (2004) that flashback re-experiencing appears to contain more autonomic and motor behaviors, is experienced more in the present tense, and is associated with more basic emotions such as horror, fear, or helplessness may suggest a dynamic component of the experience of danger consistent with looming vulnerability. This appears to reflect an overestimation of danger in individuals with both PTSD as is seen with the LCS. Also, as mentioned earlier, the LCS posits a dynamic and rapidly rising occurrence of the threat or danger, which also appears to be the case in the Hellawell and Brewin study (Hellawell & Brewin, 2004). Another consistency with the LCS is the finding of an enhanced implicit memory bias for threat-related information (e.g., Amir et al., 1998; Zeitlin & McNally, 1991) as well as trauma-related information in patients with PTSD (McNally, Amir, & Lipke, 1996). These findings are consistent (Riskind et al., 2000) in that a non-clinical sample of individuals who scored high in the LCS showed an implicit memory bias for threat-related information and on an ambiguous visual presentation of homophones. It is important to note that these studies were all conducted in a laboratory setting and may not mimic the contextual cues that are present in a non-laboratory setting that may activate trauma or threat memories or even additional symptoms related to PTSD. However, the connection between PTSD and looming should be further investigated to more clearly understand the relationship.

Conclusions and Future Directions

Clearly, additional research on the relations between the LCS and PTSD could be very beneficial in understanding the cognitive processes associated with victims of PTSD. One line of research that could be pursued would be prospective studies of

people who are at risk for onset, maintenance, of PTSD symptoms. Research could examine how the LCS magnifies the effects of other "post-traumatization" negative events on individuals, just as it does with people in non-trauma populations as in the Adler and Strunk (2010) study mentioned above. Also, it would be useful to see if the LCS acts as a moderator of other risk factor effects.

Conceptual Issues and Future Research Directions

Moreover, as briefly mentioned earlier, individuals with the LCS are more prone to fear intense emotions and loss of emotional control, which should then make them more likely to employ maladaptive defensive responses that may also include peritraumatic dissociation. It is possible, however, that variability in such fears of emotion among individuals with the LCS, as well as in other emotion regulation responses, would moderate their susceptibility to PTSD. Thus, future research could examine whether interaction effects with such factors, as well as with other cognitive vulnerabilities and main effects for LCS, could be predictive of PTSD reactions. Recall here that the LCS and anxiety sensitivity have a synergistic effect when combining to predict stress generation effects and it may be that similar interaction effects apply to other aspects of anxiety and to PTSD.

Clinical Implications

While the direct link between PTSD and the looming vulnerability is relatively unexplored, we believe that further investigation could be important in a clinical setting. Certainly, looming vulnerability is strongly related to other anxiety and anxiety-related disorders and manifests in statements or experiences of patients. For example, Riskind, Kelly, Moore, Harman, and Gaines (1992) found that individuals with a phobia related to spiders perceived them as suddenly moving toward them. Likewise, Halowell and Brewin (2002) found that flashback memories tend to incorporate more dynamic movement than their ordinary memories of their traumatic events. Thus, it is plausible that subjective perceptions of the threats dynamically moving toward them with increasing speed and danger would indicate that understanding of looming vulnerability may be important for treatment of anxiety disorders including PTSD.

However, if individuals have had repeated traumas, it is possible that they have developed compensatory mechanisms that cause them to react less. They might become deadened or engage in experiential avoidance or avoidance of emotions. This could be the case with certain aspects of the symptoms. For example, with symptoms such as trauma-related reminders leading to avoidance and decreased interest in activities, behaviors, and cognitions could involve some sort of numbing of typical emotions. Given the complexity of the symptoms and individual differences, it is

important that research continue to better understand the nature of PTSD and its relation to constructs such as the looming cognitive style.

One last note of importance would be that there may be some types of protective or coping factors that would be effective in reducing the symptoms of some PTSD victims. As we discussed earlier, self-efficacy for coping with threat has received very little attention and positive factors such as this could be important for future research and clinical implications.

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Chapter 15
CBT for Reducing Looming Vulnerability Distortions: Translational Concepts and Clinical Applications

John H. Riskind and Neil A. Rector

Despite the established efficacy of cognitive-behavioral therapy (CBT) for anxiety disorders (e.g., United Kingdom Department of Health Services, National Institute of Health and Clinical Excellence), a sizable percentage of patients do not demonstrate significant symptomatic reductions and/or remain at heightened risk of relapse following treatment (Hofmann & Smits, 2008). Efforts have been made in recent years to refine and extend CBT approaches with the aim of enhancing treatment outcomes.

In an attempt to improve the efficacy of current protocols, this chapter describes clinical approaches and concepts derived from the looming vulnerability model (Riskind, 1997; Riskind, Rector, & Taylor, 2012; Riskind & Williams, 1999). We have piloted these approaches with the hope that they can augment existing, empirically supported treatments for anxiety disorders and will be integrated into such protocols.

Looming Vulnerability Distortions: A Critical Component of Threat Cognition

As developed throughout this text, the focus of the looming vulnerability model (LVM) is on abnormal cognitive content in anxiety that is far more dynamic than the view adopted by other current CT/CBT models. It isn't only that anxious individuals have faulty threat appraisals that lead them to overestimate probabilities and costs. They also overestimate patterns of dynamic change and rapid gains in threats

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and view them as approaching (or looming) before them, thereby intensifying their anxiety.

Looming Vulnerability Distortions and Their Determinants

We suggest that anxiety derives in part from a characteristic set of looming vulnerability related cognitive and perceptual distortions. These "*looming vulnerability distortions"* are unique and different than the standard list of conventional distortions (e.g., black-white thinking) because they involve dynamic temporal and spatial parameters of threat. These dynamic, temporal, and spatial parameters of threat remain unexplored by contemporary CBT protocols. However, research has revealed that individuals overestimate the amount of time that goes by (their inner clock speeds up) when facing threats as compared to more neutral situations (see Chap. 5; Langer, Wapner, & Werner, 1961). For other examples, they overestimate the proximity of threats in space and time (Cole, Balcetis, & Dunning, 2013; Langer, Werner, & Wapner, 1965; Rachman and Cuk (1992) and the speed with which they are approaching (Basanovic, Dean, Riskind, & MacLeod, 2018; Riskind, Kleiman, Seifritz, & Neuhoff, 2014; Vagnoni, Lourenco, & Longo, 2012).

General Factors That Can Affect Perceptions and Distortions of Dynamic Growing Threat

Some of the cognitive-perceptual distortions that we will describe can arise from bi-directional relationships between focusing and dynamic properties in threat. Individuals tend to focus on possible threats more when they view them as having dynamic properties (see Chap. 6). Reciprocally, when they focus on a threat stimulus, this may cause them to perceive the stimulus as more dynamic. Studies of the "autokinetic" effect (e.g., Adams, 1912; Sherif, 1935) provide a useful laboratory-metaphor when considering this focusing effect. The autokinetic effect is defined as the tendency to perceive an illusion of movement in a stationary light source (because of moving one's own eyes and body) in ambiguous circumstances in a dark room. We suggest that the act of focusing on a feared stimulus—such as a spider or snake or an imagined social rejection scenario—can also create an illusion of movement.

This self-generated illusion of movement can be derived in part from proactive mental simulation. When they are faced with a feared stimulus or emergent threat, individuals engage in faulty proactive coping in which they mentally simulate the threat as approaching and striking. The self-generated illusion of movement results because individuals become psychologically anchored in images they simulate of threats as being closer as dynamically growing faster than they are. Tversky and

Kahneman (1974) have proposed the tendency to overweight early information is difficult to overcome. This "focusing illusion" (also known as Anchoring or Focalism) can explain how fearful focusing can lead to self-generated illusions of movement. Once psychologically anchored in early information from their mental simulations, individuals overweight the anchor even when they adjust their judgments with more information.

Another force of a general social cognitive nature that can lead to looming vulnerability distortions stems from a version of the "Planning Fallacy" originally proposed by Kahneman and Tversky (1979). The planning fallacy is defined as the overoptimistic tendency for individuals to overlook possible obstacles that may arise when they are attempting to complete future tasks. This in turn leads them to underestimate how much time will be needed to complete the tasks. We suggest that there is a *fear-based planning fallacy* tendency that works in the opposite direction. Namely, when individuals are faced with a feared situation or danger, they tend to underestimate the amount of time that is *realistically available to respond* or develop countermeasures. For example, the anxious person has a fearful tendency to *underestimate* what can be accomplished to meet a deadline that is a week away if they used their time well. The anxious person's attention becomes narrowly focused on the perceived danger and potential coping resources fade into the background. Similarly, the anxious person has a pessimistic tendency to underestimate (or discount) factors that might constrain or impede the growth and approach of threats that they anticipate. For example, spiders and contaminants have realistic constraints that prevent the spiders from moving as swiftly as they imagine from the other side of a large room.

Dysfunctional Beliefs That Can Affect Looming Vulnerability Distortions

Dysfunctional beliefs about threat and change are another general class of factors that can contribute to a person's perceptions and distortions of dynamic growing threat. Such beliefs can increase the person's vigilance for danger and proactive mental simulations of dangers and their tendencies to focus on possible dangers. The beliefs included could be those such as: "The world is dangerous," "I'm incapable of succeeding," and "People always reject me." Others include beliefs that can intensify the person's fears of change, such as: "Change in life is basically negative," "I'm vulnerable and can't deal with the danger of change," "Even when things seem to get better, they end up badly," and "When things happen, they develop too quickly for me to act." In addition, irrational beliefs about time management may also play a role. These include beliefs such as "I don't need to or know how to manage my time or plan." In addition to these other beliefs, perfectionistic beliefs can lead to procrastination cycles that heighten the sense of overwhelming looming threat.

Looming Vulnerability Distortions May Behave as Instigators of Other Standard Cognitive Distortions

We suggest that perceptions and distortions of dynamic growing threat can play a leading role in prompting other standard cognitive errors (e.g., dichotomous thinking or overgeneralization). A study by Paulhus and Lim (1994) broadly supports this idea. They presented evidence that heightened perceptions of threat evoke tendencies for individuals to think in a more simplistic and less balanced and complex manner. They followed and assessed the complexity of college students' information processing and cognitions 2 weeks before an exam, 1 week before the exam, and a week after the exam. Their data showed that cognitions a week prior to the exam became more simplistic, unidimensional, and extreme. Those findings are consistent with theoretical ideas in social psychology that people's initial immediate attributions/appraisals of events are simplistic and require a second effortful step to subsequently balance them to take account of additional information. Importantly, however, people do not normally take this extra step if they are feeling threatened, stressed, fatigued, or distracted (Gilbert & Malone, 1995).

Individuals with looming vulnerability perceptions and distortions may therefore exhibit black and white thinking, catastrophizing, or other types of distorted thinking. Furthermore, they could lead to a downward spiraling or snowballing cascade of dysfunctional cognition. As one worst case example, looming vulnerability distortions can become so overwhelming that they can reinforce hopelessness and suicidal desires to escape from psychological pain. Rector et al. (2008) described the distorted looming appraisals of a patient with GAD that appear to have contributed to her suicide.

Overview of CBT Strategies to Target LV Distortions

Taking this theoretical grounding into account, what recommended guidelines can we give clinicians for designing CBT strategies for treating looming vulnerability distortions? The recommended include these key elements: (1) assessing looming vulnerability distortions, (2) providing a psychoeducation process that involves normalizing anxiety and imparting information about perceptions and distortions of looming vulnerability, (3) helping the patients to identify these, and (4) developing a cognitive case formulation. The guidelines also include the use of methods that are novel or that can encompass adaptations and modifications of standard procedures such as: (5) Socratic questioning, (6) behavioral experiments, (7) using metaphors and mental imagery, and (8) homework assignments.

Assessing Looming Vulnerability Distortions

The practicing clinician can assess looming vulnerability distortions by synthesizing information gathered from many various sources. Examples include information from (1) patients' life circumstances, (2) data from looming vulnerability measures, (3) verbal material obtained from sessions, (4) information regarding perceptual illusions and mental imagery, and (5) information obtained by means of Socratic questioning.

1. *Patient's Circumstances*

   When developing cognitive case formulations to guide treatment, considerable information can sometimes be obtained by clinicians from the patients' factual circumstances. For some patients, for example, looming vulnerability distortions can be triggered by approaching deadlines, job interviews, examinations, public speaking events, and approaching social interactions. The clinician should also be alert for anniversary reactions to events that are not obvious such as past deaths, break-ups, significant loss events, or job. For other nonobvious examples, the clinician should be cognizant that some individuals can become more anxious when they approach a particular date or season when they experienced serious anxiety or depression and fear a "looming" relapse.

   For other subtle examples, alcohol or substance abusers may fear anniversaries of dates of traumatic occasions in which they relapsed. In such cases, individuals may misinterpret ordinary symptoms of anxiety, depression, or other symptoms such as negative, intrusive thoughts that anyone might experience as signs of an approaching relapse.

2. *Looming Cognitive Style and Other Measures*

   In addition, clinicians can get valuable information for constructing cognitive case formulations from self-report measures. For example, they can administer measures of the general LCS or other measures of more specific looming cognitive styles for specific subtypes or symptoms. These might include measures that assess perceptions of looming vulnerability to contamination, spiders, or panic attacks, or other themes. It can be noted that Riskind (2018a) is currently developing a new measure, the "Looming Cognitions Inventory," that assesses the endorsement of thoughts or feelings associated with looming vulnerability. Examples include: "every moment is bringing me much closer to the things I'm worrying about," and "when I think about my concerns, it feels like time is slipping away rapidly." Riskind (2018b) is also developing a measure of the list of looming vulnerability distortions presented later in this chapter.

   It is predicted that *change* scores that occur on such measures can be used to determine whether the perceptions and distortions that anxious patients have of dynamic growing threat are normalizing with treatment. A recent study by Katz, Rector, and Riskind (2017) has reported evidence confirming that the LCS, as assessed by (LMSQ scores) decreases during standard CBT. It is also theoretically expected that measures of LCS and looming vulnerability distortions might

be assessed as potential mediators of treatment outcome and represent meaningful treatment outcomes in their own right.

In addition to standard CBT, it is possible that other interventions such as mindfulness practices can also reduce scores on the LCS (Katz et al., 2017). Mindfulness training, for example, could help to mitigate perceptions and distortions of rapidly growing threat by shifting the anxious person's focus from mental simulations of the future to the experience of the present. By specifically targeting looming vulnerability distortions, it is plausible that looming vulnerability interventions may provide additional useful tools and even be especially effective at remediating such distortions.

3. *Verbal Material in Session*. Verbal utterances of the patients in their sessions provide valuable material. For examples, we have heard patients say things such as: "I don't have enough time"; "things are catching up to me"; "I'm falling behind and can't keep up with my work"; and "things are headed towards a crash." Particularly memorable was the statement of a patient who with no prompting stated, "it feels like each day is bringing me one more step closer to doom."
4. *Perceptual Illusions*. Clinicians should also probe patients to determine if they are experiencing perceptual illusions. For example, spider phobics perceive spiders in a glass box as hopping in their direction when they don't (Rachman & Cuk, 1992). Similarly, sexual assault victims may perceive exaggerated physical movement by potential attackers in their directions (Elwood, Williams, Olatunji, & Lohr, 2007). Victims of automobile accidents may experience perceptual illusions of cars swerving in their direction (Taylor, 2006).
5. *Mental Images*. In addition to perceptual illusions, the clinician can be alert to mental images and dynamic simulations that create perceptions of dynamic growing threat. Even static images can contain dynamic, kinetic information (e.g., a snake coiled to strike). Thus, even when images might seem static, they can represent a kind of pictorial shorthand for a dynamic growing threat.
6. *Socratic Questioning for Assessing and Modifying Looming Vulnerability Distortions*
   During Socratic questioning, the clinician can probe anxious patients looming vulnerability perceptions with questions such as "it sounds like you think you don't have enough time to be able to deal with this or feel that things are happening too fast. Is that right?"

Cognitive Case Formulation

When developing cognitive case formulations, clinicians engage in a continuing process of synthesizing data with concepts from conceptual models about the abnormal cognitive content of anxiety (e.g., future threat, anxiety sensitivity, intolerance of uncertainty, metacognition). The same is true when using the LVM. Namely,

clinicians attempt to identify distorted mental simulations and mental images of the spatial and temporal parameters of rapidly growing threat. These may reflect the list of distortions we will describe below as well as the focusing illusion and fear-based planning fallacy.

Psychoeducation Process: Normalizing, Recognizing, and Helping Patients Recognize Looming Vulnerability Distortions

In this section, we turn to the remaining key elements that we identified in our guidelines. These include: (1) psychoeducation and (2) helping practitioners to instruct the patients about the concepts and help them to recognize looming distortions as preparatory steps for CBT.

Psychoeducation to Help Patients Normalize Anxiety and Recognize Distortions

Psychoeducational information can help to normalize the patients' symptoms to reduce their frightfulness. It can also prepare them for therapeutic CBT collaboration and help them to understand the distortions that might be targeted to reduce their anxiety. Toward this end, we suggest using instructions like the following:

> "The different symptoms that you're experiencing—feelings of tension, sleep disturbance, distraction, worry—are all symptoms of anxiety. You can think of the human anxiety response as like a smoke alarm system that is triggered when our minds detect threats. This is a totally natural thing and anyone who has threatening thoughts becomes anxious. Anxiety and fear can be adaptive when there is a realistic threat that we can do something about. But when it is extreme or happens too often, it becomes maladaptive and this kind of anxiety can result from faulty and distorting thinking that magnifies threat and minimizes ways we can cope."
>
> In addition, the practitioners can add:
>
> A "Anxiety is sometimes" created by thoughts like catastrophizing and black and white thinking. There is also another major way that our minds create anxiety. Our perceptions of time and space are like an elastic that can contract towards us or stretch out. For example, someone who is afraid of deadlines might see them as coming faster than they are, or someone who is afraid of spiders may see them approaching even when they are not.
>
> The cognition distortions on this list are helping to make your anxiety worse. They may be making you feel more time pressured, or overwhelmed, or worried, or making it hard for you to correctly see that there may be things you can do to cope. These not only can make any threatening situation seem ever worse but can also cause you to perceive some of the things you fear as unstoppable when they are not.

After presenting these instructions, a clinician can describe the list of looming vulnerability distortions (or those that are relevant relevant). The distortions in the

list are based on clinical observations, research, or both. It is still being refined and could benefit from further systematic empirical study.

- *Size Distortion* occurs when an anxious person perceives the threat as physically larger and bigger than others do (Shiban et al., 2016; Vasey et al., 2012). For example, Vasey et al. showed that spider phobics who drew the size of a spider that was covered after they had seen it drew it as larger than it was. Thus, it is as if a spider phobic might see a spider on the other side of the room and think it is as big as a soccer ball, while someone who is with them might see it as the size of a small coin.
- *Space Compression* occurs when someone perceives the threat a physically closer than others do (Cole et al., 2013; Langer, Werner, & Wapner, 1965). For example, a fearful person who perceives a spider might perceive it as much closer than someone else who does not fear spiders. The fearful individual might see a threat as close even when it is far away.
- *Time Compression* occurs when the anxious person perceives threats to be closer than they are. For example, an employee who will have to give a presentation that is days or week away, feels as if the deadline is already here. Like with space compression, this can cause the person to not see they have space with which they can plan or react.
- *Misperception of Time Rushing Forward* occurs when someone has the mistaken impression that clock time is rushing forward faster than it is (Langer et al., 1961). For example, while trying to prepare for a difficult exam, a person feels as if time is going by more quickly than it actually is.
- The *All-At-Once distortion* occurs when many potential future threats or challenges—e.g., occupational and/or relationship ones—seem to be developing and approaching all at once because of time compression. For example, future projects, job performance reviews, retirement challenges, may be separated by months or even years but due to time compression a person perceives them as simultaneously confronting them at once. This can cause them to seem overwhelming and unstoppable.
- The *Minimizing Coping Time* distortion occurs when a person overlooks how much time and space he/she has left to cope, and arbitrarily assume that he/she can't do anything that can produce more positive outcomes. For example, the person might have to host a surprise graduation party for a younger sister. Even though the sister doesn't graduate for 2 months, the person feels like it will go badly because she doesn't have enough time to plan the party well. She assumes that the party is going to be bad and that her sister is going to be disappointed.
- *Minimizing Intermediate Steps* distortion occurs when the person overlooks how many intermediate steps or enabling conditions or steps are required for the outcome to occur. Due to this, he/she fails to identify many possible points in the sequence where there are chances he/she or others could change outcomes.
- *Rapidly Rising Odds* distortion. The person estimates that the odds of a negative outcome are rapidly rising from the same starting point where other individuals might experience them as more constant. For example, even though he/she is

totally prepared, he/she fears that the odds of failing a certification exam are rapidly increasing as the day of the exam approaches.

- *Misperception of Approach Movement*. The person misperceives physical threats as approaching faster or to a greater extent than they actually are. For example, while out for a jog with friends, a person who is afraid of dogs sees a large stray dog in a park. The person misperceives that the dog is approaching though his friends who are with him do not.

CBT to Modify Looming Vulnerability Distortions

Socratic Questioning

In this context, the looming vulnerability distortions of anxious patients can be modified and countered with a combination of Socratic questioning and a variety of other procedures. These include behavioral exercises, imagery rehearsal, metaphor usage, and homework assignments. We can illustrate this with the concrete example below. In this example, an anxious patient was catastrophizing that the new administration "would poison the environment" with its policies and make it toxic for his young children.

To address these fears, the therapist used a pencil to draw two points on an ordinary 8 × 12 sheet of paper. They were separated by half a page. The therapist said to the patient: "This point on the left is our present time, while the point on the right is the future you imagine when the environment is poisoned and toxic. Even though those events haven't happened yet, it sounds to me as if you are viewing this future point as it were already presently here. Does it seem to you that this is what you are doing?"

The patient said "yes" and agreed that a lot of other events could still happen that might influence the outcome. The therapist pointed out that the patient was exhibiting the cognitive distortions of time compression and minimizing-intervening steps. In addition, the patient seemed to be showing the fear-based planning fallacy.

By using Socratic questioning, the patient was helped to identify other factors that could mitigate the threat he was imagining to the health of the environment. For example, the patient identified the growing opposition to the current administration's policies and the ongoing development and adoption of innovative technologies as potentially mitigating the threat. The intervention was very helpful.

Examine available Evidence: Socratic questioning was next used to help test the validity of the patient's beliefs about the speed with which the events are approaching or developing. By this means, the patient realized that the poisoned environment he feared could not instantaneously occur and might take years or decades. Moreover, the patient identified several reasons why the odds were lower than he had initially thought.

The therapist then follows this up with a variation of the "*Consider the Opposite*" strategy. The patient was questioned about whether there might be any reasons that the risk of such poisoning might be declining and slowing down over time. That is, therapist asked if there were any reasons to think that the odds were only lower than had initially feared but might even be getting progressively lower? For example, the therapist asked: What future events could slow this down/cause the chances to go down? This intervention was also helpful.

Additionally, the patient was coached to practice *replacing negative thoughts* that contained the looming vulnerability distortions with more positive or corrective thoughts. For example, the patient could remind himself that "nothing would happen as quickly as he feared" and that "there would be opportunities for mitigating measures to prevent the environmental pollution."

Reframing Dynamic Parameters: In other cases, it can be helpful to help patients to reframe their beliefs about the dynamic parameters of threats. For example, the patient can be coached to reframe and replace faulty beliefs such as "I don't have enough time to get this done" with "this just looks impossible because I haven't structured my time well."

Time Segmentation is a strategy that works by dividing the period prior to arrival of expected negative event into separate parts or intervals. Patients can feel overwhelmed when they perceive that they must accomplish all the subproblems to achieve a goal all at once. The therapist can use time segmentation as a strategy for breaking down ostensibly insurmountable future problem into separate tasks and actions. For example, patients can be asked the following: "How many weeks, months, and hours do you have? You were assuming that you didn't have enough time. Let's think this through: Are there ways you could use the time you have?" As another example, consider the "day-by-day" approach used by dieters. This essentially can work dividing the daunting dieting task of losing a lot of weight (e.g., 50 pounds) into manageable parts (cf., Riskind, 1982).

Another related strategy is to help the patient to *Break Down (Deconstruct) the Negative Event into a Sequential Process*. This strategy is based on the fact that a prerequisite for any threatening outcome occurring is that it must progress through multiple intermediate steps and involves a temporal process. Breaking down the threatened event into intermediate steps can help to empower the patient. That is, it can help the patient to better recognize steps and action by which he/she can potentially intercede or change the outcome.

Deconstructing negative events can help overcome the anxious patient's tendency to underestimate coping resources. It can also provide an opportunity to address tendencies to minimize intervening steps that are necessary in the development of negative events that are associated with the focusing illusion and the fear-based planning fallacy. Because most feared events progress though steps, there are often multiple points where a person or other outside or unexpected forces might intercede to avert the events. Due to the fear-based planning fallacy, anxious patients underestimate unforeseen obstacles that might impede potential negative events from progressing as well as the steps that can be taken to intercede.

Behavioral Exercises and Behavioral Experiments

Standard behavioral exercises can be modified to counter looming vulnerability distortions. Behavioral exercises such as exposure can function by providing corrective learning experiences to patients that modify their threat cognitions and danger expectancies (Salkovskis, 1991; Wells et al., 1995). Therefore, exposure and response prevention can be seen as behavioral experiments to test the anxious person's distorted perceptions of dynamic growing threat (e.g., contamination, or loss of control over harm obsessions).

In addition, mental imagery exercises can be used with anxious patients as "behavioral" experiments. For example, a practitioner can ask the person to imagine that a contaminant or some other threat is growing and/or spreading, and give a SUDS rating, then have the patient rate the threat once more while visualizing it as static or shrinking. Such an experiment can provide an illustration to patients of how their perceptions of dynamic growing threat induce greater anxiety. It can be remembered that Dorfan and Woody (2006) placed a sterilized drop of urine on college student's hands and found that "moving harm: imagery produced a sensitization effect that retarded habituation as compared with safety imagery and static harm imagery."

Another example of a simple but powerful behavioral experiment can be used to counter the looming vulnerability distortion of "exaggerating the speed with which time is passing." We offer the following example of a young woman who was catastrophizing. She was "completely stressed out" and feared she would have to leave her job and unable to get another job. The practitioner provided the following instructions:

> "Imagine yourself sitting by a huge clock like Big Ben in London
>
> "Now as you think about the situation at work, imagine that the clock is ticking and raise your finger to signal to me each time a minute goes by."

The therapist counted the minutes and after a brief period, the therapist noted that the patient had counted 6 min when only 2–3 min had gone. When the therapist asked the patient how she explained the discrepancy, she recognized that "it is all in my outlook that time is going by faster in her mind than it actually is" and that this was making her more anxious.

In another variation of this strategy, the therapist can ask the patient to deliberately imagine time as going by faster. For example, they could imagine counting 5 min as having gone by when imaging an approaching threat when it has only been 2 min. This could further demonstrate how temporal distortions are contributing to her anxiety.

Mental Imagery Rehearsal and the Use of Metaphor

Imagery modification and rehearsal are frequently used in cognitive restructuring methods. As noted above, Dorfan and Woody, as well a predecessor study by Riskind et al. (2000), found evidence suggesting that mental imagery modification can provide tools for reducing looming vulnerability distortions. In the next section, we will present several additional mental imagery exercises as well as describe the possible use of metaphors in targeting looming vulnerability distortions.

"Freeze Frame"

In this "freeze frame" method, mental imagery is used with an anxious patient to slow down his or her perception of rapid threat progression. It is as if the person is led to watch a movie of the events that is slowing down in a frame-by-frame manner, until the threatening frames are finally stopped like a snapshot that is arrested in time. The technique can be used for perceptual illusions or mental images of physical threat stimuli that appear to be dynamically growing and approaching (e.g., spiders, potential physical assault, veering cars) but can also be used for other events such as social threat scenarios (e.g., rejection scenes). Patients can be provided an explanation of perceptual illusions and images: "It's a fear-related illusion, perhaps arising from the faulty way your mind is picturing the threat." They can also be informed that the fear can abate when the looming vulnerability distortion abates. They can be informed that they can cope with the illusion by not taking it seriously (e.g., "Remind yourself that it's just a harmless illusion that will eventually disappear"). Such an exercise can be paired with Socratic questioning (e.g., how likely is it that cars are veering into you every 5 ft. on the road). Freeze frame methods can help patients to achieve distance from their fears and to test their danger predictions and beliefs. For example, freezing the image of a fearful scene or stimuli can often increase patients' sense of control. As we discussed above, there is also support for the idea (Riskind, 1997) that such methods can facilitate effects of exposure in fear reduction (Dorfan & Woody, 2006; Riskind, 1997).

As noted by Riskind et al. (2012), some patients, such as motor vehicle accident victims, fear that their illusions of looming cars veering over the center lines on a road are dangerous because they might place themselves in jeopardy by acting on them—e.g., swerving into a telephone poll to avoid the illusion of a swerving car (Taylor, 2006). In most cases, however, the distortions are distressing but not dangerous, and they usually disappear over the course of exposure therapy. Even so, the therapist and patient should evaluate the evidence for and against the idea that the illusions place the patient at risk. Exposure exercises can be conducted in such a way that the distortions do not create a hazard (e.g., the motor vehicle accident victim suffering from such looming illusions might initially travel as a passenger during driving-related exposure assignments) (Taylor, 2006).

Furthermore, freeze frame techniques can be used for anxious or traumatized patients who have re-experiencing symptoms. Imaginal exposure can be modified such that the event is slowed down, as if watching a movie in a frame-by-frame manner (Taylor, 2006). Such slowing down is used to fully expose the person to all the elements of the trauma for a sufficient period to allow correction of distorted looming appraisals and fear extinction to occur. As just noted, evidence supports the idea that fear-reduction/habituation is facilitated when fearful events are slowed down or static (Dorfan & Woody, 2006; Riskind, 1997).

"Recede Frame"

In the "Recede Frame method," threatening stimuli can be imagined as moving away in reverse and growing smaller. As described in Chap. 7 (see also, Riskind et al., 2012), Davis, Gross, and Ochsner (2011) found in their study that participants had significantly fewer negative reactions when told that they should imagine a negative scene that they saw as "receding until it was the size of a postage stamp," compared with when they were told to imagine no change, or to imagine the scene as growing larger and moving toward them. Such imagery tasks can be implemented as coping strategies.

"Slowing the Conveyor Belt"

The "Slowing the Conveyor Belt" technique was illustrated by Riskind et al. (2012) with the example of an anxious patient who had a diagnosis of comorbid diagnosis of GAD and dysthymia. The "Conveyor Belt" technique was used in the extract from this session at a point in which he was highly anxious he was failing to make unsolicited "cold calls" required to generate business for his financially troubled company. He reported that he feared looking "foolish, idiotic, and small" but felt compelled to make them because otherwise his business would fail, which would cause him to lose his "wife, family, and even his sanity."

By questioning his assumptions (my whole life will be out of control…), he recognized there were "a number of things I can do to slow down the conveyor belt to doom." He said that "right now, the conveyor belt is idling," and he could even "go in the opposite direction to success" (e.g., plan and work more effectively).

"Slowing the Speedometer"

This imagery intervention involves the use of the metaphor of a speedometer to counter perceptions and distortions of rapidly growing dynamic threats. Riskind et al. illustrated the use of the technique with a patient who was reporting overwhelming fears about a variety of fears including the precariousness of his job, living on borrowed time, losing his ability to function because his anxiety would run

out of control, and the collapse of his marriage. The practitioner asked him to imagine that he could represent the speed of these various events that could be rated on a "speedometer" in terms of miles per hour (mph). The patient said "It feels like things are happening very, very quickly, like 100 mph. I'd say I'd feel about 70 or 80° out of a hundred of anxiety and about 20 or 30° of control."

The patient was instructed to imagine that the speed with which the events were coming above decreased in successive steps (e.g., from 100 mph to 95 mph and then from 95 mph to 90 mph) and then to rate his level of anxiety and feelings of control. As the speed went down the patient said he felt less anxious and when it reached 40 mph he said "That feels great! My anxiety is much lower, like about a 20 right now. And I'd rate my control like about a 60 or 70. I can really see that. I think that this has always been a problem for me. In college, I was always thinking that there were too many things to do and not enough time to do them."

"Slowing the Freight Train"

Another intervention that uses a freight train metaphor was illustrated by Riskind et al. (2012) with a young unmarried woman with GAD. She was being treated for chronic anxiety, worry, and comorbid depression (see Riskind et al., 2012). "In this session, the patient was catastrophizing about a series of events that she described as a "train of disaster" in which she would lose her job if she went back to school, having insufficient income, and that this would cause her new husband to leave her, and she'd end up doing "a menial doing temp work."

After rating her anxiety (90 on a 100-point scale), she was asked to imagine this chain or train of disasters as moving in "very small" increments toward her, such as a train that moved down the track one inch every 10 min. She rated herself as feeling greater control over her problems and her ratings of anxiety fell from 90 to 5. In a further imagery scenario, she was asked to exaggerate the speed of the onrushing scene of disasters. This exaggeration itself led her to vocalize that things were "not moving so fast" and gave her an enhanced sense of control.

Other metaphors could also be useful in CBT imagery exercises for looming vulnerability distortions. For example, a practitioner might ask a patient to imagine changing the freight train into a minibike and slowing it down. Or, the "train of disaster" could be reimagined as a toy train or a very small child on a bicycle. For another example, the patient could be asked to imagine being in a canoe without a paddle in a river that is rushing toward a waterfall, which they can then slow down and then reverse. Or they can imagine themselves on an escalator that they can slow down or reverse.

"Time Interpolation"

In a session that illustrates the "Time Interpolation" technique, a young paralegal reported feeling intensely anxious and "panicky" about an impending presentation she had to make to 40 attorneys. She reported thinking that they were "critical and confrontational" and said that she "would hate to be embarrassed" and that she "didn't talk well in front of people."

To deconstruct the negative event into a process, the practitioner used mental imagery to break down the patient's catastrophizing scenario into the following sequence of steps: (1) she would become anxious just before speaking, (2) she would say things she shouldn't and jump around illogically or say things unclearly, (3) the attorneys would frown and ask questions, (4) she would be unable to answer these well, (5) they would look confused and displeased with her answers, and (6) she would be humiliated and embarrassed.

The time interpolation technique was used to slow down her perceptions of rapidly progressing danger to counter her feelings of helplessness and to boost her perceptions of her ability and resources to cope. The therapist asked her to imagine the beginning of this sequence of steps or moments where she first feared she would begin to feel anxious. To slow down the pace of time, the therapist instructed her to imagine that time was stretched out from this point to the next point in the sequence. She was told to imagine that she had more than enough time to consider ways to cope with the events. The therapist then said: "Now let's slow down the movement from each scene to the next. Imagine that once you notice you are feeling anxiety as you start your presentation, it is as if you have forever to figure out how to handle your anxiety before it leads to anything else. You have infinite time. And when that happens, you have forever to figure out how to handle the next step before it leads to the next thing you fear will happen."

For example, she came to a point in this imagery exercise where she imagined beginning to give her talk and saying things she shouldn't or "jumping around." She was asked here to picture herself having forever to notice she was about to do it, remind herself how to handle it, and get back on task. Similarly, when the point in the sequence was reached where she imagined the attorneys start to ask questions, she imagined time as slowing down so that she had forever after they asked each question to think of appropriate responses. In the next step in the sequence, she pictured herself as having infinite time to come up with answers when she imagined the attorneys looking at her, confused and displeased with her answers. The goal of this intervention was to create a sense of sufficient time and control and to create a sense of greater time and space with which to cope each step in the catastrophizing sequence by slowing down, or stretching time. She reported that her presentation went quite well.

"Expanding the Margin of Safety"

This strategy was used with a patient who feared she faced behaviorally urgent impending entrapment by problems from "all sides" that she felt were threatening to engulf her. The therapist devised a mental imagery exercise to widen or stretch out the person's perception of their safety zone of personal space from all potential threats. This patient was a young mother who felt she was about to be engulfed on all sides by urgent problems that needed to be mitigated or controlled so they could "go away." In this session, she was given an imagery assignment to practice for homework in which she visualized the safety band of personal space around her as widening and broadening. When she came for the next session, she said that the imagery exercises seemed to help.

Tailoring Methods Tailored to the Unique Circumstances of Patients

As Riskind et al. (2012) illustrated, practitioners can creatively tailor and adapt strategies and concepts that we have described to a variety of novel circumstances. For example, a college student experienced overwhelming anxiety because she pictured herself facing an imminent catastrophe in an upcoming tap dancing performance (Riskind, Long, et al., 2005). She feared that she would lose her scholarship and become humiliated because she would be unable to keep up with the steps of the other dancers and fall further and further behind.

A standard Probability X Cost approach to catastrophizing was used but she remained extremely anxious. In a strategy specifically tailored for her, she was instructed to first picture herself running through her steps in "real time," which was defined as the speed with which she would normally dance her routine and designated as a 65 mph velocity. Next, she was pictured herself dancing at 5 mph, which would be "so slow and deliberate that it would barely resemble movement at all." In this, she was instructed to imagine impersonal details in the environment, such as the individuals dancing and other elements of the room in which she would eventually perform. As she pictured herself dancing at the slowed down pace of 5 mph, she was asked to identify the names of the moves and steps she was about to perform to instill an anchoring point in which there was a degree of confidence and personal efficacy. She reported feeling that it was very easy to dance at this speed because she had time to think about what her next step would be before she had to execute it.

She was then instructed to imagine increasing her speed by 10 mph increments so long as she still felt "confident and comfortable" at that speed. At 65 mph (normal speed), she described herself as confident that she could dance through the performance quite well with few, if any, errors. Next, she was instructed to continue with the 10 mph increments and describe how they felt. At 95 mph, she described her feet as "muddy," and on reaching 115 mph, she described her images as "jerky, puppet-like dancing" and felt she was struggling to "stay in step" and "really messing it up." The practitioner asked her to return to normal speed and to imagine herself becoming lighter, each step was becoming "springy and light," and the sounds

of her taps were as "sharp as a tack." She was asked to imagine that she could hear each of her individual steps in a well-defined manner until she reaches 95 mph. On processing the experience, she reported that imagining [herself] dancing at excessively high speeds significantly reduced her anxiety about the upcoming performance. As the client phrased it, "if I can do it at that speed, then 65 mph is no problem." This looming reduction/decatastrophizing exercise apparently worked and she subsequently reported she had successfully performed the dance.

Homework Assignments

As in standard CBT protocols, patients can be given a variety of homework assignments to enhance the efficacy of treatment. For example, therapists can provide sheets that list (a) distorted cognitions (e.g., time compression, all at once distortions) that cause distorted looming appraisals, as well as (b) prewritten rational responses to those distortions. Likewise, they can be given imagery or behavioral experiments and exercises.

Conclusion

Although work on CBT for looming vulnerability distortions is still in its preliminary stages, we believe that the concepts and techniques we have presented here are promising. It should be obvious that further individual case studies, and eventually, treatment outcome studies, and randomized controlled trials would be necessary to evaluate how much they can augment standard CBT protocols.

Several interesting questions remain for these CBT procedures. We must not only examine whether they work and which ones work best but ascertain which ones work best for which patients. Another question is how are patients who don't change in their perceptions and distortions of growing threat different from those who do change? Relatedly, we can ask questions about relapse and cognitive mediation. Are anxious patients who don't change in looming vulnerability distortions with standard CBT or other approaches such as mindfulness training more likely to relapse? Moreover, is change in looming vulnerability distortions a major mechanism of change in effective CBT treatment? A further question (Riskind et al., 2012) is whether the efficacy of a CBT approach that targets looming vulnerability distortions differs for different anxiety and anxiety-related disorders? Likewise, might they work differently for patients with certain personality disorders such as those with avoidant personality styles?

We suggest that CBT interventions to target looming vulnerability distortions have the potential to enhance standard CBT procedures when standard procedures fail to produce the expected changes. For example, even though it is known that exposure is one of the most powerful treatments for anxiety, some individuals don't

respond. For example, despite being given exposure to spiders, spider phobics may still fail to habituate. It may be that if spider phobics are imagining spiders as crawling all around on their bodies, this can impede desensitization, much as the "movement imagery" manipulation in the Dorfan and Woody study (Dorfan & Woody, 2006) impeded desensitization and distress reduction to urine drops placed on participants arms. When anxious patients have looming vulnerability distortions that exaggerate dynamic growing threat, simple exposure (or other CBT procedures) may have weaker effects unless the distortions are addressed.

Elsewhere, we have described the distinction between CBT for looming vulnerability distortions and thought stopping (Riskind et al., 2012). In thought stopping, for example, patients are taught to deliberately suppress anxiety-evoking thoughts, perceptions, and images. In our guided imagery exercises, in contrast, patients are taught methods for slowing down threat progression while keeping thoughts, perceptions, and images in mind. Finally, one might also wonder whether looming reduction is at variance with a behavioral model in which flooding and the intensification of anxiety are necessary for habituation. From a cognitive perspective, however, exposure works by producing changes in beliefs or harm expectancies, and flooding may not be necessary (Salkovskis, 1991; Wells et al., 1995). Looming reduction is regarded as a cognitively oriented set of strategies for providing new information for restructuring and changing beliefs, and not just habituation through flooding.

A final caveat is that for patients who were to simply use methods as ways of avoiding immediate feelings of anxiety without doing further therapeutic work and changing danger beliefs, looming reduction could have only transient, limited benefit (Riskind et al., 2012). Looming reduction could also become a problem in its own right if it were to develop into compulsive behavior by OCD patients. Therapists must obviously monitor such potential risks.

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Chapter 16
New Directions in Research: Anxiety and Beyond

In this chapter, we extend looming vulnerability theory and research in new directions beyond the usual perimeters of cognitive-behavioral research on anxiety. The topics we will cover include: (1) fear of disease and changes in appearance (such as due to fatness or aging); (2) the determinants of suicidality, smoking cessation, and new disorders involving anger, pathological gambling, and mood disorders; and (3) several novel constructs related to how perceptions of dynamic gains and losses can influence other disorders or problems at other levels of analysis.

Anxiety and Beyond

Fears of Serious Disease

Fears of contracting or developing serious diseases such as cancer, heart disease, or diabetes, or even frightful diseases such as Ebola, are widespread and not limited solely to individuals diagnosed with anxiety disorders or related disorders such as OCD. The role of dynamic perceptions of growing threat can be illustrated with the fear of contracting HIV and/or AIDS.

In one study of these issues, Riskind and Maddux (1994) examined whether inflated perceptions of rapid dynamic gains in growing and spreading threat contributed to fears of HIV. The study was stimulated by a story that was reported by the Wall Street Journal ("fear of AIDS," 1985) during the height of the initial hysteria about AIDS. The reporter(s) stated that tourists in the New Orleans French Quarter were eating canned food in their hotel rooms and shunning its famous restaurants (for fear of coming into contact with HIV). Riskind and Maddux thought that these tourists' extreme reactions could reflect the fact that they had inflated perceptions of rapid dynamic gains and approaching movement by HIV. For example, it seemed that the tourists may have been imagining the virus as rapidly spreading toward

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them from the air and floating or even catapulting off waiters, cooks, and other patrons in the restaurants toward themselves. In testing this hypothesis, Riskind and Maddux administered a questionnaire packet to undergraduates that contained measures of fears and behavioral avoidance as well as a measure of the looming spread of HIV. This key measure of the looming spread of HIV contained two hypothetical vignettes that described casual, everyday situations in which they might have contact with someone who had HIV (e.g., sitting next to the person on a bus or in a restaurant). The data of this study revealed that the college students' levels of fear and behavioral avoidance were significantly and positively related to inflated perceptions of the looming spread of HIV. As compared to the students who were less fearful of HIV, the fearful students imagined the HIV virus as more mobile, active and energetic, and as moving toward them from individuals who they were casually exposed to in public places (e.g., a bus or restaurant). It should be obvious that these findings parallel the studies we have described elsewhere (see Chap. 13) showing that fear of contamination in OCD is strongly related to inflated perceptions of the dynamic gains of spreading and growing contamination.

People's inflated perceptions of the rapid spread and progression of disease can also influence anxiety about cancer and other serious diseases that they develop. Levin, Li, and Riskind (2007) examined the impact of rapid dynamic gains in cancer patients who were undergoing treatment for chronic lymphocytic leukemia. A questionnaire packet was given to these patients that contained the looming cognitive style (LCS) measure (the LMSQ), and anxiety and depression symptom measures. Another aspect of the study is that they were also administered a new cancer-specific looming cognitive style questionnaire that assessed their perceptions of rapid dynamic gains by their cancer: they rated their perceptions of the rapid progression of cancer, the risk of getting rapidly sicker and the rising risk of their becoming more vulnerable to other illnesses, and their increasing risk of being paralyzed by fear and stress. Consistent with the predictions of this study, the results showed that both the looming cognitive style and the cancer-specific looming cognitive style were significantly and positively correlated with anxiety and depression.

Based on the preceding studies, it would be expected that similar faulty perceptions of dynamic growing threat will play roles in anxiety and a myriad of other medical and psychiatric problems. Moreover, exaggerated perceptions of rapid gains in threats or diseases could potentially have a significant impact on health outcomes by affecting the course of diseases (e.g., by triggering maladaptive coping that interferences with treatment) and adversely affect the quality of patients' lives.

Fears of Rapid Conversion of Food to Fat

In another domain that has significant health implications, it has been widely assumed in the field that exaggerated fear of fat play a critical etiological role in eating disorders (Powers, Schulman, Glegnorn, & Prange, 1987; Rosen, 1990;

Tylka & Subich, 1999). A study conducted by Riskind and Kleiman (2018) speculated that inflated perceptions of rapid dynamic gains in "fatness" contribute to the fear of fat. We predicted that a person who has eating disorder symptoms may distort the rapid dynamic gains in fat they can suffer from eating food. For example, the person might imagine that eating a hamburger and fries, or a piece of candy can being almost instantaneously be translated into an equivalent body mass of fat. Thus, we predicted that faulty perceptions of rapid gains in looming fat will contribute to higher levels of fear of fat as well as its correlated eating disorder symptoms (Becker, Grinspoon, Klibanski, & Herzog, 1999; Sullivan, 1995).

To test this hypothesis, a sample of primarily female undergraduate college students were given a questionnaire packet containing a measure of fear of fat, eating disorder symptoms, and a set of hypothetical fear-relevant vignettes dealing with the inflated perception of rapid dynamic gains in fat after the consumption of fattening foods. For example, a vignette asked them to imagine eating a hamburger and fries and to rate the speed with which the food could be converted to fat. Structural equations modeling analyses on these confirmed that the participant's distorted perceptions of rapid dynamic gains due to the rapid conversion of food to fat predicted their fear of fat scores on Goldfarb, Dykens, and Gerrard's (1985) fear of fat scale. Equally important, it was found that these distorted perceptions also contributed to the prediction of significant additional variance in eating disorder symptoms, above and beyond the contributions of other appraisals (the likelihood of getting fat, lack of control). Further replication of these findings in DSM-diagnosed eating disorder patients seems to be warranted, because such disorders are associated with a host of health consequences, including emotional distress in relationships (Masuda, Price, Anderson, & Wendell, 2010), poor physical health and increased mortality risk (Becker et al., 1999; Sullivan, 1995).

It seems likely that dysfunctional perceptions of rapidly growing and approaching threat are also likely implicated in other disorders and problems. For example, the LCS, which has been shown to predict higher future levels of worry (see Chap. 9), could be likely to contribute to problems with insomnia, alcoholism, and substance abuse, and as we will now see, may make significant contributions to escape motivation in suicide.

LCS and Suicidality

Research over the past decade has indicated that anxiety symptoms and disorders are major risk factors that predict liability to suicide and suicidality. Moreover, these effects are not attributable to other conditions that are comorbid with anxiety. They have been demonstrated even when comorbid conditions and sociodemographic factors have been controlled (Boden, Fergusson, & Horwood, 2007; Bolton et al., 2008; Sareen et al., 2005). Given that anxiety constitutes a major public health problem that accounts for immense suffering, we have explored the idea that perceptions of looming vulnerability to rapidly growing and approaching threat play a

significant role in suicidality (Riskind, Long, Williams, & White, 2000). One mechanism through which this could occur is that the perception of rapidly growing and approaching threat and anxiety could augment a person's escape motivation to escape from pain. Escape motivation has been seen as a core mechanism in suicide in several contemporary theories which have emphasized the desire to "escape from pain" (Shneidman, 1998) and intolerably painful circumstances (O'Connor, 2003; Williams, 1997), as well as painful self-awareness (Baumeister, 1990), and painful interpersonal circumstances (Joiner, 2005).

A few studies have been conducted to test the associations between the looming cognitive style (LCS) and suicidality. In the first of these, Schaefer, Esposito-Smythers, and Riskind (2012) designed an experiment to investigate Baumeister's hypothesis that time dilation (or overestimation) is an early sign of incipient suicidality. This study attempted to examine whether time overestimation (e.g., counting down 1 min when only 30 s have passed) predicts suicidal ideation and whether this effect is greater among individuals who have higher LCS or trait anxiety scores. Their study revealed that the participant's tendencies to overestimate time intervals predicted higher scores on Beck's Suicide Ideation scale but only when they had high scores on the LCS or trait anxiety. Thus, participants who evinced time overestimation had higher suicidality scores but only when their levels of LCS or trait anxiety were high. Individuals who were low in LCS or trait anxiety, however, showed no such relationships. It should be noted, however, that, the results of this study were limited by its cross-sectional design.

Two subsequent studies by Riskind and Kleiman (2017) took the above findings much farther and extended them with a prospective research design. They tested the hypothesis that the LCS acts to augments the effects of a person's initially high suicide ideation on suicide ideation over a month prospective interval. It was predicted that a person's LCS leads to a more negative course of suicide ideation if the person initially already has such motivation. Our theoretical rationale was that when a someone is already thinking of suicide as an escape, their tendency to perceive rapidly growing and approaching threat amplifies their escape motivation to think of suicide as a solution for problems. We conducted two studies with college students (N-416) to test this hypothesis. Our data consistently showed that the LCS and initial level of suicidality significantly interacted to predict a more negative course of suicidal ideation over a 4-week prospectively interval. As expected, college students who were already thinking of suicide, and who also had the LCS, tended to increase in suicidal ideation over the subsequent 4-weeks. These students not only evinced stability in their suicidality, but a pattern of escalating suicidality. By contrast, if students who were already thinking about suicide lacked the LCS, they showed no further increase in their suicidality and even tended to decline in suicidality over time.

It should be obvious that these findings warrant more investigation because they have the potential to advance understanding of mechanisms that lead to suicidality as well as to afford novel opportunities for treatment. Further work could thus benefit from extending these findings to clinical or other at-risk populations.

Looming Vulnerability and Smoking Cessation

Another novel avenue for research on looming vulnerability involves the application of the model to develop new applied strategies for promoting smoking cessation. In considering the previous theory and research on looming vulnerability, McDonald, O'Brien, Farr, and Haaga (2010) speculated that smokers who fail to quit smoking may be discounting, or failing to recognize, the future risks of serious medical problems. In a sense, smokers may lack an adaptive dynamic experience of threat in life-threatening health problems that can be incurred by their smoking. McDonald et al. reasoned that quit attempts by smokers could potentially be increased by heightening their perceptions of the dynamic growing threat of these adverse health risks. They tested this hypothesis by giving smokers guided imagery exercises to visualize the rapid advance and escalation of health problems that smoking behavior would bring closer. Their data showed that smokers in the looming enhancement condition showed both increased anxiety and decreased smoking rates in the following month, relative to a control condition. In an unpublished doctoral dissertation, Carrington (2015) has provided preliminary evidence that a similar guided imagery intervention might help in motivating cessation of alcohol consumption.

It is plausible that other problems might benefit from similar looming enhancement interventions. For example, such interventions could plausibly increase patients' adherence to medical recommendations in treatments for cancer, diabetes, or sexually transmitted disease, and particularly when combined with clear information about what individuals can do to reduce their perceptions of the dynamic looming threat and their fear.

Looming Provocation and Aggression: Hostility, Anger, and Paranoia

As we indicated, some additional new constructs can also be considered that are related to how perceptions of dynamic gains and losses may contribute to other disorders and problems. We will cover these issues by first considering how such perceptions may influence emotional states of anger and hostility. These emotions share the evolutionary function of mobilizing the individual to deal with perceived threat.

We will theorize that perceptions of rapidly growing and approaching threat could contribute to anger and hostility via perceptions of "looming provocation." When people are angered by what they perceive as intentional and unjustified intrusions in their affairs or unjustified provocations, they may perceive that the provocations will continue to rapidly rise and escalate in intolerable intrusiveness unless they forcefully respond. Thus, the perceptions of rapid dynamic gains in such provocations, rather than only the perception of any single provocation alone, may also significantly contribute to anger as well as aggressive actions.

Some individuals, more than others, may also tend toward anger-proneness because they develop a characteristic "looming provocation" cognitive style. Such a dysfunctional cognitive style could bias them to extrapolate from any single incident of perceived provocation that there will be increasingly intolerable provocations that will continue unless they take aggressive action to put a stop to it.

In one study that was conducted by Riskind et al. (2013), a large sample of Spanish participants were administered a packet containing the looming cognitive style (LCS) and measures of social threat cognitions (e.g., about being rejected) and mood states. Structure equations modeling indicated that: (a) the LCS for social threat predicted social threat cognitions and social anxiety, and (b) the LCS was indirectly linked to hostility via the intervening role of social threat cognitions. Why would perceptions of rapid dynamic gains in social threat situations be associated with hostility? Individuals who tend to interpret ambiguous social threat situations as both (a) rapidly escalating and as (b) intentional, unjustified rejections could be especially likely to become hostile. This suggests that a measure that is designed to assess a "looming provocation" bias would be strongly predictive of anger and hostility. A further possible prediction is that if individuals were to have both the LCS and a hostile attribution bias (Dodge, 2006; Nasby, Hayden, & DePaulo, 1980), which leads them to interpret ambiguous incidents as provocations, they will be far more hostile than if they have the hostile attribution bias alone.

Paranoia

By extending the preceding logic, it is plausible that some people more than others may have a "looming provocation/persecution" cognitive style that makes them more prone to paranoia. Such individuals might tend to interpret ambiguous signs of hostility by others or their negative intentions as signs of rapidly escalating plans and plots that could harm them. Such a cognitive style could logically contribute to a variety of the correlates of paranoid ideation, including worry, hypervigilance, and aggressive behavior. The idea that perceptions of rapidly growing and approaching threats of this kind could play a role in paranoia is consistent with evidence that anxiety and worry play important roles in persecutory delusions (Freeman, Garety, Kuipers, Fowler, & Bebbington, 2002; Morrison & Wells, 2007). A recent study with a psychotic inpatient sample found a significant positive association between LCS and worry (Clemente, Gleeson, & Lim, 2013). Unfortunately, there was no attempt to pinpoint the unique worry concerns of these psychotic patients, so it is unknown whether their looming cognitive styles were predicting worries related to persecutory ideational themes.

Looming Vulnerability in Personality Disorders

From one perspective, psychopathic and anti-social personality disorders can be seen as representing the flip side of anxiety disorders because they are associated with a lack of normal anxiety and fear of punishment (which may impair their ability to learn from past punishment). A study by Sugiura and Sugiura (2012) on Japanese students examined the relationship between a self-report measure of psychopathy and the LCS. They found a significant inverse relationship between the LCS and psychopathy that was moderated by attentional control. The pattern of the relationship revealed that psychopathy scores predicted reduced LCS but this effect only occurred for individuals who lower attentional control. In other words, the LCS was only related to psychopathy in the students who had the lowest levels of attentional control. The researchers suggested that more psychopathic individuals had lower LCS scores because they had a lower capacity to imagine the rapidly growing threat of negative outcomes.

It seems plausible that faulty perceptions of rapidly growing threats could also be related to other personality disorders. Many disorders such as borderline or avoidant personality disorder could be associated with dysfunctional perceptions that overestimate or underestimate the rapid escalation or lack of escalation of threats.

Extending the Scope of Looming Vulnerability to Positive Outcomes and Rewards: Looming Opportunity and Receding Opportunity

An interesting new set of avenues for theory and research center around the possible roles of dysfunctional perceptions of rapid dynamic gains and losses in positive outcomes and rewards. We refer to these constructs as the perceptions of "looming opportunity" and "receding opportunity." It seems possible that these constructs might be related to a variety of disorders associated with the impaired function of the behavioral activation or reward system.

A person can be said to have extreme perceptions of looming opportunity when the person is biased to perceive ambiguous situations as offering an opportunity for dynamic rapid gains in positive outcomes and rewards. The person is prone, in other words, to interpret ambiguous positive outcomes as rapidly growing and approaching. Such a cognitive bias would be likely to excite reward-seeking motivation and activate the behavioral approach (or activation) system (Alloy et al., 2012; Johnson, Edge, Holmes, & Carver, 2012). By contrast, a person can be said to have extreme perceptions of receding opportunity when the person is biased to perceive that possible opportunities for reward have likely already passed them by and are rapidly receding. It seems plausible that such perceptions would tend to dampen the behavioral facilitation system.

In the first test of these hypotheses, Riskind and Frost (2017) conducted a study to examine perceptions of looming opportunity in problem gamblers. Using a community-drawn sample of scratch ticket and lottery gamblers, Riskind and Frost administered a packet of questionnaires that included the South Oaks Gambling Screen and other measures, as well as a new measure of looming opportunity appraisals for gambling, a brief vignette-based questionnaire measure that assessed the extent to which participants were biased to interpret ambiguous gambling scenarios (e.g., the chances of winning after buying a lottery ticket) with a sense of looming opportunity. The study found numerous significant positive associations between the sense of looming opportunity (e.g., how quickly are the chances of winning increasing moment by moment?) and measures of problem gambling (e.g., the South Oaks gambling screen). Additionally, the participants' perceptions of looming opportunity and their scores on gambling measures continued to be significant when controlling for static predictions of winning (e.g., "what are the chances of winning the jackpot"), but the static prediction measure and gambling were not significantly associated. Thus, these findings lend support to the idea that inflated perceptions of rapid dynamic gains in rewards and opportunity are related to dysregulated and disinhibited reward-seeking.

The looming opportunity construct could also plausibly be extended to bipolar states because they also involve significant disinhibited reward-seeking. Further studies of cognitive factors in bipolar disorder might benefit by examining whether bipolar manic states are associated with exaggerated perceptions of looming opportunity (e.g., rapidly developing and escalating opportunities for successes in a rapidly rising stock market or gaining wide recognition for special abilities).

A Role for Looming and Receding Opportunity in Depression?

Likewise, it seems logically plausible that an absence of looming opportunity perceptions, as well as inflated perceptions of receding opportunity, could play a significant role in depression. Depression is associated with deficits in positive affect and reward-seeking motivation (Clark & Watson, 1991; Watson, Clark, & Carey, 1988) and these in turn could stem from a *loss or lack* of perceptions of dynamic gains in future opportunities. Moreover, a person who is depressed is likely to be cognitive biased to interpret opportunities as moving ever further away into the past and out of reach, or view present opportunities as rapidly dwindling. Such perceptions of receding opportunity would intuitively seem to be a component of the cognitive phenomenology of hopelessness and a depressive sense of emptiness and loss.

Perceptions of Dynamic Gains and Losses at a Macro Social Level

A few words are in order about the applicability of the theoretical concepts we have presented to higher social units of analysis beyond that of single individuals. It is suggested that they can be extended to a more community-wide or even global unit of analysis. For example, perceptions of looming vulnerability and looming provocation could play a role in conflicts between groups and nations as well as individuals, as well as in widespread panics. Similarly, perceptions of looming opportunity and receding opportunity could play a part in bull and bear oscillations in the stock market. For a third example, targeted interventions to heighten or reduce perceptions of looming vulnerability might be likely to help amplify the impact of public service announcements which are often ignored by the public until it is too late for one to act (e.g., hurricane or extreme weather warnings).

Conclusions

As we have described, the looming vulnerability model and its extensions stimulate interesting new avenues for research on problems beyond the work we have reviewed on anxiety alone. Furthermore, it inspires several intriguing new hypotheses and concepts that could be pursued in future research.

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Chapter 17
Final Synthesis and Conclusions

An anxious person surely views threats as possible or even as likely to occur and to cause harm or damage. Cognitive models (Carr, 1974; Clark & Beck, 2010; Foa & Kozak, 1986; Rapee & Heimberg, 1997) have long set forth the key variables in anxiety as the person's judgments of probability, cost, proximity, or similar static forms of relevant dimensions of threat estimation. In addition to this, the looming vulnerability model (LVM) suggests that dynamic features are also of overriding importance. Perceptions of looming vulnerability constitute a very different kind of appraisal. Although they involve the same dimensions of appraisal, they concern the dynamic patterns of change in these dimensions.

There are two parts to this issue that the LVM raises. We suggest that while static judgments on these appraisal dimensions of probability, proximity, cost, etc. can contribute to anxiety, they represent a limited and lifeless extract. We do not dispute that these underlying appraisal *dimensions* are key to anxiety. Our disagreement concerns efforts to define threat solely in terms of static judgments on these dimensions. It could be argued that patterns of dynamic change on these appraisal dimensions are the defining attributes of threat appraisal that elicit anxiety, not the static judgments on the dimensions alone. Said otherwise, the LVM proposes that the dynamics of the motion and speed with which the threat is increasing provides additional information that influences anxiety beyond the probability or position of the threat.

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Our primary purpose in this chapter is to attempt to synthesize or pull together the diverse material we have presented throughout this volume. This material from interdisciplinary sources has supported the supposition that many circumstances that create anxiety are dynamic and that adaptive psychological mechanisms have evolved to address the dynamic elements of threat. In addition, it has supported the idea that standard CT/CBT models have overlooked the importance of the dynamic elements of threat and can be improved by incorporating these theoretical features of threat. To this end, we presented considerable evidence from many intersecting lines of theoretical and empirical work and argued that the LVM has implications for understanding anxiety and anxiety disorders, cognitive vulnerability, and treatment.

There Is a Dynamic Element to Threat

The things that people fear facing in their lives have dynamic features. People are afraid of spiders crawling toward them. They worry about deadlines coming closer. They are afraid of rapid social rejections or rapidly spreading rumors. They are concerned about fires breaking out in electric circuits and spreading. They are concerned about contaminants spreading or diseases spreading. They worry about cancers growing w*ithin* us. Beyond that, it is more generally true that across the entirety of the animal kingdom, dynamic approaching objects evoke defensive reactions.

Response to Dynamic Elements as an Evolved Psychological Adaptation

As mentioned previously, it seems obvious that the foregoing observations must be related to anxiety and anxiety disorders, but how? The LVM suggests that a person's anxiety derives in great part from perceptions of rapid gains in dynamic *growing* threat. Put differently, the dynamics of the motion provides additional information to rouse anxiety beyond the probability or position of the threat. Human cognition itself has its roots in basic sensory systems and perceptual processes (Fodor, 1972, 1976; Freyd, 1987; Shepard, 1981; Shepard & Podgomy, 1978) that are designed to be sensitive to dynamic objects, motion and change. Moreover, a general principle of neural organization is that neural circuity that originally functioned for some purposes are conserved and adapted for other functions during the course of evolution (Anderson, 2010; Anderson, 2016). As a result, humans are inherently constructed to perceive and think about threats in dynamic terms (see Chap. 3). Add to this the fact that early experiences with the dynamic properties of the world provide a scaffolding or superstructure for thought (Lakoff, 2015; Williams & Bargh, 2008).

The LVM Differs from Other Contemporary CT/CBT Models

The LVM differs from other contemporary CT/CBT models in at least two closely interrelated and fundamental ways. These include the fact that the LVM emphasizes the role of a person's perceptions (simulations and imaginings) of patterns of change involving dynamic gains in growing threats. Moreover, these perceptions and simulations usually involve visual and sensorimotor processing of dynamic elements of threats and dynamic gains.

As mentioned, contemporary CT/CBT models have failed to explore or consider the role of dynamic features. In this sense, there has been an interdisciplinary divide between CT/CBT models and other fields in recognizing the central role of the dynamism, movement, and change of stimuli for perceptual and cognitive processes and behavioral responses. Unlike CT/CBT models, researchers in many adjoining fields have fully recognized the distinct additional importance of the kinetic dynamic properties of stimuli. These include fields studying: (1) wildlife behavior (Chap. 2), (2) defensive neural circuits responding to looming stimuli (Chap. 4), (3) basic cognitive and perceptual processes (see Chap. 6) such as attention and memory, (4) social cognition (see Chap. 8; e.g., Aspinwall & Taylor, 1997; Taylor, Pham, Rivkin, & Armor, 1998), and (5) emotion (Chap. 6, e.g., Baumeister & Bratslavsky, 1999; Ortony, Clore, & Collins, 1988; Scherer & Brosch, 2009).

Contemporary CT/CBT models overlook the fact that to protect themselves, all organisms must determine in some way whether threat is approaching or gaining, as opposed to static, or receding. As noted, a second related concern is, they disconnect the person's judgments from his/her visual and sensorimotor processing that embody perceptual experiences of rapid dynamic gains.

In addition, a further limitation of these contemporary models is that they define maladaptive cognitions as differing from the "realistic" judgments of an idealized "rational" person. While this view is partially derived from rational choice models in classical economics, it has become clear it lacks verisimilitude to how human judgment works. As demonstrated by work on cognitive biases in the human judgment of risk (e.g., Kahneman, 2011; Kahneman & Tversky, 1979), people are not intrinsically rational. Despite the considerable progress that CT/CBT approaches have made in understanding and treating anxiety disorders, they remain unnecessarily impoverished because they underestimate the similarities between humans and other organisms.

Across the animal kingdom, warning signals of danger are provided by an organism's sensory perceptions that potential threats are *making rapid dynamic gains i*n their proximity, size, or intensity over their previous levels (Chap. 2). Human anxiety doesn't simply derive from the proximity or probability of a threatening event or object but is also evoked by the perception that these or other aspects of threat are rising and gaining. Like other animals, moreover, the judgments that evoke human anxiety responses to threat involve *visual or other sensorimotor* processing of patterns of change and dynamic gains.

General Theoretical Implications of the LVM

The dynamic features of possible emergent threats are suggested to play potential roles in: (1) information processing in attention, memory, and threat appraisal; (2) physiological reactions and neural defense circuits; (3) affective reactions; (4) behavioral reactions.

As we demonstrated in Chap. 6, dynamic objects not only capture attention better than static objects but are also better remembered. Moreover, increases in perceived threat have potential effects on multiple psychological systems. We proposed that at each separate increase in threat, the threat re-establishes and maintains its salience and re-engages a person's attention. In addition, each separate increase reconfirms that the threat must be reckoned with and heightens its behavioral urgency. As mentioned in Chap. 5, the impact of dynamic patterns of change and gains in threats is compounded further by the fact that people extrapolate from information at hand to evaluate future threat. Put another way, it is easier for individuals to imagine the process by which the negative outcome will actually happen when there is some perception of dynamic gain or progression. In effect, the perception (or mental simulation) of rapid dynamic gains in threats makes it easier for a person to "fast-forward" to imagine and extrapolate that the negative event will occur. In contrast, when taken out of a pattern of context of implicit dynamic gain, an unchanging probability or proximity of an outcome is more difficult to extrapolate to the outcome happening.

We suggest that perceptions of patterns of change and rapid dynamic gains have effects on central etiological pathways in anxiety. One key output is in emotional reactions. As previously mentioned, contemporary CBT/CT models predict that two threats of equal magnitude (e.g., in terms of the current simple proximity or probability of a threat) would generate equal levels of anxiety or fear, even if one threat is dynamically gaining and the other is not. Drawing on emotions theories (e.g., Baumeister & Bratslavsky, 1999; Ortony et al., 1988; Scherer & Brosch, 2009), Helson's (1964) theory of adaptations levels, and other research (Chaps. 3 and 4), the LVM posits that dynamic change is a necessary condition for a more intense and sustained perception of threat.

Converging lines of evidence we have presented throughout this volume have provided abundant support for the proposed importance of perceptions of dynamic patterns of change and rapid gains in potentially emergent threats for anxiety. Few CT/CBT models have considered any of these different interlocking streams of literature. The LVM integrates them into a theoretically coherent and unified formulation that affords a more complete understanding of anxiety and the evolutionary origins of its cognitive underpinnings. Moreover, it not only helps to take account of and integrate these diverse lines of prior investigation, but also stimulates a program of research that generates new findings.

The evidence we have presented shows that perceptions of dynamic features of stimuli influence: (a) initial orienting responses and attentional capture (Chap. 6; e.g., Franconeri & Simons, 2003; Parker & Alais, 2006), (b) memory (Chap. 6; e.g.,

Buratto, Matthews, & Lamberts, 2009; Lander, Christie, & Bruce, 1999), (c) threat appraisals and perceptual distortions (Chap. 5; e.g., Pietri, Fazio, & Shook, 2012; Riskind, Kelly, Moore, Harman, & Gaines, 1992), and (d) affective reactions (Chaps. 5 and 7; e.g., Davis, Gross, & Ochsner, 2011; Hsee, Tu, Lu, & Ruan, 2014); Mobbs et al., 2010; Riskind et al., 1992).

Moreover, the link between dynamic features, vigilance and perceptual processes, and fear is supported by other studies. Auditory looming studies have revealed that tendencies to overestimate the closeness of approaching sound sources (e.g., Neuhoff, 2001) are stronger in individuals who are anxious or fearful (Riskind, Kleiman, Seifritz, & Neuhoff, 2014; Vagnoni, Lourenco, & Longo, 2012), less physically fit (Neuhoff, Long, & Worthington, 2012), female rather than male (Neuhoff, Planisek, & Seifritz, 2009), and hampered by an additional cognitive load (memorizing a seven digit number) (McGuire, Gillath, & Vitevitch, 2016). A stronger auditory looming response is observed when an approaching sound source signals potential danger (Riskind et al., 2014) such as the approach of an image of a spider as compared to a bunny rabbit (Labos & Neuhoff, 2014). Moreover, these findings converge with observations that animals in the wild (which are exposed to greater physical danger) tend to initiate flight in response to approaching objects sooner than domesticated animals (Stankowich & Blumstein, 2005).

Research has also provided abundant evidence that manipulations of dynamic approach movement have effects on negative affect, anxiety, and fear. Moreover, it has demonstrated that the effect extends to phobic stimuli such as tarantulas (Davis et al., 2011; Dorfan & Woody, 2006; Mobbs et al., 2010; Mühlberger, Neumann, Wieser, & Pauli, 2008; Riskind et al., 1992; Riskind & Maddux, 1993; Riskind, Wheeler, & Picerno, 1997) as well as to a variety of negative images or aversive stimuli, and even positive stimuli (Hsee et al., 2014; Mühlberger et al., 2008; Tajadura-Jiménez, Väljamäe, Asutay, & Västfjäll, 2010).

Research was presented that suggests that individuals don't necessarily become more anxious simply because they are at closer proximity to threats (Andrews, Freed, & Teeson, 1994; Poulton & Andrews, 1994; Rachman, 1994) and don't have a good intuitive grasp of probabilities (probability neglect; Sunstein, 2002; Sunstein & Zeckhauser, 2010). To the contrary, theoretical and empirical work on the "probability neglect" phenomenon has indicated that enormous differences in the probabilities of negative outcomes have relatively little effect on how individuals assess risk, and this is even more true when negative consequences or emotional reactions are high (Chap. 5; e.g., Bankhart & Elliott, 1974; Monat, Averill, & Lazarus, 1972; Slovic, Monahan, & MacGregor, 2000). In conjunction with this, we presented evidence in Chap. 5 that dynamic increases in probability and proximity have significant, distinct importance beyond the effects of probabilities or proximities alone (Hsee et al., 2014; Mobbs et al., 2010).

In line with the LVM, fears of spiders, contamination, rejection, disease, or other threats are associated with tendencies to simulate and overestimate the extent that the threats are rapidly dynamically gaining and increasing in probability and proximity, over their prior levels (Dorfan & Woody, 2006; Hsee et al., 2014; Riskind, Rector, & Cassin, 2011; Tolin, Worhunsky, & Maltby, 2004). As we will reiterate, a

maladaptive "looming cognitive style" (LCS) has also been studied in scores of studies that document that it correlates with and predicts future liability to anxiety symptom changes (Adler & Strunk, 2010; González-Díez, Orue, & Calvete, 2016; Riskind, Tzur, Williams, Mann, & Shahar, 2007; Sica et al., 2012).

Implications of the LVM for Understanding Anxiety Disorders

The LVM has implications for improving the ecological validity of contemporary conceptualization of anxiety and anxiety disorders. Adaptive mechanisms that are applied inflexibly can lead to dysfunctional behavior. A temporary freezing response, for example, can help organisms to escape detection from predators as well as allow them to assess the magnitude of danger and their available coping options (Hagenaars, Oitzl, & Roelofs, 2014). Sagliano, Cappuccio, Trojano, and Conson (2014) showed that such adaptive freezing responses are more likely when individuals are exposed to approaching threats (images of threatening animals presented as approaching). However, Riskind, Sagliano, Trojano, and Conson (2016) showed that when individuals have the LCS for physical danger, and characteristically tend to exaggerate the dynamic approach of threats, they tend to respond with maladaptive and excessive freezing reactions. Namely, these cognitively vulnerable individuals tended to "freeze up" and respond with slower reaction times even if they are presented with stimuli that are nonthreatening or even receding. Perhaps a similar point can be made about other defensive responses such as worry and thought suppression.

Implications of the LVM for Understanding Cognitive Vulnerability

The LVM proposes that some people more than others are predisposed to anxiety because they develop the LCS. The LCS is a cognitive vulnerability construct associated with the LVM that was introduced to capture unique aspect of cognitive vulnerability and to help address gaps in current cognitive models of anxiety. Individuals who are cognitively vulnerable with the LCS are biased to overestimate higher-order dynamic properties of threat. The LCS leads them to interpret ambiguous and potentially emergent threats and to perceive mental simulations of threats as dynamically growing, approaching, and rapidly rising in risk.

As we have seen, the LCS has consistently been shown to cross-sectionally correlate with anxiety (Chaps. 8–10) and predict future liability to anxiety symptom changes over periods ranging from 1 week to 6 months (González-Díez et al., 2016; Riskind et al., 2007; Sica et al., 2012), and particularly after the occurrence of negative life events (Adler & Strunk, 2010). Further, the LCS is elevated in anxiety

disorders (Riskind et al., 2011; Riskind & Williams, 2006) and increments the prediction of anxiety and memory and interpretative biases for threat information, above and beyond the effects of anxiety sensitivity, intolerance of uncertainty, general distress, and neuroticism (Elwood, Riskind, & Olatunji, 2011; Reardon & Williams, 2007; Riskind et al., 2007). Thus, research using cross-sectional, prospective, and lab-based experimental tasks have shown that it has promise in better understanding anxiety.

The LCS has been shown to predispose individuals to anxiety after exposure to negative environmental stimuli or life events (Chap. 8; e.g., Adler & Strunk, 2010; Williams, 2002). Further, the LCS prospectively predicts increases in levels of general anxiety, worry, social anxiety, and OCD symptoms (after adjusting for initial symptom levels) at future distances ranging from intervals of 7 days to up to 6 months. Consistent with expectations, the LCS as well as specific looming vulnerability themes has been shown to be elevated in anxiety disorders (see Chap. 9; Riskind et al., 2011; Riskind & Williams, 2006).

There is also evidence that the LCS can also lead to a state of greater behavioral urgency, and influence self-protective reactions including freezing and affect avoidance (Riskind et al., 2016; Riskind & Kleiman, 2012). Further, LCS can contribute to a cascade of negative reactions to threat in which LCS predicts increases in anxiety, and anxiety about salient threats increases LCS (Chap. 9). Furthermore, LCS may also lead to maladaptive behaviors such as stress generation (Kleiman & Riskind, 2013; Riskind, Black, & Shahar, 2010; Riskind, Kleiman, Weingarden, & Danvers, 2013).

As we have seen, there is evidence that the LCS can derive from antecedent developmental experiences such as early parenting, attachment patterns, and parental emotional abuse (Chap. 8; González-Díez et al., 2016). Moreover, paternal LCS may particularly contribute to intergenerational transmission of anxiety in college students (Riskind, Sica, Bottesi, Ghisi, & Kashdan, 2017).

Notably, the LCS may be associated not only with a predisposition to experience higher anxiety, but when mental depletion or hopelessness about evading negative events occurs, it may also be associated with anxiety-depression comorbidity (Chap. 8; Hong et al., 2017; Tzur-Bitan, Meiran, Steinberg, & Shahar, 2012). For example, cancer patients with leukemia have more depression as well as anxiety when they have the LCS (Levin, Li, & Riskind, 2007). For another example, the looming cognitive style can contribute to depression when individuals also have a depressive explanatory style (Kleiman & Riskind, 2012). The work on the LCS encourages further attention to whether disorder-specific cognitive factors can help to differentiate anxiety from depression as well as help to explain their comorbidity. For example, perseverative negative thinking and rumination appear to cross diagnostic lines and are associated with both disorders and syndromes (Ehring & Watkins, 2008; McEvoy, Watson, Watkins, & Nathan, 2013; McLaughlin & Nolen-Hoeksema, 2011; Muris, Roelof, Rassin, Franken, & Mayer, 2005).

A great deal of recent work in the field has emphasized the transdiagnostic processes that cross supposed boundaries between anxiety and depression or different subtypes of anxiety (Harvey, Watkins, Mansell, & Shafran, 2004). We do not dispute

the importance of transdiagnostic processes. Nevertheless, if we want to know what makes anxiety and depression different, it will help to learn what disorder-specific cognitive features they have. The research we have described on the LVM may help in advancing these important efforts.

Implications of the LVM for Prevention and Clinical Treatment

The fundamental premise that dynamic changes on threat dimensions are crucial to anxiety also has implications for prevention and treatment. We have suggested that the LCS and LVM can improve practitioners' ability to identify cognitively vulnerable individuals as well as provide new opportunities to reduce the risk of first episodes or recurrences and relapses in anxiety disorders. The LCS may also prove valuable in helping to assess whether anxiety disorders are treated successfully. Katz, Rector, and Riskind (2017) found evidence that LCS scores in anxiety disorder patients can be reduced by a standard 12-week CBT program (Katz et al., 2017). Moreover, their data showed that change in LCS predicted end of treatment anxiety when controlling for pre-treatment anxiety. Thus, changes in LCS could theoretically serve as cognitive markers of improvement as well as cognitively mediate the symptom improvement that occurs in CBT protocols.

An intriguing implication of this line of reasoning is that patients in CBT who don't normalize or decline in their levels of looming vulnerability distortions and LCS with treatment might be more likely than others to relapse. Relatedly, it could imply that conventional treatments for anxiety are more likely to fail if dysfunctional looming cognitive vulnerability distortions or perceptions aren't addressed. For example, exposure treatments (e.g., for spider phobias or contamination fears) could be more likely to fail if the patients' mental imagery of dynamic growing threat (e.g., they imagine spiders crawling on their bodies) isn't addressed. Supporting this idea, Dorfan and Woody (2006) found that college students failed to habituate to urine drops placed on their arms, as would otherwise be expected by conventional exposure theory, when they were given movement imagery instructions to imagine the urine drops spreading on their bodies.

It has often been our clinical impression that the interventions we presented in Chap. 15 often work by countering the feelings of mental paralysis felt by individuals with anxiety disorders (Clark & Beck, 2010). When this occurs, they seem to become ruled by the primary appraisal of "I am in danger and must get away." As such, their attention becomes narrowly focused on the perceived rapidly growing danger to themselves and their potential coping resources fade into the background. Some of the interventions to reduce looming vulnerability distortions can help to correct the short-circuiting of the secondary appraisal process and proffer the person a view in which they perceive they have additional time and space to figure out how to best cope.

In addition to standard CT/CBT protocols, there are reasons to believe that mindfulness training or other interventions may help to mitigate the effects of perceptions and distortions of rapid dynamic growing threat (e.g., by training anxious patients to focus on the present moment). However, we suggested that CT/CBT interventions that are specifically designed to target looming vulnerability distortions may help to augment the efficacy of these protocols (Chap. 15). By targeting dysfunctional perceptions of dynamic growing threat, these interventions may help to improve the efficacy of standard and familiar interventions, especially for patients who aren't responding adequately to exposure, decatastrophizing, or other of the familiar tools in the standard CBT repertoire. Thus, the CBT strategies and concepts we described in Chap. 14 promise to provide new tools for cognitive-behavioral treatments.

Integrative Power and New Directions Suggested by the LVM

The LVM model helps to integrate existing cognitive models of anxiety such as Clark and Beck's (2010) with findings from a great many diverse lines of interdisciplinary investigation outside of the clinical domain, including work on animal behavior, attention, memory, and emotion that have not been previously related to cognitive models of anxiety. We suggest that the LVM not only synthesizes disparate interdisciplinary observations but would seem to offer a more nuanced and evolutionarily informed cognitive formulation of anxiety.

More broadly, the LVM points to fruitful new directions in theory, research, and clinical practice. Thus, beyond its direct clinical implications, the LVM underscores the importance of going beyond the confining limits of using static (immobile) stimuli in experimental cognitive studies of basic adaptive processes such as anxiety, attention, memory, fear-relevant correlations, and fear conditioning. An overreliance on static stimuli will limit the advancement of understanding of cognitive processes and lack external validity outside of the laboratory (Basanovic, Dean, Riskind, & MacLeod, 2017; Riskind, Williams, Gessner, Chrosniak, & Cortina, 2000).

As we have shown throughout this volume, the LVM provides a conceptual framework for incorporating a myriad of theoretical and empirical developments from neuroscience studies of the impact of looming stimuli and studies on perception, attentional capture, and memory. Notably, the work we have presented in this volume on the LVM can be conversely integrated into a complex biopsychological framework for anxiety disorders that connects with many current trends in the field beyond narrow CT/CBT models and which includes many biological, behavioral, and social variables. For example, the LVM can be integrated with broader neuroimaging work being conducted in the anxiety disorders. As we have described, several studies have demonstrated that objects that exhibit approaching movement (i.e., they "loom") are associated with distinct signatures of brain activation during neuroimaging tasks (Bach, Neuhoff, Perrig, & Seifritz, 2009; Billington, Wilkie, Field,

& Wann, 2011; Coker-Appiah et al., 2013; Mobbs et al., 2007). For another example, several studies have indicated that neural mechanisms underlie the effects of looming stimuli on time dilation distortions (van Wassenhove, Wittmann, Craig, & Paulus, 2011; Whitman, Wassenhove, Craig, & Paulus, 2010). The LVM also connects with emotions theories (Baumeister & Bratslavsky, 1999; Carver & Scheier, 1990; Lazarus, 1991; Ortony et al., 1988; Scherer & Brosch, 2009), embodied cognition (Briñol & Petty, 2008; Niedenthal, Barsalou, Winkielman, Krauth-Gruber, & Ric, 2005), theoretical work on the hedonic treadmill (Brickman, Coates, & Janoff-Bulman, 1978), evolutionary theory (Dixon, 1998; Fanselow & Lester, 1988; Gilbert, 2001; Haselton, Nettle, & Andrews, 2005; Nesse, 2001; Ohman & Wiens, 2004), and ethological research (Grandin, 1980; Stankowich & Blumstein, 2005).

To conclude, we suggested in Chap. 16 that the LVM also has potentially novel and intriguing implications for understanding other problems and disorders. As mentioned, for example, it may be fruitful to examine the notions that inflated perceptions of patterns of change and rapidly escalating provocation ("looming provocation") can incrementally contribute to anger, while inflated perceptions of patterns of rapid dynamic gains in opportunities and gratification ("looming opportunity") can importantly contribute to problems such as gambling or bipolar disorders. We are hopeful that this volume stimulates work in these and other potentially fruitful new directions.

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