Published in final edited form as:
Emotion. 2014 June ; 14(3): 488–503. doi:10.1037/a0035305.

The Development of Infant Detection of Inauthentic Emotion

Eric A. Walle and
University of California, Merced

Joseph J. Campos
University of California, Berkeley

Abstract

Appreciating authentic and inauthentic emotional communication is central to the formation of trusting and intimate interpersonal relationships. However, when infants are able to discriminate and respond to inauthentic emotion has not been investigated. The present set of studies was designed to investigate infant sensitivity to three specific cues of inauthenticity: the contextual congruency of the emotion, the degree of exaggeration of the emotion, and the clarity with which the emotion is communicated. In each experiment, 16- and 19-month-old infants were presented with an emotional communication in which an inauthentic cue was present or absent. Infant behavioral responding to the emotional context was observed and coded. In all three experiments, 19-month-old infants, but not 16-month-old infants, detected inauthentic emotional communication and differentially responded to the environment accordingly. These findings demonstrate that infants do not simply take all emotional communication at face value and are sensitive to features of emotional contexts beyond what is expressively communicated by the adult. Possible developmental mechanisms that may account for the observed developmental shift in infant emotional development are proposed, and implications for the present findings on future research in emotion and emotional development are highlighted.

Keywords

emotion; development; authenticity

Authenticity is an ideal we strive for in many Western-European and North American societies. We value the person who is sincere, who is straightforward, who is not manipulative, who strives to practice what he or she preaches, and, above all, is trustworthy. Lack of authenticity is usually considered socially *undesirable* and a mark of deviousness in social interaction. However, societies also sometimes encourage inauthenticity for the purpose of maintaining social harmony and smooth interpersonal interactions. For instance, we expect inappropriate emotions to be concealed (e.g., we are expected not to show disgust at a disfigured person, and the recipient of an undesirable gift is expected to show enthusiastic, but inauthentic, glee to the recipient). In many cases, societies prescribe the expression of emotions that are, in fact, the opposite of an individual's true experience.

The study of authentic and inauthentic emotional communication is a central element for understanding social interactions. From a definitional perspective, we conceptualize *inauthenticity* as the display of an unfelt emotion or the deliberately manipulated manifestation of a felt one.[1] In what follows, we highlight the importance of detecting inauthentic emotional communication for human development, review the existing empirical literature investigating authenticity, and describe a set of studies that investigate the development of infant detection of inauthentic emotion.

The Importance of Detecting Inauthentic Emotion

Authentic displays of emotion help provide the basis for reliable relationships in human interaction. Infant detection of authentic and inauthentic emotion displays is essential for helping to form positive, trusting relationships with others that will enable the infant to effectively navigate social contexts. Infants must be able to identify reliable individuals in the environment to reference for information, seek out when distressed, and from whom to learn social norms in order to develop into a competent social participant (see Saarni, Campos, Camras, & Witherington, 2006). After all, security comes not only from provision of havens of safety and secure bases of exploration (Bowlby, 1969), but also from the recognition by the child that the caregiver's emotional signals are reliable and trustworthy, especially when the child encounters uncertainty. The child's working model of attachment from past social and emotional experiences helps organize interpretation and understanding of future interactions (Bretherton, 1996), and differences in such experiences have been found to differentially affect infant emotional development (e.g., Murray, 1992; Raikes & Thompson, 2006; Spinrad et al., 2007). Investigating the development of infant detection of inauthentic emotion is essential for understanding the whole story of how different emotional environments affect infant emotional development.

Detection of Inauthentic Emotion in Childhood

Much of early socialization is characterized by learning what, where, and when to display certain types of behavior. This is often characterized by certain display rules that adults are able to utilize with great ease (Ekman & Friesen, 1975), but which young children have considerable difficulty. Children understand at 6-7 years of age the motivations for, and consequences of displaying an unfelt emotion (Gosselin, Warren, & Diotte, 2002; Harris, Donnelly, Guz, & Pitt-Watson, 1986), and can produce such displays at around 6 years of age (Halberstadt, Grotjohn, Johnson, Furth, & Greig, 1992), progressively improving during the elementary years into adulthood (Feldman, Jenkins, & Popoola, 1979). For example, Saarni (1984) found that 7-year-old children are able to spontaneously produce inauthentic smiles in response to receiving a boring toy. Of note is the child's early understanding of a need to display unfelt emotions by 6 years of age (Halberstadt et al., 1992), even though the

[1]This is not to say that one's intentions when displaying inauthentic emotion are necessarily insincere or malicious. The present definition views the sincerity of one's intentional state as independent from whether the manifestation of emotional communication is congruent and canonical with one's emotional state. For example, one's intentions to refrain from laughing inappropriately at a funeral may be sincere, while at the same time the manifestation of emotion (e.g., a solemn face) is in fact inauthentic, as it is incongruent with the individual's emotional state.

ability to convincingly produce such a display is lacking (Saarni, 1984). This suggests that detection of inauthenticity may precede inauthentic production.

A limitation of the above research is that it typically focuses on phenomena that are readily amenable to experimental manipulation and includes individuals who have a well-developed conceptual and symbolic level of mentation. Paradigms often use short stories read to the child, in which the child must identify a character's internal state, determine how best for the character to behave, and how others will perceive the character. Though informative, research using school-aged children relies on paradigms demanding advanced cognitive and linguistic abilities to follow the plot of a story and verbalize a response. Infancy research calls for a different set of paradigms.

Detection of Inauthentic Emotion in Infancy

Infants are able to discern normative social interactions early in life. Extensive research by Tronick and colleagues has demonstrated infant sensitivity to situations in which social expectations are violated (e.g., Gusella, Muir, & Tronick, 1988; Tronick, Als, Adamson, Wise, & Brazelton, 1978; for reviews, see Adamson & Frick, 2003; Muir & Lee, 2003; Tronick, 2003). Furthermore, research by Walker-Andrews (1986) has found that infants are sensitive to the congruency of facial and vocal communication of emotion at 7 months of age, preferentially looking to a facial display of emotion that matches a vocalization of emotion. With these early capacities in mind, investigations of infant understanding of pretense and parent interactions may provide further insight into infant detection of inauthentic emotion. Infant understanding of pretense develops markedly between 15 and 24 months of age (see, Haight & Miller, 1992; McCune, 1995; Walker-Andrews & Kahana-Kalman, 1999). When engaging in pretend behaviors, mothers demonstrate increased smiling and looking toward their infant (Lillard & Witherington, 2004) and infants are able to correctly identify pretend and real behaviors at as young as 2.5 years of age (Ma & Lillard, 2006). These experiments relied on infant facial reactions or explicit identification of the discrepant events. However, it is essential to observe not only whether the infant notices discrepant displays of emotion, but also how noticing this discrepancy affects and regulates the child's instrumental behavior toward the emoting individual or the referent of the emotion. Highlighting this point is the research by Ma and Lillard (2006), who found that although 2-year-old infants did not explicitly differentiate pretend and real eating behaviors, these infants exhibited more spontaneous swallowing and lip licking while viewing the real eating behavior. This suggests that infants may demonstrate detection of pretense when functional behavioral responses are analyzed.

Anecdotal and empirical reports in which infants did not behave as one would expect in response to adult emotion motivated the present investigation. For example, 18-month-old infants occasionally respond to adult emotions with opposite behavioral responses than would be predicted, such as laughing at a parent's display of fear (M. D. Klinnert, personal communication, July 2007) or smiling at parental distress (Zahn-Waxler, Radke-Yarrow, & Chapman, 1992). These peculiar responses are often dismissed as indicating that infants did not understand the emotion. We offer a different interpretation: these responses may have occurred because infants did not believe the sincerity of emotional the communication.

Thus, it is possible that the ability to detect and respond to inauthentic emotion may develop around 18 months of age.

The Present Set of Studies

Our review of the literature demonstrates that research investigating the detection of inauthentic emotional communication has largely been done with adults, and what developmental research does exist has used preschool and school-aged children. Furthermore, existing developmental research has failed to investigate the ontogeny of how infant detection of such discrepancies regulates infant social behavior. Although the importance for accurately appreciating the authenticity of emotional communication is clear, a distinct gap in the literature exists in our understanding of how this important skill develops. In light of the existing developmental literature indicating that 18-month-old infants occasionally respond with unexpected behaviors to emotional communication, as well as emerging understanding of pretense at this age, the following research compared 16- and 19-month-old infants ability to detect inauthentic emotional communication.

Review of the adult literature has identified potential cues of, and strategies for, detecting inauthentic emotion displays. Three factors that differentiate an authentic from an inauthentic emotional display are: (1) the authentic display is contextually appropriate—one that fits the circumstances the perceiver of the display is encountering; (2) the authentic display is of the right intensity for the level of emotion called for under the circumstances—intense when the danger is intense, weak when the danger is weak, and intermediate when the threat is middling; and (3) the authentic display is conveyed unambiguously, without confound by a prior, simultaneous, or subsequent signal that "leaks" an alternative emotional message. A unique sample of infants were tested in three distinct paradigms in which one of the above cues was experimentally manipulated. Each paradigm was specifically designed so that an infant age group that detected the inauthentic emotion would demonstrate differential behavioral responding between emotion conditions. Thus, our paradigms are similar to those used in discriminatory behavior tasks (e.g.. discriminatory looking), in which infants either do or do not differ in behavior between targets. Age differences are determined by which age groups demonstrate the discriminatory behavior (not if one age group discriminates "more" than another). As a result, performance for each age group is essentially dichotomous (significant discrimination between conditions: yes or no); not to what degree discrimination exists. To emphasize, it was the differential behavioral responding between conditions within each age group, not "improvement" between age groups, which was of central interest to each study. As such, planned comparisons are used in each study to test our *a priori* hypotheses. [2]

Study 1: Infant Detection of Contextually Incongruent Emotion

Congruency of Context and Emotion—Adults use a variety of cues when appreciating the emotional state of another individual, one of the most important of which is the

[2]This analytic strategy is in line with the statistical literature stressing use of planned comparisons in favor of omnibus testing when investigators have *a priori* hypotheses (e.g., Furr & Rosenthal, 2003; Keppel & Wickens, 2004; Aron, Aron, & Coups, 2008).

situational context. Observers may use scripts (Abelson, 1981) that rely on available contextual elements to aid in the identification of emotions (Fehr & Russell, 1984). Although the literature is mixed as to whether context trumps emotional expression, or vice versa, in observers' identification of another's emotional state (for a review, see Matsumoto & Hwang, 2010), research clearly demonstrates that context plays an influential role in this process (e.g., Aviezer, Hassin, Bentin, & Trope, 2008; Carroll & Russell, 1996; Matsumoto, Hwang, & Yamada, 2012). Recent research by Hepach, Vaish, and Tomasello (2013) indicates that children as young as 3 years are sensitive to contextual cues related emotional communication and vary in their concern and prosocial responding accordingly. However, little research exists examining how contextual features of the environment affect infant behavioral responding to emotional signals.

Infant Sensitivity to Emotions in Context—The importance of utilizing contextual information to accurately appreciate and respond to emotional communication may be illustrated by the following example. While visiting a zoo an infant may identify her father's display as fear (affect specificity) in response to a charging polar bear (referential specificity), but also notice that a secure Plexiglas barrier is present to prevent harm, and consequently smile and approach the glass to examine the animal. Thus, the infant has demonstrated a behavioral response opposite to the emotional communication concerning the danger of the referent, but sensitive to the context within which this information is provided. Such a response would indicate that the infant used cues other than emotional and referential communication, such as the significance of the emotion in the present context. Previous developmental research suggests that young children more accurately identify emotions based on situational causes and consequences (e.g., Balconi & Carrera, 2007; Reichenbach & Masters, 1983; Widen & Russell, 2004) than facial displays (though see Widen & Russell, 2010 for an exception). Although the existing literature investigating infant use of contextual versus expressive cues has primarily used static images of facial displays or vignettes, prior studies have not manipulated the relation between the emotion and the contextually relevant features of the environment within which the infant is actively participating.

Some evidence does hint that infants may be sensitive to contextual cues of emotion. A peculiar finding from Carolyn Zahn-Waxler and colleagues' research investigating infant prosocial responding to distressed individuals provides one such instance. In this classic paradigm, the infant observes a caregiver or researcher hurt herself and express pain. Infant's behavioral responding is then observed to determine whether the infant appreciated the other's distress by responding with concern and prosocial action. This research has found that infants at 14 months of age respond to a distressed individual with concern and prosocial behaviors, and that these behaviors become more prevalent and specific to the individual's distress during the second year of life (Zahn-Waxler et al., 1992). However, of particular interest is a finding reported in the same study that 14- and 19-month-old infants were as likely to respond to adult distress with "empathic concern" as they were with "positive affect." These responses of positive affect may signify that infants picked up on other features of the environment beyond the surface level features of the distress display. Thus, rather than failing the task, these infants may have actually exceeded the task by

recognizing that the distress was simulated and appreciated the emotion as playful. The specific cue(s) the infants may have used to reach this conclusion remains unknown.[3]

Aims of Study 1—Study 1 examined whether 16- and 19-month-old infants are sensitive to the contextual congruency of an emotion, specifically parental distress, when cues in the environment provide evidence that the emotional display is not credible. This study utilized a variant of the classic Zahn-Waxler paradigm that was designed to measure infant responding to others' distress. In our variation, infants observed their parent either perceptibly hit *or* miss her hand with a toy hammer. In both conditions parents displayed pain and distress following the hammer strike, and infant behavioral responding to parents' distress was coded. It was hypothesized that infants would demonstrate more prosocial responses and expressions of concern after witnessing the parent hit her hand with the hammer, whereas infants witnessing the parent miss her hand with the hammer would display more positive affect and aggressive/playful behaviors toward the parent. Additionally, it was hypothesized that 19-month-old infants would demonstrate greater differential responding as a function of the perceived authenticity of the emotion display than 16-month-old infants.

Method

Participants—Thirty-five 16-month old infants (20 female, M_{age} = 16.1, *SD* = 0.67) and 30 19-month-old infants (14 female, M_{age} = 19.1, *SD* = 0.74) participated in Study 1. Infants were assigned to either the Hammer Hit (16-month-olds: *n* = 14; 19-month-olds: *n* = 14) or Hammer Miss condition. Infants were recruited from the San Francisco Bay Area. The average parent had a college degree and the average family income was $100,000.

Procedure—Prior to the experiment, parents were instructed how to clearly express pain and distress through the face, voice, and posture, as well as with gestures. The experiment took place in a 2 m × 2 m space in which the parent and infant were situated cater-corner at a 0.5 m × 1.25 m table, 0.35 m in height. Separate cameras captured the infant and the parent and were split into a single frame so that both angles could be viewed simultaneously.

Parents were instructed to play with a small plastic hammer toy in view of their child. The hammer toy consisted of a plank board with 5 cm supports on both ends and 6 pegs that could be pounded through on either side, and a plastic hammer. After observing the parent, infants were allowed a turn to play with the hammer toy to provide experience of the actions and force required to pound the pegs. The parent then took the toy back from the infant and, in clear view of the child, *either* hit or missed her hand with the hammer while attempting to pound the pegs. In both conditions the parent expressed a multimodal display of pain following the hammer strike for 30 seconds, during which infants were free to respond to the parent.

[3]Zahn-Waxler et al. (1992) suggested that infants may have laughed because parent simulations of distress were exaggerated, but no data on parent's affective credibility or intensity of distress was reported. Infant sensitivity to exaggerated emotion is specifically investigated in Study 2.

Coding

Internal Validity Check: A naïve researcher reviewed each episode to ensure the internal validity of Study 1. Interrater reliability was assessed using a second naïve coder who independently scored 25% of the episodes. Researchers coded whether: (1) the infant saw whether the parent hit or missed her hand (k = .86), and (2) the parent actually hit or missed her hand (k = .85). Only infants who attended to the experimental manipulation were included in the final sample. Fifteen infants were not included in the final sample because they were not looking at the hammer when it struck or missed the parent's hand. Additionally, parents who did not adhere to the experimental condition were reclassified as necessary (e.g., parents who were instructed to hit their hand but actually missed their hand were placed in the Hammer Miss group).

Parent Emotional Display: Parent emotional displays were coded separately by a naïve rater for credibility and intensity in three 10-second epochs using a 3-point scale modeled after the measures used by Young, Fox, and Zahn-Waxler (1999). Interrater reliability was assessed using a naïve independent coder who scored 25% of participants. Reliability scores for each measure are provided in parentheses.

1. Credibility (r = .74, $M_{\text{difference}}$ = 0.14) was coded as: 0 = not credible (significant break in character); 1 = passable (simulation appears spontaneous, believable, and has no breaks in character); 2 = very believable (simulation is particularly believable, and has no breaks in continuity).
2. Intensity (r = .89, $M_{\text{difference}}$ = 0.11) was coded as: 0 = little or no expression evident; 1 = moderate levels of expression; 2 = very strong expression (e.g., shrieking vocalization, vigorous hand shaking).

Only parent expressions coded as ≥ 1 for both credibility and intensity for all 3 epochs were included in the final sample. Forty-three parents were excluded from the final sample because of parent error. Although this may seem like a large number of parents to exclude, the crux of Study 1 was based on manipulating the emotional context, necessitating that great sensitivity be used to ensure that only parents who followed all instructions and provided suitable emotional displays be included in the final sample.

Infant Behavioral Responding: Four distinct infant behaviors in response to parents' distress were coded by a naïve rater. Interrater reliability was assessed using a naïve independent coder who scored 25% of participants. Reliability scores for each measure are provided in parentheses.

1. Concerned facial expressions (r = .87, $M_{\text{difference}}$ = 0.05): Affective expressions of concern for the victim were coded on a 5-point scale (0 = neutral; 1 = sobering of attention; 2 = brow furrowing with no oral component; 3 = brow furrowing with oral component; 4 = crying facial configuration).
2. Prosocial responding (k = .81): The presence of behaviors demonstrated by the infant in the service of alleviating the victim's distress (e.g., hugging, kissing hand, providing a toy/object).

3. Positive affect (k = .87): The presence of infant displays of positive affect (i.e., smiling, laughter).

4. Aggressive/playful behaviors (k = 1.0): The presence of infant aggressive or playful behaviors toward the victim while the infant was smiling (e.g., hitting the parent with the hammer, pulling on the parent).

Results

Of central importance to the present investigation was whether infants within each age group differentially responded between conditions, not whether differences were present between ages within conditions. This greatly reduces the utility of interpreting overall main or interaction effects. Thus, planned comparisons were used to test our *a priori* hypotheses for each variable.

Preliminary Analyses of Parent Emotional Expressivity—Parent credibility and intensity of distress were compared between conditions to ensure that the emotional presentations were similar. No significant differences were found between conditions for parent credibility (Hit = 2.56, SD = 0.39; Miss = 2.60, SD = 0.46), $t(65) = 0.43$, $p = .67$, d = 0.09, or parent intensity (Hit = 2.50, SD = 0.40; Miss = 2.55, SD = 0.40), $t(65) = .50$, $p = .62$, d = 0.12, of the emotional display.

Infant Concerned Facial Expressions—Pairwise comparisons examined infant displays of concerned facial expressions (see Figure 1a) to test our *a priori* hypothesis that 19-month-old infants would be more concerned in the Hit condition than in the Miss condition, but that 16-month-old infants would not differentially display concern by condition. Results showed that both 16- and 19-month-old infants displayed significantly more concern when the parent hit her hand than when the parent missed her hand with the hammer (16 months: Hit = 2.19, SD = 1.22, Miss = 0.62, SD = 0.97; $t(33) = 4.23$, $p < .000$, d = 1.42; 19 months: Hit = 2.17, SD = 1.10, Miss = 1.27, SD = 1.11; $t(28) = 2.25$, $p = .03$, d = 0.81.

Infant Prosocial Responding—Infant prosocial responding was examined within each age group (see Figure 1b) to test our prediction that the older, but not younger, age group would respond differentially as a function of the authenticity of the condition. Chi-square analyses revealed that 16-month-old infants were significantly more likely to respond with prosocial behavior when the parent hit her hand, $\chi^2(1,35) = 23.58$, $p < .000$, $\Phi = 0.82$. Nineteen-month-old infants behaved similarly, but this finding did not reach statistical significance, $\chi^2(1,30) = 2.04$, $p = .15$, $\Phi = 0.26$.

Infant Positive Affect—Differences in the presence of infant positive affect were examined within each age group (see Figure 1c) to test our a priori hypothesis that 19-month-old infants, but not 16-month-old infants would be more likely to display positive affect in the Miss condition than in the Hit condition. Chi-square analyses revealed no difference in the likelihood for 16-month-old infants to display positive affect in response to the parent hitting or missing her hand, $\chi^2(1,35) = 1.94$, $p = .16$, $\Phi = 0.24$. However, 19-

month-old infants were significantly more likely to display positive affect when the parent missed her hand, $\chi^2(1,30) = 9.02$, $p = .003$, $\Phi = 0.55$.

Infant Aggressive/Playful Behaviors—Infant aggressive/playful behaviors were examined within each age group (see Figure 1d) to test our a priori hypothesis that 19-month-old infants, but not 16-month-old infants, would be more likely to demonstrate such behaviors in the Miss condition than in the Hit condition. Chi-square analyses revealed no difference in the likelihood of 16-month-old infants to display aggressive/playful behaviors in response to the parent hitting or missing her hand, $\chi^2(1,35) = .67$, $p = .66$, $\Phi = 0.14$. Nineteen-month-old infants, on the other hand, were significantly more likely to respond with aggressive/playful behaviors when the parent missed her hand, $\chi^2(1,30) = 5.25$, $p = .02$, $\Phi = 0.42$.

Discussion

Findings from the present study indicate that 16- and 19-month-old infants are sensitive to contextually relevant features of emotional communication. Infants in both age groups were more likely to respond with concerned expressions and prosocial actions when the parent hit her hand than when the parent missed her hand. Interestingly, 19-month-old infants, but not 16-month-old infants, also responded with increased positive affect and aggressive/playful behaviors when the parent had missed her hand. This suggests that the older infants not only perceived parental distress as of less concern in the Hammer Miss condition, but also evaluated this context as one of play, evident by their positive affect and playful behaviors.

The mixed findings for 16-month-old infants, who demonstrated decreased concern and prosocial acts in the hammer-miss condition, but lack of positive affect and aggressive/playful behaviors, may suggest that these infants noticed that something about the parent's distress in the Hammer Miss condition was out of the ordinary, but were unsure as to the appropriate response. Also, a trend was found for 19-month-old infants to respond more often with prosocial actions to parent distress in the Hammer Hit condition than in the Hammer Miss condition. We wish to emphasize that this does not indicate that the older infants did "worse" because they did not demonstrate significant differential prosocial responding. It is possible that the prevalence of infant helping behaviors in both conditions is indicative of the bias of infants this age to default to help those in need (e.g., Warneken & Tomasello, 2009). Alternatively, it is also possible that older infants were practicing a script in which one helps the distressed individual (the present study did not differentiate "sincere" versus script-rehearsing helping). It is also worth mentioning that no infant in either age group responded with aggressive behaviors while not smiling. Although it is unclear if past research distinguished smiling and non-smiling when coding such behaviors (e.g., Zahn-Waxler et al., 1992), our results would suggest that such a distinction is important.

In summary, the findings of the present study indicate that: (1) 16- and 19-month-old infants are sensitive to the contextual appropriateness of parental distress, and (2) 19-month-old infants are more likely to appreciate such parental distress as playful and less authentic. Thus, 19-month-old, but not 16-motnh-old, infants demonstrate appreciation and utilization of contextual features when responding to others' emotions.

While this study focused on infant sensitivity to contextual cues, its implications are relevant to both developmental and adult research of emotion. Individuals do not simply respond to outward expressions of emotion, but utilize a host of other emotionally relevant cues, such as context, to appreciate the significance of an emotional display. An emotion that is inappropriate in a particular context may elicit confusion, as observed when mothers display sadness toward infant approach of a visual cliff (Sorce, Emde, Campos, & Klinnert, 1985). Additionally, researchers may wish to consider the contextual features of the environment when assessing the validity of an emotional stimulus. Emotion researchers consistently urge that emotions be placed back into context (see Avviezer et al., 2008). The findings from Study 1 not only emphasize the importance of context in empirical investigation of emotion, but also the care required in its construction.

Study 2: Infant Detection of Exaggerated Emotion

Detection of Exaggerated Emotion—The pioneering work by Ekman and others (e.g., Ekman & Friesen, 1971) revealed that adults are able to identify discrete emotions communicated through the face. Accordingly, studies of emotion commonly use emotional displays based on those used by Ekman and others to investigate adult identification of emotional expressions. However, such maximally intense stimuli are likely discrepant from those encountered in everyday life (see Carroll & Russell, 1996, 1997). Prior research has found that adults are able to correctly identify exaggerated emotional displays from masked and genuine emotion displays, and observers report being very confident of such classifications (Hadjistavropoulos, Craig, Hadjistavropoulos, & Poole, 1996). Thus, while adults readily *identify* obvious and exaggerated displays of emotion, they do not necessarily take the *communicative value* of such displays at face value, specifically with regard to the perceived degree of authenticity. Infants may also use the degree of exaggeration with which an emotion is communicated to evaluate the authenticity of an emotional display.

The Development of Infant Detection of Exaggerated Emotion—Empirical investigations of emotional development typically utilize variations of social referencing paradigms involving the communication of a specific emotion by an adult directed toward a toy or object. Such studies commonly use emotion displays of maximal intensity to help facilitate the recognition of the emotion by the infant. This body of research indicates that emotions are effective regulators of infant behaviors by 8.5 to 12 months of age (e.g., Boccia & Campos, 1983; Walden & Baxter, 1989). However, anecdotal evidence also suggests that while emotions such as fear may prevent an infant from approaching a novel object, 18-month-old infants will occasionally respond to such maximal displays with laughter (M. D. Klinnert, personal communication, July 2007). Such instances of positive affect may be indicative of infants' evaluation of these displays as inauthentic. Coincidentally, infant understanding of pretense has been found to develop around 18 months of age (see, Haight & Miller, 1992; McCune, 1995; Walker-Andrews & Kahana-Kalman, 1999), and that parents typically use exaggerated behavioral displays in pretend play (Leslie, 1987; Lillard & Witherington, 2004). While it has been found that adults use the degree of exaggeration to determine the authenticity of an emotional signal, it remains to be investigated when the capacity to utilize this cue develops.

Aims of Study 2—Study 2 examined whether infants use the exaggeration of an emotional display to evaluate its perceived authenticity. Sixteen- and 19-month-old infants were presented with a novel stimulus in the presence of their parent. Parents were instructed to display *either* a normative (authentic) or exaggerated (inauthentic) fearful display toward the stimulus. It was predicted that 19-month-old infants would demonstrate more differentiated behavioral responding than younger infants as a function of the authenticity of the emotion, evident by increased approach behaviors toward the stimulus in the exaggerated emotion condition. It was also predicted that older infants in the exaggerated emotion condition would display more positive affect and less negative affect in response to their parent's emotional display than infants in the normative emotion condition, but that younger infants would not show differential positive or negative emotional responses as a function of condition.

Methods

Participants—Seventy-nine parent-infant dyads completed Study 2. Thirty-eight 16-month-old infants (M_{age} = 16.24 months, *SD* = 0.65 months) were randomly distributed to either the Normative (*n* = 16; 8 female) or Exaggerated (*n* = 22; 12 female) condition, and 41 19-month-old infants (M_{age} = 18.87, *SD* = 0.69 months), randomly distributed to either the Normative (*n* = 19; 13 female) or Exaggerated (*n* = 22; 11 female) condition. Families were recruited from the San Francisco Bay Area. The average parent held a college degree and the average household income was $96,000. An additional 36 infants were tested, but excluded from the final sample due to failure to pass the manipulation checks described below.

Procedure—Parents were instructed to express either a normative or exaggerated display of fear through their face, voice, posture, and gesture. The experimenter described typical attributes of a fearful expression based on common features of fearful displays (e.g., Ekman & Friesen, 1976). Parents in the normative condition were instructed to display fear of normal intensity as they might in regular daily interactions. Parents in the exaggerated condition were instructed to display fear in an exaggerated manner (increased facial contortion, vocalic elongation of words, and exaggerated gestures). Exaggeration instructions commonly included phrases such as, "make each of the channels with which you would typically communicate bigger and over the top" or "imagine your typical display of fear and then ramp it up 10-fold." The parent, rather than an experimenter, was used to utilize infants' prior experience and acclimation of what constitutes normative or exaggerated for the emoter. We estimated that infants would be more acclimated to the level of exaggeration of the parent than to that of an unfamiliar adult. For example, infants of parents with typically muted displays might view an experimenter's normative display as exaggerated, whereas infants of parents with typically animated displays may view an experimenter's exaggerated display as normative.

During the experiment the parent and child were seated across from one another at a 0.8 m × 0.8 m table within 2 m × 1.5 m testing area. A 12 cm × 12 cm × 12 cm rubber toy (multicolored with a soft rubber base, from which several soft rubbery protrusions radiated outward), previously occluded from view, was lowered from the ceiling and came to a rest

on the table between the parent and child, but out of reach of both. As it was lowered the parent displayed either a typical or exaggerated fear display, and maintained the display for 15 seconds while the toy was on the table. Parent emotional displays were animated and multimodal, not static, during the 15-second presentation. After the 15 seconds, the toy was raised back up to ceiling and the parent expressed relief.

Coding

Parent Emotional Display: Parent emotional displays were coded separately for clarity and exaggeration by a rater naïve to infant experimental condition. Interrater reliability was assessed using a naïve independent coder who scored 25% of parents.

Clarity of Parent Emotional Display: A manipulation check ensured that parents clearly expressed fear during the emotion presentation. Coders were naïve as to the design and hypotheses of the study. First, coders selected one of five emotions (i.e., sadness, disgust, joy, fear, anger) that the parent was believed to have expressed through the face, body, and voice. To minimize rater bias of the emotion, all coders were told that they were only coding a portion of a much larger data set and that parents were allowed to freely select one of the five emotions to display. Interrater agreement was very good (k = .78). Coders then rated the clarity of the parent's emotional display as clear, weak, or ambiguous (i.e., presence of a conflicting emotion). Interrater agreement was very good (k = .79). Only infants whose parents *clearly* expressed fear, and no other emotions, were included in the final sample. Forty-five parents were excluded from the final sample because the parent displayed an emotion other than fear (N = 10) or the fear display was not expressed clearly (N = 35). Although this exclusion rate may seem high, the nature of the investigation made it essential that only parents who clearly displayed fear were included in the analyses.

Exaggeration of Parent Emotional Display: The degree of exaggeration of the clear parent fear displays was coded to ensure that parents appropriately displayed either a normative or exaggerated display consistent with the condition to which they were assigned. A research assistant naïve to the parent's experimental condition coded the level of exaggeration of the parent's display of fear on a 3-point scale: unexaggerated (normative facial display, steady vocalic envelope, tight movement pattern of hands and body), indeterminable (no definitive determination of exaggeration could be made), or exaggerated (large gestures, large side-to-side movements, frequent vocalic fluctuations, caricature facial display). Interrater agreement was very good (r = .86, $M_{\text{difference}}$ = 0.33). Parents scored as unexaggerated were placed in the unexaggerated condition (16-month-olds: n = 13; 19-month-olds: n = 15); parents scored as exaggerated were placed in the exaggerated condition (16-month-olds: n = 19; 19-month-olds: n = 14); parents scored as indeterminate were placed in the condition to which they were originally assigned (16-month-olds: n = 6 [3 normative; 3 exaggerated]; 19-month-olds: n = 12 [4 normative; 8 exaggerated]).[4]

[4]The decision to include indeterminately coded parents in their pre-assigned conditions stemmed from the likelihood that parents would naturally vary in their baseline level of exaggeration of emotion. As such, we believed that the infant, being acclimated to the parent's natural degree of emotional exaggeration, would be able to accurately judge the parent's expression because the infant would have a basis for comparison that the naïve coders lacked.

Infant Behavioral Responding: Infant approach of the toy, positive affect, and negative affect and were coded. Peak infant positive and negative affect was coded in three 5-second epochs while the toy was present. Interrater reliability was assessed using a naïve independent coder who scored 25% of infants.

Reaches to Toy: The frequency of infant reaches to the toy was coded. Infant reaching was defined as an attempt by the infant to touch or obtain the toy. Interrater reliability was very good (r = .95, $M_{\text{difference}}$ = 0.04).

Positive Affect: Infant positive affect was coded as: 0 = neutral, 1 = slightly positive (some bilateral upturning of the lips with little evidence of cheek raising or crinkling around the eyes), 2 = moderately positive (clear positive display, but no laughter), and 3 = very positive (clear positive display, audible laughter). Interrater reliability was very good (r = .97, $M_{\text{difference}}$ = 0.04).

Negative Affect: Infant negative affect was coded as: 0 = neutral, 1 = slightly negative (slight frown, furrowed brow, or widened eyes), 2 = moderately negative (clear negative display, but no crying), 3 = very negative (clear negative display with crying and/or screaming). Interrater reliability was very good (r = .93, $M_{\text{difference}}$ = 0.04).

Results

It is important to re-emphasize that this investigation was designed to examine whether infants within each age group differentially responded between conditions; not whether differences were present between ages within conditions. Thus, the analyses for Study 2 include planned comparisons to test our *a priori* hypotheses for each variable.

Infant Reaches to the Toy—Planned comparisons tested for predicted differences in infant reaching between conditions within each infant age group. Contrary to our expectations, 16-month-old infants reached significantly more often in the Normative condition (M = 1.44, SD = 1.31) than in the Exaggerated condition (M = 0.73, SD = 0.88), $t(38) = 1.99$, p = .05, d = 0.63. Nineteen-month-old infants also demonstrated differential reaching by condition, but showed the opposite effect, reaching significantly more in the Exaggerated condition (M = 1.32, SD = 1.17) than in the Normative condition (M = 0.42, SD = 0.84), $t(41) = 2.85$, p = .007, d = 0.88.

Infant Positive Affect—Our *a priori* hypothesis that 19-month old infants, but not 16-month-old infants, would demonstrate increased positive affect to exaggerated fearful displays was tested using planned comparisons. Sixteen-month-old infants did not differ in their display of positive affect in the Exaggerated (M = 0.74, SD = 0.88) and Normative (M = 0.48, SD = 0.66) conditions, $t(36) = 1.01$, p = .32, d = 0.33. A trend was found indicating that 19-month-old infants demonstrated greater positive affect in the Exaggerated condition (M = 1.06, SD = 1.01) than in the Normative condition (M = 0.56, SD = 0.91), $t(39) = 1.66$, p = .11, d = .50, but this effect did not reach significance.

Infant Negative Affect—Again, planned comparisons tested our *a priori* hypothesis that 19-month-old infants, but not 16-month-old infants, would display increased negative affect in the normative condition. Sixteen-month-old infants did not differ significantly in their display of negative affect in the Normative ($M = 0.25$, $SD = 0.46$) and Exaggerated conditions ($M = 0.59$, $SD = 0.90$), $t(36) = 1.53$, $p = .14$, $d = 0.48$. However, 19-month-old infants displayed significantly greater negative affect in the Normative condition ($M = 0.84$, $SD = 1.16$) than in the Exaggerated condition ($M = 0.09$, $SD = 0.26$), $t(39) = 2.76$, $p = .01$, $d = 0.99$.

Discussion

The present study found that both 19-month-old and 16-month-old infants differentially responded to the degree of exaggeration of emotional communication. However, we believe that only the 19-month-old infants detected inauthenticity in the exaggerated emotional display.

Although 16-month-old infants also demonstrated differential behavioral responding, it was in the opposite direction than one would hypothesize if these infants were appreciating the authenticity of the emotional display as a function of its degree of exaggeration. Sixteen-month-old infants reached significantly more frequently toward the stimulus in response to the normative display than in response to the exaggerated display and showed no significant difference in displaying positive or negative affect between the normative and exaggerated displays. This leads us to infer that while younger infants discriminated between normative and exaggerated emotional displays, this discrimination did not result in a differential appreciation of authenticity.

Contrastingly, 19-month-old infants also demonstrated differential behavioral responding, but in the opposite direction. The older infants reached significantly more in the exaggerated emotion condition than normative emotion condition, and also showed significantly more negative affect in response to the normative display and slightly more positive affect in response to the exaggerated display. We believe that these results suggest that 19-month-old infants are sensitive to the authenticity of an emotional display as a function of the level of exaggeration of the display.

This study suggests a key difference in how infants of each age group appreciate emotional communication. For 16-month-old infants, parents who were more animated in their fearful displays were more effective in eliciting infant avoidance of the stimulus. It is possible that the exaggerated emotional display was more readily identifiable, whereas the normative display may have been too subtle to elicit an inhibitory response. This suggests that 16-month-old infants may be more likely to respond with avoidant behaviors to fearful displays when the emotion is communicated in a clear, obvious, and animated manner. However, for 19-month-old infants the exaggerated fearful display resulted in a significantly less inhibited response, and actually elicited an approach response. These older infants may have appreciated the emotional context as one of pretend or play, not threat, and thus explored the environment with less wariness.

The extensive research investigating universal recognition of emotional displays has helped move the field of emotion many steps forward. However, blurring the line between emotion recognition and emotion responding will likely result in empirical investigations that fail to effectively investigate the phenomenon of interest, namely how emotional communication affects interpersonal behavior. In light of the present findings, researchers of emotion may wish to reassess whether their stimuli are optimally designed for recognizing emotion, or for the behavioral regulatory impact of such displays. In the case of the former, the exquisite work by Ekman and others stands at the forefront of empirical science. However, for researchers of the latter, stimuli that ensure validity, even at the expense of perfect reliability, may be optimal.

Study 3: Infant Detection of Masked Emotion

Detection of Masked Emotion—Masking one's emotion is a common form of emotion regulation (Butler & Gross, 2004), in which one displays an emotion different from one's internal experience (Matsumoto, Yoo, Hirayama, & Petrova, 2005). However, this regulatory strategy may also lead to slight leakage of the felt emotion, or overcompensation in intensity of the display of the unfelt emotion (Friedman & Miller-Herringer, 1991; Gross & Levenson, 1997). Observers use emotional leakages or delays in responding as indicators of when someone is displaying a masked emotion (Scherer, Feldstein, Bond, & Rosenthal, 1985; Zuckerman, DePaulo, & Rosenthal, 1981). For example, a bitter face of disappointment may initially slip out upon first hearing that a colleague received a competitive research grant and you did not, which is then followed by the more appropriate display of happiness for the colleague. The astute colleague, who notices the leaked disappointment, may respond by taming further jubilation while in your company. Thus, the more accurately individuals appreciate the experienced and communicated emotions of others, the more appropriately they will be able to respond in social contexts.

The Development of Detecting Masked Emotion—While these social skills may help adults interpret and navigate social situations, such abilities are equally important for the developing child. Although research has investigated children's understanding of, and ability to, mask emotion (e.g., Josephs, 1994; Saarni, 1984), no research to date has examined the development of infants' ability to *detect* masked emotion. As with other aspects of emotional development in the second year of life, detection of masked emotion may be facilitated by factors relating to the child's socio-emotional environment. For example, children's exposure to specific emotions early in life, such as anger, has been found to impact appreciation and understanding of emotion communication in later childhood (Pollak, Messner, Kistler, & Cohn, 2009; Pollak & Sinha, 2002). Although this research has been conducted with older children, it is possible that differences in parents' use of specific emotion regulation strategies in early development may differentially expose infants to inauthentic emotions and allow some infants to more readily detect regulated emotion. Furthermore, regulated emotion in which the expressive display is modified (i.e., masking or suppression) may specifically attune infants to the detection of such displays, whereas parent use of regulatory strategies that focus on cognitive aspects of emotion (i.e., reappraisal) may not.

Aims of Study 3—Study 3 investigated the development of infant detection of masked emotion. The experimental paradigm was designed to mimic a situation likely relatable for most parents – specifically, trying to get one's child to eat something that you yourself do not enjoy. Sixteen- and 19-month-old infants watched an actress respond to a novel food with *either* positive enjoyment, a brief disgust response masked by positive enjoyment (i.e., masked disgust), or disgust. Infants were then presented with the novel food and their behavioral responses were coded to assess whether infants responded with differential behaviors as a function of the perceived authenticity of the emotion display. It was predicted that 19-month-old infants, but not 16-month-old infants, would detect the masked emotion and regulate their response accordingly by avoiding the food (evident by decreased exploration and ingestion of the food) in response to adult masked disgust and disgust in comparison to positive emotion.

Additionally, all parents completed the Emotion Regulation Questionnaire (ERQ; Gross & John, 2003). This measure explored how infants' socio-emotional climate may affect their detection of masked emotion. In conjunction with the process model described by Gross (1998), it was predicted that infants whose parents reported high use of regulating their emotions using suppression (which focuses primarily on response modulation) would be more likely to detect the masked emotion, but parents' use of reappraisal (which focuses primarily on cognitive modulation) would have no effect.

Method

Participants—Fifty-four 16-month old infants (26 female, M_{age} = 16.00, *SD* = 0.56) and 54 19-month-old infants (28 female, M_{age} = 18.93, *SD*=0.65) completed Study 3. Eighteen infants of each age group were randomly assigned to one of three conditions: Positive Emotion, Masked Disgust Emotion, or Disgust Emotion. Infants were recruited from the San Francisco Bay Area. The average parent had a college degree and the average family income was $110,000. An additional 32 infants were tested, but excluded from the final sample due to failure to pass the manipulation checks described below.

Procedure—Infants were seated in a highchair at a table, directly facing a television monitor. The parent was seated 0.5m away from the infant, facing the opposite direction. Parents completed the ERQ during the experiment and were told not to look up or interact with their infant.

Infants were shown a 22-second video in which a plate of novel looking food (cold, bright green, spiral pasta) slid out toward a female adult actress, professionally trained in the presentation of emotion displays. A professional actress was used, rather than a parent or familiar adult, due to the complex nature of the emotion displays, particularly the masked disgust display. Similar methodology has been sued in previous research (e.g., Mumme & Fernald, 2003; Shutts, Kinzler, McKee, & Spelke, 2009). The adult looked at the food, picked up a piece, brought the piece to her face, and took a bite. The adult then expressed *either*:

1. 8 seconds of positive affect/pleasure toward the food (Positive condition),

2. 1 second of disgust toward the food followed by 8 seconds of positive affect/ pleasure toward the food (Masked Disgust condition)
3. 8 seconds of disgust toward the food (Disgust condition).

The emotions were communicated through the face, voice, and posture. The adult then set the food back on the plate and the plate slid away from her and out of frame. A similar looking plate of food, previously occluded by a curtain, slid out from underneath the television, timed such that its appearance gave the illusion that it was the same plate that was shown in the stimulus video and that the social context was interactive. The plate stopped 0.05 m from the infant and infants were allowed 30 seconds to explore the food. During this time the actress remained on the television and looked straight ahead while displaying neutral affect.

Five naïve raters coded each video for the presence of 5 emotions: anger, disgust, fear, joy, and sadness. This confirmed that the actress in each clip displayed the desired emotion(s) and no other emotion(s) (k = 1.0 for each clip).

Coding

Manipulation Check: A naïve researcher reviewed each episode to ensure the internal validity of Study 3. Interrater reliability was assessed using a second naïve coder who independently scored 25% of the episodes. Researchers coded whether: (1) the infant attended to the video clip during the experimental manipulation (k = 1.0) and parents interacted with their infant during the experimental session (k = 1.0). Only infants who attended to the experimental manipulation and whose parents did not interfere during the experiment were included in the final sample.

Physical Exploration of the Food: A naïve researcher coded each episode to measure infant physical exploration of the food. Interrater reliability was assessed using a second naïve coder who independently scored 25% of the episodes. Infant food exploration was coded on a 5-point scale: 0 = no touching of the food; 1 = touching the food on the plate; 2 = lifting the food off the plate; 3 = bringing the food close to face; 4 = ingesting the food. Peak infant food exploration was coded in two 15-second epochs and the two scores were averaged to obtain the overall level of infant food exploration for the 30-second period. Interrater agreement was very good (r = .90, $M_{\text{difference}}$ = 0.00).

Parents' Emotion Regulation: The ERQ (Gross & John, 2003) is a commonly used 10-item questionnaire to assess adult use of emotion regulation strategies, specifically suppression and reappraisal. The questionnaire features items to each regulatory strategy and scoring can be broken down to indicate adult usage of each one. The psychometric properties of the ERQ are provided by Gross and John (2003) and demonstrate acceptable measures of convergent and discriminant validity.

Results

To reiterate, this experiment was designed to investigate whether infants within each age group responded with differential behaviors between conditions, not whether differences

were present between ages within conditions. The analyses for Study 3 specifically tested our *a priori* hypotheses.

Infant Food Exploration—Planned comparisons tested our *a priori* hypothesis that 19-month old infants, but not 16-month-old infants, would demonstrate differentiated behavioral responses to the Positive and Masked Disgust conditions, but not to the Masked Disgust and Disgust conditions (see Figure 3a). Sixteen-month-old infants did not differ in their exploration of the food between the Positive (M = 1.83, SD = 1.35) and Masked Disgust conditions (M = 1.64, SD = 1.42), $t(36) = 0.42$, $p = .67$, $d = 0.14$, Positive and Disgust conditions (M = 1.56, SD = 1.20), $t(36) = 0.91$, $p = .53$, $d = 0.21$, or Masked Disgust and Disgust conditions, $t(36) = 0.45$, $p = .85$, $d = 0.06$. In contrast, 19-month-old infants demonstrated significantly greater exploration of the food in the Positive condition (M = 2.42, SD = 1.51) than in the Masked Disgust condition (M = 1.44, SD = 1.17), $t(36) = 2.16$, $p = .04$, $d = 0.73$, and Disgust condition (M = 0.97, SD = 1.23), $t(36) = 3.15$, $p < .000$, $d = 1.05$. Importantly, infants in the Masked Disgust condition did *not* differ from infants in the Disgust condition in their exploration of the food, $t(36) = 1.18$, $p = .25$, $d = 0.39$, demonstrating that infants appreciated these conditions similarly.

Infant Food Ingestion—Infant food exploration was further explored by examining the overall functional consequence of the emotion display on infant behavior (i.e., did the child eat the food). Planned comparisons were used to test our *a priori* hypothesis that 19-month-old infants, but not 16-month-old infants, would be more likely to actually eat the food in the Positive emotion condition than in the Masked Disgust condition (see Figure 3b). Sixteen-month-old infants did not differ in their likelihood to ingest the food between the Positive and Masked Disgust conditions, $\chi^2(1,36) = 0.12$, $p = .73$, $\Phi = 0.06$, Positive and Disgust conditions, $\chi^2(1,36) = 0.13$, $p = .72$, $\Phi = 0.06$, or Masked Disgust and Disgust conditions, $\chi^2(1,36) = 0.50$, $p = .48$, $\Phi = 0.12$. However, 19-month-old infants were significantly more likely to eat the food in the Positive condition than in either the Masked Disgust condition, $\chi^2(1,36) = 4.05$, $p = .04$, $\Phi = 0.34$, or the Disgust condition, $\chi^2(1,36) = 7.48$, $p = .01$, $\Phi = 0.46$. Again, of great importance is the finding that 19-month-old infants did *not* differ in their ingestion of the food between the Masked Disgust and Disgust conditions, $\chi^2(1,36) = 0.64$, $p = .42$, $\Phi = 0.13$.

Individual Differences in Infants' Responding to Masked Emotion

Infant Food Exploration: Sixteen- and 19-month-old infants' food exploration in the Masked Disgust condition was not correlated with parents' self-reported suppression (16 month olds: $r = 0.23$, $p = .36$; 19 month olds: $r = -0.13$, $p = .60$) or reappraisal (16 month olds: $r = 0.08$, $p = .77$; 19 month olds: $r = 0.20$, $p = .42$) of emotion.

Infant Food Ingestion: A closer examination compared infants in each age group who did or did not ingest the food in the Masked Disgust condition. Sixteen-month-old infants in the masked emotion condition did not differ in their eating of the food as a function of parent suppression of emotion (no ingestion: M = 2.98, SD = 0.80; ingestion: M = 2.75, SD = 0.83), $t(18) = 0.58$, $p = .57$, $d = 0.28$, or reappraisal (no ingestion: M = 5.24, SD = 0.84; ingestion: M = 5.74, SD = 0.88), $t(18) = 1.20$, $p = .25$, $d = 0.58$. Interestingly, parents of 19-month-old

infants who did not eat the food (i.e., detected the masked disgust) reported suppressing their emotions significantly more than parents of infants who ate the food (i.e., did *not* detect the masked disgust) (no ingestion: $M = 3.71$, $SD = 0.93$; ingestion: $M = 2.60$, $SD = 0.58$), $t(18) = 2.46$, $p = .03$, $d = 1.43$. No difference in parent reappraisal between the two groups was found (no ingestion: $M = 5.31$, $SD = 1.03$; ingestion: $M = 5.23$, $SD = 1.30$), $t(18) = 0.13$, $p = .90$, $d = 0.07$.

Discussion

The present study found differences in behavior by 16- and 19-month-old infants attributable to their detection of masked emotion directed toward a novel food. Nineteen-month-old infants demonstrated decreased exploration and ingestion of the food in the masked disgust condition -behaviors that were similar to those demonstrated in response to authentic disgust. Thus, it appears that these older infants were sensitive to the brief slippage of disgust by the actress and as a result avoided the food stimulus. However, 16-month-old infants did not differentially respond to the food as a function of the emotion display.

Additionally, infants' socio-emotional environment appeared to affect detection of the masked emotion. Parents of 19-month-old infants who detected the masked disgust reported suppressing emotions more frequently than parents of 19-month-olds who did not detect the masked disgust. However, parent use of reappraisal did not differ between these groups. This is consistent with theories of emotion regulation (see Gross, 1998), in which suppression involves modulating one's expression of emotion, likely perceptually similar to masking (see Matsumoto et al., 2005), but reappraisal involves modifying the personal relevance of an emotion eliciting event. The present findings suggest that exposure to parental suppression may impact infant detection of masked emotions. Specifically, infants of parents who frequently suppress their emotions may have increased exposure to masked displays that allow them greater perceptual attentiveness for detecting masked displays, thus accounting for their avoidance of the food in the masked disgust condition. We do not believe that this supposition is in conflict with existing research on the relation of parent expressiveness with children's emotion recognition (e.g., Camras et al., 1990). On the contrary, it may highlight the importance of specific emotional experience for recognizing specific features of emotional communication (though see Dunsmore, Her, Halberstadt, & Perez-Rivera, 2009). Even so, the individual difference findings from Study 3 warrant cautious interpretation given the exploratory nature of the individual differences measured and the small sample sizes.

The existing empirical literature is lacking in the study of how individuals respond to regulated emotions. The contexts within which emotions occur are typically social (Gross, Richards, & John, 2006) and individuals communicating these emotions often have the underlying goal of regulating an observer's response (see Hrubes, Feldman, & Tyler, 2004). Whereas the majority of empirical research on emotion regulation is conducted in solitary settings (Campos, Walle, Dahl, & Main, 2011), masking typically involves a social context. Research on the use and detection of masked emotion offers the opportunity to explore an understudied topic related to emotion regulation in interpersonal contexts. Such studies would complement existing research investigating basic processes of emotion regulation

strategies by examining how the use of regulated emotion impacts the behaviors of social partners and subsequent interpersonal relations.

General Discussion

Prior research on emotional development has commonly assumed that infants appreciate and respond to emotional communication regardless of discrepant information from the context or the quality of the emotional display. The present set of studies call this assumption sharply into question.

Emotional communication varies in its perceived authenticity, and appreciation of cues relating to authenticity powerfully affects one's response to others' emotion signals. This investigation examined the ontogeny of infant appreciation of three distinct cues related to the perception of emotional authenticity. The present findings indicate a difference in 16- and 19-month-old infants' appreciation and use of cues relating to the contextual congruency, expressive quality, and communicative clarity of an emotional display. In each study, 19-month-old infants, but not 16-month-old infants, responded to the emotional presentation as a function of its perceived authenticity based on these cues.

In Study 1, 19-month-old infants utilized the contextual congruency of the emotion with the preceding events to determine the authenticity of a pain display. Study 2 demonstrated that infants of this age are also sensitive to the degree of exaggeration with which an emotion is communicated when judging the believability of a fearful display. Finally, Study 3 showed that 19-month-old infants are also sensitive to the clarity of emotional communication and are able to detect when an adult attempts to mask her disgust with a positive display. This set of studies demonstrates that 19-month-old infants are sensitive to the perceived authenticity of emotional communication and coordinate distinct behavioral responses specific to whether the emotional communication is appreciated as authentic or inauthentic.

Taken together, it is clear that infants appreciate emotional communication beyond simply its outward expression and are more sensitive to features of the emotional environment than previously believed. In what follows, potential underlying mechanisms that may facilitate this capacity are proposed and implications of these findings for the study of emotion and emotional development are highlighted.

Potential Mechanisms for the Detection of Inauthentic Emotional Communication

The development of infant sensitivity to cues relevant to emotional communication is likely facilitated by a number of underlying processes. While all possible mechanisms cannot be outlined in the present report, we suggest two warranting further inquiry.

Socialization and Cultural Differences of Emotion Displays—Shifts in parenting practices designed to teach social norms may also result in infant exposure to and understanding of inauthentic emotion. Caregivers routinely engage in socialization practices throughout infancy designed to teach infants acceptable social behaviors (for a review, see Eisenberg, Cumberland, & Spinrad, 1998). During the present investigation, parents routinely reported using inauthentic emotion to create teachable moments for informing their

infant of appropriate interpersonal behaviors. Instances of such lessons by parents instructing infants on how to act and respond in social settings may facilitate script learning of appropriate social interactions, as well as opportunities to play pretend games designed to teach such social norms. For example, a parent may exaggerate her pain after being hit by the child to emphasize that hitting is bad and results in pain, and provide the context for the child to demonstrate an appropriate response (e.g., prosocial responding, saying sorry). Examining the distinction between genuine helping and script helping is an area open for research.

Infant experience with situations in which specific cues are necessary to accurately appreciate emotional communication may also increase sensitivity and utilization of such cues. Though exploratory, the individual difference findings from Study 3 suggest that parents' increased use of suppression was related to infant detection of masked emotion. Research with adults indicates one's familiarity with an emoter is related to recognizing his or her emotional displays (e.g., Elfenbein & Ambady, 2003). Matsumoto and Hwang (2011) recently documented positive training effects for detecting micro-expressions of emotion. This suggests that one's exposure and attention to specific features of emotional communication impact one's appreciation of emotional communication. Although much research is necessary to explore these findings in younger children, it is possible that differential exposure to cues of emotional authenticity may lead to variability in the child's ability to detect a specific cue or feature of emotion expression. For example, one might predict that a culture in which exaggerating emotions is more prevalent would be composed of individuals who more accurately infer an individuals' emotional state when the expressive display is exaggerated. This proposition is supported by evidence that individuals from different cultures selectively attend to specific features of facial displays of emotion (Jack, Caldara, & Schyns, 2012). It is also possible that detection of inauthentic emotions is emotion specific. For example, exposure to a specific, regularly inauthentic emotion may result in more attentional resources to ascertain the authenticity of the emotion, or specific attention to cues specific to the evaluation of the authenticity of the emotion. Thus, variability in exposure throughout development may account for detection of specific cues or particular emotions, and developmental research on this topic may help inform the general field of emotion.

Understanding of Pretense and False Beliefs—Infant understanding of pretense is likely very relevant for appreciating inauthentic emotional communication. Research indicates that infant understanding of pretense develops significantly during the second year of life, particularly between 15 and 24 months of age (see, Haight & Miller, 1992; McCune, 1995; Walker-Andrews & Kahana-Kalman, 1999). This supports our conclusion from Study 1 that 19-month-old infants used the cue of the parent missing her hand with the hammer as an indication of pretend play, whereas 16-month-old infants noticed the discrepant event, but not its significance as a pretend act. A similar conclusion may be drawn from Study 2, in which 19-month-old infants appreciated parent exaggerated fear displays as comical. Lillard (2007) found that mothers' movements and vocalizations tend to be exaggerated during pretense. Although Lillard did not find that parent pretend behaviors changed between 15 and 24 months of age, it is possible that infants require a few months of experience to

effectively understand pretense in different contexts. It is also possible that parent use of pretense may vary across contexts. For example, parents may pretend in social interactions earlier than they pretend using physical objects with their infants. Lillard and Witherington (2004) have found that parents change functional movements when interacting with objects during pretense. It is possible that functional behaviors related to emotional communication might also be altered in such contexts. Research is needed to more closely examine parents' use of pretend emotions in everyday interactions with their infant, as well as examine how specific expressive behaviors change during such instances. Infants' understanding that individuals may have beliefs contrary to the appearance of a situation may also be relevant. In each of the present studies, one might presume that the infant effectively disentangled the outward expression of emotion from the perceived internal emotional state of the individual. Thus, infants were able to accurately infer the mental state of a social partner and respond accordingly. Recent research indicates that infants as young as 18 months may have some comprehension that others can have beliefs contrary to reality (Scott, Baillargeon, Song, & Leslie, 2010; Scott & Baillargeon, 2009). Although this research is not without criticism (e.g., Apperly & Butterfill, 2009; Perner & Roessler, 2012), its coincidence in development with emerging understandings of pretense and detection of inauthentic emotion gives cause for future investigations to explore possible links between these phenomena.

Limitations and Future Directions

Further research is needed to investigate a number of specific features relevant to the present line of investigation. First, it is not known whether infants appreciate other inauthentic emotions than those studied in the above contexts. Examining other emotions (e.g., anger, shame, interest) would provide a richer perspective on the development of each emotion in infancy, as well as the particular cues relevant to the authenticity of different emotions. One might also wonder if specific modalities are particularly effective in communicating the believability of an emotional display. For example, existing research indicating that the voice is particularly effective in communicating emotional information (Mumme, Fernald, & Herrera, 1996; Vaish & Striano, 2004) might suggest that the vocalic envelope was the key feature in infants' differentiation between the normative and exaggerated fearful display. Further research is needed to tease apart these emotional cues to determine what specific features infants use to determine whether an emotional display is authentic.

Second, one might also investigate infant perceptual discrimination of authentic and inauthentic emotional communication. We believe that the differences in infant behavioral responding at 19 months of age supports the conclusion that this discriminatory capacity is present at this age. However, we would also predict that infants would demonstrate perceptual sensitivity at ages younger than those tested in the current investigation. Such results would not contradict our own findings, but rather show that a perceptual ability precedes the infant's ability to *use* this capacity to engage in adaptive behaviors as a function of the authenticity of the emotional communication. The use of eye tracking and looking time measures would be candidate methodologies for investigating such discriminatory abilities.

It would also be worthwhile to examine whether infant detection of inauthentic emotion varies depending on prior experience with the individual. For example, infants may be more likely to "forgive" false emotional communication from a trusted caregiver than a stranger (e.g., Corriveau & Harris, 2009). The individual differences reported in Study 3, while intriguing, warrant cautious interpretation and call for naturalistic observations to explore how infants' socio-emotional environment relates to emotional responding. Additionally, although the use of a familiar caregiver provided the child with an assumed baseline of comparison for the display presented in the experimental context, it increased the variability within each condition. Future research may wish to use a trained experimenter to ensure greater consistency within conditions.

Finally, it should be obvious to the reader that while the present set of studies attempted to manipulate the authenticity of the emotions used in each experiment, all emotions were, in essence, inauthentic. The adult was never actually hurt, afraid, disgusted, or pleased. While this is a common concession for most researchers of emotional development, and emotion in general (for an excellent summary of this conundrum, see Ekman, 1971 p. 241), this limitation warrants acknowledgement. Even so, the appropriate differential responding evident by infants in the present set of studies indicates that those emotions designed to appear authentic were in fact deemed so. This highlights that the emotional signal cannot be entirely separated from the context within which the signal is observed.

Implications for Research on Emotion

This empirical investigation focused on three distinct features relating to emotional communication. However, the implications for this research are likely far broader than any single cue and relevant to emotion research with both developmental and adult populations.

From a developmental perspective this research is relevant at two levels of empirical significance. First, these findings stress that researchers pay careful attention to the contextual relevancy of the emotional presentation, quality with which the emotion is displayed, and the clarity with which the emotion is communicated when designing studies to investigate emotional development in infancy. Second, this research lays the foundation for a wealth of future research to further explore infant appreciation of each cue studied in the present investigation, as well as the possible mechanisms related to its functioning. Furthermore, while a great deal of progress was made during the 1980s and early 1990s to understand infant emotional development, it is important for researchers to recognize that many very basic issues related to emotional development remain uninvestigated.

More generally, the emphasis of our research on individuals' appreciation of and response to other's emotions highlights the value of examining "emotions as behavior regulators" (Klinnert, Campos, Sorce, Emde, & Svejda, 1983). This perspective advocates for empirical studies of emotion to take place in socially relevant contexts in which the participant may flexibly respond to a personally relevant and ecologically valid stimulus. The "limitations" of developmental paradigms, which typically necessitate empirical contexts in which the participant actively engage with and respond to the environment, reveal themselves as strengths for providing contexts that capture the significance of emotions in human interactions.

Acknowledgments

Work on this paper was supported by grants from the Amini Foundation for the Study of Affects and the National Institute of Child Health and Human Development (HD-62766). We gratefully thank Ryan Jensen for his work on this project, as well as Alexandra Main, Audun Dahl, and Minxuan He for their helpful feedback.

References

Abelson RP. Psychological status of the script concept. American Psychologist. 1981; 36:715–729. http://dx.doi.org/10.1037/0003-066X.36.7.715.

Adamson LB, Frick JE. The still face: A history of a shared experimental paradigm. Infancy. 2003; 4:451–473. http://dx.doi.org/10.1207/S15327078IN0404_01.

Apperly IA, Butterfill SA. Do humans have two systems to track beliefs and belief-like states? Psychological Review. 2009; 116:953–970. http://dx.doi.org/10.1037/a0016923. [PubMed: 19839692]

Aron, A.; Aron, EN.; Coups, E. Statistics for Psychology. 5th ed.. Prentice-Hall; Upper Saddle River, NJ: 2008.

Aviezer, H.; Hassin, RR.; Bentin, S.; Trope, Y. Putting facial expressions back in context. In: Ambady, N.; Skowronski, JJ.; Ambady, N.; Skowronski, JJ., editors. First impressions. Guilford Publications; New York, NY: 2008. p. 255-286.

Balconi M, Carrera A. Emotional representation in facial expression and script: A comparison between normal and autistic children. Research in Developmental Disabilities. 2007; 28:409–422. http://dx.doi.org/10.1016/j.ridd.2006.05.001. [PubMed: 16828256]

Boccia, M.; Campos, JJ. Maternal emotional signaling: Its effects on infants' reactions to strangers; Paper presented at the Biennial Meeting of the Society for Research on Child Development; Detroit, MI. 1983, April; http://dx.doi.org/10.1002/cd.23219894404

Bowlby, J. Attachment and loss: Vol. 1: Attachment. Basic Books; New York, NY: 1969.

Bretherton, I. Internal working models of attachment relationships as related to resilient coping. In: Noam, GG.; Fischer, KW., editors. Development and vulnerability in close relationships. Lawrence Erlbaum Associates; Mahwah, NJ: 1996. p. 3-27.

Campos JJ, Walle EA, Dahl A, Main A. Reconceptualizing emotion regulation. Emotion Review. 2011; 3:26–35. http://dx.doi.org/10.1177/1754073910380975.

Camras LA, Ribordy S, Hill J, Martino S, Sachs V, Spaccarelli S, Stefani R. Maternal facial behavior and the recognition and production of emotional expression by maltreated and nonmaltreated children. Developmental Psychology. 1990; 26:304–312. http://dx.doi.org/10.1037/0012-1649.26.2.304.

Carroll JM, Russell JA. Do facial expressions signal specific emotions? judging emotion from the face in context. Journal of Personality and Social Psychology. 1996; 70:205–218. http://dx.doi.org/10.1037/0022-3514.70.2.205. [PubMed: 8636880]

Carroll JM, Russell JA. Facial expressions in hollywood's protrayal of emotion. Journal of Personality and Social Psychology. 1997; 72:164–176. http://dx.doi.org/10.1037/0022-3514.72.1.164.

Corriveau K, Harris PL. Choosing your informant: Weighing familiarity and recent accuracy. Developmental Science. 2009; 12:426–437. http://dx.doi.org/10.1111/j.1467-7687.2008.00792.x. [PubMed: 19371367]

Dunsmore JC, Her P, Halberstadt AG, Perez-Rivera MB. Parents' beliefs about emotions and children's recognition of parents' emotions. Journal of Nonverbal Behavior. 2009; 33:121–140. http://dx.doi.org/10.1007/s10919-008-0066-6. [PubMed: 20160992]

Ekman, P. Universals and cultural differences in facial expressions. In: Cole, J., editor. Nebraska Symposium on Motivation. Vol. 19. University of Nebraska Press; Lincoln, NE: 1971. p. 207-282.

Ekman P, Friesen WV. Constants across cultures in the face and emotion. Journal of Personality and Social Psychology. 1971; 17:124–129. http://dx.doi.org/10.1037/h0030377. [PubMed: 5542557]

Ekman P, Friesen WV. Measuring facial movement. Environmental Psychology and Nonverbal Behavior. 1976; 1:56–75. http://dx.doi.org/10.1007/BF01115465.

Ekman, P.; Friesen, WV. Unmasking the face: A guide to recognizing emotions from facial clues. Prentice-Hall; Oxford, England: 1975.

Eisenberg N, Cumberland A, Spinrad TL. Parental socialization of emotion. Psychological Inquiry. 1998; 9:241–273. http://dx.doi.org/10.1207/s15327965pli0904_1. [PubMed: 16865170]

Elfenbein HA, Ambady N. When familiarity breeds accuracy: Cultural exposure and facial emotion recognition. Journal of Personality and Social Psychology. 2003; 85:276–290. http://dx.doi.org/10.1037/0022-3514.85.2.276. [PubMed: 12916570]

Fehr B, Russell JA. Concept of emotion viewed from a prototype perspective. Journal of Experimental Psychology: General. 1984; 113:464–486. http://dx.doi.org/10.1037/0096-3445.113.3.464.

Feldman RS, Jenkins L, Popoola O. Detection of deception in adults and children via facial expressions. Child Development. 1979; 50:350–355. http://dx.doi.org/10.2307/1129409.

Friedman HS, Miller-Herringer T. Nonverbal display of emotion in public and in private: self-monitoring, personality, and expressive cues. Journal of Personality and Social Psychology. 1991; 61:766–775. http://dx.doi.org/10.1037/0022-3514.61.5.766. [PubMed: 1753331]

Furr RM, Rosenthal R. Evaluating theories efficiently: The nuts and bolts of contrast analysis. Understanding Statistics. 2003; 2:33–67. http://dx.doi.org/10.1207/S15328031US0201_03.

Gosselin P, Warren M, Diotte M. Motivation to hide emotion and children's understanding of the distinction between real and apparent emotions. Journal of Genetic Psychology. 2002; 163:479–495. http://dx.doi.org/10.1080/00221320209598697. [PubMed: 12495232]

Gross JJ. Antecedent- and response-focused emotion regulation: Divergent consequences for experience, expression, and physiology. Journal of Personality and Social Psychology. 1998; 74:224–237. http://dx.doi.org/10.1037/0022-3514.74.1.224. [PubMed: 9457784]

Gross JJ, John OP. Individual differences in two emotion regulation processes: Implications for affect, relationships, and well-being. Journal of Personality and Social Psychology. 2003; 85:348–362. http://dx.doi.org/10.1037/0022-3514.85.2.348. [PubMed: 12916575]

Gross JJ, Levenson RW. Hiding feelings: The acute effects of inhibiting negative and positive emotion. Journal of Abnormal Psychology. 1997; 106:95–103. http://dx.doi.org/10.1037/0021-843X.106.1.95. [PubMed: 9103721]

Gross, JJ.; Richards, JM.; John, OP. Emotion regulation in everyday life. In: Snyder, DA.; Simpson, JA.; Hughes, JN., editors. Emotion regulation in families: Pathways to dysfunction and health. American Psychologist Association; Washington, DC: 2006. p. 13-35.

Gusella JL, Muir D, Tronick EA. The effect of manipulating maternal behavior on three- and six-month-olds' affect and attention. Child Development. 1988; 59:1111–1124. http://dx.doi.org/10.2307/1130278. [PubMed: 3168619]

Hadjistavropoulos HD, Craig KD, Hadjistavropoulos T, Poole GD. Subjective judgments of deception in pain expression: Accuracy and errors. Pain. 1996; 65:251–258. http://dx.doi.org/10.1016/0304-3959(95)00218-9. [PubMed: 8826514]

Haight W, Miller PJ. The development of everyday pretend play: A longitudinal study of mothers' participation. Merrill-Palmer Quarterly: Journal of Developmental Psychology. 1992; 38:331–349.

Halberstadt AG, Grotjohn DK, Johnson CA, Furth MS, Greig MM. Children's abilities and strategies in managing the facial display of affect. Journal of Nonverbal Behavior. 1992; 16:215–230. http://dx.doi.org/10.1007/BF01462003.

Harris PL, Donnelly K, Guz GR, Pitt-Watson R. Children's understanding of the distinction between real and apparent emotion. Child Development. 1986; 57:895–909. http://dx.doi.org/10.2307/1130366. [PubMed: 3757608]

Hepach R, Vaish A, Tomasello M. Young children sympathize less in response to unjustified emotional distress. Developmental Psychology. 2013; 49:1132–1138. http://dx.doi.org/10.1037/a0029501. [PubMed: 22889390]

Hrubes, D.; Feldman, RS.; Tyler, JM. Emotion-focused deception: The role of deception in the regulation of emotion. In: Philippot, P.; Feldman, RS., editors. The regulation of emotion. Lawrence Erlbaum; Mahwah, NJ: 2004. p. 101-126.

Jack RE, Caldara R, Schyns PG. Internal representations reveal cultural diversity in expectations of facial expressions of emotion. Journal of Experimental Psychology: General. 2012; 141:19–25. http://dx.doi.org/10.1037/a0023463. [PubMed: 21517206]

Josephs IE. Display rule behavior and understanding in preschool children. Journal of Nonverbal Behavior. 1994; 18:301–326. http://dx.doi.org/10.1007/BF02172291.

Keppel, G.; Wickens, TD. Design and Analysis. 4th ed.. Prentice-Hall; Upper Saddle River, NJ: 2004.

Klinnert, MD.; Campos, J.; Sorce, J.; Emde, RN.; Svejda, M. The development of social referencing in infancy. In: Plutchik, R.; Kellerman, H., editors. Emotion theory, research, and experience, Vol. 2: Emotions in early development. Academic Press; New York, NY: 1983. p. 57-68.

Leslie. Pretense and representation: The origins of “theory of mind.”. Psychological Review. 1987; 94:412–426. http://dx.doi.org/10.1037/0033-295X.94.4.412.

Lillard, A. Pretend play in toddlers. In: Brownell, CA.; Kopp, CB.; Brownell, CA.; Kopp, CB., editors. Socioemotional development in the toddler years: Transitions and transformations. Guilford Press; New York, NY: 2007. p. 149-176.

Lillard AS, Witherington DC. Mothers’ behavioral modifications during pretense and their possible signal value for toddlers. Developmental Psychology. 2004; 40:95–113. http://dx.doi.org/10.1037/0012-1649.40.1.95. [PubMed: 14700467]

Ma L, Lillard AS. Where is the real cheese? Children’s ability to discriminate between real and pretend acts. Child Development. 2006; 77:1762–1777. http://dx.doi.org/10.1111/j.1467-8624.2006.00972.x. [PubMed: 17107459]

Matsumoto D, Hwang HS. Judging faces in context. Social and Personality Psychology Compass. 2010; 3:393–402. http://dx.doi.org/10.1111/j.1751-9004.2010.00271.x.

Matsumoto D, Hwang HS. Evidence for training the ability to read microexpressions of emotion. Motivation and Emotion. 2011; 35:181–191. http://dx.doi.org/10.1007/s11031-011-9212-2.

Matsumoto D, Hwang HS, Yamada H. Cultural differences in the relative contributions of face and context to judgments of emotions. Journal of Cross-Cultural Psychology. 2012; 43:198–218. http://dx.doi.org/10.1177/0022022110387426.

Matsumoto D, Yoo SH, Hirayama S, Petrova G. Development and validation of a measure of display rule knowledge: The display rule assessment inventory. Emotion. 2005; 5:23–40. http://dx.doi.org/10.1037/1528-3542.5.1.23. [PubMed: 15755217]

McCune L. A normative study of representational play in the transition to language. Developmental Psychology. 1995; 31:198–206. http://dx.doi.org/10.1037/0012-1649.31.2.198.

Muir D, Lee K. The still-face effect: Methodological issues and new applications. Infancy. 2003; 4:483–491. http://dx.doi.org/10.1207/S15327078IN0404_03.

Mumme DL, Fernald A. The infant as onlooker: Learning from emotional reactions observed in a television scenario. Child Development. 2003; 74:221–237. http://dx.doi.org/10.1111/1467-8624.00532. [PubMed: 12625447]

Mumme DL, Fernald A, Herrera C. Infants’ responses to facial and vocal emotional signals in a social referencing paradigm. Child Development. 1996; 67:3219–3237. http://dx.doi.org/10.2307/1131775. [PubMed: 9071778]

Murray L. The impact of postnatal depression on infant development. Journal of Child Psychology and Psychiatry. 1992; 33:543–561. http://dx.doi.org/10.1111/j.1469-7610.1992.tb00890.x. [PubMed: 1577898]

Perner J, Roessler J. From infants’ to children’s appreciation of belief. Trends in Cognitive Sciences. 2012; 16:519–525. http://dx.doi.org/10.1016/j.tics.2012.08.004. [PubMed: 22964134]

Pollak SD, Messner M, Kistler DJ, Cohn JF. Development of perceptual expertise in emotion recognition. Cognition. 2009; 110:242–247. http://dx.doi.org/10.1016/j.cognition.2008.10.010. [PubMed: 19059585]

Pollak SD, Sinha P. Effects of early experience on children’s recognition of facial displays of emotion. Developmental Psychology. 2002; 38:784–791. http://dx.doi.org/10.1037/0012-1649.38.5.784. [PubMed: 12220055]

Raikes HA, Thompson RA. Family emotional climate, attachment security and young children’s emotion knowledge in a high risk sample. British Journal of Developmental Psychology. 2006; 24:89–104. http://dx.doi.org/10.1348/026151005X70427.

Reichenbach L, Masters JC. Children’s use of expressive and contextual cues in judgments of emotion. Child Development. 1983; 54:993–1004. http://dx.doi.org/10.2307/1129903.

Saarni C. An observational study of children's attempts to monitor their expressive behavior. Child Development. 1984; 55:1504–1513. http://dx.doi.org/10.2307/1130020.

Saarni, C.; Campos, JJ.; Camras, LA.; Witherington, D. Emotional development: Action, communication, and understanding. In: Eisenberg, N.; Damon, W.; Lerner, RM., editors. Handbook of Child Psychology: Vol. 3, Social, emotional, and personality development. Wiley; New York, NY: 2006. p. 237-309.

Scherer KR, Feldstein S, Bond RN, Rosenthal R. Vocal cues to deception: A comparative channel approach. Journal of Psycholinguistic Research. 1985; 14:409–425. http://dx.doi.org/10.1007/BF01067884. [PubMed: 4032322]

Scott RM, Baillargeon R. Which penguin is this? Attributing false beliefs about object identity at 18 months. Child Development. 2009; 80:1172–1196. http://dx.doi.org/10.1111/j.1467-8624.2009.01324.x. [PubMed: 19630901]

Scott RM, Baillargeon R, Song H, Leslie AM. Attributing false beliefs about non-obvious properties at 18 months. Cognitive Psychology. 2010; 61:366–395. http://dx.doi.org/10.1016/j.cogpsych.2010.09.001. [PubMed: 21047625]

Shutts K, Kinzler KD, McKee CB, Spelke ES. Social information guides infants' selection of foods. Journal of Cognition and Development. 2009; 10:1–17. http://dx.doi.org/10.1080/15248370902966636. [PubMed: 19809590]

Sorce JF, Emde RN, Campos JJ, Klinnert MD. Maternal emotional signaling: Its effect on the visual cliff behavior of 1-year-olds. Developmental Psychology. 1985; 21:195–200. http://dx.doi.org/10.1037/0012-1649.21.1.195.

Spinard TL, Eisenberg N, Gaertner B, Popp T, Smith CL, Kupfer A, Greving K, Liew J, Hofer C. Relations of maternal socialization and toddlers' effortful control to children's adjustment and social competence. Developmental Psychology. 2007; 43:1170–1186. http://dx.doi.org/10.1037/0012-1649.43.5.1170. [PubMed: 17723043]

Tronick EZ. Things still to be done on the still-face effect. Infancy. 2003; 4:475–482. http://dx.doi.org/10.1207/S15327078IN0404_02.

Tronick E, Als H, Adamson L, Wise S, Brazelton TB. The infants' response to entrapment between contradictory messages in face-to-face interactions. Journal of the American Academy of Child Psychiatry. 1978; 17:1–13. http://dx.doi.org/10.1016/S0002-7138(09)62273-1. [PubMed: 632477]

Vaish A, Striano T. Is visual reference necessary? contributions of facial versus vocal cues in 12-month-olds' social referencing behavior. Developmental Science. 2004; 7:261–269. http://dx.doi.org/10.1111/j.1467-7687.2004.00344.x. [PubMed: 15595366]

Walden TA, Baxter A. The effect of context and age on social referencing. Child Development. 1989; 60:1511–1518. http://dx.doi.org/10.2307/1130939. [PubMed: 2612256]

Walker-Andrews AS. Intermodal perception of expressive behaviors: Relation of eye and voice. Developmental Psychology. 1986; 22:373–377. http://dx.doi.org/10.1037/0012-1649.22.3.373.

Walker-Andrews AS, Kahana-Kalman R. The understanding of pretence across the second year of life. British Journal of Developmental Psychology. 1999; 17:523–536. http://dx.doi.org/10.1348/026151099165456.

Warneken F, Tomasello M. The roots of human altruism. British Journal of Psychology. 2009; 100:455–471. http://dx.doi.org/10.1348/000712608X379061. [PubMed: 19063815]

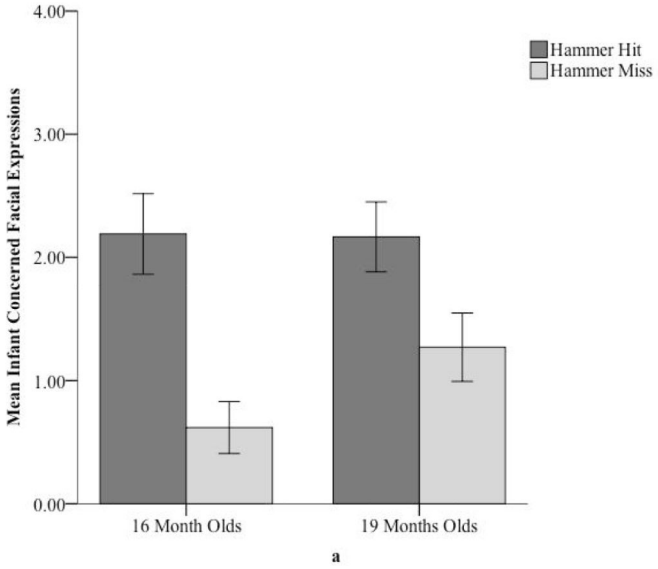
Widen SC, Russell JA. The relative power of an emotion's facial expression, label, and behavioral consequence to evoke preschoolers' knowledge of its cause. Cognitive Development. 2004; 19:111–125. http://dx.doi.org/10.1016/j.cogdev.2003.11.004.

Widen SC, Russell JA. Children's scripts for social emotions: Causes and consequences are more central than are facial expressions. British Journal of Developmental Psychology. 2010; 28:565–581. http://dx.doi.org/10.1348/026151009X457550d. [PubMed: 20849034]

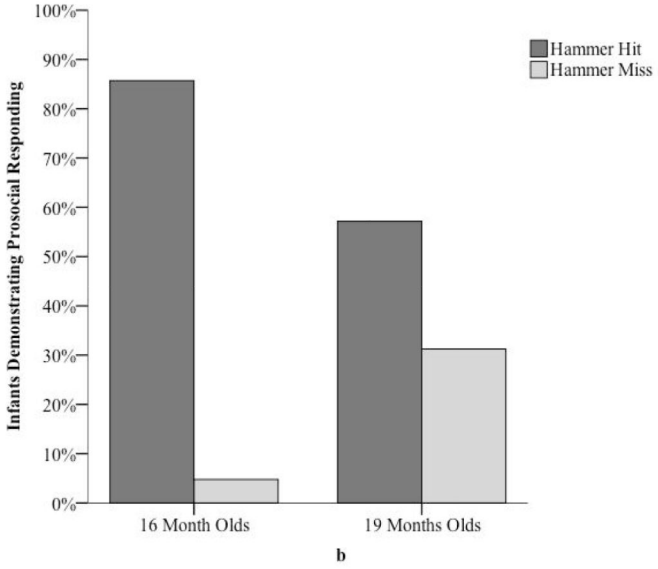
Young SK, Fox NA, Zahn-Waxler C. The relations between temperament and empathy in 2-year-olds. Developmental Psychology. 1999; 35:1189–1197. http://dx.doi.org/10.1037/0012-1649.35.5.1189. [PubMed: 10493645]

Zahn-Waxler C, Radke-Yarrow M, Wagner E, Chapman M. Development of concern for others. Developmental Psychology. 1992; 28:126–136. http://dx.doi.org/10.1037/0012-1649.28.1.126.

Zuckerman, M.; DePaulo, BM.; Rosenthal, R. Verbal and nonverbal communication of deception. In: Berkowitz, L., editor. Advances in experimental social psychology. Vol. 14. Academic Press; New York, NY: 1981. p. 1-59.



a



b

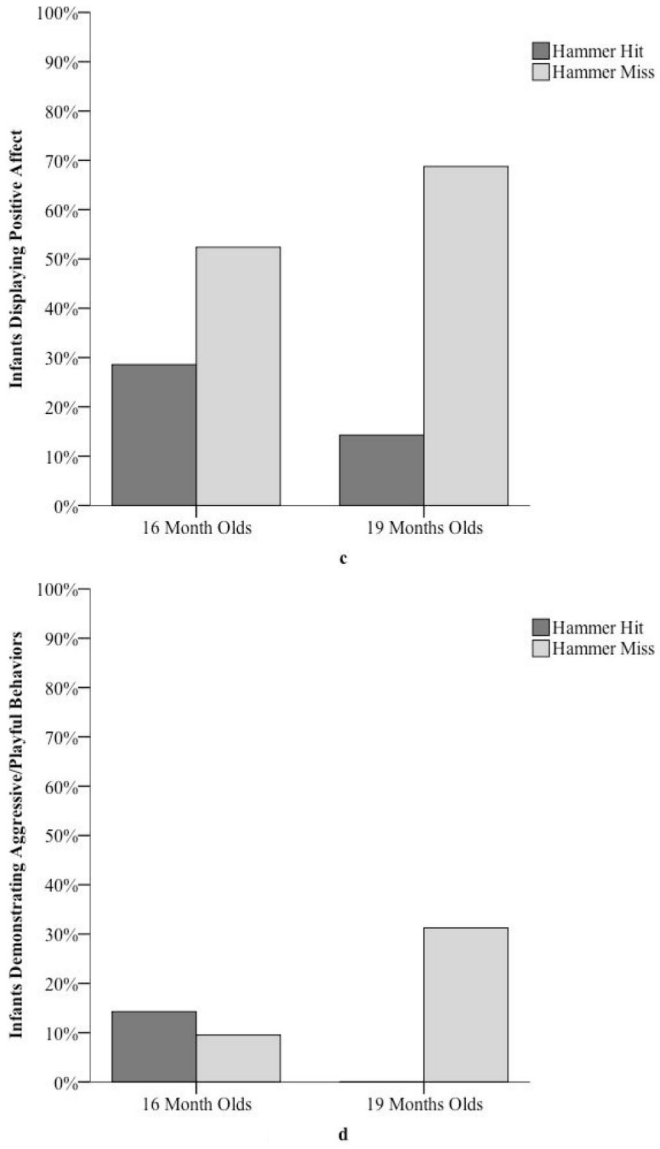
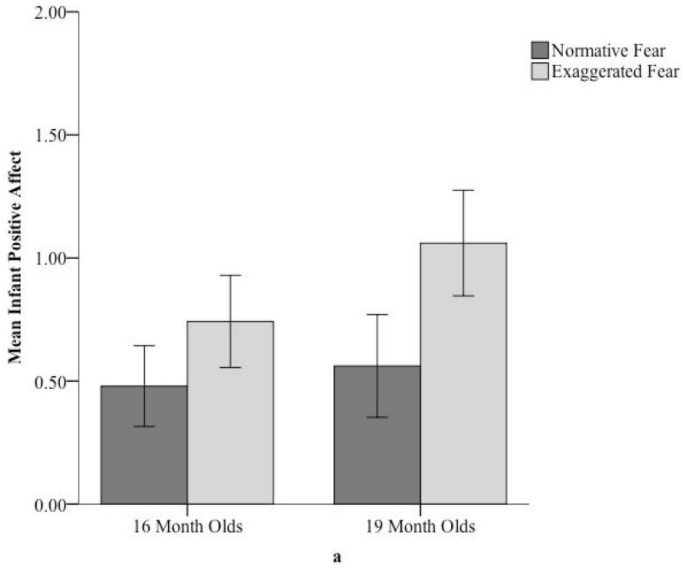
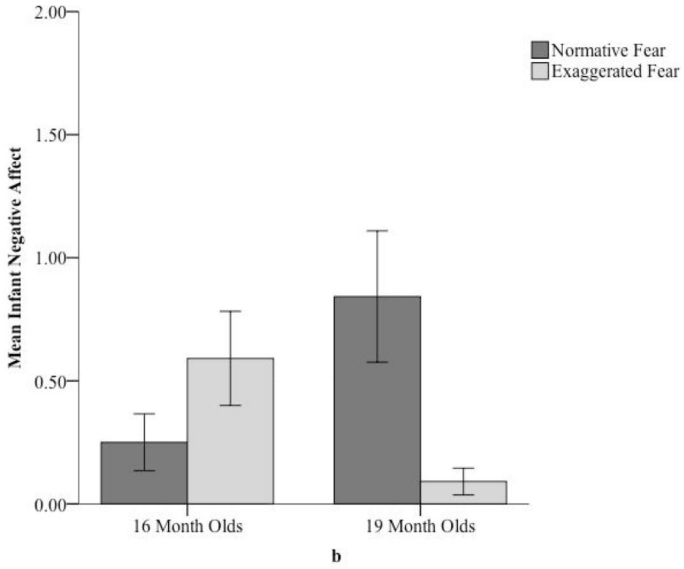


Figure 1.

Infant behavioral responding in Study 1: mean infant concerned facial expressions (Figure 1a), percentage of infants demonstrating prosocial responding (Figure 1b), percentage of infants demonstrating positive affect (Figure 1c), and percentage of infants demonstrating aggressive/playful behaviors (Figure 1d). (Error bars represent +/− 1 standard error of the mean)



a



b

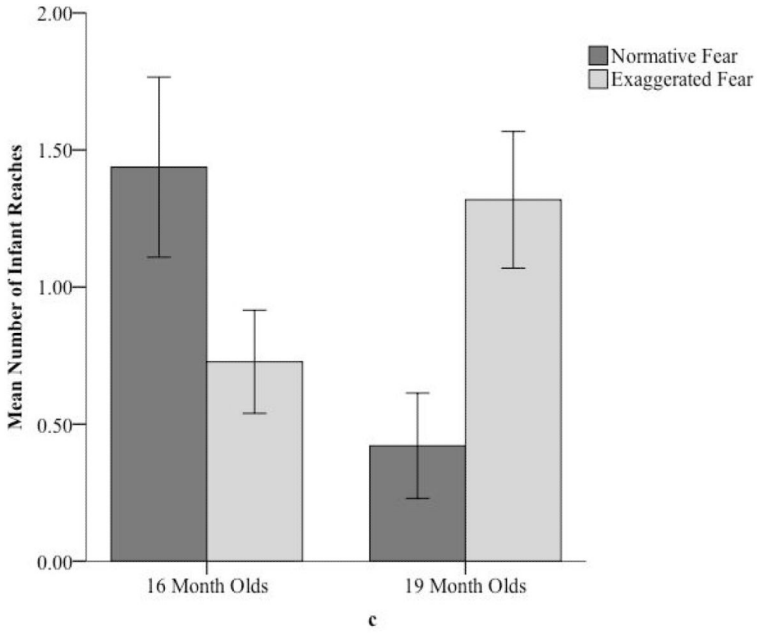


Figure 2.

Infant behavioral responding in Study 2: mean infant positive affect (Figure 2a), mean infant negative affect (Figure 2b), and mean number of infant reaches for the stimulus (Figure 2c). (Error bars represent +/− 1 standard error of the mean)

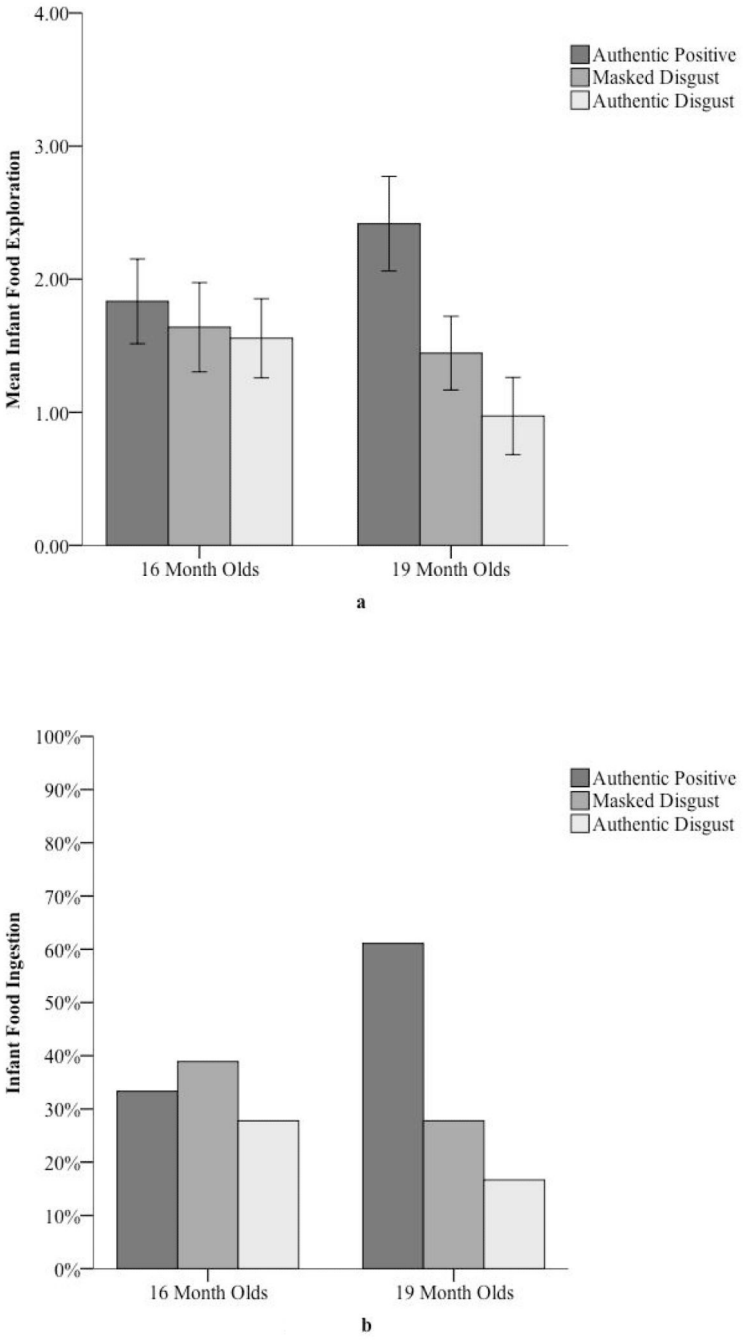


Figure 3.

Infant behavioral responding in Study 3: mean infant food exploration (Figure 3a) and percentage of infants who ingested the food (Figure 3b). (Error bars represent +/− 1 standard error of the mean)