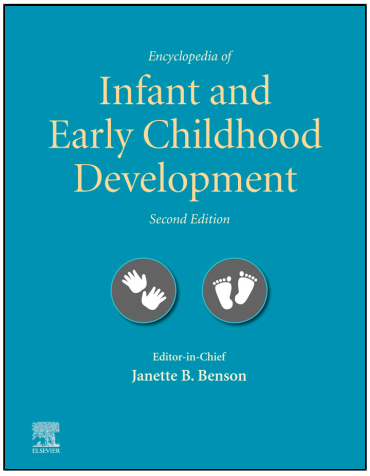

From Walle, E.A., Lopez, L.D., 2020. Emotion Recognition and Understanding in Infancy and Early Childhood. In: Benson, J.B. (Ed.), Encyclopedia of Infant and Early Childhood Development, 2nd edition. vol. 1, Elsevier, pp. 537–545.
https://dx.doi.org/10.1016/B978-0-12-809324-5.23567-0
ISBN: 9780128165126

Emotion Recognition and Understanding in Infancy and Early Childhood

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Defining Emotion Recognition and Understanding

It is essential to define emotion before considering its recognition and understanding in infancy and childhood. Researchers continually debate what is (and is not) an emotion (e.g., Russell, 2014). For this review we adopt the functionalist perspective that emotions are the relations between the individual and their perceived environment on matters of personal significance (Campos et al., 1994). Emotion involves cognition, neural activation, expression, action, regulation, and social context, and no single element can be meaningfully disassociated from the whole of the experience (Barrett and Campos, 1987; Lazarus, 1991). Emotion *discrimination* is one's ability to discern perceptual differences between affective displays, such as perceiving the difference between a sadness and anger facial expression, whereas emotion *recognition* uses this ability to anticipate a social partner's likely behavior (Walker-Andrews, 1997). Emotion *understanding* involves appreciation for significant relations between a person and the environment that underlie the emotional expression (Walle et al., 2017). Thus, the task for the developing human is to *discriminate* the emotion being displayed (e.g., sadness, not fear), *recognize* the value of this signal (e.g., the person may withdraw and begin to cry), and *understand* the significant person–environment relation (e.g., loss of something valued).

This perspective diverges somewhat from traditional views of emotion recognition and understanding that emphasize perceiving and identifying emotional signals, such as facial, bodily, and vocal expressions. While discriminating and identifying signals plays an important role in facilitating the recognition of others' emotions, they are not the understanding of the emotion itself. Consider what is meant by the word "justice." An infant may discriminate the word "justice" from other words, and a young child might identify the word when seen in printed text. However, in neither case would such discrimination or recognition be considered synonymous with understanding the abstract, real-world meaning of justice. Likewise, discriminating, recognizing, and understanding emotions is not merely labeling a facial expression or running away from a threat; they entail appreciating significant person–environment relations.

We describe early discriminatory capabilities that lay the foundation for recognizing discrete emotions (i.e., differences between qualitatively distinct emotions, e.g., sadness, anger, joy, pride). Next, we review research illustrating how these perceptual abilities are utilized to understand the communicative value of emotional expressions and coordinate adaptive responses. Finally, we describe some factors that facilitate and influence the development of emotion recognition and understanding.

Discriminating and Recognizing Emotions

Emotions can be communicated through several distinct modalities. Below we describe the development of emotion recognition in face, voice, and body.

Encyclopedia of Infant and Early Childhood Development, Second Edition, 2020, 537–545

Facial Expressions of Emotion

The study of early emotional development has largely focused on infants' discrimination and recognition of facial expressions by examining perceptual and neural processes. Infants have a natural preference to look at human faces over other stimuli (e.g., Fantz, 1963), likely due to low-level properties inherent to faces, such as contrast, dynamism, and up-down asymmetry (see Pascalis and Kelly, 2009). Infants visually discriminate the affective valence of facial expressions at 3 months (e.g., Barrera and Maurer, 1981). Measures of neural activation also indicate that young infants can discriminate between emotional facial expressions. Seven-month-olds' event-related potential (ERP) patterns when viewing positive and neutral facial expressions are distinct from when they view negative facial expressions (Taylor-Colls and Fearon, 2015), although infant ERPs are similar when viewing angry and fearful facial expressions (Nelson and de Haan, 1996). This suggests that young infants can discriminate between negative and nonnegative emotional expressions before they can discriminate between within-valence emotional expressions (e.g., angry vs fearful).

Infant discrimination of discrete emotional facial expressions is not observed until later in the first year of life. Flom and Bahrick (2007) conducted a rigorous series of studies examining the visual discrimination of discrete emotional facial expression by habituating infants to images of specific emotional facial expressions and then measuring dishabituation (recovery of looking) when the facial expression was categorically changed, for example, from anger to sadness. They found that when presented only with visual stimuli, infants discriminated discrete facial emotions between and within valence at 7 months of age, though 4- and 5-month-old infants did so when multimodal and voice-only expressions were used, respectively. Thus, infants gradually transition from discriminating emotion valence to discrete emotions within valence during the middle of the first year of life.

Infants are also sensitive to changing facial expressions during social interactions. In a more ecologically valid study, 5-month-old infants demonstrated behavioral changes when an interactive social partner switched between happy and sad facial expressions (D'Entremont and Muir, 1999). Further support for infants' appreciation of affective facial expressions in social interactions can be seen in studies using the still-face paradigm (Tronick et al., 1978), in which an adult disrupts their contingent interaction with the infant by adopting a neutral facial expression. Specifically, 6-month-old infants respond negatively when maternal affect is disrupted by his or her adoption of a still face (e.g., Gusella et al., 1988). Taken together, these findings indicate that in the first year of life, infants can discriminate discrete facial cues of emotion and have some understanding of their significance in social contexts.

Vocal Expressions of Emotion

Studies have also examined infants' ability to discriminate and appreciate affective vocalizations. Infants match happy and sad vocalizations with corresponding facial expressions at 3.5 months of age (e.g., Kahana-Kalman and Walker-Andrews, 2001). Further research utilizing habituation and intermodal matching paradigms demonstrate that 5-month-old infants distinguish joy, sadness, and anger vocalizations (Flom and Bahrick, 2007), and 6-month-olds can distinguish discrete positive emotion vocalizations of relief and triumph (Soderstrom et al., 2017). Furthermore, EEG research suggests that 7-month-old infants allocate more attention to angry vocalizations than sad vocalizations (Grossmann et al., 2005).

Vocal affect can also regulate infants' behavior when communicated about an object or action. Maternal prohibition vocalizations negatively influence infant affect at 5 months (Fernald, 1993), and 12-month-old infants can use maternal affect communicated through voice alone (i.e., absent of other expressive modalities) to regulate their behavior toward novel toys (Mumme, Fernald & Herrera, 1996) or situations (Vaish and Striano, 2004). Twelve-month-olds can also use vocal cues of emotion to infer intentionality (i.e., purposeful "there" versus accidental "whoops"; Sakkalou and Gattis, 2012), prosociality (e.g., positive vocal affect with helping actions; Paquette-Smith and Johnson, 2016), and social context (i.e., crying paired with separation from a care figure; Biro et al., 2014). Additionally, 4-year-olds can use prosodic features of emotional speech to infer goal attainment (upward pitch signaling goal completion; Quam and Swingley, 2012) and referential intent (negative affect paired with a broken toy; Berman et al., 2010).

Paralinguistic cues, such as emotion prosody, also influence early infant social behaviors over lexical information, though this effect is inversely associated with the child's vocabulary development (Friend, 2001). Interestingly, although 6-year-olds can identify paralinguistic cues, they often fixate on the content of verbal communication over such emotional information to regulate their behavior (Morton et al., 2003). This tendency diminishes in later childhood and adulthood as paralinguistic cues again trump verbal content (Morton and Trehub, 2001), for example with sarcasm. Thus, while infants are sensitive to vocal cues of emotion, language acquisition corresponds with greater reliance on verbal content than emotional quality, with older children gradually reverting back to utilizing the emotionality of verbalizations to determine meaning. Such findings demonstrate the importance of considering nonlinearity in emotional development.

Bodily Expressions of Emotion

Fewer studies have examined infant and child discrimination of emotional body postures. Early research on this topic revealed that 4- to 5-year-old children labeled fear, sadness, and happiness conveyed in short clips of expressive dance and could also produce movements indicative of these emotions by differentially "dancing" a stuffed bear to music associated with each discrete emotion (Boone and Cunningham, 1998, 2001). Subsequent studies have demonstrated that recognition of emotional postures develops throughout childhood (Ross et al., 2012). For example, 4-year-olds can identify fear, sadness, and happiness from dynamic and nondancing displays of postural expressions of emotions (Nelson and Russell, 2011), 6-year-olds can

categorize static postures of these emotions, and 8-year-olds use emotional postures when categorizing incongruent facial and bodily expressions of emotions (Mondloch et al., 2013).

Recent research suggests that sensitivity for discrete emotional postures may be present in infancy. Studies using EEG measures have found that 8-month-old infants demonstrate differential activation patterns when viewing happy and fear postures that correspond with cortical areas associated with approach and avoidance, respectively (Missana and Grossmann, 2015). Furthermore, preferential looking paradigms indicate that 4- to 6-month-old infants match happy and angry dynamic postures with corresponding vocalizations and facial expressions (e.g., Zieber et al., 2014). Though sparse, this research suggests that young infants can discriminate bodily expressions of discrete emotions.

Multiple Emotion Cues and Paradigmatic Artifacts

As meticulous as the above research is in demonstrating the development of discriminatory sensitivity to specific modalities of emotional expressions, it is important to state the obvious: "people do not present themselves to babies as voiceless faces or faceless voices (p. 133, Flavell, 1985)." Examining individual components of emotional expression risks shortchanging and oversimplifying how infants perceive and process emotional communication. Indeed, infants can discriminate multimodal expressions of emotion (e.g., facial and vocal together) by 4 to 5 months of age, many months earlier than they can discriminate vocal and facial cues alone (Flom and Bahrick, 2007). Infants also demonstrate sensitivity to intermodal matching (e.g., pairing the face and voice) of emotional expressions by 7 months of age (e.g., Soken and Pick, 1999). Consequently, presenting emotional cues in isolation likely underestimates the age when infants are sensitive to distinct affective displays.

How infants and young children discriminate and recognize emotional expressions is also affected by research methodology. Studies of infant emotion processing can be influenced by static versus dynamic emotional expression stimuli (e.g., D'Entremont and Muir, 1997), socially contingent versus noncontingent interactions (e.g., Montague and Walker-Andrews, 2001), familiarity of the emoter with the infant (e.g., Kahana-Kalman and Walker-Andrews, 2001), and even the order in which emotions are presented in experimental paradigms (e.g., Ludemann and Nelson, 1988; Pochedly et al., 2012). Consider the fascinating work by Nelson and colleagues (e.g., Nelson et al., 2018) illustrating the *illusory recognition* phenomenon, wherein individuals identify a novel, made-up emotion by using a process of elimination of the known emotion expressions presented in an array. Although the 2.5- to 10-year-old children had no preexisting label or concept for the novel emotional expression, they accurately matched the novel label (e.g., pax, tolen) with the corresponding novel expression (Nelson et al., 2018). Thus, similar to adults, young children can outsmart some paradigms (e.g., choice-from-array tasks) and demonstrate responses that obfuscate their emotion knowledge.

A growing body of research also suggests that emotion perception is susceptible to cross-modal (i.e., congruency of the expressive modalities) and contextual (i.e., the surrounding scene) influences (Aviezer et al., 2017). For example, accuracy to identify emotional facial expressions significantly decreases when emotionally expressive faces are placed on emotionally incongruent bodies (e.g., a sadness face on an angry bodily posture is less likely to be categorized as sadness), particularly when the expressions are presented dynamically (Nelson and Mondloch, 2017). Moreover, multimodal affective incongruency has been found to impact the neural processing of emotion in 8-month-old infants (Rajhans et al., 2016). These findings underscore the importance of considering the ecological and methodological validity of laboratory studies of early emotion discrimination and recognition.

Appreciating and Understanding Others' Emotions

Infant discrimination and recognition of discrete emotional expressions is not synonymous with appreciating the communicative value of affective signals. To do so entails two component processes of emotional understanding. First, infants must accurately locate the specific target or internal states about which the emotion is communicated, an ability termed *referential specificity* present in the second year of life. For example, 14-month-old infants appreciate the target of a disgust expression as the contents of a container rather than the container itself (Repacholi, 1998). Second, infants must appreciate the value of the emotion signal, such as understanding that sadness conveys loss, whereas disgust communicates contamination. This ability, known as *affect specificity* (see Saarni et al., 2006), is not reliably demonstrated until 18 to 24 months (Martin et al., 2008; Walle et al., 2017). These component processes cohere to allow infants to identify and recognize who is communicating what, identify the referent of the emotional communication, and, most importantly, appreciate the value of the communication relative to the referent. Observing the coordination of these skills is necessary to infer that the emotion is understood (i.e., the significant relation between an individual and the environment).

Infant Behavioral Responding to Emotion

Research paradigms that measure infants' goal-directed behaviors provide clearer findings regarding infant recognition and understanding of emotional communication. One such behavior is *social referencing*: when an individual is confronted with an ambiguous object or event, looks toward an available social partner, and uses that person's emotional communication to appraise the source of ambiguity and coordinate an adaptive behavioral response (Campos, 1983). This process requires that infants utilize referential and affective specificity to appreciate the relational significance (i.e., the emotion) (Walle et al., 2017). Research in which infants are faced with an ambiguous situation, such as the visual cliff (Sorce et al., 1985), a stranger (e.g., Feinman and Lewis, 1983), or a novel

object (e.g., Hornik et al., 1987), indicates that infants use others' emotions to guide their own behaviors by the end of the first year. However, such studies have primarily compared infants' response to emotions varying by valence (i.e., positive vs. negative), not discrete categories of emotion (e.g., anger vs. disgust vs. fear).

Research comparing infants' responses to discrete categories of emotions is sparse. One study using the visual cliff found that infants avoided the drop-off when the mother displayed fear or anger, but one-third crossed when she displayed sadness (Sorce et al., 1985). Eighteen-month-olds are also more likely to push away a food labeled with disgust than one labeled with sadness (Anderson, 1994), and 17-month-olds express greater concern toward someone who is sad than fearful (Martin et al., 2008). A large-scale study by Walle and colleagues compared 16-, 19-, and 24-month-old infants' behavioral responses to an adult expressing joy, sadness, fear, anger, or disgust (Walle et al., 2017). Infants demonstrated distinct goal-directed behaviors in response to joy (i.e., increased relaxed play, increased stimulus exploration) and sadness (i.e., increased prosocial responding) at 16 months, and to disgust (i.e., information seeking) by 19 months. Interestingly, infants did not differentially respond to anger (i.e., increased social avoidance, decreased vocalizations) until 24 months of age. These studies indicate that infants' understanding of the affective value of discrete emotions and their ability to use such information to regulate their own behavior unfolds gradually over the second year of life.

Development of Emotion Concepts

As a complement to behavioral research, investigators have also examined the development of emotion concepts across childhood. Emotion concepts allow children to understand the value of affective communication by linking events, behaviors, and possible consequences associated with each emotion, and thus create emotion scripts of how distinct affective states unfold (Fehr and Russell, 1984). The development of emotion concepts may be accounted for by a constructionist framework, in which one builds associations between contexts, events, communicative expressions, and behaviors through emotional interactions and experiences (see Russell, 2003). Thus, emotion concepts develop from a bottom-up process as specific emotion-related elements cohere into more sophisticated constructs. Alternatively, children may have an innate ability to distinguish universal expressions of emotion (Izard, 1971) that provides the basis for distinct emotion concepts to which corresponding emotion-related information is added, such as mental states, goals, and behaviors. Consequently, advances in cognitive development facilitate the progression to more elaborate emotion concepts through children's greater understanding of the underlying components that differentiate emotion categories (e.g., Pons et al., 2004).

Notwithstanding the ontological underpinnings of emotion concepts, empirical findings indicate that emotion categories emerge gradually and sequentially in development (Widen, 2013). Such studies often ask children to sort or label pictures of emotional facial expressions or label a character's emotion in a story. Research indicates that children progress through distinct levels of emotion labeling, with valenced labels present by the end of the second year of life (Russell and Widen, 2002). Labels for discrete emotions emerge gradually in the second year, with children initially labeling happiness, followed by differentiating between either happiness and sadness *or* happiness and anger at 2.5 to 3 years of age, then using all three labels early in the third year, and finally acquiring labels for scared, surprised, and disgusted around age 4 (Widen and Russell, 2003, 2010). Additionally, children's emotion concepts are influenced by parent emotionality and patterns of socialization, such as emotion explanations and responsiveness to the child (e.g., Denham et al., 1994), though further research examining such influences is needed.

Additional Aspects of Emotion Understanding

Thus far we have described basic competencies demonstrated by infants and young children for discriminating, recognizing, and understanding emotional communication. Next, we highlight factors that influence how children seek out, use, and predict others' emotions.

Who to Reference? Who to Believe?

Infants seek out emotional communication from a variety of sources, including fathers, day care providers, and familiarized experimenters (Camras and Sachs, 1991; Dickstein and Parke, 1988; Klinnert et al., 1986). However, infants demonstrate increasing selectivity in who they reference as a function of the context and the attributes of available adults. Infants consider the familiarity, expertise, and attentiveness of an adult when considering who to reference for emotional information as early as 10 months of age (e.g., Stenberg, 2012; Striano and Rochat, 2000). Interestingly, primary caregivers are not always the preferred source for information. In laboratory settings, 12-month-old infants reference an experimenter more than a caregiver and use the experimenter's emotional expressions to guide their own interactions with ambiguous objects (Stenberg, 2009), a pattern that increases with age (Walden and Kim, 2005). Moreover, when two experimenters are available, infants seek information from the experimenter who demonstrates greater competence and has more expertise about the specific context (e.g., Stenberg, 2012). Thus, while an adult's attentiveness and familiarity are considered, their knowledge of the current context is the prevailing factor for who infants reference. This supports the view that infants do not only use social cues in the environment to disambiguate situations but also rely on situational knowledge of available social partners and look toward individuals deemed more knowledgeable about the current situation.

Research also indicates that infants do not take all emotional expressions at "face value". For example, 18-month-old infants show less concern when witnessing an adult displaying unwarranted distress, given preceding events (Chiarella and Poulin-Dubois, 2013). Infants at this age are also less likely to demonstrate prosocial behavior in such inauthentic emotional contexts and will laugh at and even hit a parent in a playful manner (Walle and Campos, 2014), though these behaviors are less clear in 16-month-old infants. Similarly, 18-month-olds, but not 16-month-olds, are less likely to taste a food that an adult has attempted to mask her own disgust toward and can appreciate when fearful emotional expressions are overexaggerated for the context (Walle and Campos, 2014). These findings underscore that infants do not merely respond to whatever emotion is displayed by a social partner; rather, infants come to appreciate the relational significance of the person and the environment in the second year of life and thus understand the emotion itself. This research demonstrates that infants have a rich understanding of how to seek out and utilize others' emotional communication based on who is likely to know what in specific contexts and under specific circumstances.

Understanding Nonostensive Emotional Communication

In addition to appreciating others' emotions that are communicated ostensively (i.e., featuring directed social cues such as eye contact), infants also understand emotional signals when ostensive cues are absent. For example, 12-month-olds can appreciate a parent's nonostensive cues of anxiety toward a stranger and are similarly wary of the new person (de Rosnay et al., 2006), whereas 10-month-old infants do not, unless ostensive cues are provided (Feinman and Lewis, 1983). Further evidence of infants' use of indirectly observed emotional communication is apparent when infants "eavesdrop" on the emotional communication between two adults. For example, 18-month-olds are less likely to imitate an action when an experimenter, who was previously angered by another adult for performing the action, is present and able to view the infant's actions. Fascinatingly, this reluctance to imitate largely vanishes if the angry experimenter leaves the room, is distracted, or has their eyes closed (Repacholi and Meltzoff, 2007; Repacholi et al., 2008). Importantly, at no point in these paradigms was the person communicating the emotion toward the child; the child merely observed a social partner's emotions and used that information to guide their own interaction with the environment. Furthermore, infants can extend such observed experiences to other contexts in which the actor is not displaying the emotion. For example, 15-month-olds who observed an adult angered by someone else's action were less likely to imitate a completely new action when the previously angry, but now neutral, adult was present and more likely to give up their toys in a subsequent encounter with that adult (Repacholi et al., 2016). These findings suggest that infants can use observed social information to learn about a person's emotional dispositions and anticipate how the person may respond in future situations.

Understanding Elicitors of Emotion

A growing body of literature has begun to examine the development of children's expectations for events that elicit specific emotions. In such work, researchers often pair an emotion-eliciting event (e.g., obtaining a desired treat) with either a congruent (i.e., happiness) or incongruent (e.g., disgust) emotion display. A looking time study by Skerry and Spelke (2014) found that 10-month-old infants, but not 8-month-olds, expected that achieving one's goal would result in happiness, but expectations for what elicited a negative emotion was not observed. Conversely, physiological measures of infant sympathetic nervous system arousal indicate that 10-month-olds have an expectation for an adult's emotional behavior following a negative event, but not a positive event (Hepach and Westerman, 2013). Expectations for the congruency of both positive and negative emotion-event pairings are not observed until 12 months of age (Reschke et al., 2017), though expectations for elicitors of discrete negative emotions (i.e., sadness vs. anger) were not observed. A recent investigation by Wu et al. (2017) found evidence for 12- to 17-month-old infants' expectations of events likely to elicit displays of laughter, excitement, and adoration, suggesting that appreciation for within-valence emotional outcomes likely develops early in the second year. Further research assessing infants' behavioral responding suggests that 18-month-olds are more likely to seek out additional information when an event and subsequent emotion are incongruent (Chiarella and Poulin-Dubois, 2013), possibly indicating sensitivity for the elicitors of discrete emotions. Research on this aspect of emotional development holds substantial promise for furthering our understanding of infants' ability to appreciate others' mental states, make predictions about events and outcomes in the environment, and respond adaptively in social situations when overt communicative cues may be unclear or absent (see Chiarella and Poulin-Dubois, 2015; Newton et al., 2014).

Developmental Influences on Emotion Recognition and Understanding

Factors that facilitate the development of emotion recognition and understanding are many and interwoven. Below we highlight four candidate sources of change and individual variability in emotional development, specifically self-experience, cognitive development, emotional ecology, and caregiver emotion talk.

Self-experience

Infants are not passive observers; they interact with a social and material world filled with success and frustration. As such, emotional development is best considered as a bidirectional process between infants and an expanding social world (see Fogel

et al., 1992; Saarni et al., 2006). Examining periods in development characterized by qualitative transitions in how infants interact with the world can provide important considerations for the nonlinearity of emotional development. For example, infant experience with self-produced locomotion (e.g., crawling, walking) corresponds with a shifting of attention toward exploring objects and perhaps unsurprisingly, increased maternal prohibition and redirection of infant behaviors (Campos et al., 1992; Green et al., 1980). A longitudinal study by Biringen et al. (1995) observed infants transitioning from crawling to walking. The researchers found that mothers and infants became more affectively positive across this developmental transition, but maternal perceptions of infant emotions also became more negative, likely reflecting increased "testing of wills" during prohibitive situations. Interestingly, these changes in infants' personal experience with goal fulfillment and frustration coincide proximally in development with the aforementioned studies examining infants' developing understanding for the elicitors of positive and negative emotions (e.g., Skerry and Spelke, 2014; Reschke et al., 2017). Thus, infants may generate experiences interacting with their environment that, in turn, inform their appreciation of others' relations with the environment.

Cognitive Development

Cognition plays a central role in many theories of emotion, perhaps most prominently for appraisal theory (e.g., Lazarus, 1982; Ellsworth and Scherer, 2003). However, empirical research connecting emotional and cognitive development has been largely neglected (see Reschke, Walle & Dukes, 2017). Consider children's developing understanding of others' mental states or theory of mind. This capacity is essential for emotion understanding and social interaction and thus likely related to how children appreciate others' goals and behaviors. Understanding the goal-directedness of others' actions is informative for understanding their relations with the environment (i.e., their emotions). Appreciating others' goal-directed actions is present fairly early in development. For example, 14-month-old infants can discern when another person's actions are intentional or accidental (e.g., Carpenter et al., 1998) and are less likely to assist an experimenter when a failed action is performed intentionally (e.g., Sakklou and Gattis, 2012). Furthermore, research indicates 9-month-old infants appreciate when a social partner is unable versus unwilling to perform an action and respond with increased impatience and negative affect toward the latter (Behne et al., 2005). Emotion and action are inextricably linked in the emotion process (see Campos et al., 1989; Frijda, 1986), and thus appreciating others' behaviors is central for understanding their emotions.

Understanding what others perceive and know also impacts how young children behave in emotional contexts. For example, consider the aforementioned findings by Repacholi and Meltzoff (2007) that infant behavioral inhibition diminished when the previously angry emoter left the room or could not perceive the child's behavior. Such selective regulation of behavior is likely linked with infant understanding of perceptual affordances (e.g., Meltzoff and Brooks, 2008). Moreover, infant social behavior is influenced by knowing what a social partner knows or falsely believes. In a creative study by Buttleman, Carpenter, and Tomasello (2009), infants observed an adult favor a particular toy that was then placed in one of two boxes. Unbeknownst to the adult (but known to the infant), the location of the box with the toy was then switched, resulting in the adult having a false belief regarding the location of the desired object. When the adult later struggled and expressed frustration to open the incorrect box, 18-month-olds redirected the adult to the correct box—thereby completing the adult's relational goal while engaging in a behavior that was unhelpful with respect to the adult's attempts to open the incorrect box. Infants lacking false-belief understanding would unlikely behave in this manner. Such paradigms illustrate the importance for considering young children's developing cognitive abilities for appreciating their emotional understanding in social settings.

Emotional Ecology

The home environment significantly impacts children's emotion recognition and understanding. On the one hand, observing little expressivity in the home environment can result in stunted emotional development. For example, children of depressed parents are at risk for a host of suboptimal developmental outcomes (see Grace et al., 2003). When interacting with their children, depressed parents typically display less positive affect (Cohn et al., 1990) and more sadness and anger (Pickens and Field, 1993), demonstrate atypical emotion interaction patterns (Goodman and Gotlib, 1999), are less responsive (Weinberg and Tronick, 1998), and provide less emotion coaching (e.g., Garber et al., 1991). The decreased emotional scaffolding provided by depressed parents results in poorer emotion recognition, understanding, and regulation (e.g., Goodman et al., 1993; Silk et al., 2006) and poorer social relations (Field et al., 1988; Zahn-Waxler et al., 1984).

Conversely, growing up in overly expressive environments also influences how children perceive and respond to emotions. Research by Pollak et al. (e.g., Pollak et al., 2009; Pollak and Sinha, 2002) has found that children from abusive homes more readily recognize facial and vocal cues of anger, but such sensitivity does not generalize to other emotions (e.g., disgust, joy). Additionally, children raised in homes with frequent interparent disputes demonstrate more elaborate means of responding to such intense emotional contexts and will progress through multiple forms of coping (Cummings et al., 1981). Infant gender can also shape their emotional ecology. For example, mothers are generally more emotionally communicative with daughters but direct more intense displays of fear toward sons (Rosen et al., 1992). Considering how the child's everyday emotional environment influences emotion recognition and understanding represents an important direction studying emotional development.

Caregiver Talk About Emotions

How caregivers talk about emotions has been linked with how children process, understand, and respond to others' emotions. A longitudinal study by Lagattuta and Wellman (2002) found that parent talk about emotions increased throughout early childhood, with talk about negative emotions outpacing that of positive emotions by the second year. Such conversations often highlighted the causes of the emotion, connections between a person's mental state and their emotion, and emotion-related consequences. Caregivers also talk about emotions in distinct ways depending on their child's gender. Parents engage in more emotion and mental state talk with girls than with boys (e.g., Adams et al., 1995; Kuebli and Fivush, 1992) and also pose more questions to girls than boys about emotion contexts (Knothe and Walle, 2018). Additionally, parents differ in the quality of their talk across discrete emotions. For example, when describing pictures of emotional contexts to their infants, parents tended to emphasize the elicitor of the emotion more for fearful and disgust contexts, whereas they increased their focus on the person expressing the emotion when describing sadness and anger contexts (Knothe and Walle, 2018).

Correspondingly, caregiver talk about specific emotions helps to socialize and teach young children appropriate responses to emotional contexts. The amount of parent talk about others' mental states and emotions is associated with children's expressions of concern toward distressed adults (Garner, 2003; Zahn-Waxler et al., 1979), helping behavior (Drummond et al., 2014; Newton et al., 2016), and later emotional understanding (Garner et al., 1997). Furthermore, the quality of parent emotion talk also matters. A study by Brownell and colleagues examined the relation of parent emotion talk while reading a picture book with their child and the child's subsequent propensity to help and share with a social partner. Over and above total parent talk about emotions, parent encouragement of their toddlers' active reflection about others' emotions predicted the child's level of prosocial responding in a helping task (Brownell et al., 2013). These findings emphasize the importance of considering both the quantity and the quality of the input when examining factors that impact emotional development.

Conclusion

This chapter demonstrates a wealth of research on the development of emotion recognition and understanding. Discriminating, appreciating, and responding to others' emotional communication develop markedly throughout infancy and early childhood. However, of equal importance is researchers' careful consideration of the phenomenon of interest at both the construct and methodological level. Emotions are more than the sum of their parts. As such, the study of emotional development necessitates a holistic, rather than piecemeal, theoretical, and empirical approach.

References

Adams, S., Kuebli, J., Boyle, P.A., Fivush, R., 1995. Gender differences in parent–child conversations about past emotions: a longitudinal investigation. Sex. Roles 33, 309–323.

Anderson, E., 1994. Young Children's Understanding of Facial and Vocal Expressions of Emotion (Unpublished doctoral dissertation). DePaul University, Chicago.

Aviezer, H., Ensenberg, N., Hassin, R.R., 2017. The inherently contextualized nature of facial emotion perception. Curr. Opin. Psychol. 17, 47–54.

Barrett, K.C., Campos, J.J., 1987. Perspectives on emotional development II: a functionalist approach to emotions. In: Osofsky, J.D. (Ed.), Handbook of Infant Development, second ed. Wiley, New York, NY, pp. 555–578.

Barrera, M.E., Maurer, D., 1981. Recognition of mother's photographed face by the three-month-old infant. Child Dev. 714–716.

Behne, T., Carpenter, M., Tomasello, M., 2005. One-year-olds comprehend the communicative intentions behind gestures in a hiding game. Dev. Sci. 8, 492–499.

Berman, J.M., Chambers, C.G., Graham, S.A., 2010. Preschoolers' appreciation of speaker vocal affect as a cue to referential intent. J. Exp. Child Psychol. 107, 87–99.

Biringen, Z., Emde, R.N., Campos, J.J., Appelbaum, M.I., 1995. Affective reorganization in the infant, the mother, and the dyad: the role of upright locomotion. Child Dev. 66, 499–514.

Biro, S., Alink, L.R., van IJzendoorn, M.H., Bakermans-Kranenburg, M.J., 2014. Infants' monitoring of social interactions: the effect of emotional cues. Emotion 14, 263–271.

Boone, R.T., Cunningham, J.G., 1998. Children's decoding of emotion in expressive body movement: the development of cue attunement. Dev. Psychol. 34, 1007–1016.

Boone, R.T., Cunningham, J.G., 2001. Children's expression of emotional meaning in music through expressive body movement. J. Nonverbal Behav. 25, 21–41.

Brownell, C.A., Svetlova, M., Anderson, R., Nichols, S.R., Drummond, J., 2013. Socialization of early prosocial behavior: parents' talk about emotions is associated with sharing and helping in toddlers. Infancy 18, 91–119.

Buttelmann, D., Carpenter, M., Tomasello, M., 2009. Eighteen-month-old infants show false belief understanding in an active helping paradigm. Cognition 112, 337–342.

Camras, L.A., Sachs, V.B., 1991. Social referencing and caretaker expressive behavior in a day care setting. Infant Behav. Dev. 14, 27–36.

Campos, J.J., 1983. The importance of affective communication in social referencing: a commentary on Feinman. Merrill-Palmer Q. 29, 83–87.

Campos, J.J., Campos, R.G., Barrett, K.C., 1989. Emergent themes in the study of emotional development and emotion regulation. Dev. Psychol. 25, 394–402.

Campos, J.J., Kermoian, R., Zumbahlen, M.R., 1992. Socioemotional transformations in the family system following infant crawling onset. N. Dir. Child Dev. 55, 25–40.

Campos, J.J., Mumme, D.L., Kermoian, R., Campos, R.G., 1994. A functionalist perspective on the nature of emotion. Monogr. Soc. Res. Child Dev. 59, 284–303.

Carpenter, M., Akhtar, N., Tomasello, M., 1998. Fourteen-through 18-month-old infants differentially imitate intentional and accidental actions. Infant Behav. Dev. 21, 315–330.

Chiarella, S.S., Poulin-Dubios, D., 2015. "Aren't you supposed to be sad?" Infants do not treat a stoic person as an unreliable emoter. Infant Behav. Dev. 38, 57–66.

Chiarella, S.S., Poulin-Dubios, D., 2013. Cry babies and pollyannas: infants can detect unjustified emotional reactions. Infancy 18, E81–E96.

Cohn, J., Campbell, S.B., Matias, R., Hopkins, J., 1990. Face-to-face interactions of postpartum depressed and nondepressed mother-infant pairs at 2 months. Dev. Psychol. 26, 15–23.

Cummings, E.M., Zahn-Waxler, C., Radke-Yarrow, M., 1981. Young children's responses to expressions of anger and affection by others in the family. Child Dev. 52, 1274–1282.

de Rosnay, M.M., Cooper, P.J., Tsigaras, N., Murray, L., 2006. Transmission of social anxiety from mother to infant: an experimental study using a social referencing paradigm. Behav. Res. Ther. 44, 1165–1175.

Denham, S.A., Zoller, D., Couchoud, E.A., 1994. Socialization of preschoolers' emotion understanding. Dev. Psychol. 30, 928–936.

D'Entremont, B., Muir, D., 1999. Infant responses to adult happy and sad vocal and facial expressions during face-to-face interactions. Infant Behav. Dev. 22, 527–539.

D'Entremont, B., Muir, D.W., 1997. Five-month-olds attention and affective response to still-faced emotional expressions. Infant Behav. Dev. 21, 563–568.

Dickstein, S., Parke, R.D., 1988. Social referencing in infancy: a glance at fathers and marriage. Child Dev. 59, 506–511.
Drummond, J., Paul, E.F., Waugh, W.E., Hammond, S.I., Brownell, C.A., 2014. Here, there and everywhere: emotion and mental state talk in different social contexts predicts empathic helping in toddlers. Front. Psychol. 5, 361.
Ellsworth, P.C., Scherer, K.R., 2003. Appraisal processes in emotion. In: Davidson, R.J., Scherer, K.R., Goldsmith, H.H. (Eds.), Handbook of Affective Sciences. Oxford University Press, New York, NY, pp. 572–595.
Fantz, R.L., 1963. Pattern vision in newborn infants. Science 140, 296–297.
Fehr, B., Russell, J.A., 1984. Concept of emotion viewed from a prototype perspective. J. Exp. Psychol. Gen. 113, 464–486.
Fernald, A., 1993. Approval and disapproval: infant responsiveness to vocal affect in familiar and unfamiliar languages. Child Dev. 64, 657–674.
Field, T., Healy, B., Goldstein, S., Perry, S., Bendell, D., Schanberg, S., Zimmerman, E.A., Kuhn, C., 1988. Infants of depressed mothers show "depressed" behavior even with nondepressed adults. Child Dev. 59, 1569–1579.
Feinman, S., Lewis, M., 1983. Social referencing at ten months: a second-order effect on infants' responses to strangers. Child Dev. 54, 878–887.
Flavell, J.H., 1985. Cognitive Development, second ed. Prentice-Hall, New York, NY.
Flom, R., Bahrick, L.E., 2007. The development of infant discrimination of affect in multimodal and unimodal stimulation: the role of intersensory redundancy. Dev. Psychol. 43, 238–252.
Fogel, A., Nwokah, E., Dedo, J.Y., Messinger, D., Dickson, K.L., Matusov, E., Holt, S.A., 1992. Social process theory of emotion: a dynamic systems approach. Soc. Dev. 1, 122–142.
Friend, M., 2001. The transition from affective to linguistic meaning. First Lang. 21, 219–243.
Frijda, N.H., 1986. The Emotions. Cambridge University Press, New York, NY.
Garber, J., Braafladt, N., Zeman, J., 1991. The regulation of sad affect: an information-processing perspective. In: Garber, J., Dodge, K.A. (Eds.), The Development of Emotion Regulation and Dysregulation. Cambridge University Press, New York, NY, pp. 208–240.
Garner, P.W., 2003. Child and family correlates of toddlers' emotional and behavioral responses to a mishap. Infant Ment. Health J. 24, 580–596.
Garner, P.W., Jones, D.C., Gaddy, G., Rennie, K.M., 1997. Low-income mothers' conversations about emotions and their children's emotional competence. Soc. Dev. 6, 37–52.
Goodman, S.H., Brogan, D., Lynch, M.E., Fielding, B., 1993. Social and emotional competence in children of depressed mothers. Child Dev. 64, 516–531.
Goodman, S.H., Gotlib, I.H., 1999. Risk for psychopathology in the children of depressed mothers: a developmental model for understanding mechanisms of transmission. Psychol. Rev. 106, 458–490.
Grace, S.L., Evindar, A., Stewart, D.E., 2003. The effect of postpartum depression on child cognitive development and behavior: a review and critical analysis of the literature. Arch. Wom. Ment. Health 6, 263–274.
Green, J.A., Gustafson, G.E., West, M.J., 1980. Effects of infant development on mother-infant interactions. Child Dev. 51, 199–207.
Grossmann, T., Striano, T., Friederici, A.D., 2005. Infants' electric brain responses to emotional prosody. Neuroreport 16, 1825–1828.
Gusella, J.L., Muir, D., Tronick, E.Z., 1988. The effect of manipulating maternal behavior during an interaction on three- and six-month-olds' affect and attention. Child Dev. 59, 1112–1124.
Hepach, R., Westermann, G., 2013. Infants' sensitivity to the congruence of others' emotions and actions. J. Exp. Child Psychol. 115, 16–29.
Hornik, R., Risenhoover, N., Gunnar, M., 1987. The effects of maternal positive, neutral, and negative affective communications on infant responses to new toys. Child Dev. 58, 937–944.
Izard, C.E., 1971. The Face of Emotion. Appleton-Century-Crofts, East Norwalk, CT.
Kahana-Kalman, R., Walker-Andrews, A.S., 2001. The role of person familiarity in young infants' perception of emotional expressions. Child Dev. 72, 352–369.
Klinnert, M.D., Emde, R.N., Butterfield, P., Campos, J.J., 1986. Social referencing: the infant's use of emotional signals from a friendly adult with mother present. Dev. Psychol. 22, 427–432.
Knothe, J.M., Walle, E.A., 2018. Parental communication about emotional contexts: differences across discrete categories of emotion. Soc. Dev. 27, 247–261.
Kuebli, J., Fivush, R., 1992. Gender differences in parent–child conversations about past emotions. Sex. Roles 27, 683–698.
Lagattuta, K.H., Wellman, H.M., 2002. Differences in early parent-child conversations about negative versus positive emotions: implications for the development of psychological understanding. Dev. Psychol. 38, 564–580.
Lazarus, R.S., 1982. Thoughts on the relations between emotion and cognition. Am. Psychol. 37, 1019–1024.
Lazarus, R.S., 1991. Emotion and Adaptation. Oxford University Press, New York, NY.
Ludemann, P.M., Nelson, C.A., 1988. Categorical representation of facial expressions by 7-month-old infants. Dev. Psychol. 24, 492–501.
Martin, N.G., Witherington, D.C., Edwards, A., 2008. The development of affect specificity in infants' use of emotion cues. Infancy 13, 456–468.
Meltzoff, A.N., Brooks, R., 2008. Self-experience as a mechanism for learning about others: a training study in social cognition. Dev. Psychol. 44, 1257–1265.
Missana, M., Grossmann, T., 2015. Infants' emerging sensitivity to emotional body expressions: insights from asymmetrical frontal brain activity. Dev. Psychol. 51, 151–160.
Mondloch, C.J., Horner, M., Mian, J., 2013. Wide eyes and drooping arms: adult-like congruency effects emerge early in the development of sensitivity to emotional faces and body postures. J. Exp. Child Psychol. 114, 203–216.
Montague, D.P.F., Walker-Andrews, A.S., 2001. Peekaboo: a new look at infants' perception of emotion expressions. Dev. Psychol. 37, 826–838.
Morton, J.B., Trehub, S.E., 2001. Children's understanding of emotion in speech. Child Dev. 72, 834–843.
Morton, J.B., Trehub, S.E., Zelazo, P.D., 2003. Sources of inflexibility in 6-year-olds' understanding of emotion in speech. Child Dev. 74, 1857–1868.
Mumme, D.L., Fernald, A., 1996. Infants' responses to facial and vocal emotional signals in a social referencing paradigm. Child Dev. 67, 3219–3237.
Nelson, C.A., de Haan, M., 1996. Neural correlates of infants' visual responsiveness to facial expressions of emotion. Dev. Psychobiol. 29, 577–595.
Nelson, N.L., Mondloch, C.J., 2017. Adults' and children's perception of facial expressions is influenced by body postures even for dynamic stimuli. Vis. Cognit. 25, 563–574.
Nelson, N.L., Russell, J.A., 2011. Preschoolers' use of dynamic facial, bodily, and vocal cues to emotion. J. Exp. Child Psychol. 110, 52–61.
Nelson, N.L., Nowicki, E., Diemer, M.C., Sangster, K., Cheng, C., Russell, J.A., 2018. Children can create a new emotion category through a process of elimination. Cogn. Dev. 47, 117–123.
Newton, E.K., Goodman, M., Thompson, R.A., 2014. Why do some toddlers help a stranger? Origins of individual differences in prosocial behavior. Infancy 19, 214–226.
Newton, E.K., Thompson, R.A., Goodman, M., 2016. Individual differences in toddlers' prosociality: experiences in early relationships explain variability in prosocial behavior. Child Dev. 87, 1715–1726.
Pascalis, O., Kelly, D.J., 2009. The origins of face processing in humans: phylogeny and ontogeny. Perspect. Psychol. Sci. 4, 200–209.
Paquette-Smith, M., Johnson, E.K., 2016. I don't like the tone of your voice: infants use vocal affect to socially evaluate others. Infancy 21, 104–121.
Pickens, J., Field, T., 1993. Facial expressivity in infants of depressed mothers. Dev. Psychol. 29, 986–988.
Pochedly, J.T., Widen, S.C., Russell, J.A., 2012. What emotion does the "facial expression of disgust" express? Emotion 12, 1315–1319.
Pollak, S.D., Messner, M., Kistler, D.J., Cohn, J.F., 2009. Development of perceptual expertise in emotion recognition. Cognition 110, 242–247.
Pollak, S.D., Sinha, P., 2002. Effects of early experience on children's recognition of facial displays of emotion. Dev. Psychol. 38, 784–791.
Pons, F., Harris, P., de Rosnay, M., 2004. Emotion comprehension between 3 and 11 years: developmental periods and hierarchical organization. Eur. J. Dev. Psychol. 1, 127–152.
Quam, C., Swingley, D., 2012. Development in children's interpretation of pitch cues to emotions. Child Dev. 83, 236–250.
Rajhans, P., Jessen, S., Missana, M., Grossmann, T., 2016. Putting the face in context: body expressions impact facial emotion processing in human infants. Dev. Cogn. Neurosci. 19, 115–121.
Repacholi, B.M., 1998. Infants' use of attentional cues to identify the referent of another person's emotional expression. Dev. Psychol. 34, 1017–1025.

Repacholi, B.M., Meltzoff, A.N., 2007. Emotional eavesdropping: infants selectively respond to indirect emotional signals. Child Dev. 78, 503–521.
Repacholi, B.M., Meltzoff, A.N., Hennings, T.M., Ruba, A.L., 2016. Transfer of social learning across contexts: exploring infants' attribution of trait-like emotions to adults. Infancy 21, 785–806.
Repacholi, B.M., Meltzoff, A.N., Olsen, B., 2008. Infants' understanding of the link between visual perception and emotion: "If she can't see me doing it, she won't get angry". Dev. Psychol. 44, 561–574.
Reschke, P.J., Walle, E.A., Flom, R., Guenther, D., 2017a. Twelve-month-old infants' sensitivity to others' emotions following positive and negative events. Infancy 22, 874–881.
Reschke, P.J., Walle, E.A., Dukes, D., 2017b. Interpersonal development in infancy: the interconnectedness of emotion understanding and social cognition. Child Dev. Perspect. 11, 178–183.
Rosen, W.D., Adamson, L.B., Bakeman, R., 1992. An experimental investigation of infant social referencing: mothers' messages and gender differences. Dev. Psychol. 28, 1172–1178.
Ross, P.D., Polson, L., Grosbras, M., 2012. Developmental changes in emotion recognition from full-light and point-light displays of body movement. PLoS One 7, 1–8.
Russell, J.A., 2014. Four perspectives on the psychology of emotion [Special section]. Emot. Rev. 6, 291–321.
Russell, J.A., 2003. Core affect and the psychological construction of emotion. Psychol. Rev. 110, 145–172.
Russell, J.A., Widen, S.C., 2002. A label superiority effect in children's categorization of facial expressions. Soc. Dev. 11, 30–52.
Saarni, C., Campos, J.J., Camras, L.A., Witherington, D., 2006. Emotional development: action, communication, and understanding. In: Eisenberg, N., Damon, W., Lerner, R.M. (Eds.), Handbook of Child Psychology, Social, Emotional, and Personality Development, sixth ed., vol. 3. Wiley, New York, NY, pp. 226–299.
Sakkalou, E., Gattis, M., 2012. Infants infer intentions from prosody. Cogn. Dev. 27, 1–16.
Silk, J.S., Shaw, D.S., Skuban, E.M., Oland, A.A., Kovacs, M., 2006. Emotion regulation strategies in offspring of childhood-onset depressed mothers. J. Child Psychol. Psychiat. 47, 69–78.
Skerry, A.E., Spelke, E.S., 2014. Preverbal infants identify emotional reactions that are incongruent with goal outcomes. Cognition 130, 204–216.
Soderstrom, M., Reimchen, M., Sauter, D., Morgan, J.L., 2017. Do infants discriminate non-linguistic vocal expressions of positive emotions? Cognit. Emot. 31, 298–311.
Soken, N.H., Pick, A.D., 1999. Infants' perception of dynamic affective expressions: do infants distinguish specific expressions? Child Dev. 70, 1275–1282.
Sorce, J.F., Emde, R.N., Campos, J.J., Klinnert, M.D., 1985. Maternal emotional signaling: its effect on the visual cliff behavior of 1-year-olds. Dev. Psychol. 21, 195–200.
Stenberg, G., 2009. Selectivity in infant social referencing. Infancy 14, 457–473.
Stenberg, G., 2012. Why do infants look at and use positive information from some informants rather than others in ambiguous situations? Infancy 17, 642–671.
Striano, T., Rochat, P., 2000. Emergence of selective social referencing in infancy. Infancy 1, 253–264.
Taylor-Colls, S., Fearon, R.M.P., 2015. The effects of parental behavior on infants' neural processing of emotion expressions. Child Dev. 86, 877–888.
Tronick, E., Als, H., Adamson, L., Wise, S., Brazelton, T.B., 1978. The infant's response to entrapment between contradictory messages in face-to-face interaction. Pediatrics 62, 403.
Vaish, A., Striano, T., 2004. Is visual reference necessary? Contributions of facial versus vocal cues in 12-month-olds' social referencing behavior. Dev. Sci. 7, 261–269.
Walden, T.A., Kim, G., 2005. Infants' social looking toward mothers and strangers. Int. J. Behav. Dev. 29, 356–360.
Walker-Andrews, A.S., 1997. Infants' perception of expressive behaviors: differentiation of multimodal information. Psychol. Bull. 121, 437–456.
Walle, E.A., Campos, J.J., 2014. The development of infant detection of inauthentic emotion. Emotion 14, 488–503.
Walle, E.A., Reschke, P.J., Camras, L.A., Campos, J.J., 2017. Infant differential behavioral responding to discrete emotions. Emotion 17, 1078–1091.
Walle, E.A., Reschke, P.J., Knothe, J.M., 2017. Social referencing: defining and delineating a basic process of emotion. Emot. Rev. 9, 245–252.
Weinberg, M.K., Tronick, E.Z., 1998. The impact of maternal psychiatric illness on infant development. J. Clin. Psychiat. 59, 53–61.
Widen, S.C., 2013. Children's interpretation of facial expressions: the long path from valence-based to specific discrete categories. Emot. Rev. 5, 72–77.
Widen, S.C., Russell, J.A., 2003. A closer look at preschoolers' freely produced labels for facial expressions. Dev. Psychol. 39, 114–128.
Widen, S.C., Russell, J.A., 2010. Children's scripts for social emotions: causes and consequences are more central than are facial expressions. Br. J. Dev. Psychol. 28, 565–581.
Wu, Y., Muentener, P.J., Schulz, L., 2017. One- to four-year-olds connect diverse positive emotional vocalizations to their probable causes. Proc. Natl. Acad. Sci. USA 114, 11896–11901.
Zahn-Waxler, C., Cummings, E.M., McKnew, D.H., Radke-Yarrow, M., 1984. Altruism, aggression, and social interactions in young children with a manic-depressive parent. Child Dev. 55, 112–122.
Zahn-Waxler, C., Radke-Yarrow, M., King, R.A., 1979. Child rearing and children's prosocial initiations toward victims of distress. Child Dev. 50, 319–330.
Zieber, N., Kangas, A., Hock, A., Bhatt, R.S., 2014. Infants' perception of emotion from body movements. Child Dev. 85, 675–684.