Published in final edited form as:

Dev Psychol. 2019 September ; 55(9): 1801–1811. doi:10.1037/dev0000789.

Progress in Understanding the Emergence of Human Emotion

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Abstract

In the past several decades, research on emotional development has flourished. Scientists have made progress in understanding infants', children's, and adults' abilities to recognize, communicate, and regulate their emotions. However, many questions remain unanswered or only partly answered. We are poised to move from descriptions of aspects of emotional functioning to conceptualizing and studying the developmental mechanisms that underlie those aspects. The gaps in our knowledge provide numerous opportunities for further investigation. With this special issue of *Developmental Psychology*, we aim to stimulate such progress, especially among colleagues at the beginning of their careers. The articles in this issue are intended to challenge our concepts and take research on emotional development in new directions. Toward this end, this special issue includes empirical studies, theoretical articles, novel conceptualizations, methodological innovations, and invited commentaries from scholars across a range of disciplines. In this introductory essay, we briefly review the history of research on emotional development and provide an overview of the contributions of this special issue with thoughts about the current state of the developmental science and areas in which further advancement on emotional development must be made. These include understanding the nature of emotion itself, identifying the mechanisms that produce developmental changes, examining emotion regulation within differing social contexts, and creating measures of culture that acknowledge globalization, historical change, and within-culture differences.

Keywords

emotion; emotional development; affect; emotion theory

That emotion plays a central role in our lives is a truth so self-evident that it is difficult to fathom its almost total neglect by academic psychologists during the mid-to-late-20th century. At that time, the attention of psychological scientists was so focused on an important revolution in our thinking about cognition that it overwhelmed—and in fact

subsumed—progress on emotion. As enshrined in most psychology textbooks of the time, emotion was considered to be largely (and at best) an epiphenomenon, as represented by the two-factor theory that defined emotion as the cognitive labeling of physiological arousal (Schachter & Singer, 1962). But soon afterward, the ideas of Tomkins (1962) and research by Ekman in the late 1960s (Ekman & Friesen, 1971) stimulated a new era of emotion theorizing and research, as did debate about the role of cognition in emotion and emotion in cognition (Lazarus, 1982; Zajonc, 1980). In a landmark investigation, Ekman, Sorenson, and Friesen (1969) reported on emotion expression recognition in a preliterate culture in Papua New Guinea. This research, combined with other studies of children (e.g., Izard, 1971), culminated in a view of emotion consistent with the then-current view of neurobiology. That is, emotion was considered to be grounded in a set of biologically based “programs” in the brain that automatically generated corresponding facial expressions, phenomenological experiences, and neurobiological responses when emotion programs were activated (Ekman, 1972; Izard, 1977). This view situated the study of emotion within the evolutionary and biological perspectives that were popular at the time. But this perspective on emotion did not require developmental data and raised few—if any—critical developmental questions.

The agenda of scientists 50 years ago was to demonstrate that emotions existed, and that they were constituted similarly across cultures, individuals, ages. A few studies appeared in the literature that described the overt emotional behavior of infants and children at different ages (e.g., Emde, Gaensbauer, & Harmon, 1976; Odom & Lemond, 1972; Zelazo, 1972). However, gathering descriptive data about children at different ages is not the same as studying how change happens, and the dominant views of this era did not emphasize the important question of how emotions develop as children age. These early “affect program” theories did acknowledge in general terms that emotions were shaped during the course of development by personal experience and sociocultural norms (Ekman, 1972; Izard, 1977). For example, Ekman’s neurocultural theory (Ekman, 1972) proposed that the automatic expressive output generated by an affect program could be overridden in accordance with culturally derived display rules (see also Hochschild, 1979). Izard (1977) posited that discrete affect programs provided children with psychological processes that could operate independently of higher order cognition and motivate behaviors that enhance development, for example, anger motivates overcoming obstacles and interest motivates exploration. Nonetheless, the studies of this time mainly sought to demonstrate that emotions could be studied with the same rigor and experimental approaches used to examine cognition; therefore, issues about the mechanisms through which these phenomena changed across age in scope and complexity remained largely ignored.

During the 1970s and 1980s, studies and theories of infants’ and children’s emotions began to emerge and provided a foundation for later research. For example, Lewis and Brooks (1974) found that many—but not all—infants exhibit fear of strangers as they reach the end of their first year of life. Campos and his colleagues (e.g., Klinnert, Campos, Sorce, Emde, & Svejda, 1983) showed that infants’ behavior on the visual cliff was influenced by their mothers’ emotional facial expressions. Izard, Huebner, Risser, and Dougherty (1980) documented infant facial movements produced during stressful but routine medical inoculation procedures. Each of these research programs led to the introduction of the first theories of emotional development.

Closely aligned (but not identical to) Ekman's theory, Izard (1977) proposed differential emotions theory. This theory also described "affect programs" for a small number of discrete biologically based emotions that emerged during infancy via maturation. Their emergence was indexed by the appearance of infant versions of prototypic facial configurations that were similar to those that had been described for adults. In this view, subsequent development primarily involved the creation of affective-cognitive "structures" that reflected infants' particular experience in their family and culture and formed the foundation of their personality development (Izard, 1978).

Sharing the view of emotions as adaptive and functional, Campos (Barrett & Campos, 1987) challenged the definition of emotion as an intrapsychic process, describing it as relational. Specifically, they defined emotion as a process through which individuals attempt to maintain or change their relations with the environment in terms of its significance for well-being. An important component of this theory was its emphasis on response flexibility rather than a focus on "affect programs" with their associated sets of fixed responses. Reflecting his interest in the development of consciousness, Michael Lewis (e.g., Lewis & Michalson, 1983) proposed a distinction between emotional state and emotional experience, the latter involving a more advanced level of self-awareness that emerges during the second year of life (see also Lewis, 2014). Based on this distinction, he proposed a developmental sequencing in which new "self-conscious" emotions (such as pride and jealousy) also emerge during the second year. Still, most of the evidence from this early period of emotion investigation did not directly address any purported developmental mechanisms; rather the evidence provided rich descriptions of emotion phenomena in infants and children. However, without a deeper evidence base, it was difficult for scientists to test hypotheses about the nature of emotion itself and/or the mechanisms that might underlie emotional development.

Nonetheless, research on infants' and children's emotions blossomed between the end of the 20th and the beginning of the 21st century. To illustrate, a PsycINFO search for peer-reviewed articles on "emotional development" or "emotion" in the 0-to12-year age range yielded only 553 articles for the 20-year period between 1980 and 1999. But over 18,000 articles on this topic appeared over the next 20 years, between 2000 and 2018. However, at the same time as the study of emotional development has increasingly captured the attention of many researchers, our understanding of emotion, and its development, is incomplete and still undergoing change. New questions are being raised regarding the relationship between facial movements and emotion that raise further questions about emotion learning (Barrett, Adolphs, Marsella, Martinez, & Pollak, 2019; Fernández-Dols & Crivelli, 2013; Fernández-Dols & Russell, 2017), new frameworks for understanding the neurobiological systems underlying emotion across species are recasting what needs to be understood about the emergence of biological mechanisms underlying emotion (Adolphs & Anderson, 2018), new theories of emotion itself are being proposed in the adult literature that rest on yet untested assumptions about children's early experiences (Barrett, 2017), and new approaches to understanding learning are being applied to emotion (Plate, Wood, Woodard, & Pollak, 2018; Wu & Schulz, 2018). These challenges call for a new wave of thinking and research on emotional development.

What is now needed are conceptual models that postulate the developmental processes that underlie aspects of emotional functioning. These models should state how they define or conceptualize emotion. Moreover, developmental models should extend their conceptualizations of the social world beyond mother–child interaction. We need to understand how children give meaning to emotion events and how their meaning-making develops with age. We need models that help us understand how and why different types of emotion emerge and change with age, as well a framework for emotional processes that spans any specific emotion category. If emotions are regulated, we need to specify precisely what is being regulated and precisely what is doing the regulation. We must recognize that the assessment of emotion perception is not the equivalent of informing us about emotional experience (Hess, 2017). Nor does discrimination of different facial configurations necessarily mean that an infant understands differences in emotional meaning. We must also move away from studying specific emotion categories in isolation, because this is not how children experience their social worlds. We must better integrate context into laboratory studies given that emotions not only appear to reflect appraisal of context, but emotional signals are often indeterminate without context. Moreover, infants and young children's experiences of an event are not going to be the same across contexts and across age. We must appreciate the temporality of emotion processing and how it changes, even moment-to-moment, as situations evolve (Cole & Hollenstein, 2018). These are a lot of imperatives for a new generation of research on emotional development, but as demonstrated by the contributions in this special issue, these goals are ones that can be addressed through developmental science and are within reach.

Motivation and Goals for the Special Issue: New Perspectives on the Ontogenesis of Human Emotion

When Eric Dubow, the editor of *Developmental Psychology*, approached us about organizing a special issue for this journal on emotional development, he told us that he felt the time was right for emotion research to be brought to the attention of a wider developmental audience. In addition, we were motivated by our belief that a substantial body of research has already been accumulated so as to provide a strong foundation for future studies that can address many unresolved questions and issues. It is time to consider both where we are and where we want to go as a field. As such, this special issue is intended to present and highlight examples of innovative recent approaches and thinking to a range of questions about emotional development and to inspire new directions for future research.

One sign that the field of emotional development is ready for new directions and emphases was that our call for this special issue drew a response that drastically exceeded what we expected (and set a record for this journal). We were both thrilled and over-whelmed to receive 10-fold more submissions than could be accommodated. Therefore, we made some critical decisions. First, we chose not to include many excellent articles that represented established and continuing programs of research that would likely appear in a regular issue of the journal. Instead, we sought to highlight novel topics, approaches, perspectives, or methods that might stimulate new thinking about the development of emotion. Second, we devoted extra consideration to articles by authors whose primary expertise was not in

emotional development, emotion, or developmental psychology as long as they offered fresh perspectives that could challenge, inspire debate, and generate new research ideas in emotional development. Third, we sought to address the limitation imposed by our not being able to include articles covering the entire range of topics and perspectives relevant to understanding the emergence of human emotion. We did so by inviting scholars representing a range of different disciplinary, cultural, global, and theoretical viewpoints to contribute their ideas and reactions to the issues raised (or ignored) within the articles in this special issue. Taken together, we intend this collection of articles to represent a range of new conceptual frameworks, new methodologies, new empirical data, and new opinions and critiques. We hope it will stimulate a new generation of research. Finally, we asked authors to try to achieve consistency in referring to emotions. We achieved this by drawing attention to when authors believed emotion terms were used by others in ways that were not empirically supported (e.g., claims that infants were “scared” without sufficient evidence to substantiate that inference). We also asked authors to remind readers that emotion words (such as *fear* or *happy*) do not necessarily map onto any single emotion state, but broad categories with individual and contextual variation.

In considering the past and future of research on emotional development, we identified three areas in which novel advances have the potential to be made. Each of the articles in this special issue addresses at least one of the following themes that can guide a next generation of research in this field.

New Ways to Conceptualize Emotion and Emotional Development

Nearly all of the currently prominent theories of emotion are adult-oriented—they are based and predicated upon observations of mature individuals (for reviews, see Cunningham, 2013; Russell, 2014; Tracy & Randles, 2011). Despite the fact that many of these theories offer speculations about the early origins of emotion, they are not informed by the direct study of infant and child development. At present, there is no widely accepted theory of emotional development that systematically guides research. That is not necessarily a bad thing. However, many studies focus on specific emotion categories in isolation, without defining and conceptualizing the broader construct of emotion, leaving pieces that may not cohere into a complete picture. Therefore, we accepted several articles for this special issue because they offered new theories about emotional development and/or novel conceptualizations of emotion constructs.

Drawing upon research on infant social interactions in both Western and non-Western cultures, Holodynski and Seeger (2019) propose that infants initially produce undifferentiated positive and negative emotional expressions rather than expressions of specific discrete emotions such as joy, anger, fear, sadness and so forth. However, these positive and negative expressions subsequently are shaped into culturally conventional expressions of specific emotions through the process of social interactions (see also Holodynski & Friedlmeier, 2006). Drawing upon Vygotsky’s (1962) proposition that social speech leads to the development of thought, they propose that emotional communication is similarly internalized to eventually function as signals to the self.

The article by Hoemann, Xu, and Barrett (2019) also embeds emotional development in a process of adaptation to the social and nonsocial environment. This adaptation involves the person's active inference of environmental demands based on a combination of sensory input and conceptual knowledge. According to these authors (see also Barrett, 2017), emotional development is rooted in infants' responses to environmental stimuli in the form of valence (perceived pleasantness or unpleasantness) and arousal. Subsequently, these "affective" responses are transformed into "emotions" as conceptual categories learned by observing others' use of emotion words and labels. Hoemann et al.'s (2019) proposal breaks down long-held distinctions in the field between purportedly basic versus secondary emotions and between universal versus culturally specific emotions. In their view, all adult emotions are generated by the same developmental process, a form of language-based conceptual learning. This view differs markedly from the view that humans have innate, biologically prepared programs, such as the "affect programs" described earlier. This is a view advanced by anthropologists, who asserted that language played the pivotal role in the construction of emotions (Lutz, 2011; Rosaldo, 1980; Wierzbicka, 1999). Yet, few psychologists made contact with this work. Hoemann et al.'s (2019) proposal reconnects emotion to these rich ideas from decades ago.

Pereira, Barbosa, de Haan, and Ferreira-Santos (2019) harness recent interest in predictive processing views of humans' adaptive functioning. Focusing on one important aspect of emotion functioning, they propose a new way to construe mechanisms underlying the processing of facial configurations that has important implications for emotion recognition. One of the newest, and perhaps most exciting, perspectives to enter the realm of emotion involves the use of mathematical models. Statistical frameworks, such as Bayesian inference, are being used as ways to understand how people update the probability for a hypothesis as more evidence or information becomes available. These approaches have already generated important applications in many areas of cognitive psychology and neuroscience. Bayesian approaches are functional—the theorem does not impose constraints on exactly how calculations are performed, and there are likely many ways this is done across different situations. But Pereira et al. (2019) illustrate the utility of this approach using one particular model, predictive coding. The main idea here is that what children learn to perceive is a function of their expectations and the fit of those predictions with the present stimuli. Critically, from a developmental perspective, children's errors in their perceptions and inferences are a good thing. It is through these errors that individuals are able to increase their future efficiency and accuracy. With emotion, it is often not possible to know the external, latent causes for incoming sensory stimuli—so inference is necessary. One question is whether this type of theory can be applied to internal stimuli, such as feeling states?

The new ideas presented in these articles generate new hypotheses to be tested but also raise questions about the range of developmental phenomena that they can account for, as well as aspects of emotional development that might require different kinds of explanations. For example, D'Arms and Samuels (2019) raise questions about the relations between cognitions about emotions and emotional experiences. And Boddice (2019) reminds us that cultural, social, economic, and political factors throughout history change how people think about, experience, and express emotions, as well as what is even considered to be an emotion. Finally, Frankenhuys (2019) makes the point that many of these theories can be

empirically tested and evaluated with formal mathematical models, an approach that has rarely been employed in the field of emotional development, but one that holds great promise.

Two contributions to this special issue offer novel conceptualizations of particular emotions. The first involves interest. The construct of “interest” has been treated differently by various emotion theories—as a discrete emotion, as a feature of valence akin to approach, or as a cognitive operation and not an emotion at all. Hammond and Drummond (2019) illustrate the potential value in moving away from the traditional focus on emotions as decontextualized constructs. They argue that interest is a building block of a broader category, namely prosocial behavior, and their effort to embed interest in this interactional process offers potential for better understanding emotional development. Specifically, this view holds that not only interest, but behaviors such as caring, concern, and helping behaviors warrant consideration as critical aspects of emotional development. As noted by Reddy (2019), conceptualizing interest as leading to interpersonal engagement broadens the study of emotional development to include interpersonal relationships and mutual understanding. However, the value of considering cognition as well as social engagement is illustrated in another of the invited commentaries. Vaish (2019) suggests that the negativity bias found in infant studies (i.e., a bias toward attending to negative information) might explain some possibly counterintuitive findings described by Hammond and Drummond (2019), for example, that infants appear to be particularly interested in the distress shown by others.

The second novel conceptualization of a specific emotion concerns fear. LoBue and Adolph (2019) challenge traditional interpretations that adult observers may make when studying this emotion in infants. What is now considered a classic example of infant emotion elicitation is the visual cliff paradigm. In this procedure, the infant is placed on a clear table surface under which two levels of blocked flooring give the appearance of a cliff. Infants who detect the difference in levels demonstrate that they have depth perception. Campos, Bertenthal, and Kermoian (1992) found that 70% of the 12-month-old infants they studied were willing to cross a moderately deep visual cliff if they saw their mothers posing a happy expression but no infant crossed if their mother showed an expression of fear. When observing infants’ avoidance of the deep side of a visual cliff, many researchers have applied the term *fear* to the infant’s experience and behavior. However, LoBue and Adolph (2019) propose that avoidance behavior alone is insufficient to conclude that infants are afraid (as adults typically construe fear). These authors also emphasize variability among infant responses to the visual cliff procedure that have often been ignored in the literature. For example, some infants smile while skirting around the edge of the table. Their analysis, in a way that is similar to Hoemann et al. (2019), serves to raise the awareness of researchers about the complex relation between adult use of linguistic emotion labels (e.g., “fear”) and the emotion experiences and behaviors of preverbal infants. This article also raises a broader issue about the need for emotional development researchers to delve more deeply into children’s interpretation of events as a predictor of their emotion-relevant behaviors.

New Ways to Consider Mechanisms Underlying Emotion and Emotion Change

A developmental perspective requires a consideration of mechanisms that can account for both consistency and change in emotional processes. In recent years, considerable attention has turned to investigating cortical mechanisms underlying emotion. Two contributions to this issue represent novel approaches to studying neural foundations. The article by Stern, Botdorf, Cassidy, and Riggins (2019) is particularly noteworthy in that it focuses on the hippocampus, a structure that is often studied with respect to cognition rather than emotion. Based on emerging evidence that the hippocampus is involved in adult empathic responding (possibly through its involvement in emotional memories), their study investigated the relationship between empathy and hippocampal volume in children who had participated in a potentially empathy-inducing procedure. This kind of approach serves as a reminder that more work in emotional development needs to explicate the role of other developmental processes (such as memory, attention, and motor development) in the emergence of emotion behaviors. Stern et al.'s research embeds emotion in a larger network of neural processes that become specialized over development. Vaish's (2019) commentary suggests that future research should also consider whether hippocampal volume is related to prosocial behavior more broadly, including behaviors motivated by factors other than empathy. Guassi Moreira, McLaughlin, and Silvers (2019) also propose a new way to consider brain mechanisms involved in emotional development, more specifically in the regulation of emotion. Their approach examines age-related changes in the spatial and temporal variability within neural networks implicated in emotion regulation. Their findings of age differences in the functioning of these networks may help account for why adult-oriented models of emotion regulation and/or particular regulation strategies often studied in adults may not hold much explanatory power for young children.

Similarly, Gross and Cassidy's (2019) review suggests that care must be taken when applying adult-oriented models of emotion regulation to children. More specifically, their review draws from J. J. Gross's (2015) process model but at the same time questions an implicit assumption in that model, namely that emotion suppression is a nonoptimal form of emotion regulation. Similar to some adult-oriented researchers (e.g., Tamir, Halperin, Porat, Big-man, & Hasson, 2019), Gross and Cassidy (2019) advocate a more contextualized view of suppression that acknowledges the beneficial role it may play in some social situations (e.g., when a child is confronted by a bully). Indeed, as noted in the commentary by Silk (2019), we know very little about how strategies develop and how children acquire the skill to use them effectively and flexibly in different situations (for a review, see Gullone, Hughes, King, & Tonge, 2010).

In addition to the need to examine the contextual embedding and neural underpinnings of specific emotion regulation strategies, there is a need to examine how these strategies are socialized. Lavelli, Carra, Rossi, and Keller (2019) address this need by focusing on dyadic exchanges between mothers and infants at 4 to 12 weeks. Their use of temporal microanalyses in a longitudinal design represents a powerful method for addressing how interaction regulates infant behavior. Although cross-cultural studies of mother–infant

interaction are not new, Lavelli et al. (2019) advance understanding of cultural influences by studying immigrant West African dyads residing in Italy. By comparing their social exchanges with those of Cameroonian Nso and Italian dyads, they examine whether the new culture modifies the traditional ways immigrant mother-infant dyads would interact in their native community. Indeed Lavelli et al. find that immigrant mothers had adopted interaction patterns of their new culture, providing evidence that acculturation influences mother-infant emotional ex-changes. Notably, in all three groups, the influence of maternal behavior on infant behavior over time is seen in fine-grained temporal relations. As noted by both Dennis-Tiwary (2019) and Silk (2019), Lavelli et al.'s (2019) study (as well as those of Guassi Moreira and other authors in our special issue) exemplifies a focus on temporal dynamics that promises to bring a more nuanced understanding of interpersonal interactions and relations across and within cultures.

New Methodological Approaches to Exploring Emotion and Emotional Development

It has often been observed that significant leaps in scientific progress may be propelled by the advent of novel technological developments. Some of the most exciting innovations in the fields of emotion and emotional development involve the introduction or application of novel methodologies for collecting, coding, and analyzing data. Several of the articles accepted for our special issue illustrate these methodological advances as well as present novel substantive findings.

Benson et al.'s (2019) experience-sampling study exemplifies the value of introducing an ecologically sensitive, time series method that has rarely been used in developmental research. While emotions are often studied in the controlled setting of a laboratory, they are (of course) most often enacted outside the lab in the course of daily life. Investigating the natural experience of emotion is both challenging and necessary. Benson et al. (2019) illuminate how persons ranging from 18 to 89 years of age experience emotions "in the wild." They report that older adults varied their use of emotion regulation strategies across different emotion episodes less than did younger participants. Although the reasons for this developmental difference could not be determined, the researchers speculate that there may be less variability in the emotion-eliciting situations that older adults encounter. Future experience-sampling studies might investigate this possibility and the utility of the experience sampling approach to understanding emotion across development.

In the field of emotion, the study of facial expression production (as opposed to recognition) has long been impeded by the labor-intensive process of manual facial configuration coding. Recently, a number of automated computerized coding systems have been developed that have the potential to greatly reduce this burden. Still, given their present level of accuracy, extreme caution should be exercised when considering the adoption of such systems. Furthermore, commercially available systems constrain the range of possible data that can be generated from a given study because they are based on the assumption that emotions can be assessed by measuring the morphology of facial movements in isolation (Barrett et al., 2019). Martinez (2019) provides an expert-led tour of the landscape, explaining how these

systems are developed, how they operate and their limitations. His article should be mandatory reading for those seeking to evaluate studies that employ automated facial coding systems or wish to use such a system in their own research.

The study of coherence among components of the emotion process has played a prominent role in the history of emotion and is highly relevant to current controversies about the nature of emotion itself. Yang, Ram, Loughheed, Molenaar, and Hollenstein (2019) present a novel approach to investigating this issue through dynamic systems modeling. Their results show substantial individual variation in links between skin conductance, respiratory sinus arrhythmia, and self-reported distress by adolescents. Of particular interest, patterns of coordination differed in relation to trait anxiety measures. Their innovative analytic strategy might be applied fruitfully in studies examining relations among other components of emotion across development.

Emotional Development: Thoughts About the Future and the Past

Curating this special issue provided us with an opportunity to explore ideas about where this field has been, where it is now, and where it is poised to progress in enabling us to more fully understand how emotion develops across the life span. In our view, the following issues emerge as the most critical—and exciting—opportunities for advancement of the field.

What Is Emotion?

The study of emotion has been a provocative one, with many competing theories about the nature of human emotion. By and large, developmentalists have stayed out of this crossfire. But correspondingly, there has been little direct articulation of an operational and empirically falsifiable definition of emotion in developmental studies. And in this manner, many articles attempt to address issues of developmental change without scientists clearly articulating precisely what is changing.

Most accounts of emotional development begin with similar notions of the infant vacillating between bipolar states of quiescence and distress. This distinction between generally feeling good versus bad has long been taken as the precursor for growth into adults' more complex emotion taxonomies (Bridges, 1932; Lewis & Michalson, 1983; Sroufe, 1996; Widen, 2013). In this tradition, emotion expressed early in life is described as general distress/crying/irritability versus pleasure/satiation/interest. But these states may be better characterized as “affect”—a barometer of body physiology without any of the detailed concomitants of emotion. Thus the experience of negative affect may be enough for infants to know they do not feel good, but not enough to indicate what to do next or what to expect from others' to help change the negative state of affairs (Barrett, Adolphs, Marsella, Martinez, & Pollak, 2019). What we need to know is how young children become able to link experiences of affect with more specific intentions to act, to be able to understand and predict how others will act, and to make adaptive choices about their behavior given contextual demands.

For these reasons, we encourage scholars to better articulate their own view regarding emotion itself, to frame their empirical descriptions of children's behavior or physiology. We

did not push all of the authors in this special issue to state a definition of emotion in their articles because such a construal requires considerable time and thought. Nor did we impose upon authors any specific construal of emotion. However, we did ask authors to reflect upon some of their assumptions, particularly their use of emotion category labels. For example, the phrase “facial expression of emotion” makes an assumption that a movement in facial musculature is a reliable readout (an expression) of an individual’s internal emotional state. A description of a stimulus as an “angry face” makes an assumption that an invariant signal exists in the world that both captures human experience of an emotion and can be accurately perceived by an observer as such. Claiming that an infant displayed “fear” or “sadness” makes an assumption that a set of behaviors is sufficient to map an infant’s internal experience onto an adult observer’s frame of reference. These assumptions may well be sound, but making explicit where researchers are making inferences or profound theoretical assumptions will help scholars think critically in new and creative ways about the nature and ontogenesis of emotion.

Along these same lines, researchers will need to more clearly describe and justify or support their criteria for identifying when instances of an emotion are present in their studies. When and how do we determine what an infant or young child feels? How can we be clear about the ways these experiences map onto adult conceptions of the experience? It is likely that such criteria will vary across investigations reflecting a diverse range of methodologies. However, developmental scholars should certainly be aware of current debates in the adult literature about the nature of emotion, and consider how each piece of developmental research relates to various extant views, addressing the extent to which evidence confirms or disconfirms those views.

At the same time, as also noted earlier, developmentalists should exercise appropriate caution before applying models and measures derived from adult research to children. Extant theories of emotion, usually based upon observations of adult functioning, do not grapple with issues of origins or change over time. And studies of emotion-related behaviors in more mature individuals rarely acknowledge the range of other domains (such as aspects of cognition, language, and motor skills) that need to also be developed for an individual to engage in adult-like emotion behaviors. This is not to say that theories of emotion based upon adults are invalid, only that it is unsound to assume that functions observed in adults are present and activated in children, or that the processes underlying emotion in mature individuals are identical to those responsible for the emergence, acquisition, and learning of emotion over development.

How Does Emotion Understanding Develop?

The next frontier for research in emotional development will require scholars to bring a greater level of precision to the interpretation of results generated by some methods commonly used to study emotion perception, discrimination, categorization and understanding. Many studies of infants’ perception of facial expressions, for example, measure whether infants can detect or discriminate between emotion stimuli. However, the ability to discriminate between facial or verbal stimuli is not the same as categorizing stimuli on the basis of emotional meaning. No doubt, it is challenging to design well-controlled

experiments that do a good job of distinguishing recognition or discrimination from understanding. Emotion stimuli, such as faces, differ in their constituent perceptual features (e.g., the proposed expressions for fear and surprise contain widened eyes, whereas the proposed expression for sadness does not), contributing more ambiguity to the interpretation of findings. Thus, when an infant discriminates smiling from scowling faces, it is tempting to infer that the infant perceives expressions of anger and happiness when the basis for discrimination may be simply the presence or absence of teeth in the image (Caron, Caron, & Myers, 1985).

Studies of infants' perception and understanding of facial expressions are also difficult to interpret because of other limitations inherent in stimuli: Infants (and also children) are typically shown still, posed photographs of facial configurations (e.g., Leppänen, Richmond, Vogel-Farley, Moulson, & Nelson, 2009), but these may not elicit the same response as the dynamic facial behavior they see in daily life. At the same time, facial stimuli usually involve exaggerated or peak facial movements that are not typical of the expressive variation that children actually encounter (Grossmann, 2010). Unlike adults, infants may have had little or no experience with viewing photographs of anything, including heads of people with no bodies and no context. Young children do not primarily experience others' emotions through still images. In the real world, children are confronted with multidimensional emotional behavior that happens quickly, can be enacted differently by different persons, and (as we have repeatedly emphasized) is largely dependent upon context. Most infants may have more experience with certain facial configurations than with others (e.g., smiling vs. frowning), and familiarity is known to influence perception. These factors may make it difficult to know what accounts for observations of differential attention to facial stimuli. Future research should strive to include stimuli across modalities that represent the full range of emotion signals that children experience in their environments.

A further important and pervasive confound in developmental studies of emotion perception is that most studies are not designed to test whether infants and children discriminate facial configurations in terms of specific discrete emotions (e.g., anger vs. fear vs. joy) or whether they are discriminating in terms of affective dimensions (i.e., pleasant vs. unpleasant; high arousal vs. low arousal). Often, a facial configuration that is intended to depict a pleasant emotion (happiness) is compared with one that is intended to depict an unpleasant emotion (e.g., anger or sadness or fear), or these configurations are compared with a neutral face at rest (e.g., Leppänen et al., 2009; Montague & Walker-Andrews, 2001). Only recently has this limitation been addressed in studies that compare a wider range of emotions (including some similar in valence and arousal) in the context of both social referencing and infant perception studies (e.g., Ruba, Johnson, Harris, & Wilbourn, 2017; Ruba, Meltzoff, & Repacholi, 2019; Walle, Reschke, Camras, & Campos, 2017). In sum, it will be critical for future studies to determine whether infants are differentiating stimuli in terms of broad dimensions (e.g., pleasant from unpleasant or even approach- vs. avoidance-relatedness, Harmon-Jones, Schmeichel, Mennitt, & Harmon-Jones, 2011) or whether they understand something more specific about the depicted emotion.

Mechanisms, Mechanisms, Mechanisms

Several articles in this special issue deal with mechanisms that underlie emotion responding. Examples include both neurobiological (Guassi Moreira et al., 2019; Stern et al., 2019) and socialization processes (Lavelli et al., 2019). These articles illustrate that mechanisms of emotion functioning operate at different levels of analysis. But there is a need for much additional research elucidating the developmental mechanisms responsible for the emergence, changes, and elaborations in human emotion.

To advance such knowledge, developmental psychologists will need to move out of our comfort zones. Experimental tasks used to study emotion recognition with children place constraints on participants that may limit researchers' ability to make valid inferences regarding the mechanisms that underlie their responses. For example, choice-from-array tasks (where children see a number of stimulus items and then select a "correct" answer from a fixed set of response options) produce results that are fairly reproducible across studies: Children label scowling facial configurations as angry, match positive vignettes with smiling facial configurations, recognize that a "sad" face looks different from a "fearful" face, and so on. Yet when children are offered a limited range of categories to choose from, they may be prevented from telling us how they really perceive the stimulus (for discussion, see Widen & Russell, 2013). For example, most studies do not allow children the option of responding with nonemotional mental states. People often respond to scowling faces with words such as "determined" or "puzzled," to wide-eyed faces as "hopeful," and to gasping faces as "pained" (Carroll & Russell, 1996; Crivelli & Gendron, 2017). Thus, forced-choice methods help answer some questions, but limited response options make it difficult to identify the underlying mechanisms children use interpreting emotion stimuli in their daily social lives.

The choice of emotion stimuli may be particularly problematic in physiological studies that seek to examine neurobiological mechanisms involved in emotion perception. For example, in neuroimaging studies with children, tasks must be kept relatively short and experimental conditions limited to allow for adequate analyses of data. Thus, children may be presented with only a single "emotion" (such as anger vs. neutral) or only a single pleasant versus a single unpleasant emotion category (i.e., happiness vs. anger vs. neutral). In these cases, all of the options differ in terms of valence and/or arousal. Therefore, as in many studies of infants, no conclusion can be drawn about differences in neural responding across a range of emotions that may be similar in these dimensions of affect (e.g., anger, disgust, and fear). The stimuli may also be confounded by familiarity. As with infants, children may have more first-hand experience with displays of smiles relative to facial configurations purported to represent fear or disgust. Unfortunately, there are few studies assessing children's actual exposure to emotion signals. For these reasons, studies seeking to identify neural mechanisms underlying emotion should ensure that multiple emotion categories are compared to each other as well as to a baseline or no-emotion condition. Hopefully, future studies will sample a broader number of emotion categories than those used in most extant research, and also include non-English emotion categories.

One way of circumventing some of the problems generated by the complexity of real-world emotion cues may be to alter our perspective. Rather than focusing only on responses to stimulus items, researchers might turn their attention to identifying the process that children use to work through multidimensional cues and arrive at a judgment about another person's emotions. To respond effectively in the real world, children may need to generate hypotheses about what others are feeling and evaluate those hypotheses. At the same time, they must understand their own feelings and interactional goals to respond effectively to in their dynamic everyday environments.

Emotion Regulation

Emotion regulation is a correlate of many aspects of children's functioning. As noted by Silk (2019), while it appears to be the most studied of all aspects of children's emotion behavior, we still know little about its development (see also Gullone et al., 2010). Notably, emotion regulation is associated with socioemotional competence and mental health in both children and adults (Beau-chaine, 2015; Keenan, 2000; Sheppes, Suri, & Gross, 2015; Southam-Gerow & Kendall, 2002; Spinrad et al., 2006). This robust relation has fueled efforts to promote emotion regulation through early childhood social-emotional learning programs (e.g., Denham & Brown, 2010; McClelland, Tominey, Schmitt, & Duncan, 2017) and to directly connect the basic science of emotional development to applications in clinical psychology (Cole, Michel, & Teti, 1994; Schäfer, Naumann, Holmes, Tuschen-Caffier, & Samson, 2017).

One unintended consequence of this emphasis on individual differences is a dearth of information on how and why emotion regulation changes over time, both moment-to-moment and year-to-year (Cole & Hollenstein, 2018; Diaz & Eisenberg, 2015). Emotion regulation is a process that occurs in context and is a process that changes with age, experience, and practice—yet it is challenging to parse these separate effects. Advances in methods to evaluate temporal data over different time courses and to analyze time-series data in ways that capture regulatory influences can be incorporated into longitudinal studies (see Cole & Hollenstein, 2018).

At the same time, much work needs to be done to clarify the relationship between children's experiences of emotion as distinct from their abilities to regulate their emotion. This is particularly challenging because emotion processes are both the entity being regulated and the entity doing the regulating (Pollak, 2005). For example, how can we evaluate whether an apparently unregulated child has appropriately developed regulatory abilities, but is experiencing more extreme or intense emotions than typically require regulating? Some scholars hold that emotion and emotion regulation are ontologically distinct processes, whereas others have concluded that emotion itself is an inherently regulatory process in that it both responds to and influences one's relations with other persons and environmental circumstances. Thus, what is commonly referred to as emotion "regulation" is really emotion reorganization in response to the changing of one's goals and/or environmental demands (Campos, Frankel, & Camras, 2004). This view gains support from studies using neural or cardiac activity that show the intertwined dynamics of biological systems that have been related to these two aspects of emotion functioning (Hollenstein, 2015; Lewis &

Stieben, 2004). Still unresolved is how to integrate and understand constructs such as regulatory effort, effortful control, and inhibitory processes in emotional development (Cole, Ram, & English, 2018; RamsOOK, Cole, & Fields-Olivieri, 2018).

Further research is necessary to evaluate or elaborate proposals regarding mechanisms underlying the development of self-regulation. For example, one well-known proposal holds that regulation of emotion is a function of the interaction of a child's internal cognitive and linguistic resources and external resources, such as the support of caregivers (Kopp, 1982, 1989). Although cognition and family factors contribute to the development of emotion regulation (Morris, Silk, Steinberg, Myers, & Robinson, 2007; Perry & Calkins, 2018), we lack evidence demonstrating how these factors influence developmental changes in regulating emotion. Furthermore, evidence showing under what circumstances and how children develop strategy effectiveness, context appropriateness, or flexibility in their emotion regulation is open for discovery.

Another issue that requires further investigation comes from the domain of adult clinical and social psychology, where the strategy of emotion suppression is often regarded as nonoptimal for adults' management of negative emotion. However, we do not know whether this is uniformly true for children. Gross and Cassidy (2019) grapple with this problem in their treatment of this understudied strategy, noting its potential effectiveness for children and youth in certain situations. Still, many questions remain. How is emotion suppression different than expressive control or display rule usage? How does emotion suppression or any potential strategy develop? Does strategy use necessarily entail regulatory effectiveness? If not, should we conceptualize "regulation" as strategy use or strategy effectiveness (Cole et al., 2018).

What Is It About Culture?

The study of culture merits increased attention by researchers interested in emotional development. Studying differences in emotional development both between cultures and within a culture that is not our own allows us to explore perennial questions about universality, but also creates opportunities to discern socialization mechanisms that might not be apparent without contrasting the development of children's emotions embedded in environments characterized by different practices, beliefs, and values. As often pointed out in recent years, most developmental research involves samples from WEIRD (i.e., Western, educated, industrialized, rich, and democratic) societies that represent only 12% of the world's population (Azar, 2010). Moreover, most of these studies compare individuals or families in different nations, overlooking the need to identify cultural (not geographical) boundaries and measure the putative sources of cultural influence. Within-culture studies, cross-cultural studies that clearly identify and measure predicted cultural influences, and studies of cultures within nations are all necessary for a full accounting of emotional development. The inclusion of individuals or dyads that represent multiple cultures, such as the West African immigrant families that live in Italy in Lavelli and colleagues' (2019) article is useful.

Culture is not static; it changes and studying cultural change and its relation to emotional development adds importantly to our understanding of both universal and culturally variable aspects of development (see Chen, Cen, Li, & He, 2005, for an example). In addition, the cultural history of emotion is often ignored in theories of emotion, with most psychological and neuroscientific models treating current emotion categories as if they are basic, stable, everlasting “things” in the real world. As pointed out by Boddice (2019), historical perspectives provide a broader view of the range of phenomena that need to be explained and accounted for in a developmental model.

We believe that there are some thorny questions and issues that merit additional attention in cross-cultural studies of children’s emotions. Analogous to our call for scholars of emotional development to define what it is they think is developing, researchers studying cultural aspects of emotional development rarely offer a definition of culture. Often, studies are considered cross-cultural if participants from two or more nations are compared. But from a developmental perspective, this approach is limited. For example, characterizations of families across cultures are often not directly measured in the study. When researchers compare parents residing in the United States and China, they might assume that Chinese parents are more authoritarian than their U.S. counterparts, or that parental beliefs and practices are based on Confucianism. These assumptions are rarely directly measured among the study participants. Societies change over time and Chinese parents may no longer aspire to the Confucian ideals as they did in previous generations. Rather they may be motivated to prepare their children for a global society and be less invested in more traditional practices.

Cultures not only change, they are porous, and they are not homogenous. They contain subgroups, including those that vary in status (e.g., ethnic majorities or minorities) and those who have immigrated. These subgroups may have different emotion-relevant beliefs, values, and practices and the emotional development of their children may consequently differ (Cole, Tamang, & Shrestha, 2006). Regardless of parental beliefs, children around the world are likely to have exposure to a wider range of cultures through social media. Thus, for any study of cultural influences, we need cogent arguments for why differences between participant groups should emerge, appropriate measurement of the cultural influences predicted to account for differences, and, ideally, examination of how those influences change children’s functioning as they age. In this manner, studies of children from different countries, in the absence of deeper characterization of the children’s experiences, is unlikely to yield deep insights into emotional development. While parents around the world no doubt hold different beliefs and values, for children to be influenced by beliefs they must be implemented through practices (e.g., Rogoff, 2003; Super & Harkness, 1986).

Concluding Remarks

As illustrated by the success of popular movies such as Pixar’s *Inside Out* (Docter et al., 2015), emotional development has captured the attention of laypersons as well as developmental scientists. But it is the work of scholars to ensure that there is a full accounting of the nature and course of emotional development such that it can be properly represented in popular media as well as in the scientific literature. The contributions in this special issue illustrate the considerable progress that has been made. They also point to the

many opportunities that still remain and the many new ideas and techniques that can inform how developmental data are acquired and analyzed moving forward. We look forward to seeing such continued progress in our efforts to understand both the nature of emotion itself, and the mechanisms underlying both healthy and maladaptive emotional developmental within and across cultures.

Acknowledgments

Seth D. Pollak was supported by the National Institute of Mental Health through Grant R01MH61285 and a James McKeen Cattell Sabbatical Award; Pamela M. Cole was supported by the Eunice Kennedy Shriver National Institute of Child Health and Human Development through Grant R01HD076994. We express heartfelt gratitude to Deanna Maida for shepherding this special issue to a successful completion.

References

- Adolphs R, & Anderson DJ (2018). *The neuroscience of emotion: A new synthesis*. Princeton, NJ: Princeton University Press.
- Azar B (2010). Are your findings WEIRD? *APA Monitor*, 41, 11.
- Barrett KC, & Campos JJ (1987). Perspectives on emotional development: II. A functionalist approach to emotions In Osofsky J (Ed.), *Handbook of infant development* (2nd ed., pp. 555–578). New York, NY: Wiley.
- Barrett LF (2017). *How emotions are made: The secret life of the brain*. New York, NY: Houghton Mifflin Harcourt.
- Barrett LF, Adolphs R, Marsella S, Martinez A, & Pollak S (2019). Emotional expressions reconsidered: Challenges to inferring emotion in human facial movements. *Psychological Science in the Public Interest*, 20(1), 1–68. [PubMed: 31313636]
- Beauchaine TP (2015). Future directions in emotion dysregulation and youth psychopathology. *Journal of Child and Adolescent Psychology*, 44, 875–896. 10.1080/15374416.2015.1038827
- Benson L, English T, Conroy DE, Pincus AL, Gerstorf D, & Ram N (2019). Age differences in emotion regulation strategy use, variability, and flexibility: An experience sampling approach. *Developmental Psychology*, 55, 1951–1964. 10.1037/dev0000727 [PubMed: 31464497]
- Boddice R (2019). The developing brain as historical artefact. *Developmental Psychology*, 55, 1994–1997. 10.1037/dev0000758
- Bridges KM (1932). Emotional development in early infancy. *Child Development*, 3, 324–341. 10.2307/1125359
- Campos JJ, Bertenthal B, & Kermoian R (1992). Early experience and emotional development: The emergence of wariness of heights. *Psychological Science*, 3, 61–64. 10.1111/j.1467-9280.1992.tb00259.x
- Campos JJ, Frankel CB, & Camras L (2004). On the nature of emotion regulation. *Child Development*, 75, 377–394. 10.1111/j.1467-8624.2004.00681.x [PubMed: 15056194]
- Caron RF, Caron AJ, & Myers RS (1985). Do infants see emotional expressions in static faces? *Child Development*, 56, 1552–1560. 10.2307/1130474 [PubMed: 4075873]
- Carroll JM, & Russell JA (1996). Do facial expressions signal specific emotions? Judging emotion from the face in context. *Journal of Personality and Social Psychology*, 70, 205–218. 10.1037/0022-3514.70.2.205 [PubMed: 8636880]
- Chen X, Cen G, Li D, & He Y (2005). Social functioning and adjustment in Chinese children: The imprint of historical time. *Child Development*, 76, 182–195. 10.1111/j.1467-8624.2005.00838.x [PubMed: 15693766]
- Cole PM, & Hollenstein T (2018). *Emotion regulation: A matter of time*. New York, NY: Routledge 10.4324/9781351001328
- Cole PM, Michel MK, & Teti LOD (1994). The development of emotion regulation and dysregulation: A clinical perspective. *Monographs of the Society for Research in Child Development*, 59, 73–100. 10.1111/j.1540-5834.1994.tb01278.x [PubMed: 7984169]

- Cole PM, Ram N, & English MS (2018). Toward a unifying model of self-regulation: A developmental approach. *Child Development Perspectives*, 13, 91–96. 10.1111/cdep.12316 [PubMed: 31543929]
- Cole PM, Tamang BL, & Shrestha S (2006). Cultural variations in the socialization of young children's anger and shame. *Child Development*, 77, 1237–1251. 10.1111/j.1467-8624.2006.00931.x [PubMed: 16999795]
- Crivelli C, & Gendron M (2017). Facial expressions and emotions in indigenous societies In Fernandez-Dols JM & Russell JA (Eds), *The science of facial expression* (pp. 497–515). New York, NY: Oxford 10.1093/acprof:oso/9780190613501.003.0026
- Cunningham W (2013). Introduction to special section: Psychological constructivism. *Emotion Review*, 5, 335–343. 10.1177/1754073913489786 [PubMed: 25431620]
- D'Arms J, & Samuels R (2019). Could emotion development really be the acquisition of emotion concepts? *Developmental Psychology*, 55, 2015–2019. 10.1037/dev0000767 [PubMed: 31464505]
- Denham SA, & Brown C (2010). "Plays nice with others": Social-emotional learning and academic success. *Early Education and Development*, 21, 652–680. 10.1080/10409289.2010.497450
- Dennis-Tiway TA (2019). The future of emotion regulation research is in how we measure the dynamics of change. *Developmental Psychology*, 55, 2006–2008. 10.1037/dev0000752 [PubMed: 31464503]
- Diaz A, & Eisenberg N (2015). The process of emotion regulation is different from individual differences in emotion regulation. *Psychological Inquiry*, 26, 37–47. 10.1080/1047840X.2015.959094
- Docter P, Del CR, LeFauve M, Cooley J, Rivera J, Poehler A, . . . Walt Disney Studios Motion Pictures. (2015). *Inside out* [Movie].
- Ekman P (1972). Universals and facial differences in facial expressions of emotion In Cole J (Ed.), *Nebraska Symposium on Motivation* (Vol. 19, pp. 207–282). Lincoln: University of Nebraska Press.
- Ekman P, & Friesen WV (1971). Constants across cultures in the face and emotion. *Journal of Personality and Social Psychology*, 17, 124–129. 10.1037/h0030377 [PubMed: 5542557]
- Ekman P, Sorenson ER, & Friesen WV (1969). Pan-cultural elements in facial displays of emotion. *Science*, 164, 86–88. 10.1126/science.164.3875.86 [PubMed: 5773719]
- Emde RN, Gaensbauer TJ, & Harmon RJ (1976). Emotional expression in infancy: A biobehavioral study. *Psychological Issues Monograph Series*, 10, 1–200.
- Fernández-Dols JM, & Crivelli C (2013). Emotion and expression: Naturalistic studies. *Emotion Review*, 5, 24–29. 10.1177/1754073912457229
- Fernández-Dols JM, & Russell JA (Eds.). (2017). *The science of facial expression* (pp. 497–515). New York, NY: Oxford 10.1093/acprof:oso/9780190613501.003.0026
- Frankenhuis WE (2019). Modeling the evolution and development of emotions. *Developmental Psychology*, 55, 2002–2005. 10.1037/dev0000732 [PubMed: 31464502]
- Gross JT, & Cassidy J (2019). Expressive suppression of negative emotions in children and adolescents: Theory, data, and a guide for future research. *Developmental Psychology*, 55, 1938–1950. 10.1037/dev0000722 [PubMed: 31464496]
- Gross JJ (2015). Emotion regulation: Current status and future prospects. *Psychological Inquiry*, 26, 1–26. 10.1080/1047840X.2014.940781
- Grossmann T (2010). The development of emotion perception in face and voice during infancy. *Restorative Neurology and Neuroscience*, 28, 219–236. [PubMed: 20404410]
- Guassi Moreira JF, McLaughlin KA, & Silvers JA (2019). Spatial and temporal cortical variability track with age and affective experience during emotion regulation in youth. *Developmental Psychology*, 55, 1921–1937. 10.1037/dev0000687 [PubMed: 31464495]
- Gullone E, Hughes EK, King NJ, & Tonge B (2010). The normative development of emotion regulation strategy use in children and adolescents: A 2-year follow-up study. *Journal of Child Psychology and Psychiatry, and Allied Disciplines*, 51, 567–574. 10.1111/j.1469-7610.2009.02183.x
- Hammond SI, & Drummond JK (2019). Rethinking emotions in the context of infants' prosocial behavior: The role of interest and positive emotions. *Developmental Psychology*, 55, 1882–1888. 10.1037/dev0000685 [PubMed: 31464492]

- Harmon-Jones C, Schmeichel BJ, Mennitt E, & Harmon-Jones E (2011). The expression of determination: Similarities between anger and approach-related positive affect. *Journal of Personality and Social Psychology*, 100, 172–181. 10.1037/a0020966 [PubMed: 20853981]
- Hess U (2017). Emotion categorization In Cohen H & Lefebvre C (Eds.), *Handbook of categorization in cognitive science* (pp. 107–126). Amsterdam, the Netherlands: Elsevier 10.1016/B978-0-08-101107-2.00005-1
- Hochschild AR (1979). Emotion work, feeling rules, and social structure. *American Journal of Sociology*, 85, 551–575.
- Hoemann K, Xu F, & Barrett LF (2019). Emotion words, emotion concepts, and emotional development in children: A constructionist hypothesis. *Developmental Psychology*, 55, 1830–1849. 10.1037/dev0000686 [PubMed: 31464489]
- Hollenstein T (2015). This time, it's real: Affective flexibility, time scales, feedback loops, and the regulation of emotion. *Emotion Review*, 7, 308–315. 10.1177/1754073915590621
- Holodynski M, & Friedlmeier W (2006). Development of emotions and their regulation: A socioculturally based internalization model. Boston, MA: Kluwer Academic.
- Holodynski M, & Seeger D (2019). Expressions as signs and their significance for emotional development. *Developmental Psychology*, 55, 1812–1829. 10.1037/dev0000698 [PubMed: 31464488]
- Izard CE (1971). *The face of emotion*. East Norwalk, CT: Appleton-Century-Crofts.
- Izard C (1977). *Human emotions*. New York, NY: Plenum Press 10.1007/978-1-4899-2209-0
- Izard C (1978). On the ontogenesis of emotions and emotion-cognition relationships in infancy In Lewis M & Rosenblum L (Eds.), *The development of affect* (pp. 389–413). New York, NY: Plenum Press 10.1007/978-1-4684-2616-8_17
- Izard CE, Huebner RR, Risser D, & Dougherty LM (1980). The young infant's ability to produce discrete emotion expressions. *Developmental Psychology*, 16, 132–140. 10.1037/0012-1649.16.2.132
- Keenan K (2000). Emotion dysregulation as a risk factor for child psychopathology. *Clinical Psychology: Science and Practice*, 7, 418–434. 10.1093/clipsy.7.4.418
- Klinnert M, Campos J, Sorce J, Emde R, & Svejda M (1983). Emotions as behavior regulators: Social referencing in infancy In Plutchik R & Kellerman H (Eds.), *Emotion: Theory, research and experience* (pp. 57–86). New York, NY: Academic Press.
- Kopp CB (1982). Antecedents of self-regulation: A developmental perspective. *Developmental Psychology*, 18, 199–214. 10.1037/0012-1649.18.2.199
- Kopp CB (1989). Regulation of distress and negative emotions: A developmental view. *Developmental Psychology*, 25, 343–354. 10.1037/0012-1649.25.3.343
- Lavelli M, Carra C, Rossi G, & Keller H (2019). Culture-specific development of early mother–infant emotional co-regulation: Italian, Cameroonian, and West African immigrant dyads. *Developmental Psychology*, 55, 1850–1867. 10.1037/dev0000696 [PubMed: 31464490]
- Lazarus RS (1982). Thoughts on the relations between emotion and cognition. *American Psychologist*, 37, 1019–1024. 10.1037/0003-066X.37.9.1019
- Leppänen JM, Richmond J, Vogel-Farley VK, Moulson MC, & Nelson CA (2009). Categorical representation of facial expressions in the infant brain. *Infancy*, 14, 346–362. 10.1080/15250000902839393 [PubMed: 20953267]
- Lewis M (2014). *The rise of consciousness and the development of emotional life*. New York, NY: Guilford Press Publishing.
- Lewis M, & Brooks J (1974). Self, others, and fear. Infants' reactions to people In Lewis M & Rosenblum L (Eds.), *The origins of fear: The origins of behavior* (Vol. 2, pp. 195–227). New York, NY: Wiley.
- Lewis M, & Michalson L (1983). Children's emotions and moods: Developmental theory and measurement. New York, NY: Plenum Press 10.1007/978-1-4613-3620-4
- Lewis MD, & Stieben J (2004). Emotion regulation in the brain: Conceptual issues and directions for developmental research. *Child Development*, 75, 371–376. 10.1111/j.1467-8624.2004.00680.x [PubMed: 15056193]

- LoBue V, & Adolph KE (2019). Fear in infancy: Lessons from snakes, spiders, heights, and strangers. *Developmental Psychology*, 55, 1889–1907. 10.1037/dev0000675 [PubMed: 31464493]
- Lutz CA (2011). *Unnatural emotions: Everyday sentiments on a Micronesian atoll and their challenge to Western theory*. Chicago, IL: University of Chicago Press.
- Martinez AM (2019). The promises and perils of automated facial action coding in studying children's emotions. *Developmental Psychology*, 55, 1965–1981. 10.1037/dev0000728 [PubMed: 31464498]
- McClelland MM, Tominey SL, Schmitt SA, & Duncan R (2017). SEL interventions in early childhood. *The Future of Children*, 27, 33–47. 10.1353/foc.2017.0002
- Montague DP, & Walker-Andrews AS (2001). Peekaboo: A new look at infants' perception of emotion expressions. *Developmental Psychology*, 37, 826–838. 10.1037/0012-1649.37.6.826 [PubMed: 11699756]
- Morris AS, Silk JS, Steinberg L, Myers SS, & Robinson LR (2007). The role of the family context in the development of emotion regulation. *Social Development*, 16, 361–388. 10.1111/j.1467-9507.2007.00389.x [PubMed: 19756175]
- Odom RD, & Lemond CM (1972). Developmental differences in the perception and production of facial expressions. *Child Development*, 43, 359–369. 10.2307/1127541 [PubMed: 5034725]
- Pereira MR, Barbosa F, de Haan M, & Ferreira-Santos F (2019). Understanding the development of face and emotion processing under a predictive processing framework. *Developmental Psychology*, 55, 1868–1881. 10.1037/dev0000706 [PubMed: 31464491]
- Perry NB, & Calkins SD (2018). A biopsychosocial perspective on the development of emotion regulation across childhood In Cole PM & Hollenstein T (Eds.), *Emotion regulation: A matter of time* (pp. 3–30). New York, NY: Routledge.
- Plate RC, Wood A, Woodard K, & Pollak SD (2018). Probabilistic learning of emotion categories. *Journal of Experimental Psychology: General*. Advance online publication. 10.1037/xge0000529
- Pollak SD (2005). Early adversity and mechanisms of plasticity: Integrating affective neuroscience with developmental approaches to psychopathology. *Development and Psychopathology*, 17, 735–752. 10.1017/S0954579405050352 [PubMed: 16262990]
- Ramsook KA, Cole PM, & Fields-Olivieri MA (2018). What emotion dysregulation looks like: Inferences from behavioral observations In Beauchaine TP & Crowell SE (Eds.), *Oxford handbook of emotion dysregulation*. New York, NY: Oxford University Press Retrieved from <https://www.oxfordhandbooks.com/view/10.1093/oxfordhb/9780190689285.001.0001/oxfordhb-9780190689285-e-5>
- Reddy V (2019). Meeting infant affect. *Developmental Psychology*, 55, 2020–2024. 10.1037/dev0000773 [PubMed: 31464506]
- Rogoff B (2003). *The cultural nature of human development*. Oxford, United Kingdom: Oxford university press.
- Rosaldo MZ (1980). *Knowledge and passion* (Vol. 4). Cambridge, United Kingdom: Cambridge University Press.
- Ruba AL, Johnson KM, Harris LT, & Wilbourn MP (2017). Developmental changes in infants' categorization of anger and disgust facial expressions. *Developmental Psychology*, 53, 1826–1832. 10.1037/dev0000381 [PubMed: 28758786]
- Ruba AL, Meltzoff AN, & Repacholi BM (2019). How do you feel? Preverbal infants match negative emotions to events. *Developmental Psychology*, 55, 1138–1149. 10.1037/dev0000711 [PubMed: 30829508]
- Russell J (2014). Four perspectives on the psychology of emotion: An introduction. *Emotion Review*, 6, 291 10.1177/1754073914534558
- Schachter S, & Singer JE (1962). Cognitive, social, and physiological determinants of emotional state. *Psychological Review*, 69, 379–399. 10.1037/h0046234 [PubMed: 14497895]
- Schäfer JÖ, Naumann E, Holmes EA, Tuschen-Caffier B, & Samson AC (2017). Emotion regulation strategies in depressive and anxiety symptoms in youth: A meta-analytic review. *Journal of Youth and Adolescence*, 46, 261–276. 10.1007/s10964-016-0585-0 [PubMed: 27734198]
- Sheppes G, Suri G, & Gross JJ (2015). Emotion regulation and psychopathology. *Annual Review of Clinical Psychology*, 11, 379–405. 10.1146/annurev-clinpsy-032814-112739

- Silk JS (2019). Context and dynamics: The new frontier for developmental research on emotion regulation. *Developmental Psychology*, 55, 2009–2014. 10.1037/dev0000768 [PubMed: 31464504]
- Southam-Gerow MA, & Kendall PC (2002). Emotion regulation and understanding: Implications for child psychopathology and therapy. *Clinical Psychology Review*, 22, 189–222. 10.1016/S0272-7358(01)00087-3 [PubMed: 11806019]
- Spinrad TL, Eisenberg N, Cumberland A, Fabes RA, Valiente C, Shepard SA, . . . Guthrie IK (2006). Relation of emotion-related regulation to children's social competence: A longitudinal study. *Emotion*, 6, 498–510. 10.1037/1528-3542.6.3.498 [PubMed: 16938090]
- Sroufe LA (1996). *Emotional development*. New York, NY: Cambridge University Press 10.1017/CBO9780511527661
- Stern JA, Botdorf M, Cassidy J, & Riggins T (2019). Empathic responding and hippocampal volume in young children. *Developmental Psychology*, 55, 1908–1920. 10.1037/dev0000684 [PubMed: 31464494]
- Super CM, & Harkness S (1986). The developmental niche: A conceptualization at the interface of child and culture. *International Journal of Behavioral Development*, 9, 545–569. 10.1177/016502548600900409
- Tamir M, Halperin E, Porat R, Bigman YE, & Hasson Y (2019). When there's a will, there's a way: Disentangling the effects of goals and means in emotion regulation. *Journal of Personality and Social Psychology*, 116, 795–816. 10.1037/pspp0000232 [PubMed: 30614729]
- Tomkins S (1962). *Affect imagery consciousness: Volume I: The positive affects*. New York, NY: Springer.
- Tracy J, & Randles D (2011). Four models of basic emotions: A review of Ekman and Cordaro, Izard, Levenson, and Panksepp and Watt. *Emotion Review*, 3, 397–405. 10.1177/1754073911410747
- Vaish A (2019). Something old, something new: Leveraging what we know to optimize new directions in emotional development research. *Developmental Psychology*, 55, 1998–2001. 10.1037/dev0000774 [PubMed: 31464501]
- Vygotsky LS (1962). *Thought and language*. Cambridge, MA: MIT Press 10.1037/11193-000
- Walle EA, Reschke PJ, Camras LA, & Campos JJ (2017). Infant differential behavioral responding to discrete emotions. *Emotion*, 17, 1078–1091. 10.1037/emo0000307 [PubMed: 28358558]
- Widen SC (2013). Children's interpretation of facial expressions: The long path from valence-based to specific discrete categories. *Emotion Review*, 5, 72–77. 10.1177/1754073912451492
- Widen SC, & Russell JA (2013). Children's recognition of disgust in others. *Psychological Bulletin*, 139, 271–299. 10.1037/a0031640 [PubMed: 23458434]
- Wierzbicka A (1999). *Emotions across languages and cultures: Diversity and universals*. Cambridge, United Kingdom: Cambridge University Press 10.1017/CBO9780511521256
- Wu Y, & Schulz LE (2018). Inferring beliefs and desires from emotional reactions to anticipated and observed events. *Child Development*, 89, 649–662. 10.1111/cdev.12759 [PubMed: 28271499]
- Yang X, Ram N, Loughheed JP, Molenaar PCM, & Hollenstein T (2019). Adolescents' emotion system dynamics: Network-based analysis of physiological and emotional experience. *Developmental Psychology*, 55, 1982–1993. 10.1037/dev0000690 [PubMed: 31464499]
- Zajonc RB (1980). Feeling and thinking: Preferences need no inferences. *American Psychologist*, 35, 151–175. 10.1037/0003-066X.35.2.151
- Zelazo P (1972). Smiling and vocalizing: A cognitive emphasis. *Merrill-Palmer Quarterly*, 18, 349–365.