CHAPTER 9

Emotion Development from an Experimental and Individual Differences Lens

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INTRODUCTION

Developmental psychology, like the broader science of psychology, sets out to capture a phenomenon of interest in a moment in time, noting both the central tendency (the normative centroid) and variation surrounding the center. From this point, however, developmental psychology sets itself a bit apart in its added motivation to build from a single snapshot to capture both change over time and the mechanisms that fuel change. This scientific worldview is applied across a wide spectrum of phenomena, including behavior, cognition, and affect, and across multiple layers of analysis. At times, the field has struggled with how to best empirically translate this shared worldview. Thus, there have been, and continue to be, deep discussions on the role of metatheory and methods, debates as to whether we are a science of the laboratory or the field, and arguments characterizing the role of developmental psychologists as quiet anthropological observers or the active tinkerers of the chemistry lab.

It is in this context that the current chapter examines the methodological and theoretical considerations at play in the study of emotion development. A number of crucial reviews (Denham, 1998; Ekman, 1999; Harris, 1989; M. Lewis, 2010) examine the nature and teleology of emotion, carefully charting the rise and transformation of emotion(s) across development and contexts. This is not one of them. Rather, this chapter focuses on the approaches developmental psychologists have taken in examining emotion, both historically and today. In doing so, we document an ongoing struggle to place experimental work within our subfield of affective developmental science. Here we use the specific term "affective developmental science" as it reflects the (current) focus on capturing and explaining variance in emotion across the life span using a broad spectrum of empirical tools. Not surprisingly, we argue that experimental work has an important role in shaping our understanding of socioemotional variation previously observed in naturalistic settings while also providing the vital clues needed to inform future observational work. Although this may not appear to be a controversial statement, the field often has been suspicious of this approach, remaining on guard, lest developmental psychology fall into the trap of "deifying the manipulative experimental method" (McCall, 1977, p. 336).

In discussing the role of experimental methods in affective developmental science, we also note a research tradition that has received relatively less attention: the identification and systematic study of individual differences. To some extent, both naturalistic and experimental researchers share a faint disdain for individual differences. The naturalistic approach, in its purest incarnation, wishes to capture near-universal developmental pathways (Wohlwill, 1973), while the experimental approach wishes to impose strict control such that the only variation present builds directly from the clever manipulations imposed by the researcher (Reese & Lipsitt, 1970). However, we suggest that individual differences, systematically studied rather than systematically removed, play an important role in delineating mechanisms of socioemotional development, help define what we mean by "normative," reveal the ways in which individual traits come together with environmental context to shape trajectories, and focus our resources on the strongest targets for identification, prevention, and intervention.

Thus, this chapter looks to see how experimental methods, coupled with an eye to capturing individual differences, may help expand our understanding of emotion and socioemotional development. We base this discussion on the premise that emotions are biologically prepared adaptive processes (P. M. Cole, Martin, & Dennis, 2004; Dennis, Buss, & Hastings, 2012; Hastings, Miller, Kahle, & Zahn-Waxler, 2014). From this perspective, emotions are integral to generating a goal, maintaining progress toward the goal, and assessing the impact of attaining, or failing to attain, the goal. Emotions are pervasive across development. They draw from, and are reflected in, neurobiological, perceptual, cognitive, and behavioral systems (Thompson, 2011). It is the multidimensional nature of emotion that most clearly calls for a multidimensional approach that incorporates both descriptive and experimental work and both a normative and an individual differences lens.

In this chapter we also lean heavily on the temperament literature, using the construct as a model system to illustrate the promise (and limitations) of the experimental and individual differences approach to studying emotion development. In part, this reflects the authors' biases in the work they have carried out to date. However, we would like to believe that this emphasis also reflects a real (if perhaps unintended) tradition within the study of temperament of drawing from multiple research streams to study a core question centered on the early and evolving mechanisms that shape developmental pathways from infancy through senescence.

Specifically, we draw on the literature examining behavioral inhibition. Kagan and colleagues (Garcia Coll, Kagan, & Reznick, 1984; Kagan, 1994, 2012) first described the temperamental trait of behavioral inhibition in children. As infants, behaviorally inhibited children display signs of fear and wariness in response to unfamiliar stimuli (Schmidt et al., 1997), and this trait is marked by heightened vigilance, motor quieting, and withdrawal from novelty (Garcia Coll et al., 1984; Kagan, Reznick, & Snidman, 1987). By elementary school, many behaviorally inhibited children fear social circumstances, displaying poorly regulated social behavior and social reticence (Coplan, Rubin, Fox, Calkins, & Stewart, 1994; N. A. Fox et al., 1995). This difficulty with social interaction, in turn, increases the likelihood of peer rejection, low self-esteem, poor social competence, and even academic difficulties (Hastings, Kahle, & Nuselovici, 2014; Rubin, Chen, & Hymel, 1993; Schmidt, Fox, Schulkin, & Gold, 1999). Longitudinal studies of behavioral inhibition, and the broader construct of temperamental shyness, have found a marked increased risk for anxiety, particularly social anxiety, by midadolescence (Chronis-Tuscano et al., 2009; Clauss & Blackford, 2012; Kagan, Snidman, McManis, & Woodward, 2001).

Of particular interest to this chapter, the construct of behavioral inhibition first emerged from careful observation of children both in their natural environment and in the laboratory. Experimental studies then probed the mechanisms that led to observed profiles of behavioral inhibition and underscored the link to socioemotional outcomes (Kagan, 2012). Temperament, as a construct, also argues for the importance of individual differences in children's experience of and response to their social worlds. Thus, this area of research will help illustrate many of the core arguments touched on in this chapter.

HISTORICAL TRENDS SHAPING THE STUDY OF EMOTION DEVELOPMENT

What Does It Mean to Be a "Real" Science?

The subfield of affective developmental science did not emerge, in either name or form, from a historical vacuum. Indeed, the name itself reflects current trends regarding how to best approach centuries-old questions regarding development. Overton (2006) argued that every field has meta-theories that shape trends in research across subdisciplines. Meta-theories provide the concepts and contexts from which specific theories and methods can emerge. That is, they create the narrative that shape the questions asked by the field. Overton suggested that the current meta-theory that defines the scientific method is rooted in "observation, causation, and induction-deduction" (p. 19). Within that, more localized historical forces can shape specific theories central to the field. Meta-theories then lead to meta-methods—acceptable strategies for answering questions of interest. For example, the dominance of behaviorism in the early 20th century reflected the shared understanding that the environment was the primary force shaping developmental trajectories (Watson, 1926). This view was then supplemented (and perhaps supplanted) by biologically based mechanisms and cognitive processes (Bjorklund, 1997) that brought the individual child into the developmental process.

Researchers tend to accept and embrace tools that are most adequate to explore the world described by the meta-theory. The use of acceptable methods—rooted in acceptable theories—helps us both judge the quality of any one study and place the field within the larger community of science. Today's affective developmental science reflects these historical trends.

Cronbach (1957) painted a vivid picture of the various forces coming together to create a modern science of psychology. In his presidential address to the American Psychological Association, he noted that the field was split into two competing factions. Experimental psychology was a tight little island, with clear borders and strict rules of admission. "Correlational" psychology, in contrast, was the Holy Roman Empire—large, sprawling, and perhaps ultimately ungovernable. In his estimation, the well-guarded island was "much the more coherent of our two disciplines," This was all for the better since "it is these methods which qualify us as scientists, rather than philosophers or artists" (p. 671). This fit with psychology's striving to display its scientific bona fides, so that it would be deemed worthy companions to the hard(er) sciences of physics, biology, and chemistry.

The historical trend was clear. Any discipline, or subdiscipline, of psychology would need to fit these strictures in order to be allowed into the fold. For example, Cronbach (1957) singled out Harlow as creating a truly experimental psychology of development. In Harlow's work, one could see tight control of the organism's environment, the clear definition of the outcome (dependent) variable of interest, and the systematic manipulation of processes (the independent variable) contributing to a rich mechanistic view of socioemotional development (Harlow, 1958).

The field of "child psychology" was critiqued for having few experimental controls and techniques, being frequently atheoretical, and trying to capture complex variables that were difficult to define or control (Wohlwill, 1973). The men and women interested in the developing child were very much aware of these pervasive critiques and acted accordingly, moving away from naturalistic observational methods. In response, child psychology gave way to a new "developmental psychology" that looked to experimental science as its brethren and empirical ideal.

These trends were evident as early as the 1930s, when the historical antecedents to today's developmental psychology worked to place themselves under the umbrella of experimental psychology, distinguishing themselves from prior impressionistic studies and popular "baby diaries" (Wallace, Franklin, & Keegan, 1994). In doing so, researchers often took on the traditional topics of experimental psychology, simply replacing adults with children as the organism of study. The long line of studies in children's learning and learning theory (Reese & Lipsitt, 1970) fit this mold. As McCall (1977) noted, researchers were working to "infuse developmental psychology with scientific respectability" (p. 333).

However, by the 1970s, many leaders of the field fretted that a "substantial science of naturalistic developmental processes" was lacking (McCall, 1977, p. 333) and that developmental psychology had suffered in "the invasion of the experimentalists" (Wohlwill, 1973, p. 8). Wohlwill (1973) argued that if developmental psychology did not reembrace a focus on development, the field would lose its place as a distinct contributor to psychology. Rather, it would devolve into a paler branch of general psychology defined simply by the age of the participants. Wohlwill's concern resulted in a call to arms, exhorting the new generation of developmental psychologists to embrace the longitudinal study. Researchers were to invest the time and effort to create sustained and careful description of children's natural trajectories. This naturalistic focus was to distinguish developmental psychology, and developmental psychologists, from the mechanistic tinkerers of the other subdisciplines.

In the last four decades, the field has embraced the ideal so wholeheartedly that today many discussion sections include the mea culpa limitation of being cross-sectional, experimental, or both. The experimentalists took a strategic retreat to focus on infancy—and, in particular, cognitive development in infancy (Aslin & Fiser, 2005). Work focused on socioemotional development was "to remain at an essentially descriptive level" (Wohlwill, 1973, p. 14). The methodological exclusivity was bidirectional. For example, Reese and Lipsitt (1970) wrote a comprehensive 700+-page book reviewing experimental child psychology. In it, they devoted 45 pages to set transfer in learning and 10 pages to all of emotional development.

The distinction in approach, and the animosity among proponents, often was attributed to differences in training and scientific background. Boring (1929) went so far as to suggest that the divide was rooted in personality traits clustering in the two camps. Whatever trait-level differences were evident, they were then magnified by the specific training histories within the camps. Specific developmental curricula in graduate training programs emerged in the 1970's and 1980's, narrowing the range of variables and processes related to child development examined by any one group of researchers. As a result, each camp thought the other vaguely scientifically suspect. This suspicion echoed Catell's (1898) earlier concern that, after training as experimental psychologists, "regard for the body of nature becomes that of the anatomist, rather than that of the lover" (p. 152).

A shared common interest in variation did manage to bridge the methodological divide. Although the experimentalist was thought to focus solely on the variation he or she created, the correlational psychologist was interested in already existing variation to be found in nature. Ironically, the shared focus on variation also led to a shared antipathy toward individual differences.

Within the correlational camp, the focus was on variation across a central tendency that is presumed to be somewhat linear and driven by a single, shared, causal mechanism. These developmental functions capture the amount or frequency of a behavior across age for an individual or group of individuals. Indeed, McCall (1977) argued for a descriptive science of developmental function rather than prediction. When individual differences were invoked, the focus was on relative rank ordering for an individual on a given attribute relative to rank ordering on the same trait at a different time. In this view, "correlation" implies stability of individual differences. This approach was not meant to embrace a diversity of mechanism or pathway.

Experimentalists did not have much more use for individual differences in their work, as they were seen as the enemy of experimental control. Individual differences were the marker of sloppy methodology and agents obscuring functional mechanisms. Indeed, Watson (1926) argued that if you can experimentally make and unmake individual differences at will, then by definition the differences have little scientific importance. The experimental ideal was to identify and manipulate a strong "treatment" that could reliably and universally bring about a predicted pattern of behavior. This point of view failed to highlight that the capacity to show variation, either at the level of a specific trait or in a class of individuals, may in and of itself provide needed insight into a construct of interest and openness to developmental change.

These historical trends, although perhaps not as starkly etched, still are evident in our modern science. As such, they shape both the questions asked in developmental affective science and how we go about answering these questions.

What Are the Core Methodologies in Developmental Science?

Developmental science is focused on determining causality, capturing a profile or relation at a moment in time, and then tracing how and why the relation shifts over time. This focus on description and explanation can be subdivided into two central questions: (1) What causes the mean value of a trait in a population? and (2) What causes individual variation between people? These two questions are matched to corresponding methodologies.

Once a question is agreed on, the agreement often leads to a core set of methodologies (Overton, 2006). For example, Eisenberg (Eisenberg, 2000; Eisenberg, Champion, & Ma, 2004; Eisenberg & Spinrad, 2004) has carried out an extensive and highly influential line of research examining socioemotional development. Based on this line of work, she and her colleagues (Morris, Robinson, & Eisenberg, 2006) discussed the importance of using a multi-method approach to this work. These methods include self-report, informant report, direct behavioral observation, and biological correlates of emotion. These methods then can be used as part of a longitudinal or cross-sectional study. At the outset, however, Morris et al. (2006) noted that they would make little mention of either experimental methods or individual differences in their review because they studied socioemotional development. Readers interested in experimental methods were directed to the chapter in the volume reviewing social psychology (Smith & Harris, 2006) or reviews of cognitive development methods (Damon, Kuhn, & Siegler, 1998).

The methodological divide can reflect the researchers' core inquiry centered on Can versus Does. The first question asks if a specific mechanism or factor can shape the outcome of interest. For example, if we modulate levels of anger, can we see variation in levels of aggression? To ask this question, we often rely on experimental methods that manipulate a potential mechanism of interest and then carefully track any and all changes in the outcome. This is a mechanistic approach to the developmental question. However, this approach highlights the possible—not the probable. The other side of the equation looks to see if this mechanism actually does play a role in development under normal conditions. For example, do variations in levels of anger among children link to more aggressive behavior? For this work, researchers often call on observations in relatively naturalistic settings. An example of this dual question can be seen in classic work in the literature examining the development of anger and aggression in children (Coie & Dodge, 1998).

Observational studies have examined the contexts in which children show aggression (Maccoby, 1998), the general characteristics of aggressive children (Fry & Gabriel, 1994), and the environmental correlates of aggression (Andison, 1977). Acts of aggression then are tied to markers for anger. This work shows that anger, and subsequent aggression, can be triggered by limited resources; that overt aggression (often erroneously seen as a proxy for anger) is more often evident in boys; and that anger and aggression may be associated with exposure to exemplars, such as through viewing violent television programs. However, these conclusions are drawn from patterns of aggression (the operationalization of anger) that are clearly visible and tied to tangible triggers, underplaying more subtle acts of aggression that may arise from equivalent experiences of anger (Crick et al., 2001).

Systematically observing anger among children, even in the form of aggressive behavior, is difficult (Underwood, Galen, & Paquette, 2001) and often requires covert operations (Pepler & Craig, 1995). Experimental studies have long been used to both generate and explain instances of anger and aggression (Lewin, Lippitt, & White, 1939). In general, they build on available theory to isolate potential functional mechanisms, which may or may not be linked to presumed underlying levels of anger. For example, Cohen and Prinstein (2006) began with the theoretical assumption that adolescents wish to enhance their status among peers. This social goal, coupled with a belief that emulating a high-status peer will enhance their own standing, will lead adolescents to endorse risky or aggressive behavior they typically would reject if left to their own devices. For this test of the theory, Cohen and Prinstein selected adolescents deemed to have average levels of social status, based on peer nominations. This was a "control" factor to try to minimize the impact of participant characteristics (but see next paragraph). Participants then were led to believe that they were to interact via a chatroom with either high- or low-social-status peers from their school, again based on the same initial selection ratings. As expected, participants endorsed and engaged in aggressive social interactions when paired with an aggressive high-status peer relative to the low-status peer.

As a brief aside, we note that the aggression literature illustrates two of the core arguments made in this chapter. First, Cohen and Prinstein (2006) noted significant individual differences in the impact of their experimental manipulation. In particular, highly anxious adolescents were more susceptible to peer contagion relative to their less anxious peers. Throughout the chapter, we return to the argument that strong individual differences often are found in the socioemotional literature, and they are an important conduit to better understanding our constructs of interest. Second, this literature also illustrates the links between naturalistic observation and experimental manipulation within the field. As a case in point, Anderson and Bushman (1997) conducted a meta-analysis to examine the relation between aggression in the laboratory and aggression in context. They argued for a strong connection between the two sources of data. Of interest here is the title of their paper, “External Validity of ‘Trivial’ Experiments: The Case of Laboratory Aggression.”

The literature on emotion and aggression captures how both mechanistic (“can”) and observational (“do”) studies provide unique information regarding socioemotional development. Longitudinal studies can help capture the rich descriptive architectures of development. Although they may lack the controls needed for strict causal inferences, new and evolving statistical techniques can capture this complexity (Khoo, West, Wu, & Kwok, 2006). These methods point to strong and plausible causal mechanisms that emerge in variable interrelations that shift over time.

However, given the intensive nature of these studies, trade-offs often are made. Researchers either focus on relatively smaller samples but institute rich and multilayered observation of development (N. A. Fox, Snidman, Haas, Degnan, & Kagan, 2015; Klein, Dyson, Kujawa, & Kotov, 2012), or they take a population approach, with less intensive measures that allow for more heterogeneous and variable samples (Chantala & Tabor, 2010). Longitudinal studies, by definition, are designed to capture a phenomenon over time. As such, they set at the outset methodologies and measures that often must be carried out without change within and across time. Shared measures allow for direct comparisons across the entire cohort at any one wave of study (T1) and over the life of the study (T1 versus T2 versus T3, etc.). Thus, they are a snapshot in the history of the field, reflecting the agreed-on outlines of knowledge at a point in time. Yet, as all developmental researchers have encountered, the data and theory supporting their carefully considered design can shift underneath their feet even as they carry out their studies. Science and time marches on, and scientists are then left to react.

Often short-term experimental studies can help probe the contours of new knowledge raised within longitudinal studies. The use of experimental studies may add to our shared understanding in a timelier manner than the ongoing longitudinal study. If we are lucky, we can add additional measures to later study waves in order to reflect the changing scientific consensus. Even when doing so is not possible, researchers can shift the questions asked and reconfigure study variables to reflect the new questions of interest. In this way, manipulations that create short-term variations in emotional state can be used to outline long-term trait-level profiles. Thus, new knowledge can emerge from a (partially) redundant network of studies, as described and illustrated (see Figure 9.1) six decades ago (Cronbach, 1957).

Current Approaches to Emotion Development

As noted, we approach emotions as biologically prepared adaptive processes that act in context for personal goal-setting (P. M. Cole

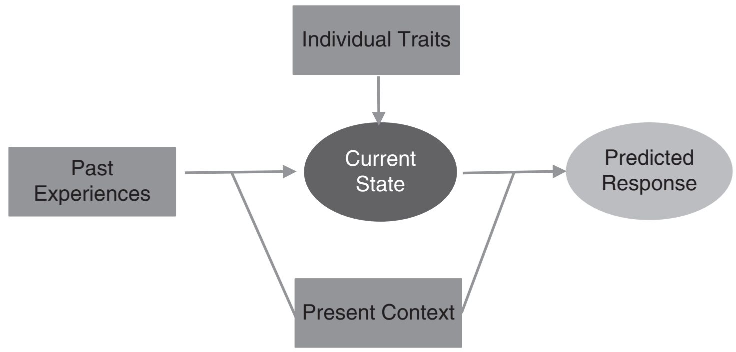

Figure 9.1 Illustrative model, based on Cronbach (1957), for a framework of processes thought to shape development. Overlapping sets of studies varying in design and timing that focus on subcomponents of the model can help improve our understanding of more complex and integrated systems. Color version of this figure is available at http://onlinelibrary.wiley.com/book/10.1002/9781119170174.

et al., 2004; Hastings, Miller, et al., 2014). From a developmental perspective, emotions are the initial language of communication (Tronick, 1989) and the core scaffolding for social interaction (Grossmann, 2015). Emotions are often in their rawest and purest form in infancy, before the emergence of stable and effective self-regulatory mechanisms. Given their pervasive role in development and functioning, it is not surprising that emotions, as a class, are complex and multifaceted. Emotions can vary by valence and intensity, the identity and context of probable triggers, their latency to emerge, the time to subsist, and the ease of regulation (Hastings, Kahle, & Han, 2014). This structural complexity is paralleled by equal complexity in the measures used to capture emotion. These measures each vary in chronometry, sensitivity to fluctuations in state, pace of change over the course of development, connection to social relationships, and level of association with biological functions, variations that have important adaptive survival processes that often are linked only tangentially to the socioemotional processes we as researchers wish to capture. In our discussion, we build from Larsen and Prizmic-Larsen (2006), who suggested that our measures of emotions generally have focused on three broad categories: language, behavior, and physiology.

Language measures provide an opportunity to capture an individual's subjective experience. For a field focused on affect, one could argue that this is '*the*' marker of our construct of interest. It seems intuitive that to measure anger, it is incumbent that we focus on individuals who are experiencing anger. We know a person is angry when they report "I feel angry." However, language measures are also often fraught with considerations above and beyond developmental change in the underlying emotion. Linguistic measures create the puzzle of disentangling changes in the construct to be reported (anger), the child's understanding of the construct (what are the typical antecedents and phenomenology of anger), and the ability (e.g., of preverbal infants) and willingness ("Will I get in trouble if I say I'm angry?") to report on their emotional states. Repeated probes across contexts or with clever interviewers (e.g., puppets; Measelle, Ablow, Cowan, & Cowan, 1998) can help reveal subjective states. For example, the Berkeley Puppet Interview (Measelle et al., 1998) was designed to assess children's self-concept but has been used to assess emotional and behavioral patterns in children as young as age 4. In this way, the method works to "meet" the child where he or she is developmentally—a general recommendation for both naturalistic and experimental methods.

Within the laboratory, researchers have attempted to manipulate task conditions to see if the pattern of report changes across context and time. For example, in the disappointing toy paradigm (Saarni, 1984), children are presented with a less-than-engaging present (e.g., a truck without a wheel; an unwound Slinky). By manipulating the presence and absence of additional people, the specific task demands, and the expectations built prior to the toy's presentation, researchers can note variation in report. Generally, children are less likely to report disappointment in the presence of an experimenter or parent (Tobin & Graziano, 2011) or when the experimenter attributes personal significance to the toy (Talwar, Murphy, & Lee, 2007). In this way, researchers can note and chart the emergence of children's understanding of—or ability to conform to—display rules, which govern when and how socially sanctioned emotions can be expressed (see Chapter 15 in this volume; Zeman & Garber, 1996). As noted in the discussion concerning anger, there are marked individual differences in this literature as well. In particular, there are sex (P. M. Cole, 1986), temperament (Kieras, Tobin, Graziano, & Rothbart, 2005), and culturally linked (Garrett-Peters & Fox, 2007; Yap, Ji, & Hong, 2017) variations in children's willingness to show displeasure within the paradigm.

Another way to work around a child's linguistic shortcomings is to rely on parental or teacher report (De Los Reyes, 2011; Morris et al., 2006). Parents and/or teachers have had the opportunity to interact with and observe the child across time and context. As such, they may have a more comprehensive view of core characteristics than can be captured either by the occasional observer or by laboratory manipulation. However, informant report also can add a level of complexity, as we are relying on the informant's ability to accurately assess and report on the target child's internal mental states. Of course, this added layer of subjectivity then means that it is now left to the researcher to infer the child's mental states underlying the adult's report—always a tricky proposition.

Although adult informants are chosen for their linguistic and cognitive sophistication, as well as their broader experience with the child, ironically, parents and teachers may be more open than children to the pressures of demand characteristics and measurement reactivity. Demand characteristics suggest that individuals are reluctant to endorse patterns of thought and behavior frowned on in the social context (Polivy & Doyle, 1980). Thus, one may find that questionnaire data produce children who are more prosocial and less aggressive than the children observed roaming the wilds of the playground (Underwood et al., 2001). This concern goes hand in hand with issues of measurement reactivity, which reflects the extent to which the methodology raises the participant's awareness of the construct of interest and consequently influences the participant's ability to modify behavior or response (Smith & Harris, 2006). Adults are much more likely to be alert to the "hidden" agenda behind our questioning and to shift their responses accordingly.

The second category of emotion research from Larsen and Prizmic-Larsen (2006) embraces the role of behavior. In many ways, behavior is the core concern of this chapter, as we have discussed the two competing ideals within socioemotional research. The first ideal calls for observing behavior in naturalistic settings, documenting developmental arcs as they emerge in response to new contexts and challenges. The second ideal targets specific contexts and processes to then manipulate and shift in order to observe and document subsequent behavior. We argue that these approaches fundamentally rely on each other to validate, expand, and apply the knowledge generated about emotional behavior.

Coupling observation and experimental manipulation may help us address core developmental trajectories in the experience and expression of emotion. For example, we may be interested in the prevalence and intensity of negative and positive affect in children and the subjective impact of peer interactions. Early in life, it may be easier to capture these socioemotional constructs in a natural setting, as young children often are expressive, boisterous, and loud. We are less likely to see the same behaviors and interactions as clearly in older children and adolescents, particularly as children develop more self-regulatory skills (Pérez-Edgar, 2015) that will be carried into adulthood (see Chapter 15 in this volume), reflecting display rules shaped by the larger society and their specific peer networks (Zeman & Garber, 1996).

Thus, research in a lab setting, even without an experimental manipulation, may increase our ability to see our constructs of interest as they become more internalized and are communicated more subtly. Indeed, researchers often move a naturalistic observation into the laboratory in order to capture more closely socioemotional processes during set events. For example, Eisenberg and colleagues has had parents and adolescents discuss issues of concern in order to closely observe patterns of emotion during the conversation (e.g., Hofer et al., 2013). Luckily, the laboratory setting then opens up the opportunity for experimental manipulation as well. Potential manipulations can include shifting the discussion partners across family members (McDowell, Kim, O'Neil, & Parke, 2002), priming specific emotions (Jouriles, Murphy, & O'Leary, 1989), or modifying the difficulty of a shared task (Dennis, 2006). The laboratory setting also opens up the opportunity for new, previously unavailable, levels of analysis.

The third broad category of research (Larsen & Prizmic-Larsen, 2006) encompasses the use of physiological and neural measures to capture emotion processes embedded in biological systems. This is the newest addition to the research arsenal for affective developmental science. Its relative novelty, complexity, and cost have led to a vague sense that bio-based measures are a special class of data onto itself. That is, there is a tendency to treat evidence of neural patterns associated with emotion as prima facie evidence for a "mechanism." However, mechanisms arise from functional influences on current state and lawfully direct change over time. As van der Molen and Molenaar (1994) noted, "[T]he usefulness of psychophysiological measures depends on the demonstration of the sensitivity of the measures to task manipulations derived from developmental psychology" (p. 466). Neural activity can act as a descriptive or correlational data point to our end state of interest (Gee et al., 2013; Giedd et al., 1999) as easily as it can serve as the conduit for change within an experimental study (McClure et al., 2007; Pérez-Edgar et al., 2007). Finally, these measures can spur on and reflect emotions, acting as both the mechanism and the embodiment of underlying change. Thus, method and theory are just as important when it comes to interpreting bio-based measures as when we examine linguistic or behavioral data.

Physiological and neural measures also have distinct advantages in our attempt to capture emotion-linked processes over time. First, as long as the measure is tolerable to children, we can characterize the same measure, in the same form, repeatedly over time (Wolfe & Bell, 2007). With linguistic and behavioral data, developmental psychologists must carefully titrate and change measures in order to meet the child's current level of functioning and typical contexts. Doing so often places the developmental psychologist at odds with the statistician, who may insist that change over time can be captured only when the identical measure is at hand at each time point (Willett, Singer, & Martin, 1998). Although we all benefit from recent statistical advances sensitive to developmental considerations (Foster, 2010), biological measures (at least in their surface presentation) could show the needed mark of homotypic continuity, minimizing these analytic concerns. As such, they can contribute to our attempt to capture emotional processes by revealing patterns of stability (or change) that otherwise would be obscured by development in higher-order markers of emotion. The temperament literature has made extensive use of electroencephalogram activity from infancy through adolescence to reveal patterns of approach and avoidance motivations tied to general affective patterns as well as individual differences in trait-level markers and individual response to specific affective challenges (N. A. Fox, Hane, & Pérez-Edgar, 2006; N. A. Fox, Kirwan, & Reeb-Sutherland, 2012). In another example, Forbes, Fox, Cohn, Galles, and Kovacs (2006) found that children in the disappointing toy paradigm show a physiological response to receiving the toy, even in the absence of overt facial changes and report. Thus, the use of this task over time can help researchers disassociate the developmental arc of emotion expression from underlying markers of emotional reactivity.

In addition, the temporal dynamics of emotion can be better captured through the use of psychophysiology, often integrated with behavioral and linguistic measures (N. A. Fox et al., 2012). When bringing together our populations of interest (often children) with our specific content questions, this new subniche of research falls under the umbrella of developmental affective psychophysiology (Hastings, Kahle, & Han, 2014). Theoretically, one would expect that a triggering event or thought will create a temporal cascade across levels of emotion. Based on information processing models (Dodge, 1991), the child begins by encoding and interpreting emotion-linked cues. From there, the succession of goal clarification, response construction, and response selection occur. Accompanying these fundamentally cognitive processes, there are also behavioral mechanisms that ebb and flow at each point in time. These cascades are internal to the child and are evident only later in overt behavior or report. These "outcomes" cannot track the pattern of emotion, as they reduce all contributing processes to a single overt marker. This blurring of multiple processes can obscure any true signals of emotion. Thus, we are challenged to align the chronometry of emotion with the chronometry of our measures. Some methods, such as questionnaires, cannot adequately measure chronometry; they must work at the level of chronicity. For that reason, multiple strategies are needed to better capture the emotion patterns seen within and across individuals. In particular, we need measures that are temporally and spatially sensitive, allowing researchers to better delineate the components and time course of emotion processes.

Biological measures reflect in real time a complex and multilayered web of mechanisms that draw on processes that emerge from the brain and encompass the entire body. For example, central nervous system measures have examined brain structure (diffusion tensor imaging) and function (functional magnetic resonance imaging), both at rest and in response to affective stimuli. Emotion-linked neural activity is distributed widely across the brain, reflecting the pervasive and flexible role of emotion in cognition and behavior (Hastings, Kahle, et al., 2014). For example, the amygdala, striatum, and prefrontal cortex are implicated as hubs for core functions of emotion triggers, including punishment, reward, and self-monitoring. The systematic coordination of activity is central to adaptive and flexible functioning.

A series of studies in the temperament literature has shown that patterns of responses in limbic, striatal, and prefrontal regions are associated with patterns of negative and positive affect, from childhood into adulthood (N. A. Fox et al., 2012; N. A. Fox & Helfinstein, 2013). Much of the translational interest in behavioral inhibition is based on its association with increased risk for social anxiety disorder (Clauss & Blackford, 2012). Although the clinical literature historically has been a separate line of research from developmental science, this work also has found a distributed neural network associated with pediatric anxiety, encompassing the amygdala, the bed nucleus of the stria terminalis, the striatum, and multiple regions of the prefrontal cortex (Blackford & Pine, 2012).

The first major study of amygdala function in behavioral inhibition found that young adults categorized as inhibited in the second year of life showed significant bilateral amygdalar activation to the presentation of novel faces versus fixation relative to participants without a history of behavioral inhibition (Schwartz, Wright, Shin, Kagan, & Rauch, 2003). Fox and colleagues (Pérez-Edgar et al., 2007) found that adolescents with a history of childhood behavioral inhibition also showed increased amygdala activation when attending to their subjective fear of emotion faces during an attention-emotion face task, coupled with amygdala deactivation when passively viewing the same faces. Intriguingly, McClure and colleagues (2007) found the same pattern of hyperactivation and deactivation across conditions in clinically anxious adolescents completing the identical functional magnetic resonance imaging task.

Guyer et al. (2006) were among the first to show that adolescents with a history of behavioral inhibition showed increased striatal response in anticipation of increasing monetary rewards. Building on this initial finding, it may be that the striatal hyperresponse to monetary reward is evident only when reward is contingent on one's own performance (Bar-Haim et al., 2009) and when anticipated feedback is met with a negative response (Helfinstein et al., 2011). This heightened striatal response in behavioral inhibition also is linked to increased anxiety, particularly in the context of genetic risk (Pérez-Edgar, Hardee, et al., 2014) and increased levels of substance use (Lahat et al., 2012). Adolescents with a history of behavioral inhibition also show striatal hypersensitivity to anticipated social evaluation (Guyer et al., 2014), particularly if previously exposed to harsh parenting (Guyer et al., 2015).

To fully influence emotional functioning, the central nervous system must work to shape how the rest of the bodily systems help the child move through and react to developmental challenges. The autonomic nervous system regulates the functions of our internal organs and acts as a bidirectional conduit for responding, assessing, and exploiting the environment (Hastings, Kahle, et al., 2014). Within the umbrella of the autonomic nervous system, the sympathetic (SNS) and parasympathetic systems work together to carry out allodynamic control (Hastings, Kahle, et al., 2014), carefully titrating the individual's internal experiences and how the person navigates the environment.

For example, young children were asked to carry out an impossible task designed to trigger frustration and other negative emotions (Kahle, Miller, Lopez, & Hastings, 2016). They were asked to draw a "perfect" green circle and then repeatedly told they failed to meet this ideal. Across the 3-minute task, a measure of SNS (pre-ejection period, PEP) was assessed 10 times. Researchers then measured PEP three times during a 1-minute recovery period in which the child was praised for the last circle drawn. Across this time series, Kahle et al. found that there was shortening PEP (SNS activation) during the frustration induction, followed by lengthening PEP (SNS inhibition) during the recovery period. Further, children who had more SNS activation during the induction were observed to express more anger during the recovery period. Thus, this SNS pattern may reflect the chronometry of one physiological aspect of the onset, experience, and attenuation of an anger response to the laboratory-induced frustration, with a more persistent behavioral aspect of the anger experience being evident downstream in the time course of the emotion.

Within the behavioral inhibition literature, autonomic nervous system measures have proved crucial to examining the proposed mechanisms underlying the phenotype. The complex behavioral pattern seen in behavioral inhibition is hypothesized to result from a hyperaroused limbic system, centered on the amygdala. In proposing this model, Kagan, Reznick, and Snidman (1988) drew on a line of research linking the amygdala to the acquisition of conditioned fear (Davis, Walker, & Lee, 1997), the induction of vigorous limb movements (Amaral, Price, Pitkanen, & Carmichael, 1992), and the modulation of distress cries (Newman, 1985). However, there were (and are) methodological and developmental barriers to examining the functioning of amygdala directly in children across age and context. Thus, two decades of studies chose behavioral or physiological outcomes that reflected the presumed activation of nuclei within the amygdala.

For example, children and adolescents with a history of behavioral inhibition showed elevated attention to novelty (Marshall, Reeb, & Fox, 2009; Reeb-Sutherland, Vanderwert, et al., 2009) and to behavioral errors (McDermott et al., 2009) and had difficulty disengaging from threat cues (Pérez-Edgar & Fox, 2005), as marked by event-related potentials. They also exhibited increased potentiated startle to threat (Reeb-Sutherland, Helfinstein, et al., 2009), greater right frontal electroencephalogram asymmetry at rest (Calkins, Fox, & Marshall, 1996; Hane, Fox, Henderson, & Marshall, 2008), perturbations in salivary cortisol levels at rest and after provocation (Pérez-Edgar, Schmidt, Henderson, Schulkin, & Fox, 2008; Schmidt, Fox, Sternberg, et al., 1999), higher heart rates and lower heart rate variability at rest (Marshall & Stevenson-Hinde, 1998), unique patterns of cardiac reactivity to emotionally laden narratives (Bar-Haim, Fox, VanMeenen, & Marshall, 2004), and lower thresholds for detecting threat in the environment (LoBue & Pérez-Edgar, 2014; Reeb-Sutherland et al., 2015). In each case, the specific functional marker was chosen for study because it was hypothesized to grow out of the hypersensitive limbic response to novelty and uncertainty presumed to fuel the observed behavioral profile of behavioral inhibition (Kagan, 2012; White, Lamm, Helfinstein, & Fox, 2012).

Although the biological system is carefully interwoven in functioning, our methods are not always adequate to unlocking these mechanisms (Miskovic & Schmidt, 2012; Schmidt & Segalowitz, 2008). Indeed, Larsen and Prizmic-Larsen (2006) suggested that "the various components of emotion will never correlate substantially with each other" (p. 342). For example, Nesse et al. (1985) examined measures of distress during in vivo exposure therapy in phobic individuals. Although they noted increases in subjective anxiety, pulse, blood pressure, plasma norepinephrine, epinephrine, insulin, cortisol, and growth hormone, there was only modest convergence in the “magnitude, consistency, timing, and concordance” (p. 320) of their measures.

Our empirical imprecision reflects the fact that the response systems we use as core measures of emotion have roles that extend far beyond serving as indicators of emotion. Although cardiac activity provides the foundation for calculations of heart rate, heart rate variability, and respiratory sinus arrhythmia, these relatively discrete markers of emotion and mood state are embedded within much broader and pervasive survival functions (Dennis et al., 2012; Hastings, Kahle, et al., 2014). These markers will function separately from, and independent of, our interests in capturing variations in affective development and emotional functioning. Of course, there is the added difficulty that the biomarkers of emotion also mutually influence each other, and each has its own developmental trajectory. Although infants may show a robust startle response from birth (N. A. Fox et al., 2012; Marshall et al., 2009), studies examining electrophysiological measures have to take into account a slow developmental progression in form and function (Bell & Cuevas, 2012; Bell & Wolfe, 2007; Cuevas & Bell, 2011). Thus, we need close observation in the laboratory, ideally over time, to isolate and track fluctuations that follow (even if weakly) our experimental manipulations. Here, we also rely on newly emerging statistical tools that can handle multiple weakly correlated measures.

One final item to note regarding the categories of functioning laid out by Larsen and Prizmic-Larsen (2006) is that the authors do not explicitly make mention of cognition, and cognitive processes, in measuring emotion. This, in part, reflects two historical forces. First, as mentioned earlier, is the notion that socioemotional development should rely on naturalistic observation while cognitive processes are best understood through careful manipulation in the laboratory. This methodological distinction also reflects a second historical force—namely, the assumption that cognitive and emotional processes are qualitatively different, playing out across different realms of complexity and control and reliant on different underlying neural substrates. From this perspective, emotions are visceral and somewhat primitive states that emerge early in development and are controlled only loosely. Cognitive processes, in contrast, emerge later in development, are controlled and deliberate, and work externally to impose order on emotions run amok.

However, this view underestimates both the emergence of cognitive competencies in infants and the degree of integration between cognition and emotion across development. Recent work on affect-biased attention suggests that core cognitive mechanisms may play a core role in socioemotional development (Pérez-Edgar, Taber-Thomas, Auday, & Morales, 2014). Affect-biased attention, as used by Todd, Cunningham, Anderson, and Thompson (2012), refers to “attentional biases that cause preferential perception of [any] particular category of stimulus based on its relative affective salience” (p. 365). It is likely that affect-biased attention influences cognitive and emotional development from infancy (Morales, Fu, & Pérez-Edgar, 2016). For example, preferential attention allocation toward emotionally salient objects emerges early in development, likely due to specific perceptual markers (LoBue, Rakison, & DeLoache, 2010). In the competition for limited attentional resources, infants prioritize objects that decrease danger and increase reward (Peltola, Leppänen, Palokangas, & Hietanen, 2008).

No other object is as closely tied to survival, punishment, and reward as the human face (Hoehl & Striano, 2010). Due to the coupling of perceptual cues, rewarding daily events (e.g., feeding), and long hours of exposure, infants quickly begin to show preferential looking to human faces (Leppänen & Nelson, 2009). This preference is magnified when the face also conveys an emotional threat signal. Thus, affect-biased attention is early appearing, likely rooted in evolutionary concerns, and has the potential to influence broad patterns of socioemotional behavior throughout life. Affect-biased attention, particularly if stable and entrenched, also can act as a developmental tether that helps sustain early socioemotional and behavioral profiles over time, even in the face of internal and external forces that typically act to shape early tendencies (Pérez-Edgar, Taber-Thomas, et al., 2014). Testing this argument opens another door to the use of experimental methods within developmental affective science.

BRIDGING TWO RESEARCH TRADITIONS

Experimental Work in Emotion Development

Although researchers enter into heated debates over the nature of emotion, characterizing them as discrete entities (Izard, 1993) or varying across spectrums (Barrett, 1998), there is general agreement that emotions are multifaceted, expressed at multiple levels of functioning, and subserved by processes that emerge and recede over the course of time and across contexts. The thorny question then becomes how to best (try to) tame each of these components, "slowing" them down just enough so that we can capture them briefly and track their paths. In this sense, the emotion researcher is the kindred spirit of the particle physicist.

Morris and colleagues (2006) argued that developmental psychology is somewhat unique relative to other subspecialties in its strong emphasis on context. Behavior, thought, and change in behavior and thought are believed to be highly influenced by, and perhaps limited to, specific contexts (Anderson & Bushman, 1997). Given this point of view, experimental methods, particularly if in the laboratory, are thought to be divorced from context. The laboratory setting is thought to sacrifice the probable ("does") in favor of the potential ("'can'"). The overarching argument of the chapter has been that experimental methods are not at odds with descriptive/correlational work. Rather, these two streams of science are complementary and, indeed, depend on each other for advancement.

Specific strengths to the experimental approach complement the strengths of nonexperimental methods. In experiments, (1) we manipulate the independent variable, (2) participants are sorted via random assignment, and (3) we have control over the operation of the variables and the general setting. These three traits, as a set, allow researchers to focus specifically on questions of interest while controlling, or pushing to the background, factors known (and unknown) that also may be at play in our specific dependent variable. This experimental meta-method provides the traditional foundation for being able to infer the presence of causal relations between variables.

A focus on manipulation naturally constrains the level of analysis (Loeber & Farrington, 1994). Researchers can quickly, and rightly, point to pivotal constructs at the heart of emotion development that cannot be manipulated in a "true" experimental fashion. These constructs include theoretical titans, such as temperament, socioeconomic status, ethnicity, and gender. Foundational work has shown how each of these factors covary with behavior, cognition, and adaptive outcome across development (M. Lewis, 2010). In addition, emotions are generated by complex social and contextual processes that are not readily replicable in a laboratory setting. However, this is not to say that nonrandomizable traits cannot be examined productively through experimental methods. Rather, we are emphasizing that we can use identified traits to see how individuals respond to variations in controlled stimuli and situations.

For example, hormonal systems are central to the individual's ability to respond to environmental challenges quickly and flexibly. Marceau and colleagues (2014) examined within-person coupling across cortisol, dehydroepiandrosterone, and testosterone across three conditions: parent–adolescent conflict discussion (anger induction), social performance (anxiety induction), and venipuncture (pain and fear induction). They found that, unlike in adults, adolescents show positive coupling across all three stressors. Layering on individual difference factors, Han, Miller, Cole, Zahn-Waxler, and Hastings (2015) found that adolescents with more externalizing problems had greater positive coupling between cortisol and testosterone in the context of the conflict discussion. Manipulating context to (somewhat specifically) elicit anger, therefore, allowed for the identification of relations between trait-level characteristics and hormonal systems that could not be manipulated directly themselves. Yet lacking random assignment, this could not be considered a true experiment.

Another factor that may disadvantage the experimental approach is our core belief that development is reflected in change over time, often associated with age (Overton, 2006). Traditionally, the argument has been that one cannot capture developmental change, *true* change, in the experimental laboratory. Capturing change opens the window to allow researchers to look for, or unearth, the mechanisms that support developmental trajectories. However, age, in and of itself, is not a developmental mechanism. It is a convenient time marker. Thus, we need clever and systematic studies that observe processes that covary with constructs of interest, coupled with direct manipulation whenever possible. Carefully designed and focused experimental studies can verify the nature of the relations that are identified in descriptive cross-sectional and longitudinal work.

For example, with age there are marked changes in the expressive function of an affective signal. Babies can cry for multiple reasons. They are hungry, tired, ill, angry, or simply bored. Cries, over time, take on greater specificity and are tailored more narrowly to specific triggers. With time, the crying may cease altogether, replaced by distinct vocalizations or regulated into a fully internalized form. It is unlikely that the variation in the presence of a putative cry trigger and subsequent response needed for systematic study would emerge spontaneously in a natural setting. Experimental studies have worked to capture this variation by building on reliable laboratory-based cognitive tasks and layering on an affective component by varying either the stimulus or the testing context. One example of such an approach is the Laboratory Assessment Battery of Temperament, which has a set sequence of interactions and objects designed to elicit a range of emotions in toddlers and preschool-age children, including anger, frustration, sadness, and joy (Buss & Goldsmith, 2000).

For older children, we also can manipulate standardized cognitive tasks in order to modulate the emotional content, or context, of task performance (Prencipe et al., 2011; Zelazo, Qu, & Müller, 2005). Traditional task variants are designated as "cool" while affectively charged variants are "hot." Performance in the cool and hot conditions is then compared to isolate the impact of an emotional component on the cognitive, behavioral, or physiological measure of interest.

For example, Lewis and colleagues (M. D. Lewis, Hitchcock, & Sullivan, 2004; M. D. Lewis, Lamm, Segalowitz, Stieben, & Zelazo, 2006; M. D. Lewis & Stieben, 2004) have carried out a series of studies using variants of the standard go/no-go task. In this task, children are instructed to make a response when they view a stimulus (e.g., an X) and refrain from responding when presented with another stimulus (e.g., an O). By modulating the ratio of go and no-go trials, researchers can shift accuracy rates and reaction times. Performance on the standard task is thought to reflect development in frontostriatal networks (Durston et al., 2002). In the affective version of the task, Lewis found that negative mood induction increased electrophysiological responses to the task, relative to the cool baseline condition (M. D. Lewis & Stieben, 2004).

The study of emotional development is complicated further by the fact that our construct of interest, emotion, is coupled very quickly to a process, emotion regulation, designed to push and pull the initial construct. (See Chapter 15 in this volume.) Thus, the psychologist must be nimble in the attempt to measure a construct even as the object of study is employing *that very construct* to modify its behavioral manifestation. This is a thorny issue for all developmental psychologists, but we suggest that experimental methods may help us puzzle it through. Standardized laboratory tasks can help track if the responses triggered by the same stimulus/condition/manipulation change across development.

For example, a number of empirical tasks have been designed to assess the interplay between emotion and effortful control. These include the Stroop color-word task (Stroop, 1935) and its emotional variants (Pérez-Edgar & Fox, 2003), the Stroop-analog Day-Night task (Gerstadt, Hong, & Diamond, 1994) and its emotional Happy-Sad variant (Lagattuta, Sayfan, & Monsour, 2011), the go/no-go task (Casey et al., 1997), the spatial conflict task (Gerardi-Caulton, 2000), and the flanker task (Eriksen, 1995). Other than the original Stroop task, none of these tasks requires reading competency. All of the tasks also can be designed for use with adults and are amenable for use with psychophysiological and imaging techniques (N. A. Fox et al., 2006). Each task has been modified to meet the skill and interest level of children, from toddlerhood through adolescence (Pérez-Edgar & Bar-Haim, 2010). Since children generally become progressively better at masking their affective or cognitive responses to our laboratory tasks, in vivo methods are particularly useful in revealing underlying neurobiological patterns of reactivity and regulation (Luna & Sweeney, 2004).

Finally, we suggest that experimental methods may be particularly beneficial in charting emotion development from its nascent form to its adult manifestation. Cognitive development often explicitly looks to note when and how children come to acquire a specific skill or come to match the final adult form. This focus on timing and mechanism may be due to the fact that researchers regularly deal with constructs that can be placed on concrete and readily agreed-on metrics. Thus, there are a multitude of studies tracking the developmental pathways of measures, such as vocabulary size, numerosity, and spatial reasoning.

The same perspective can be harder to impose on socioemotional measures. When simply focusing on a construct in isolation, it can be difficult to state whether a child is "better" or "worse" in expressing anger or happiness. This relative argument does not make a great deal of sense. It may be better to examine when, how, or if a child can engage and manage emotion in order to reliably and effectively attain a specific goal. Thus, the comparative metric is not built into the emotion per se but into the functional impact of the emotion on broader patterns of behavior. In the same vein, emotion regulation, when effective, increases the degree to which an emotion facilitates attaining a goal. The mark of regulation or dysregulation may be specific to the goal at hand as well as the context in which the child is embedded (Hastings, Kahle, et al., 2014). Then we can step back and see if the underlying mechanism for this affective pattern, and the context in which is evoked, is the same. Emotions often are "felt" below the surface, but not overtly expressed, perhaps, ironically, due to the development of self-regulation. Neural and electrophysiological mechanisms can play an important role in getting "under the skin."

Thus, the use of multiple levels of analysis is crucial. However, experimental work has not always embraced this challenge. Morris et al. (2006) criticized experimental designs in that "these types of studies rarely use a multimethod approach, instead relying primarily on the experimental tasks to assess a specified cognitive ability" (p. 379). This is not an unfair critique. However, the fault lies not in the method but in us, the researchers. Luckily, a focus on socioemotional functioning, especially in an era with more widespread access to bio-based measures (Dennis et al., 2012; Hastings, Kahle, et al., 2014), has pushed the field to embrace multiple methods, even at the cost of "messier" data than one would find with the traditional, tightly controlled, one independent variable: one dependent variable ideal.

Also creating noise and 'messiness' is the fact that child-centered nonrandomizable traits can, and often do, impact the data. Indeed, often there will be moments when individual differences overwhelm central tendencies (Hastings, Kahle, et al., 2014). Thus, we argue that both natural observation and experimental studies can benefit by embracing the specific traits and proclivities that children carry within themselves through their environments and into the laboratory.

Individual Differences in Emotion Development

If anything can unite the methodological and theoretical traditions of descriptive and experimental research discussed in this current chapter, it is the fact that neither camp is particularly excited by the presence of individual variation. For the traditional experimentalist, individual differences are an annoyance—an "error variance" that is to be eliminated through strict control at each level of the laboratory protocol. Although there is a role for equifinality and multifinality in our theoretical language, for the developmental psychologist, they create another mechanism and factor that needs to be chased down when evident in the data. Noting factors that impact trajectories is no small feat when dealing with either long-term careful observation or carefully controlled experimental studies manipulating a curated set of variables. There are inherent tensions between outlining nomothetic laws that focus on universal sequences and their contexts and identifying idiographic patterns that are unique to individuals (Scarr, 1992; Scarr & McCartney, 1983). Although both methodological camps are focused on the environment, either as a variable to control or as a factor to describe carefully, there is often the implicit assumption that the shape and meaning of any one environment can be presumed to be static within and across participants.

However, the environment does not have the same meaning for all individuals. Scarr (1992) argued that a child constructs a unique reality for him- or herself. Thus, individual differences are to be expected in any study of complex developmental functions. Within the temperament literature, one can see clear differences in how children react to ostensibly identical social contexts. Some children rush to embrace the novelty of the social world, while others pull back from ambiguous and unexpected threats. These variations appear early and shape the child's "experienced environment." In this way, fairly subtle individual differences can impact socioemotional functioning from infancy by creating cascading and self-reinforcing biases in social cognition and behavior. The current discussion has returned repeatedly to the importance of context for both emotion and emotional development. The focus on context is in line with the arguments that (1) emotions have broad developmental functions and (2) the success of any affective strategy is tied to the specific constraints and expectations of the environment. Recognizing that a given context—even an experimentally manipulated one—is not experienced in the same way by all people adds yet another level of complexity but also affords novel opportunities for insight. Petrill and Brody (2002) argued that experimental psychology creates variability by manipulating the environment, while researchers interested in individual differences study variations that occur naturally. In particular, the latter is focused on using statistical methods to "partition sources of variance in a measure." Bringing together both approaches may be particularly helpful when examining issues of socioemotional development.

For both cognitive and socioemotional studies, the most common and obvious individual difference factor seen in the literature is sex or gender. There is a long literature suggesting that boys and girls differ in the rate, intensity, and context under which they display positive and negative emotions (Brody, 1985; Kring & Gordon, 1998). However, much of this literature relies on the questionnaire report, from either child or an outside observer (Else-Quest, Hyde, Goldsmith, & Van Hulle, 2006). Although these data are important for capturing subjective experience and broad patterns of response, they are hard-pressed to capture affect in the moment. In addition, observer report may be influenced by cultural expectations shaping acceptable presentation patterns in boys and girls (Chaplin, Cole, & Zahn-Waxler, 2005).

To examine the influence of methodology, Chaplin and Aldao (2013) examined patterns of emotion generated by direct observations of children. They found that gender-linked differences in affect and internalizing/externalizing difficulties emerged with age. There were no observed differences in infancy, with the first deviations evident in toddlerhood before widening in childhood.

In addition, the social context played a role, with sex-linked variation in emotional expression when alone versus when with parents and peers. This finding may reflect the internalization of display rules over time as a function of parental and cultural socialization (Klimes-Dougan et al., 2007; Zahn-Waxler et al., 2008). Alternately, it may be that biologically based differences in emotion expression may emerge over time due to the developmental trajectory of underlying mechanisms, such as the interplay between subcortical and prefrontal hyperreactivity (Hare et al., 2008). In distinguishing these possible mechanisms, we also can look to see if girls are better able to modulate their emotions or if they are more socially motivated to do so. Of course, it is important to point out that it would be difficult to gather the data needed to do so outside of a laboratory setting.

With respect to gender and other factors of interest, we are lucky, as a science, that individual differences are likely to be lawful rather than a random assortment of disconnected and independent traits. To capture these individual differences, we often have to shift from a focus on variance across conditions to variance among individuals. This change in focus is then coupled by a shift from a variable-centered analytic approach to a person-centered approach. Thus, the focus is not on how a variable behaves across context or time but on how individuals, or groups of individuals, navigate these environments. An example of this work can be found in the pediatric clinical literature.

Careful observational studies have noted that a subset of children show elevated levels of mood dysregulation and irritability that are extreme, long lasting, and outside developmentally appropriate norms (Leibenluft, 2011). Mood dysregulation also shows a phenomenological and diagnostic link to bipolar disorder (Leibenluft & Rich, 2008). However, there is an ongoing debate as to whether the observed behavior is a developmental precursor to the adult form of bipolar disorder (a prodrome) or a disorder onto itself (e.g., disruptive mood dysregulation disorder from the fifth edition of the *Diagnostic and Statistical Manual of Mental Disorders*). To help disentangle these associated constructs, Rich and colleagues (2005, 2007) completed a set of experimental studies using the Affective Posner task.

In the Posner cued-attention task (Posner & Cohen, 1984), participants are presented with a single cue on one side of the visual field (left or right). The cue is meant to pull attention to its location automatically. Following cue removal, a target probe appears either in the same location as the cue (valid trials) or on the opposite side of the cue (invalid trials). Participants are asked to press a button to indicate probe location. The validity score is the reaction time on invalid trials minus valid trials. This difference (the validity effect) is believed to represent the effort required to disengage from the cue location in order to shift to the probe location. In the affective Posner task, the cues have an emotional valence based on punishment and reward cues, emotional words, or emotional facial expressions (Derryberry & Reed, 2002; E. Fox, Russo, Bowles, & Dutton, 2001; Pérez-Edgar, Fox, Cohn, & Kovacs, 2006).

In Rich's studies (Rich et al., 2005, 2007), the trial blocks all involved the same stimuli and task demands but differed in the contingencies presented with variations in performance. Block 1 served as the baseline, with children informed of the accuracy of their responses ("Good job!" or "Incorrect!"). In block 2, children won or lost 10 cents on the basis of their performance and were informed of the accuracy of their response and whether they had won or lost money. During block 3, correct responses resulted in accurate feedback and reward on 44% of trials, but on 56% of trials, rigged feedback informing participants that they had been too slow was provided randomly regardless of performance, and participants steadily lost money.

Using the experimental manipulation, with an eye to individual differences, the researchers found no difference at baseline between typically developing children, children with the narrowly defined bipolar phenotype, and children with severe mood dysregulation. However, as task demands increased, the typically developing children showed different response patterns relative to both risk groups. Using behavioral, neurophysiological (event-related potentials, and functional magnetic resonance imaging measures (Deveney et al., 2013), this line of research has distinguished differential patterns of arousal with the titration of negative feedback and frustration.

As we have noted, large-scale longitudinal studies have shown a strong link between early behavioral inhibition and later social anxiety (Clauss & Blackford, 2012). Smaller-scale laboratory studies have been used in a complementary process to probe the mechanisms that potentially may underscore developmental patterns observed over time. For example, Pérez-Edgar and Fox (2005) had behaviorally inhibited children complete an affective Posner task similar to the one used with children with mood dysregulation (Rich et al., 2007). They found that compared to the traditional (affect-neutral) Posner task, performance in the affective Posner task was marked by dramatic decreases in reaction times, an increase in errors, an increased validity effect, and increased electrocortical activity. Temperamentally shy children in the study differed from their nonshy peers within the affective Posner task only. In addition, shy children preferentially attended to the negative cues presented during the task. Here the use of a controlled task setting provided the opportunity to compare performance across shared circumstances and contexts, and levels of analyses, that cannot be readily observed in more uncontrolled, natural settings.

CONCLUSION AND FUTURE DIRECTIONS

The current discussion has focused on historical tensions that have worked to shape the interplay between broad areas of research within developmental psychology. As Overton (2006) noted, an adherence to specific theoretical worldviews can result in downstream clashes regarding the methods used to study questions of interest. In many ways, methodology has played an unacknowledged role in aiding, or blocking, our willingness to cross empirical boundaries.

Some of these barriers initially appear trivial. For example, Smith and Harris (2006) noted that experimental studies within social psychology are focused on controlling, shifting, and tracking the independent variable. The ability to systematically target the independent variable is a core measure of scientific rigor. In contrast, developmental psychologists, particularly within naturalistic studies, often are devoted to capturing the dependent variable and then characterizing the factors that surround it. These differences make it a bit harder for researchers to build on each other's work, which adds to bifurcations in literatures and even less likelihood of cross-fertilization.

We continue to see these divisions today. For example, within developmental affective science, there is now a subdivision for developmental affective neuroscience. Within that world, there are questions regarding empirical links and boundaries to developmental *social* neuroscience and developmental *cognitive* neuroscience. However, even with these tendencies to define and divide, there exist current examples of (slow-moving) lines of research that draw on multiple traditions of naturalistic observation and experimental manipulations and incorporate both universal patterns and individual differences.

For example, our discussion of affect-biased attention is part of a larger literature suggesting that attention to threat may play a causal role in the emergence of clinical anxiety problems (Morales et al., 2016; Todd et al., 2012). From the observational side, there is correlational evidence that individuals high in anxiety show attention biases to threat (Wilson & MacLeod, 2003). Much of this work is based on biases captured via computer tasks, most often the dot-probe task (Roy, Dennis, & Warner, 2015; Todd et al., 2012). In this task, participants see a pair of stimuli simultaneously, most often for 500 ms; one stimulus is emotionally salient (e.g., threatening), and the other is neutral (e.g., nonthreatening). A probe replaces one of the two stimuli. The individual is required to respond as accurately and as quickly as possible to the probe. An attentional bias toward emotional stimuli is inferred when participants preferentially attend to emotional cues, resulting in decreased reaction times to probes replacing the emotional stimuli compared to the neutral stimuli. For instance, in the original dot-probe task, MacLeod and Mathews (MacLeod, Mathews, & Tata, 1986; Mathews & MacLeod, 1985) found that anxious individuals were faster to respond to probes following threatening words. In contrast, control participants were faster to respond to probes following neutral words, exhibiting a bias away from threat (MacLeod et al., 1986).

This pattern is evident from young childhood through adulthood, reinforcing the argument for an etiological role in anxiety (Shechner et al., 2012). Children diagnosed with an anxiety disorder also were shown to display an attentional bias toward threat compared to nonanxious controls (Roy et al., 2008). In addition, temperamentally at-risk, but healthy, adolescents displayed the same bias pattern (Pérez-Edgar, Bar-Haim, McDermott, et al., 2010). Finally, the magnitude of attention bias has been found to predict levels of anxiety symptoms (Waters, Mogg, Bradley, & Pine, 2008), suggesting a relation across the anxiety dimension and in childhood as well as adulthood. Interestingly, even when group-level main effects of bias are not evident, bias pattern interacts with behavioral inhibition status to predict social anxiety and social withdrawal (C. Cole, Zapp, Fettig, & Pérez-Edgar, 2016; Morales, Pérez-Edgar, & Buss, 2015; Pérez-Edgar et al., 2010, 2011; White et al., 2017).

However, as we have already noted, strong patterns of covariation are necessary, but not sufficient, to infer causality. Thus, researchers have worked to complement these initial observations with mechanistic studies that manipulate attention to threat and examine subsequent changes in anxiety (Roy et al., 2015). The most persuasive evidence for this comes from experimental investigations, such as attention bias modification (ABM) studies (Bar-Haim, 2010; Eldar et al., 2008; Hakamata et al., 2010).

In ABM studies, experimental manipulations of the attentional bias (i.e., reducing or augmenting the bias) in children and adults are examined to see if they lead to the expected changes in anxious thought and behavior (i.e., reduction or augmentation of anxiety, respectively). Manipulating the contingency of threat cues is thought to implicitly train the individual to attend away from threat cues or toward safety cues. For example, Amir and colleagues (Amir, Beard, Burns, & Bomyea, 2009; Amir, Beard, Taylor, et al., 2009) randomized individuals diagnosed with generalized anxiety disorder into either ABM or a control condition. After eight sessions, the ABM group showed significant reductions in attentional bias toward threat and anxiety, as evaluated by self-reports and clinical interview (Amir et al., 2009).

The two sets of studies outlined, correlational and experimental, help the field create a more complex understanding of the potential relation between attention to threat and anxiety, providing evidence for multiple forms of validity. This approach also can point to concerns that would not otherwise be evident. That is, although some meta-analyses of ABM studies provided support for the causal role of attention

(Bar-Haim, 2010; Hakamata et al., 2010), others questioned the reliability and breadth of the relation by finding important moderators (e.g., ABM delivered in the clinic versus at home; Cristea, Kok, & Cuijpers, 2015; Heeren, Mogoaşe, Philippot, & McNally, 2015; Linetzky, Pergamin-Hight, Pine, & Bar-Haim, 2015; Mogoaşe, David, & Koster, 2014). Questions are also evident from more correlational data. In the only longitudinal study to our knowledge, attention bias to threat at age 5 failed to predict later anxiety at age 7 (White et al., 2017). Rather, concurrent affect-biased attention toward both threat and reward moderated the relation between early fearful temperament and anxiety, such that early fearful temperament predicted anxiety only for children who displayed a bias toward threat or those who did not display a bias toward reward.

Luckily, we can bring together experimental and individual difference (person-centered) approaches to probe these emerging questions further. For example, Morales, Taber-Thomas, and Pérez-Edgar (2017) had children complete both an affective Posner variant and a dot-probe task. They found no significant correlations in attention to threat across tasks for the full sample. However, behaviorally inhibited children did show a cross-task correlation in attention to threat. Morales et al. then classified the children as showing, or not showing, a stable pattern across tasks (either threat vigilance or threat avoidance). As expected, the stable group was dominated by children high in behavioral inhibition. Importantly, it was within the stable groups that children showed elevated levels of anxiety. Thus, Morales et al. brought together natural individual variation, experimental manipulation, and variable- and person-centered approaches to note subtle patterns in questions of interest and to address open issues in the larger literature. This relatively small, cross-sectional study can serve as the foundation for larger, long-term systematic studies.

The fits and starts of this literature, with novel findings that later seem weaker (pessimistic view) or more nuanced (optimistic view) than initially thought, reflect broader trends. That is, these data are situated within a broader call in the field for a more robust and reproducible science (Lindsay, 2015; Open Science Collaboration, 2015). We would argue that the issues raised in this chapter speak to these concerns. This review cannot touch on all important issues, such as publication trends for nonsignificant findings and questionable statistical methods in search of significance. However, we suggest that the use of multiple methods in and out of the laboratory can allow us to probe a core shared question from multiple points of view. Including an individual differences approach then allows us to see when and how and for whom our "settled" answer actually applies. Just as individual puzzle pieces may look quite different, it is unrealistic to believe that every probe will produce the same answer. However, when brought together, the puzzle pieces should form a coherent, and three-dimensional, portrait of both emotions (our constructs of interest) and the child in which they reside.

Our field's current difficulty in reproducibility may be in small part a reflection of our overreliance on "average" and "normative." From this point of view, experimental manipulations always should produce the same outcome, across individuals and across time. Individual differences are thought to create bothersome noise that should be titrated out through clever experimental design. However, when replication fails, the specter of the "hidden" moderator is raised. We suggest that this approach may be incorrect both at outset and in the post mortem. Our review suggests that the strength of our science, regardless of the current label applied, lies in its ability to cross theoretical and empirical divides to incorporate multiple methods and the worldviews that fuel them. In this way we can better capture our elusive target—the ever-evolving emotional child moving through space and time, working to shape the world just as the world changes the child.

REFERENCES

Amaral, D., Price, J., Pitkanen, A., & Carmichael, S. (1992). Anatomical organization of the primate amygdaloid complex. In *The amygdala: neurobiological aspects of emotion, memory, and mental dysfunction* (pp. 1–66). New York, NY: Wiley.

Amir, N., Beard, C., Burns, M., & Bomyea, J. (2009). Attention modification program in individuals with generalized anxiety disorder. *Journal of Abnormal Psychology*, *109*, 28–33. doi:10.137/a0012589

Amir, N., Beard, C., Taylor, C. T. K., H., Elias, J., Bums, M., & Chen, X. (2009). Attention training in individuals with generalized social phobia: a randomized controlled trial. *Journal of Consulting and Clinical Psychology*, *77*, 961–973. doi:10.1037/a0016685

Anderson, C. A., & Bushman, B. J. (1997). External validity of "trivial" experiments: the case of laboratory aggression. *Review of General Psychology*, *1*, 19.

Andison, F. S. (1977). TV violence and viewer aggression: a cumulation of study results 1956–1976. *Public Opinion Quarterly*, *41*, 314–331.

Aslin, R. N., & Fiser, J. (2005). Methodological challenges for understanding cognitive development in infants. *Trends in Cognitive Sciences*, *9*, 92–98.

Bar-Haim, Y. (2010). Research review: attention bias modification (ABM): a novel treatment for anxiety disorders. *Journal of Child Psychology and Psychiatry*, *51*(8), 859–870.

Bar-Haim, Y., Fox, N. A., Benson, B., Guyer, A. E., Williams, A., Nelson, E. E., … Ernst, M. (2009). Neural correlates of reward processing in adolescents with a history inhibited temperament. *Psychological Science*, *20*, 1009–1018. doi:10.1111/j.1467–9280.2009.02401.x

Bar-Haim, Y., Fox, N. A., VanMeenen, K. M., & Marshall, P. J. (2004). Children's narratives and patterns of cardiac reactivity. *Developmental Psychobiology*, *44*, 238–249. doi:10.1002/dev.20006

Barrett, L. F. (1998). Discrete emotions or dimensions? The role of valence focus and arousal focus. *Cognition & Emotion*, *12*, 579–599.

Bell, M. A., & Cuevas, K. (2012). Using EEG to study cognitive development: issues and practices. *Journal of Cognition and Development*, *13*(3), 281–294.

Bell, M. A., & Wolfe, C. D. (2007). The cognitive neuroscience of early socioemotional development. In C. A. Brownell & C. B. Kopp (Eds.), *Socioemotional development in the toddler years: transitions and transformations* (pp. 345–369). New York, NY: Guilford Press.

Bjorklund, D. F. (1997). In search of a metatheory for cognitive development (or, Piaget is dead and I don't feel so good myself). *Child Development*, *68*, 144–148.

Blackford, J. U., & Pine, D. S. (2012). Neural substrates of childhood anxiety disorders: a review of neuroimaging findings. *Child and Adolescent Psychiatric Clinics of North America*, *21*, 501–525. doi:10.1016/j.chc.2012.05.002

Boring, E. G. (1929). *History of experimental psychology*. N.p.: Genesis Publishing.

Brody, L. R. (1985). Gender differences in emotional development: a review of theories and research. *Journal of Personality*, *53*, 102–149.

Buss, K. A., & Goldsmith, H. H. (2000). *Manual and normative data for the Laboratory Temperament Assessment Battery—Toddler Version*. Department of Psychology Technical Report, University of Wisconsin.

Calkins, S. D., Fox, N. A., & Marshall, T. R. (1996). Behavioral and physiological antecedents of inhibited and uninhibited behavior. *Child Development*, *67*, 523–540.

Casey, B. J., Trainor, R. J., Orendi, J. L., Schubert, A. B., Nystrom, L. E., Giedd, J. N., … Rapoport, J. L. (1997). A developmental functional MRI study of prefrontal activation during performance of a Go-No-Go task. *Journal of Cognitive Neuroscience*, *9*, 835–847. doi:10.1162/jocn.1997.9.6.835

Cattell, J. M. (1898). The biological problems of today: psychology. *Science*, *7*, 152–154.

Chantala, K., & Tabor, J. (2010). *National Longitudinal Study of Adolescent Health: Strategies to perform a design-based analysis using the Add Health data*. Retrieved from University of North Carolina at Chapel Hill. http://citeseerx.ist.psu.edu

Chaplin, T. M., & Aldao, A. (2013). Gender differences in emotion expression in children: a meta-analytic review. *Psychological Bulletin*, *139*, 735–765.

Chaplin, T. M., Cole, P. M., & Zahn-Waxler, C. (2005). Parental socialization of emotion expression: gender differences and relations to child adjustment. *Emotion*, *5*, 80.

Chronis-Tuscano, A., Degnan, K. A., Pine, D. S., Pérez-Edgar, K., Henderson, H. A., Diaz, Y., … Fox, N. A. (2009). Stable behavioral inhibition during infancy and early childhood predicts the development of anxiety disorders in adolescence. *Journal of the American Academy of Child & Adolescent Psychiatry*, *48*, 928–935. doi:10.1097/CHI.ob013e3181ae09df

Clauss, J. A., & Blackford, J. U. (2012). Behavioral inhibition and risk for developing social anxiety disorder: a meta-analytic study. *Journal of the American Academy of Child and Adolescent Psychiatry*, *51*, 1066–1075. doi:10.106/j.jaac

Cohen, G. L., & Prinstein, M. J. (2006). Peer contagion of aggression and health risk behavior among adolescent males: an experimental investigation of effects on public conduct and private attitudes. *Child Development*, *77*, 967–983.

Coie, J. D., & Dodge, K. A. (1998). Aggression and antisocial behavior. In W. Damon & N. Eisenberg (Eds.), *Handbook of child psychology* (5th ed.), *Social, emotional, and personality development* (Vol. 3, pp. 779–862). New York, NY: Wiley.

Cole, C., Zapp, D. J., Fettig, N. B., & Pérez-Edgar, K. (2016). Impact of attention biases to threat and effortful control on individual variations in negative affect and social withdrawal in very young children. *Journal of Experimental Child Psychology*, *141*, 210–221.

Cole, P. M. (1986). Children's spontaneous control of facial expression. *Child Development*, *57*, 1309–1321.

Cole, P. M., Martin, S. E., & Dennis, T. A. (2004). Emotion regulation as a scientific construct: Methodological challenges and directions for child development research. *Child Development*, *75*, 317–333.

Coplan, R. J., Rubin, K. H., Fox, N. A., Calkins, S. D., & Stewart, S. L. (1994). Being alone, playing alone, and acting alone: distinguishing among reticence and passive and active solitude in young children. *Child Development*, *65*, 129–137. doi:10.1111/j.1467-8624.1994.tb00739.x

Crick, N. R., Nelson, D. A., Morales, J. R., Cullerton-Sen, C., Casas, J. F., & Hickman, S. E. (2001). Relational victimization in childhood and adolescence. In J. Juvonen & S. Graham (Eds.), *Peer harassment in school: the plight of the vulnerable and victimized* (pp. 196–214). New York, NY: Guilford Press.

Cristea, I. A., Kok, R. N., & Cuijpers, P. (2015). Efficacy of cognitive bias modification interventions in anxiety and depression: meta-analysis. *British Journal of Psychiatry 206*(1), 7−16.

Cronbach, L. J. (1957). The two disciplines of scientific psychology. *American Psychologist*, *12*, 671.

Cuevas, K., & Bell, M. A. (2011). EEG and ECG from 5 to 10 months of age: developmental changes in baseline activation and cognitive processing during a working memory task. *International Journal of Psychophysiology*, *80*(2), 119–128.

Damon, W., Kuhn, D., & Siegler, R. S. (Eds.). (1998). *Handbook of child psychology* (5th ed., Vol. 2), *Cognition, perception and language*. Chichester, UK: Wiley.

Davis, M., Walker, D. L., & Lee, Y. (1997). Amygdala and bed nucleus of the stria terminalis: differential roles in fear and anxiety measured with the acoustic startle reflex. *Philosophical*

Transactions of the Royal Society of London Series B, Biological Sciences, *352*, 1675–1687.

De Los Reyes, A. (2011). More than measurement error: discovering meaning behind informant discrepancies in clinical assessments of children and adolescents. *Journal of Clinical Child and Adolescent Psychology*, *40*, 1–9.

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

Dennis, T. A. (2006). Emotional self-regulation in preschoolers: the interplay of child approach reactivity, parenting, and control capacities. *Developmental Psychology*, *42*, 84.

Dennis, T. A., Buss, K. A., & Hastings, P. D. (2012). Introduction to the monograph: physiological measures of emotion from a developmental perspective: state of the science. *Monographs of the Society for Research in Child Development*, *77*, 1–5.

Derryberry, D., & Reed, M. A. (2002). Anxiety-related attentional biases and their regulation by attentional control. *Journal of Abnormal Psychology*, *111*, 225–236.

Deveney, C. M., Connolly, M. E., Haring, C. T., Bones, B. L., Reynolds, R. C., Kim, P., … Leibenluft, E. (2013). Neural mechanisms of frustration in chronically irritable children. *JAMA Psychiatry*, *170*, 1186–1194.

Dodge, K. A. (1991). Emotion and social information processing. In J. Garber & K. Dodge (Eds.), *The development of emotion regulation and dysregulation* (pp. 159–181). New York, NY: Cambridge University Press.

Durston, S., Thomas, K. M., Yang, Y., Ulug, A. M., Zimmerman, R. D., & Casey, B. J. (2002). A neural basis for the development of inhibitory control. *Developmental Science*, *5*(4), F9–F16.

Eisenberg, N. (2000). Emotion, regulation, and moral development. *Annual Review of Psychology*, *51*, 665–697.

Eisenberg, N., Champion, C., & Ma, Y. (2004). Emotion-related regulation: an emerging construct. *Merrill-Palmer Quarterly*, *50*, 236–259. doi:10.1056/NEJMoa0908629

Eisenberg, N., & Spinrad, T. L. (2004). Emotion-related regulation: sharpening the definition. *Child Development*, *75*, 334–339. doi:10.1111/j.1467-8624.2004.00674.x

Ekman, P. (1999). Basic emotions. In T. Dalgleish & M. J. Power (Eds.). *Handbook of cognition and emotion* (pp. 45–60). Chichester, UK: Wiley.

Eldar, S., Ricon, T., & Bar-Haim, Y. (2008). Plasticity in attention: implications for stress response in children. *Behaviour Research and Therapy*, *46*(4), 450–461.

Else-Quest, N. M., Hyde, J. S., Goldsmith, H. H., & Van Hulle, C. A. (2006). Gender differences in temperament: a meta-analysis. *Psychological Bulletin*, *132*(1), 33.

Eriksen, C. (1995). The flankers task and response competition: a useful tool for investigating a variety of cognitive problems. In C. Bundesen & H. Shibuya (Eds.), *Visual selective attention* (pp. 101–118). Hillsdale, NJ: Erlbaum.

Forbes, E. E., Fox, N. A., Cohn, J. F., Galles, S. F., & Kovacs, M. (2006). Children's affect regulation during a disappointment: psychophysiological responses and relation to parent history of depression. *Biological Psychology*, *71*(3), 264–277.

Foster, E. M. (2010). Causal inference and developmental psychology. *Developmental Psychology*, *46*, 1454.

Fox, E., Russo, R., Bowles, R., & Dutton, K. (2001). Do threatening stimuli draw or hold visual attention in subclinical anxiety? *Journal of Experimental Psychology: General*, *130*(4), 681–700.

Fox, N. A., Hane, A. A., & Pérez-Edgar, K. (2006). Psychophysiological methods for the study of developmental psychopathology. In D. Cicchetti & D. J. Cohen (Eds.), *Developmental psychopathology* (Vol. 2, pp. 381–426). Hoboken, NJ: Wiley.

Fox, N. A., & Helfinstein, S. M. (2013). The contribution of temperament to the study of social cognition: learning whether the glass is half empty or half full. In M. R. Banaji & S. Gelman (Eds.), *Navigating the social world: what infants, children, and other species can teach us*. (pp. 49–53). Oxford, UK: Oxford University Press.

Fox, N. A., Kirwan, M., & Reeb-Sutherland, B. (2012). Measuring the physiology of emotion and emotion regulation—timing is everything. *Monographs of the Society for Research in Child Development*, *77*, 98–108.

Fox, N. A., Rubin, K. H., Calkins, S. D., Marshall, T. R., Coplan, R. J., Porges, S. W., … Stewart, S. (1995). Frontal activation asymmetry and social competence at four years of age. *Child Development*, *66*, 1771–1784. doi:10.1111/j.1467-8624.1995.tb00964.x

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

Fry, D. P., & Gabriel, A. H. (1994). Preface: the cultural construction of gender and aggression. *Sex Roles*, *30*, 165–167.

Garcia Coll, C., Kagan, J., & Reznick, J. S. (1984). Behavioral inhibition in young children. *Child Development*, *55*, 1005–1019. doi:10.2307/1130152

Garrett-Peters, P. T., & Fox, N. A. (2007). Cross-cultural differences in children's emotional reactions to a disappointing situation. *International Journal of Behavioral Development*, *31*, 161–169.

Gee, D. G., Humphreys, K. L., Flannery, J., Goff, B., Telzer, E. H., Shapiro, M., … Tottenham, N. (2013). A developmental shift from positive to negative connectivity in human amygdala–prefrontal circuitry. *Journal of Neuroscience*, *33*, 4584–4593.

Gerardi-Caulton, G. (2000). Sensitivity to spatial conflict and the development of self-regulation in children 24–36 months of age. *Developmental Science*, *3*, 397–404. doi:10.1111/1467-7687.00134

Gerstadt, C. L., Hong, Y. H., & Diamond, A. (1994). The relationship between cognition and action: performance of children 3 ½–7 years old on a Stroop-like day-night test. *Cognition*, *53*, 129–153.

Giedd, J., Blumenthal, J., Jeffries, N., Castellanos, F., Liu, H., & Zijdenbos, A. (1999). Brain development during childhood and adolescence: a longitudinal MRI study. *Nature Neuroscience*, *2*, 861–863.

Grossmann, T. (2015). The development of social brain functions during infancy. *Psychological Bulletin*, *141*, 1266–1287.

Guyer, A. E., Benson, B., Choate, V. R., Bar-Haim, Y., Pérez-Edgar, K., Jarcho, J. M., … Nelson, E. E. (2014). Lasting associations between early-childhood temperament and late-adolescent reward-circuitry response to peer feedback. *Development and Psychopathology*, *26*, 229–243.

Guyer, A. E., Jarcho, J. M., Pérez-Edgar, K., Degnan, K. A., Pine, D. S., Fox, N. A., & Nelson, E. E. (2015). Temperament and parenting styles in early childhood differentially influence neural response to peer evaluation in adolescence. *Journal of Abnormal Child Psychology*, *43*, 863–874.

Guyer, A. E., Nelson, E. E., Pérez-Edgar, K., Hardin, M. G., Roberson-Nay, R., Monk, C. S., … Ernst, M. (2006). Striatal functional alteration in adolescents characterized by early childhood behavioral inhibition. *Journal of Neuroscience*, *26*(24), 6399–6405.

Hakamata, Y., Lissek, S., Bar-Haim, Y., Britton, J. C., Fox, N. A., Leibenluft, E., … Pine, D. S. (2010). Attention bias modification treatment: a meta-analysis toward the establishment of novel treatment for anxiety. *Biologival Psychiatry*, *68*(11), 982–990.

Han, G., Miller, J. G., Cole, P. M., Zahn-Waxler, C., & Hastings, P. D. (2015). Adolescents' internalizing and externalizing problems predict their affect-specific HPA and HPG axes reactivity. *Developmental Psychobiology*, *57*, 769–785.

Hane, A. A., Fox, N. A., Henderson, H. A., & Marshall, P. J. (2008). Behavioral reactivity and approach-withdrawal bias in infancy. *Developmental Psychology*, *44*, 1491–1496.

Hare, T. A., Tottenham, N., Galvan, A., Voss, H. U., Glover, G. H., & Casey, B. J. (2008). Biological substrates of emotional reactivity and regulation in adolescence during an emotional go-no go task. *Biological Psychiatry*, *63*, 927–934.

Harlow, H. F. (1958). The nature of love. *American Psychologist*,*13*, 573–685.

Harris, P. L. (1989). *Children and emotion: the development of psychological understanding*. Cambridge, MA: Basil Blackwell.

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

Hastings, P. D., Kahle, S. S., & Han, G. H. P. (2014). Developmental affective psychophysiology: using physiology to inform our understanding of emotional development. In K. Lagattuta (Ed.), *Children and emotion: new insights into developmental affective science* (Vol. 26, pp. 13–28). Basel, Switzerland: Karger.

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

Heeren, A., Mogoaşe, C., Philippot, P., & McNally, R. J. (2015). Attention bias modification for social anxiety: a systematic review and meta-analysis. *Clinical Psychology Review*, *40*, 76–90.

Helfinstein, S. M., Benson, B., Pérez-Edgar, K., Bar-Haim, Y., Detloff, A., Pine, D. S., … Ernst, M. (2011). Striatal responses to negative monetary outcomes differ between behaviorally inhibited and non-inhibited adolescents. *Neuropsychologia*, *49*, 479–485. doi:10.1016/j.neuro psychologia.2010.12.015

Hoehl, S., & Striano, T. (2010). The development of emotional face and eye gaze processing. *Developmental Science*, *13*(6), 813–825.

Hofer, C., Eisenberg, N., Spinrad, T. L., Morris, A. S., Gershoff, E., Valiente, C., … Eggum, N. D. (2013). Mother–adolescent conflict: stability, change, and relations with externalizing and internalizing behavior problems. *Social Development*, *22*, 259–279.

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

Jouriles, E. N., Murphy, C. M., & O'Leary, K. D. (1989). Effects of maternal mood on mother-son interaction patterns. *Journal of Abnormal Child Psychology*, *17*, 513–525.

Kagan, J. (1994). On the nature of emotion. *Monographs of the Society for Research in Child Development*, *59*(2–3), 7–24, 250–283.

Kagan, J. (2012). The biography of behavioral inhibition. In M. Zentner & R. L. Shiner (Eds.), *Handbook of temperament* (pp. 69–82). New York, NY: Guilford Press.

Kagan, J., Reznick, J. S., & Snidman, N. (1987). The physiology and psychology of behavioral inhibition in children. *Child Development*, *58*, 1459–1473. doi:10.2307/1130685

Kagan, J., Reznick, J. S., & Snidman, N. (1988). Biological bases of childhood shyness. *Science*, *240*, 167–171.

Kagan, J., Snidman, N., McManis, M., & Woodward, S. (2001). Temperamental contributions to the affect family of anxiety. *Psychiatric Clinics of North America*, *24*(4), 677–688. doi: 10.1016/S0193-953X(05)70257–4

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

Khoo, S. T., West, S. G., Wu, W., & Kwok, O. M. (2006). Longitudinal methods. In M. Eid & E. Diener (Eds.), *Handbook of multimethod measurement in psychology* (pp. 301–317). Washington, DC: American Psychological Association.

Kieras, J. E., Tobin, R. M., Graziano, W. G., & Rothbart, M. K. (2005). You can't always get what you want: effortful control and children's responses to undesirable gifts. *Psychological Science*, *16*, 391–396.

Klein, D. N., Dyson, M. W., Kujawa, A., & Kotov, R. (2012). Temperament and internalizing disorders. In M. Zentner & R. L. Shiner (Eds.), *Handbook of temperament* (pp. 541–561). New York, NY: Guilford Press.

Klimes-Dougan, B., Brand, A. E., Zahn-Waxler, C., Usher, B., Hastings, P. D., Kendziora, K., & Garside, R. B. (2007). Parental emotion socialization in adolescence: differences in sex, age and problem status. *Social Development*, *16*, 326–342.

Kring, A. M., & Gordon, A. H. (1998). Sex differences in emotion: expression, experience, and physiology. *Journal of Personality and Social Psychology*, *74*, 686.

Lagattuta, K. H., Sayfan, L., & Monsour, M. (2011). A new measure for assessing executive function across a wide age range: children and adults find happy-sad more difficult than day-night. *Developmental Science*, *14*, 481–489.

Lahat, A., Pérez-Edgar, K., Degnan, K. A., Guyer, A. E., Lejuez, C. W., Ernst, M., … Fox, N. A. (2012). Early childhood temperament predicts substance use in young adults. *Translational Psychiatry*, *2*, e157.

Larsen, R. J., & Prizmic-Larsen, Z. (2006). Measuring emotions: implications of a multimethod perspective. In M. Eid & E. Diener (Eds.), *Handbook of multimethod measurement in psychology* (pp. 337–351). Washington, DC: American Psychological Association.

Leibenluft, E. (2011). Severe mood dysregulation, irritability, and the diagnostic boundaries of bipolar disorder in youths. *American Journal of Psychiatry*, *168*, 129–142.

Leibenluft, E., & Rich, B. A. (2008). Pediatric bipolar disorder. *Annual Review of Clinical Psychology*, *4*, 163–187.

Leppänen, J. M., & Nelson, C. A. (2009). Tuning the developing brain to social signals of emotions. *Nature Reviews Neuroscience*, *10*(1), 37–47.

Lewin, K., Lippitt, R., & White, R. K. (1939). Patterns of aggressive behavior in experimentally created "social climates." *Journal of Social Psychology*, *10*, 269–299.

Lewis, M. (2010). The emergence of human emotions. In M. Lewis, J. M. Haviland-Jones, & L. F. Barrett (Eds.), *Handbook of emotions* (pp. 304–319). New York, NY: Guilford Press.

Lewis, M. D., Hitchcock, D. F. A., & Sullivan, M. W. (2004). Physiological and emotional reactivity to learning and frustration. *Infancy*, *6*, 121–143.

Lewis, M. D., Lamm, C., Segalowitz, S. J., Stieben, J., & Zelazo, P. D. (2006). Neurophysiological correlates of emotion regulation in children and adolescents. *Journal of Cognitive Neuroscience*, *18*, 430–443.

Lewis, M. D., & Stieben, J. (2004). Emotion regulation in the brain: conceptual issues and directions for developmental research. *Child Development*, *75*, 371–376.

Lindsay, D. S. (2015). Replication in psychological science. *Psychological Science*, *26*, 1827–1832.

Linetzky, M., Pergamin-Hight, L., Pine, D. S., & Bar-Haim, Y. (2015). Quantitative evaluation of the clinical efficacy of attention bias modification treatment for anxiety disorders. *Depression and Anxiety*, *32*(6), 383–391.

LoBue, V., & Pérez-Edgar, K. (2014). Sensitivity to social and non-social threats in temperamentally shy children at-risk for anxiety. *Developmental Science*, *17*, 239–247.

LoBue, V., Rakison, D., & DeLoache, J. S. (2010). Threat perception across the lifespan: evidence for multiple converging pathways. *Current Directions in Psychological Science*, *19*, 375–379.

Loeber, R., & Farrington, D. P. (1994). Problems and solutions in longitudinal and experimental treatment studies of child psychopathology and delinquency. *Journal of Consulting and Clinical Psychology*, *62*, 887.

Luna, B., & Sweeney, J. A. (2004). The emergence of collaborative brain function: fMRI studies of the development of response inhibition. *Annals of the New York Academy of Sciences*, *1021*, 296–309. doi:10.1196/annals.1308.035

Maccoby, E. E. (1998). *The two sexes: growing up apart, coming together*. Cambridge, MA: Harvard University Press.

MacLeod, C., Mathews, A., & Tata, P. (1986). Attentional bias in emotional disorders. *Journal of Abnormal Psychology*, *95*, 15–20. doi:10.1037//0021-843X.95.1.15

Marceau, K., Shirtcliff, E. A., Hastings, P. D., Klimes-Dougan, B., Zahn-Waxler, C., Dorn, L. D., & Susman, E. J. (2014). Within-adolescent coupled changes in cortisol with DHEA and testosterone in response to three stressors during adolescence. *Psychoneuroendocrinology*, *41*, 33–45.

Marshall, P. J., Reeb, B. C., & Fox, N. A. (2009). Electrophysiological responses to auditory novelty in temperamentally different 9-month-old infants. *Developmental Science*, *12*, 568–582.

Marshall, P. J., & Stevenson-Hinde, J. (1998). Behavioral inhibition, heart period, and respiratory sinus arrhythmia in young children. *Developmental Psychobiology*, *33*(3), 283–292.

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

McCall, R. B. (1977). Challenges to a science of developmental psychology. *Child Development*, *48*(2), 333–344.

McClure, E. B., Monk, C. S., Nelson, E. E., Parrish, J. M., Adler, A., Blair, R. J. R., … Pine, D. S. (2007). Abnormal attention modulation of fear circuit function in pediatric generalized anxiety disorder. *Archives of General Psychiatry*, *64*, 109–116.

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

McDowell, D. J., Kim, M., O'Neil, R., & Parke, R. D. (2002). Children's emotional regulation and social competence in middle childhood: the role of maternal and paternal interactive style. *Marriage & Family Review*, *34*, 345–364.

Measelle, J. R., Ablow, J. C., Cowan, P. A., & Cowan, C. P. (1998). Assessing young children's views of their academic, social, and emotional lives: an evaluation of the Self-Perception Scales of the Berkeley Puppet Interview. *Child Development*, *69*, 1556–1576.

Miskovic, V., & Schmidt, L. A. (2012). Early information processing biases in social anxiety. *Cognition & Emotion*, *26*, 176–185.

Mogoaşe, C., David, D., & Koster, E. H. (2014). Clinical efficacy of attentional bias modification procedures: An updated meta-analysis. *Journal of Clinical Psychology*, *70*(12), 1133–1157.

Morales, S., Fu, X., & Pérez-Edgar, K. (2016). A developmental neuroscience perspective on affect biased attention. *Developmental Cognitive Neuroscience*, *21*, 26–41.

Morales, S., Pérez-Edgar, K., & Buss, K. A. (2015). Attention biases towards and away from threat mark the relation between early dysregulated fear and the later emergence of social withdrawal. *Journal of Abnormal Child Psychology*, *43*, 1067–1078.

Morales, S., Taber-Thomas, B. C., & Pérez-Edgar, K. (2017). Patterns of attention to threat across tasks in behaviorally inhibited children at risk for anxiety. *Developmental Science*, *20*, e12391.

Morris, A. S., Robinson, L. R., & Eisenberg, N. (2006). Applying a multimethod perspective to the study of developmental psychology. In M. Eid & E. Diener (Eds.), *Handbook of multimethod measurement in psychology* (pp. 371–384). Washington, DC: American Psychological Association.

Nesse, R. M., Curtis, G. C., Thyer, B. A., McCann, D. S., Huber-Smith, M. J., & Knopf, R. F. (1985). Endocrine and cardiovascular responses during phobic anxiety. *Psychosomatic Medicine*, *47*, 320–332.

Newman, J. (1985). The infant cry of primates: an evolutionary perspective. In C. F. Z. Boukydis & B. M. Lester (Eds.), *Infant crying: theoretical and research perspectives* (pp. 307–323). New York, NY: Plenum Press.

Open Science Collaboration. (2015). Estimating the reproducibility of psychological science. *Science*, *349*(6251), aac4716. doi:10.1126/science.aac4716

Overton, W. F. (2006). Developmental psychology: philosophy, concepts, methodology. In R. M. Lerner & W. Damon (Eds.), *Handbook of child psychology* (pp. 18–88). Hoboken, NJ: Wiley.

Peltola, M. J., Leppänen, J. M., Palokangas, T., & Hietanen, J. K. (2008). Fearful faces modulate looking duration and attention disengagement in 7-month-old infants. *Developmental science*, *11*(1), 60–68.

Pepler, D. J., & Craig, W. M. (1995). A peek behind the fence: naturalistic observations of aggressive children with remote audiovisual recording. *Developmental Psychology*, *31*, 548.

Pérez-Edgar, K. (2015). Effortful control in adolescence: individual differences within a unique developmental window. In G. Oettingen & P. M. Gollwitzer (Eds.), *Self-regulation in adolescence* (pp. 78–102). Cambridge UK: Cambridge University Press.

Pérez-Edgar, K., & Bar-Haim, Y. (2010). Application of cognitive-neuroscience techniques to the study of anxiety-related processing biases in children. In J. Hadwin & A. Field (Eds.), *Information processing biases in child and adolescent anxiety* (pp. 183–206). Chichester, UK: Wiley.

Pérez-Edgar, K., Bar-Haim, Y., McDermott, J. M., Chronis-Tuscano, A., Pine, D. S., & Fox, N. A. (2010). Attention biases to threat and behavioral inhibition in early childhood shape adolescent social withdrawal. *Emotion*, *10*, 349–357. doi:10.1037/a0018486

Pérez-Edgar, K., & Fox, N. A. (2003). Individual differences in children's performance during an emotional Stroop task: a behavioral and electrophysiological study. *Brain and Cognition*, *52*, 33–51. doi:10.1016/S0278-2626(03)00007-1

Pérez-Edgar, K., & Fox, N. A. (2005). A behavioral and electrophysiological study of children's selective attention under neutral and affective conditions. *Journal of Cognition and Development*, *6*(1), 89–118.

Pérez-Edgar, K., Fox, N. A., Cohn, J. F., & Kovacs, M. (2006). Behavioral and electrophysiological markers of selective attention in children of parents with a history of depression. *Biological Psychiatry*, *60*, 1131–1138.

Pérez-Edgar, K., Hardee, J., Guyer, A. E., Benson, B., Nelson, E. E., Gorodetsky, E., … Ernst, M. (2014). DRD4 and striatal modulation of the link between childhood behavioral inhibition and adolescent anxiety. *Social, Cognitive, and Affective Neuroscience*, *9*, 445–453. doi:10.1093/scan/nst001

Pérez-Edgar, K., Reeb-Sutherland, B. C., McDermott, J. M., White, L. K., Henderson, H. A., Degnan, K. A., … Fox, N. A. (2011). Attention biases to threat link behavioral inhibition to social withdrawal over time in very young children. *Journal of Abnormal Child Psychology*, *39*, 885–895. doi:10.1007/s10802-011-9495-5

Pérez-Edgar, K., Roberson-Nay, R., Hardin, M. G., Poeth, K., Guyer, A. E., Nelson, E. E., … Ernst, M. (2007). Attention alters neural responses to evocative faces in behaviorally inhibited adolescents. *NeuroImage*, *35*, 1538–1546.

Pérez-Edgar, K., Schmidt, L. A., Henderson, H. A., Schulkin, J., & Fox, N. A. (2008). Salivary cortisol levels and infant temperament shape developmental trajectories in boys at risk for behavioral maladjustment. *Psychoneuroendocrinology*, *33*, 916–925.

Pérez-Edgar, K., Taber-Thomas, B., Auday, E., & Morales, S. (2014). Temperament and attention as core mechanisms in the early emergence of anxiety. In K. Lagattuta (Ed.), *Children and emotion: new insights into developmental affective science* (Vol. 26, pp. 42–56). Basel, Switzerland: Karger.

Petrill, S. A., & Brody, N. (2002). Personality and individual differences. In H. Pashler (Ed.), *Stevens' handbook of experimental psychology*, (Vol. 4, pp. 563–600). Hoboken, NJ: Wiley.

Polivy, J., & Doyle, C. (1980). Laboratory induction of mood states through the reading of self-referent mood statements: affective changes or demand characteristics? *Journal of Abnormal Psychology*, *89*, 286.

Posner, M. I., & Cohen, Y. (1984). Components of visual orienting. In H. Bouma & D. Boushuis (Eds.), *Attention and performance X* (pp. 531–556), London, UK: Erlbaum.

Prencipe, A., Kesek, A., Cohen, J., Lamm, C., Lewis, M. D., & Zelazo, P. D. (2011). Development of hot and cool executive function during the transition to adolescence. *Journal of Experimental Child Psychology*, *108*, 621–637. doi:10.1016/j.jecp.2010.09.008

Reeb-Sutherland, B. C., Helfinstein, S. M., Degnan, K. A., Pérez-Edgar, K., Henderson, H. A., Lissek, S., … Fox, N. A. (2009). Startle modulation in behaviorally inhibited adolescents with a lifetime occurrence of anxiety disorders. *Journal of the American Academy of Child & Adolescent Psychiatry*, *48*, 610–617.

Reeb-Sutherland, B. C., Vanderwert, R. E., Degnan, K. A., Marshall, P. J., Pérez-Edgar, K., Chronis-Tuscano, A., … Fox, N. A. (2009). Attention to novelty in behaviorally inhibited adolescents moderates risk for anxiety. *Journal of Child Psychology and Psychiatry*, *50*, 1365–1372.

Reeb-Sutherland, B. C., Williams, L. R., Degnan, K. A., Pérez-Edgar, K., Chronis-Tuscano, A., Leibenluft, E., … Fox, N. A. (2015). Identification of emotional facial expressions among behaviorally inhibited adolescents with lifetime anxiety disorders. *Cognition & Emotion*, *29*, 372–382.

Reese, H. W., & Lipsitt, L. P. (1970). *Experimental child psychology*. New York, NY: Academic Press.

Rich, B. A., Schmajuk, M., Pérez-Edgar, K., Fox, N. A., Pine, D. S., & Leibenluft, E. (2007). Different psychophysiological and behavioral responses elicited by frustration in pediatric bipolar disorder and severe mood dysregulation. *American Journal of Psychiatry*, *164*(2), 309–317.

Rich, B. A., Schmajuk, M., Pérez-Edgar, K., Pine, D. S., Fox, N. A., & Leibenluft, E. (2005). The impact of reward, punishment, and frustration on attention in pediatric bipolar disorder. *Biological Psychiatry*, *58*, 532–539.

Roy, A. K., Dennis, T. A., & Warner, C. M. (2015). A critical review of attentional threat bias and its role in the treatment of pediatric anxiety disorders. *Journal of Cognitive Psychotherapy*, *29*(3), 171–184.

Rubin, K., Chen, X., & Hymel, S. (1993). Socioemotional characteristics of withdrawn and aggressive children. *Merrill-Palmer Quarterly*, *39*, 518–534.

Saarni, C. (1984). An observational study of children's attempts to monitor their expressive behavior. *Child Development*, *55*(4), 1504–1513.

Scarr, S. (1992). Developmental theories for the 1990s: development and individual differences. *Child Development*, *63*, 1–19.

Scarr, S., & McCartney, K. (1983). How people make their own environments: a theory of genotype-environmental effects. *Child Development*, *54*, 424–435.

Schmidt, L. A., Fox, N. A., Rubin, K. H., Sternberg, E. M., Gold, P. W., Smith, C. C., & Schulkin, J. (1997). Behavioral and neuroendocrine responses in shy children. *Developmental Psychobiology*, *30*, 127–140.

Schmidt, L. A., Fox, N. A., Schulkin, J., & Gold, P. W. (1999). Behavioral and psychophysiological correlates of self-presentation in temperamentally shy children. *Developmental Psychobiology*, *35*, 119–135. doi:10.1002/(SICI)1098-2302(199909)35:2<119::AID-DEV5>3.0.CO;2-G

Schmidt, L. A., Fox, N. A., Sternberg, E. M., Gold, P. W., Smith, C. C., & Schulkin, J. (1999). Adrenocortical reactivity and social competence in seven-year-olds. *Personality and Individual Differences*, *26*(6), 977–985.

Schmidt, L. A., & Segalowitz, S. J. (2008). *Developmental psychophysiology: theory, systems, and methods*. New York, NY: Cambridge University Press.

Schwartz, C. E., Wright, C. I., Shin, L. M., Kagan, J., & Rauch, S. L. (2003). Inhibited and uninhibited infants "grown up": adult amygdalar response to novelty. *Science*, *300*, 1952–1953.

Shechner, T., Britton, J. C., Pérez-Edgar, K., Bar-Haim, Y., Ernst, M., Fox, N. A., … Pine, D. S. (2012). Attention biases, anxiety, and development: toward or away from threats or rewards? *Depression & Anxiety*, *29*, 282–294. doi:10.1002/da.20914

Smith, R. H., & Harris, M. J. (2006). Multimethod approaches in social psychology: between- and within-method replication and multimethod assessment. In M. Eid & E. Diener (Eds.), *Handbook of multimethod measurement in psychology* (pp. 385–400). Washington, DC: American Psychological Association.

Stroop, J. R. (1935). Studies of interference in serial verbal reactions. *Journal of Experimental Psychology*, *18*, 643–662. doi:10.1037/h0054651

Talwar, V., Murphy, S. M., & Lee, K. (2007). White lie-telling in children for politeness purposes. *International Journal of Behavioral Development*, *31*, 1–11.

Thompson, R. A. (2011). Emotion and emotion regulation: two sides of the developing coin. *Emotion Review*, *3*, 53–61.

Tobin, R. M., & Graziano, W. G. (2011). The disappointing gift: dispositional and situational moderators of emotional expressions. *Journal of Experimental Child Psychology*, *110*, 227–240.

Todd, R. M., Cunningham, W. A., Anderson, A. K., & Thompson, E. (2012). Affect-biased attention as emotion regulation. *Trends in Cognitive Sciences*, *16*, 365–372. doi:10.1016/j.tics.2012.06.003

Tronick, E. Z. (1989). Emotions and emotional communication in infants. *American Psychologist*, *44*, 112.

Underwood, M. K., Galen, B. R., & Paquette, J. A. (2001). Top ten challenges for understanding gender and aggression in children: why can't we all just get along? *Social Development*, *10*, 248–266.

van der Molen, M. W., & Molenaar, P. C. M. (1994). Cognitive psychophysiology: a window to cognitive development and brain maturation. In G. Dawson & K. W. Fischer (Eds.), *Human behavior and the developing brain* (pp. 456–491). New York, NY: Guilford Press.

Wallace, D. B., Franklin, M. B., & Keegan, R. T. (1994). The observing eye: a century of baby diaries. *Human Development*, *37*, 1–29.

Waters, A. M., Mogg, K., Bradley, B. P., & Pine, D. S. (2008). Attentional bias for emotional faces in children with generalized anxiety disorder. *Journal of the American Academy of Child & Adolescent Psychiatry*, *47*(4), 435–442.

Watson, J. B. (1926). Behaviourism: a psychology based on reflex-action. *Philosophy*, *1*, 454–466.

White, L. K., Degnan, K. A., Henderson, H. A., Pérez-Edgar, K., Walker, O. L., Schechner, T., … Fox, N. A. (2017). Developmental relations between behavioral inhibition, anxiety, and attention biases to threat and positive information. *Child Development*, *88*, 141–155.

White, L. K., Lamm, C., Helfinstein, S. M., & Fox, N. A. (2012). Neurobiology and neurochemistry of temperament in children. In M. Zentner & R. L. Shiner (Eds.), *Handbook of temperament* (pp. 347–367). New York, NY: Guilford Press.

Willett, J. B., Singer, J. D., & Martin, N. C. (1998). The design and analysis of longitudinal studies of development and psychopathology in context: statistical models and methodological recommendations. *Development and Psychopathology*, *10*, 395–426.

Wilson, E. J., & MacLeod, C. (2003). Contrasting two accounts of anxiety-linked attentional bias: Selective attention to varying levels of stimulus threat intensity. *Journal of Abnormal Psychology*, *112*(2), 212–218.

Wohlwill, J. F. (1973). *The study of behavioral development*. New York, NY: Academic Press.

Wolfe, C., & Bell, M. (2007). The integration of cognition and emotion during infancy and early childhood: regulatory processes associated with the development of working memory. *Brain and Cognition*, *65*, 3–13.

Yap, S., Ji, L., & Hong, E. (2017). Culture and cognition. In J. T. Wixted & S. Thompson-Schill (Eds.), *The Stevens' handbook of experimental psychology and cognitive Neuroscience* (4th ed., Vol. 3), *Language and thought*. Hoboken, NJ: Wiley.

Zahn-Waxler, C., Park, J., Usher, B., Belouad, F., Cole, P., & Gruber, R. (2008). Young children's representations of conflict and distress: a longitudinal study of boys and girls with disruptive behavior problems. *Development and Psychopathology*, *20*, 99–119.

Zelazo, P., Qu, L., & Müller, U. (2005). Hot and cool aspects of executive function: relations in early development. In W. Schneider, R. Schumann-Hengsteler, & B. Sodian (Eds.), *Young children's cognitive development: interrelationships among executive functioning, working memory, verbal ability, and theory of mind* (pp. 71–93). Mahwah, NJ: Erlbaum.

Zeman, J., & Garber, J. (1996). Display rules for anger, sadness, and pain: it depends on who is watching. *Child Development*, *67*, 957–973.