

Factors Facilitating Emotion Understanding in Infancy: Commentary on Ogren and Johnson

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The development of emotion understanding constitutes the convergence of a host of processes that yield a related, yet qualitatively distinct, construct. The article provided by Ogren and Johnson (this issue, DOI: 10.1159/000511628) highlights three developmental processes likely to facilitate emotion understanding in childhood: family expressiveness, parent-child discussion of emotions, and child language. The authors' contribution to this complex and hotly debated topic in emotional development is timely and I agree with many of their points. However, their emphasis on processes present in early childhood risks underemphasizing factors likely to facilitate emotion understanding in infancy. In providing my own conceptualization of emotion understanding, this commentary seeks to complement their review by highlighting three additional factors important for the development of emotion understanding, specifically the infant's (a) early personal emotional experiences, (b) perception of emotion via nonexpressive channels, and (c) ability to form categories prior to the acquisition of language.

Defining Emotion Understanding

Emotions are an individual's relations with their environment on matters of personal significance with their goals (see Barrett & Campos, 1987). Thus, it follows that emotion understanding is how one appreciates others' relational significance with their perceived environment (Walle & Lopez, 2020). It is in this way that emotions can be differentiated from mere meaning-making or categorization. Specifically, in order to understand another's emotion in a particular context, it is insufficient to perceive a person's actions as goal-directed (e.g., the person is running in a forest); rather, the action must be perceived as significant to the individual's goals in relation with their environment (e.g., there is a bear chasing them), which thus manifests the presence of an emotion (i.e., fear). Lacking an appreciation of these relational elements precludes understanding of the individual's emotion. Thus, the action of running is goal-directed, but not emotional; the bear is an animal, but not in of itself fear-instilling (as when one sees a bear at a zoo); the fearful expression lacks meaning when stripped of context (see Dewey, 1895; Campos et al., 1989; Hassin et al., 2013). It is the convergence of these elements that constitutes the understanding of the person's emotion.

In this way emotion and emotion understanding are best viewed as emergent phenomena greater than the sum of their parts (see Coan, 2010). Pinning down emotion understanding to a single element, such as labeling or categorization, overlooks the complexity of what is to be understood (see also Barrett, 2020). For example, while a child may label an elephant or categorize an elephant as distinct from a lion, one would not conclude that the child *understands* the elephant: its biology, lifespan, ecosystem, evolution, etc. Likewise, labeling or categorizing a person as angry is insufficient for *understanding* the person's anger: its source, goal relevance, the person's prior history or coping potential, etc. (for a related point, see Main et al., 2017). Thus, emotion understanding emerges from an observer's attention to and processing of various aspects of the emotional context, and the coordination of these elements to understand the relational significance of the individual with their perceived environment (i.e., the emotion). No single element of the emotional context is necessarily prioritized or sufficient for emotion understanding. As a consequence, the development of the individual's ability to appreciate one contextual element (e.g., discriminating facial expression) is no more or less important than another (e.g., knowledge of cultural norms) for facilitating emotion understanding.

Factors Facilitating the Development of Infant Emotion Understanding

The above conceptualization of emotion, and by extension of emotion understanding, has important consequences for studying the development of emotion understanding. The factors described by Ogren and Johnson (this issue, DOI: 10.1159/000511628) are undoubtedly involved in the development of emotion understanding. However, the above theoretical stance brings to the fore other factors likely to facilitate emotion understanding at ages younger than those primarily reviewed by Ogren and Johnson (this issue, DOI: 10.1159/000511628). Below I describe three such factors for the development of emotion understanding in infancy.

Personal Experience Facilitates the Understanding of Relational Significance

The role of self-experience for development has a rich history in developmental psychology (e.g., Piaget, 1952; Held & Hein, 1963; Campos et al., 2000). Of particular relevance is the bidirectional developmental unfolding of infants' actions and their perception of others' actions

(e.g., Thelen, 1994; Kanakogi & Itakura, 2011). This research demonstrates that the infant's own perceptual and behavioral experiences facilitate their understanding of others' mental states. For example, 3-month-old infants' experience grasping objects via an experimental manipulation corresponds with their perception of an agent's reaching as goal directed (Sommerville et al., 2005), and 12-month-old infants' personal experience with the affordances of a blindfold corresponds with their interpretation of what an agent can see (Meltzoff & Brooks, 2008). Such personal experience interacting with the world is similarly likely to allow the infant to understand others' emotions.

Infants' emerging understanding of emotion is best viewed as a bidirectional process facilitated by their interaction with and response to an expanding social world (see Saarni et al., 2006). Indeed, changes in how infants express emotions provide insight into their personal experience of such encounters. For example, infant anger expressions develop markedly in the first year of life, progressing from general distress, to attention toward the goal blockage at 4 months, and then toward the agent inducing the blockage at 7 months (Stenberg & Campos, 1990). Likewise, the stimuli that may elicit fear and the degree of fear intensity to various stimuli change across infancy, particularly in the case of strangers (Scarr & Salapatek, 1970). Specific developmental transitions also change infants' emotional experiences, such as increased positive interactions and greater "testing of wills" reported by parents of walking infants (Biringen et al., 1995). Moreover, infants purposefully initiate emotional experiences, such as engaging in previously prohibited behaviors while referencing the caregiver (Dunn & Munn, 1985), with such instances providing opportunities to negotiate around the sources of such emotions (Kuczynski & Kochanska, 1990). The above research highlights that infants themselves are an important source for facilitating their understanding of emotion early in development (see Walle et al., 2012). Research systematically examining infants' experience with significant goal relations in the environment represents an exciting avenue for further research on this topic. For example, one might provide the infant an obstacle that either does or does not block the infant's goal, thereby eliciting an emotion of anger. Following such personal experience with the goal blockage, one might hypothesize that the infant would accurately anticipate and appreciate an agent's own goal relation with the obstacle and likely emotion.

The above points do not discount the role of socialization practices by the caregiver, such as emotion conversa-

tions, for developing emotion understanding. As highlighted by Ogren and Johnson (this issue, DOI: 10.1159/000511628), research examining parent-child emotion talk indicates that such conversations are present early in childhood (e.g., Lagattutta & Wellman, 2002), are used to highlight specific aspects of emotional contexts (Knothe & Walle, 2018), and influence child responding in subsequent emotional contexts (Brownell et al., 2013). However, an antecedent factor to such discussions rests in infants' first-hand emotional experiences that provide the basis for inferring the emotional experiences of others.

Relational Significance Involves Perceiving More than Facial Expressions

As with any emerging understanding, experience with emotion exemplars is central for differentiating and understanding emotions. Given the canonical approach that emotional expressions are central to emotion experience, it is unsurprising that emotion expressions have taken center stage in studying the emotional ecology of the developing human. Extensive research has tested infant discrimination (e.g., LaBarbera et al., 1976; Young-Browne et al., 1977; for an excellent review, see Walker-Andrews, 1997) and responding (e.g., Sorce et al., 1985; Walle et al., 2017; for a review, see Walle & Campos, 2012) to discrete emotions, as well as individual differences in such abilities (e.g., Pollak & Sinha, 2002; Pollak et al., 2009). Likewise, infants discriminate vocal expressions early in development (e.g., Flom & Bahrick, 2007), can use vocal expressions to guide their behavior (e.g., Mumme et al., 1996), and appreciate the specific concerns expressed through specific acoustic forms that such vocalizations may take (Dahl & Tran, 2016). The ontogeny of appreciating emotion communicated through posture, movement, and touch is less prevalent in the literature (e.g., Boone & Cunningham, 1998; Hertenstein & Campos, 2001; Weiss et al., 2001), but no less important for study. While emotional expressions serve important functions for social interactions, exclusive study of overt expressive channels risks missing other ways in which relational significance can be perceived.

Indeed, infants can perceive an emotion even when no overt emotional expression is provided. Consider studies that attempt to "control" experimenter expressivity (e.g., providing neutral expressions), only to find that child participants persist in responding to the context as emotional. For example, Newton et al. (2014) found that 18- to 20-month-old infants responded with prosocial behavior when an experimenter experienced loss, even when no

expression of sadness was communicated. Infants also demonstrate an expectation for particular emotions as a function of prior events (Hepach & Westermann, 2013; Skerry & Spelke, 2014; Reschke et al., 2017b; Wu et al., 2017, 2018), indicating that infants anticipate discrete emotions from the relational significance of a context when overt expressions were absent. Moreover, 15-month-old infants use an individual's previous emotional response to predict their emotions in future interactions (Repacholi et al., 2016), demonstrating that infants' person knowledge of the individual provided the necessary information regarding their likely emotion. This research indicates that infants go beyond simply perceiving a physical expression; they infer the person's mental state, their significant relation with the environment (see Reschke et al., 2017a).

Research utilizing more naturalistic and contextually embedded stimuli would further our understanding of what infants attend to in emotional contexts. For example, while infants may fixate on emotional faces, analyzing how visual attention is distributed across contextual elements and the temporal patterning of such attention is crucial for understanding how the infant processes the relational significance of the person with the environment (i.e., the emotion). One might predict that such divergence of attentional allocation from the person expressing the emotion to that which the person is emoting about follows a similar patterning as the emergence of secondary intersubjectivity in the first year of life. Such research would fill an important gap in our understanding of when infants discriminate emotional expressions and when they appreciate their relational meaning.

Clearly, exposure to emotional expressions plays an important role in facilitating the development of emotion understanding. However, emotional expressivity alone is insufficient to assess the infant's emotional ecology and the information utilized by the infant for their developing emotion understanding.

Categories of Relational Significance Can Exist without Language

Categories are useful in that they make "discriminably different things equivalent" (Bruner et al., 1956, p. 231). A conceptualization of emotion understanding as one's understanding of emotion categories can result in paradigms designed to elicit categorical responses to the stimuli. Because indices of categories are generally verbal in nature, interpretation of such empirical research can lead to a "linguacentic perspective" (Keil, 2003, p. v) of the phenomenon. However, while providing a label can serve

to constrain or expand one's categorizations (Waxman & Markow, 1995), it need not follow that labels are necessary for categorization.

A wealth of research indicates that preverbal infants have an early understanding of human emotion (see Ruba & Repacholi, 2020). Infants can discriminate (Flom & Bahrick, 2007), form perceptual categories of discrete emotions at 4–7 months (Ruba et al., 2017; White et al., 2019), and differentially respond to emotions at 4–10 months (e.g., Montague & Walker-Andrews, 2001; Walden & Ogan, 1988), well before emotion labels enter their vocabularies (e.g., Ridgeway et al., 1985). Such research indicates that language is not a necessary prerequisite for early emotion understanding in infancy. Furthermore, language is not sufficient for emotion understanding. For example, while young children readily assign an emotion label to a novel facial expression (Nelson & Russell, 2016), the addition of this label to the child's lexicon falls short of allowing them to understand the relational significance and communicative value of the expression. More concretely, although identifying and labeling a specific emotion category may be aspects of emotion understanding, they are insufficient in and of themselves to constitute emotion understanding.

This leads to a sensible empirical concern: without labels to help constrain categorical membership, how is the infant to make sense of a seemingly statistically noisy emotion learning environment? Researchers of language acquisition have found that infants are quite skilled at detecting statistical regularities (e.g., Saffran et al., 1996; Maye et al., 2002) and are more skilled at parsing the signal from the noise than previously thought (Suanda et al., 2019). In considering the emotion-learning environment, one's conceptualization of emotion is central for operationalizing the signal that is to be gleaned. Emotions conceptualized as an individual's expressions or behaviors yields an exceedingly noisy environment full of idiosyncratic displays. Conversely, emotions as verbal labels provide greater regularity of the signal but require that the infant understands language. However, emotions viewed as one's significant relations with the environment transcend the variability across expressions, people, and objects/events present, and prioritize a more abstract, yet reliable, signal. This functionalist perspective brings coherence to the equipotentiality and equifinality of emotion (see Walle & Campos, 2012; Walle et al., 2017). Indeed, in unsupervised learning conditions, young children can adjust categorical boundaries of emotion to be attuned to the person expressing the emotion (Plate et al.,

2019), though research using such paradigms with infants is needed. It would be interesting to conduct a study where instead of providing a novel emotion label or associating a label with a face (e.g., Nelson & Russell, 2016), the child instead observed a novel significant relation and corresponding novel expression. One could then introduce the emotion label to examine how its addition influenced the child's understanding of the previously unlabeled emotion.

The issue at hand is not whether humans form categories of emotion, but rather what is to be categorized. A view conceptualizing emotion as significant person-environment relations provides sufficient regularity of the signal and flexibility of its manifestation for categorization by the developing human. This is not to say that language is unimportant for the development of emotion understanding; Ogren and Johnson (this issue, DOI: 10.1159/000511628) provide a compelling review of how language facilitates and shapes emotion understanding. However, emphasizing language as necessary for or part and parcel of emotion understanding oversteps the theoretical foundation of emotion.

Conclusion

Viewing emotions, and by extension emotion understanding, as emergent constructs that are greater than the sum of their parts necessitates viewing their development as similarly emergent. Ogren and Johnson (this issue, DOI: 10.1159/000511628) highlight three aspects of the child's life likely to facilitate emotional understanding. In this commentary, I have presented three additional factors. Importantly, these elements, along with others (e.g., interpersonal responding; cultural knowledge), work together to foster the development of an ability greater than its component pieces, a construct broader than facial perception, perspective taking, or labeling.

Moreover, it is imperative that researchers not be constrained by the adult form of emotional understanding when considering its development. Just as Western perspectives have historically dominated the study of psychological processes, so too do researchers of development risk over-reliance on adult conceptualization of the construct for determining its presence and functioning in the developing human or nonhuman animal. To say that the developing human lacks an emotion at a particular age because its manifestation does not match that of the adult version places too central the "finished" form over that which develops. Moreover, development is charac-

terized not only by linear changes, but qualitative changes, as well. Thus, just as emotions are emergent, so too is their development, as basic processes develop, change, and coalesce. While cross-domain research on emotional

development is to be encouraged, it is essential that researchers keep in mind that it is the integration and interaction of these domains, rather than their mere presence, from which the construct develops.

References

- Barrett, K. C. (2020). Emotional development is complicated. *Developmental Psychology, 56*(4), 833–836. <https://doi.org/10.1037/dev0000882>
- Barrett, K. C., & Campos, J. J. (1987). Perspectives on emotional development II: A functionalist approach to emotions. In J. D. Osofsky (Ed.), *Handbook of infant development* (pp. 555–578). Hoboken, NJ: John Wiley & Sons.
- 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 and its timing. *Child Development, 66*(2), 499–514. <https://doi.org/10.2307/1131593>
- Boone, R. T., & Cunningham, J. G. (1998). Children's decoding of emotion in expressive body movement: The development of cue attenuation. *Developmental Psychology, 34*(5), 1007–1016. <https://doi.org/10.1037/0012-1649.34.5.1007>
- 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*(1), 91–119. <https://doi.org/10.1111/j.1532-7078.2012.00125.x>
- Bruner, J. S., Goodnow, J. J., & Austin, G. A. (1956). *A study of thinking*. Hoboken, NJ: John Wiley & Sons.
- Campos, J. J., Anderson, D. I., Barbu-Roth, M. A., Hubbard, E. M., Hertenstein, M. J., & Witherington, D. (2000). Travel broadens the mind. *Infancy, 1*(2), 149–219. https://doi.org/10.1207/S15327078IN0102_1
- Campos, J. J., Campos, R. G., & Barrett, K. C. (1989). Emergent themes in the study of emotional development and emotion regulation. *Developmental Psychology, 25*(3), 394–402. <https://doi.org/10.1037/0012-1649.25.3.394>
- Coan, J. A. (2010). Emergent ghosts of the emotion machine. *Emotion Review, 2*(3), 274–285. <https://doi.org/10.1177/1754073910361978>
- Dahl, A., & Tran, A. Q. (2016). Vocal tones influence young children's responses to prohibitions. *Journal of Experimental Child Psychology, 152*, 71–91. <https://doi.org/10.1016/j.jecp.2016.07.009>
- Dewey, J. (1895). The theory of emotion. *Psychological Review, 2*(1), 13–32. <https://doi.org/10.1037/h0070927>
- Dunn, J., & Munn, P. (1985). Becoming a family member: Family conflict and development of social understanding in the second year. *Child Development, 56*(2), 480–492. <https://doi.org/10.2307/1129735>
- Flom, R., & Bahrick, L. E. (2007). The development of infant discrimination of affect in multimodal and unimodal stimulation: The role of intersensory redundancy. *Developmental Psychology, 43*(1), 238–252. <https://doi.org/10.1037/0012-1649.43.1.238>
- Hassin, R. R., Aviezer, H., & Bentin, S. (2013). Inherently ambiguous: Facial expressions of emotions, in context. *Emotion Review, 5*(1), 60–65. <https://doi.org/10.1177/1754073912451331>
- Held, R., & Hein, A. (1963). Movement-produced stimulation in the development of visually guided behavior. *Journal of Comparative and Physiological Psychology, 56*(5), 872–876. <https://doi.org/10.1037/h0040546>
- Hepach, R., & Westermann, G. (2013). Infants' sensitivity to the congruence of others' emotions and actions. *Journal of Experimental Child Psychology, 115*(1), 16–29. <https://doi.org/10.1016/j.jecp.2012.12.013>
- Hertenstein, M. J., & Campos, J. J. (2001). Emotion regulation via maternal touch. *Infancy, 2*(4), 549–566. https://doi.org/10.1207/S15327078IN0204_09
- Kanakogi, Y., & Itakura, S. (2011). Developmental correspondence between action prediction and motor ability in early infancy. *Nature Communications, 2*(1), 341. <https://doi.org/10.1038/ncomms1342>
- Keil, F. C. (2003). Categories, cognitive development, and cognitive science. In D. H. Raikson & L. M. Oakes (Eds.), *Early category and concept development: Making sense of the blooming, buzzing confusion* (pp. v–xii). Oxford, UK: Oxford University Press.
- Knothe, J. M., & Walle, E. A. (2018). Parental communication about emotional contexts: Differences across discrete categories of emotion. *Social Development, 27*(2), 247–261. <https://doi.org/10.1111/sode.12276>
- Kuczynski, L., & Kochanska, G. (1990). Development of children's noncompliance strategies from toddlerhood to age 5. *Developmental Psychology, 26*(3), 398–408. <https://doi.org/10.1037/0012-1649.26.3.398>
- LaBarbera, J. D., Izard, C. E., Vietze, P., & Parisi, S. A. (1976). Four- and six-month-old infants' visual responses to joy, anger, and neutral expressions. *Child Development, 47*(2), 535–538. <https://doi.org/10.2307/1128816>
- 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. *Developmental Psychology, 38*(4), 564–580. <https://doi.org/10.1037/0012-1649.38.4.564>
- Main, A., Walle, E. A., Kho, C., & Halpern, J. (2017). The interpersonal functions of empathy: A relational perspective. *Emotion Review, 9*(4), 358–366. <https://doi.org/10.1177/1754073916669440>
- Maye, J., Werker, J. F., & Gerken, L. (2002). Infant sensitivity to distributional information can affect phonetic discrimination. *Cognition, 82*(3), B101–B111. [https://doi.org/10.1016/S0010-0277\(01\)00157-3](https://doi.org/10.1016/S0010-0277(01)00157-3)
- Meltzoff, A. N., & Brooks, R. (2008). Self-experience as a mechanism for learning about others: A training study in social cognition. *Developmental Psychology, 44*(5), 1257–1265. <https://doi.org/https://doi.org/10.1037/a0012888>
- Montague, D. P. F., & Walker-Andrews, A. S. (2001). Peekaboo: A new look at infants' perception of emotion expressions. *Developmental Psychology, 37*(6), 826–838. <https://doi.org/10.1037/0012-1649.37.6.826>
- Mumme, D. L., Fernald, A., & Herrera, C. (1996). Infants' responses to facial and vocal emotional signals in a social referencing paradigm. *Child Development, 67*(6), 3219–3237. <https://doi.org/10.2307/1131775>
- Nelson, N. L., & Russell, J. A. (2016). A facial expression of pax: Assessing children's "recognition" of emotion from faces. *Journal of Experimental Child Psychology, 141*, 49–64. <https://doi.org/10.1016/j.jecp.2015.07.016>
- 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*(2), 214–226. <https://doi.org/10.1111/inf.12043>
- Ogren, M., & Johnson, S. P. (2020). Factors facilitating early emotion understanding development: Contributions to individual differences. *Human Development, 64*, this issue. <https://doi.org/10.1159/000511628>
- Piaget, J. (1952). *The origins of intelligence in children* (M. Cook, transl.). New York, NY: W. W. Norton & Co. <https://doi.org/10.1037/11494-000>
- Plate, R. C., Wood, A., Woodard, K., & Pollak, S. D. (2019). Probabilistic learning of emotion categories. *Journal of Experimental Psychology, General, 148*(10), 1814–1827. <https://doi.org/10.1037/xge0000529>
- Pollak, S. D., Messner, M., Kistler, D. J., & Cohn, J. F. (2009). Development of perceptual expertise in emotion recognition. *Cognition, 110*(2), 242–247. <https://doi.org/10.1016/j.cognition.2008.10.010>
- Pollak, S. D., & Sinha, P. (2002). Effects of early experience on children's recognition of facial displays of emotion. *Developmental Psychology, 38*(5), 784–791. <https://doi.org/10.1037/0012-1649.38.5.784>

- Repacholi, B., Meltzoff, A., Hennings, T., & Ruba, A. (2016). Transfer of social learning across contexts: Exploring infants' attribution of trait-like emotions to adults. *Infancy, 21*(6), 785–806. <https://doi.org/10.1111/inf.12136>
- Reschke, P. J., Walle, E. A., & Dukes, D. (2017a). Interpersonal development in infancy: The interconnectedness of emotion understanding and social cognition. *Child Development Perspectives, 11*(3), 178–183. <https://doi.org/10.1111/cdep.12230>
- Reschke, P. J., Walle, E. A., Flom, R., & Guenther, D. (2017b). Twelve-month-old infants' sensitivity to others' emotions following positive and negative events. *Infancy, 22*(6), 874–881. <https://doi.org/10.1111/inf.12193>
- Ridgeway, D., Waters, E., & Kuczaj, S. A. (1985). Acquisition of emotion-descriptive language: Receptive and productive vocabulary norms for ages 18 months to 6 years. *Developmental Psychology, 21*(5), 901–908. <https://doi.org/10.1037/0012-1649.21.5.901>
- Ruba, A. L., Johnson, K. M., Harris, L. T., & Wilbourn, M. P. (2017). Developmental changes in infants' categorization of anger and disgust facial expressions. *Developmental Psychology, 53*(10), 1826–1832. <https://doi.org/10.1037/dev0000381>
- Ruba, A. L., & Repacholi, B. M. (2020). Do preverbal infants understand discrete facial expressions of emotion? *Emotion Review, 12*(4), 235–250. <https://doi.org/10.1177/1754073919871098>
- Saarni, C., Campos, J. J., Camras, L. A., & Whiting, D. (2006). Emotional development: Action, communication, and understanding. In N. Eisenberg, W. Damon, & R. M. Lerner (Eds.), *Handbook of child psychology: Vol. 3. Social, emotional, and personality development* (6th ed., pp. 226–299). Hoboken, NJ: John Wiley & Sons.
- Saffran, J. R., Aslin, R. N., & Newport, E. L. (1996). Statistical learning by 8-month-old infants. *Science, 274*(5294), 1926–1928. <https://doi.org/10.1126/science.274.5294.1926>
- Scarr, S., & Salapatek, P. (1970). Patterns of fear development during infancy. *Merrill-Palmer Quarterly of Behavior and Development, 16*, 53–90.
- Skerry, A. E., & Spelke, E. S. (2014). Preverbal infants identify emotional reactions that are incongruent with goal outcomes. *Cognition, 130*(2), 204–216. <https://doi.org/10.1016/j.cognition.2013.11.002>
- Sommerville, J. A., Woodward, A. L., & Needham, A. (2005). Action experience alters 3-month-old infants' perception of others' actions. *Cognition, 96*(1), B1–B11. <https://doi.org/10.1016/j.cognition.2004.07.004>
- Sorce, J., Emde, R., Campos, J., & Klinnert, M. (1985). Maternal emotional signaling: Its effect on the visual cliff behavior of 1-year-olds. *Developmental Psychology, 21*(1), 195–200. <https://doi.org/10.1037/0012-1649.21.1.195>
- Stenberg, C., & Campos, J. (1990). The development of anger expression in infancy. In N. Stein, B. Leventhal, & T. Trabasso (Eds.), *Psychological and biological approaches to emotion* (pp. 247–282). Mahwah, NJ: Erlbaum Associates.
- Suanda, S. H., Barnhart, M., Smith, L. B., & Yu, C. (2019). The signal in the noise: The visual ecology of parents' object naming. *Infancy, 24*(3), 455–476. <https://doi.org/10.1111/inf.12278>
- Thelen, E. (1994). Three-month-old infants can learn task-specific patterns of interlimb coordination. *Psychological Science, 5*(5), 280–285. <https://doi.org/10.1111/j.1467-9280.1994.tb00626.x>
- Walden, T. A., & Ogan, T. A. (1988). The development of social referencing. *Child Development, 59*(5), 1230–1240. <https://doi.org/10.2307/1130486>
- Walker-Andrews, A. S. (1997). Infants' perception of expressive behaviors: Differentiation of multimodal information. *Psychological Bulletin, 121*(3), 437–456. <https://doi.org/10.1037/0033-2909.121.3.437>
- Walle, E. A., & Campos, J. (2012). Interpersonal responding to discrete emotions: A functional approach to the development of affect specificity. *Emotion Review, 4*(4), 413–422. <https://doi.org/10.1177/1754073912445812>
- Walle, E. A., Dahl, A., & Campos, J. J. (2012). How can one piece together emotion when a crucial piece is missing? *Emotion Review, 4*(3), 299–300. <https://doi.org/10.1177/1754073912439770>
- Walle, E. A., & Lopez, L. D. (2020). Emotion recognition and understanding in infancy and early childhood. In J. B. Benson (Ed.), *Encyclopedia of infant and early childhood development* (2nd ed., Vol. 1, pp. 537–545). Amsterdam, the Netherlands: Elsevier. <https://doi.org/10.1016/B978-0-12-809324-5.23567-0>
- Walle, E. A., Reschke, P. J., Camras, L. A., & Campos, J. J. (2017). Infant differential behavioral responding to discrete emotions. *Emotion (Washington, D.C.), 17*(7), 1078–1091. <https://doi.org/10.1037/emo0000307>
- Waxman, S. R., & Markow, D. B. (1995). Words as invitations to form categories: Evidence from 12- to 13-month-old infants. *Cognitive Psychology, 29*(3), 257–302. <https://doi.org/10.1006/cogp.1995.1016>
- Weiss, S. J., Wilson, P., Seed, M. S. J., & Paul, S. M. (2001). Early tactile experience of low birth weight children: Links to later mental health and social adaptation. *Infant and Child Development, 10*(3), 93–115. <https://doi.org/10.1002/icd.236>
- White, H., Chroust, A., Heck, A., Jubran, R., Galati, A., & Bhatt, R. S. (2019). Categorical perception of facial emotions in infancy. *Infancy, 24*(2), 139–161. <https://doi.org/10.1111/inf.12275>
- Wu, Y., Muentener, P., & Schulz, L. E. (2017). One-to-four-year-olds connect diverse positive emotional vocalizations to their probable causes. *Proceedings of the National Academy of Sciences of the United States of America, 114*(45), 11896–11901. <https://doi.org/10.1073/pnas.1707715114>
- Wu, Y., Schulz, L. E., & Saxe, R. (2018). Toddlers connect emotional responses to epistemic states. In *Proceedings of the 40th Annual Meeting of the Cognitive Science Society* (pp. 2711–2716), Madison, WI.
- Young-Browne, G., Rosenfeld, H., & Horowitz, F. (1977). Infant discrimination of facial expressions. *Child Development, 48*(2), 555–562. <https://doi.org/10.2307/1128653>