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Social Looking, Social Referencing and Humor Perception in 6- and-12-month-old Infants

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Abstract

Social referencing refers to infants' use of caregivers as emotional referents in ambiguous situations (Walden, 1993). Studies of social referencing typically require ambulation, thereby over-looking younger, non-ambulatory infants (i.e., 8-mos) and resulting in a widespread assumption that young infants do not employ this strategy. Using a novel approach that does not require mobility, we found that when parents provided unsolicited affective cues during an ambiguous-absurd (i.e., humorous) event, 6-month-olds employ one component of social referencing, social looking. Additionally, 6-month-olds who did not laugh at the event were significantly more likely to look toward parents than their counterparts who found the event funny. Sequential analyses revealed that, following a reference to a smiling parent, 6-month olds were more likely to smile at the parent, but by 12 months were more likely to smile at the event suggesting that older infants are influenced by parental affect in humorous situations. The developmental implications of these findings are discussed, as well as the usefulness of studying humor for understanding important developmental phenomena.

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Keywords

social referencing; humor; infancy; emotion regulation; social development

Although most infants begin to laugh by 4 months of age, little is known about how or why they interpret a stimulus as humorous. One possibility is that infants rely on emotional cues from others when confronted with absurd events that are initially ambiguous to them. This phenomenon is broadly referred to as social referencing (SR) and has been clearly observed in infants in the second part of the first year (Walden, 1993) when they are confronted with an ambiguous, but potentially threatening stimulus like a visual cliff. In this study, we investigated SR longitudinally from 6- to 12-months examining: 1) if infants employ SR by the end of the first half of the first year; and 2) if younger and older infants employ SR in ambiguous-absurd situations. Our goal was to track the emergence of SR and its components as it develops in the context of social engagement (Stack & Lewis, 2008).

In the classic sense, SR involves three sequential components: the infant actively seeks another person's affective appraisal of a stimulus, that individual provides a clear affective message about the stimulus, and the infant regulates his/her affect and behavior toward the event to align with that message (Rosen, Adamson, & Bakeman, 1992). Walden (1993) describes SR as a simple but powerful strategy used especially by pre-verbal infants who must rely on others' cues to self-regulate in a variety of novel situations. As "universal novices" (p. 188) most situations are new to infants and they must determine how to respond (Walden, 1993). According to Campos (1983), SR is a biologically organized process that has the value of communicating important emotional messages (e.g., threat and joy) in situations of uncertainty. Numerous studies with infants show "clear, pervasive, and observable" (p. 84) effects on infants' affect communicated cross-modally via others' facial, vocal, and gestural cues (Vaish & Striano, 2004), a redundancy that, according to Campos (1983), suggests fundamental significance for adaptation whereby the naïve infant learns vicariously via others' affect.

Despite acknowledging the importance of SR to infant social-emotional development, most research has ignored infants younger than 8 months of age. Except for a few studies (e.g., Devouche, 2004; Feinman & Lewis, 1983), SR research protocols have primarily relied on mobility as a dependent variable to assess the influence of SR on infants' behavioral decisions (e.g., whether to approach a threatening stimulus like a visual cliff or caged rabbit), therefore requiring older infants who are mobile. It is clear that infants use SR by the end of the first year (Walden & Baxter, 1989). However, infants younger than 6-months exhibit several skills (e.g., detection and discrimination of emotional expressions in visual and vocal modalities, coordination of gaze-following and affect) consistent with an earlier-than-expected emergence of social referencing (Vaillant-Molina & Bahrck, 2012). Recent investigations using eye-tracking technologies have begun to demonstrate that 6-month-old infants look at adults for information and that 9-month-olds' looking behavior can be influenced by an experimenter's behavior (Senju, Csibra, & Johnson, 2008). These findings suggest that SR is a developmental possibility in young infants. Components or precursors of SR (e.g., social looking) may emerge earlier in the first year before converging into

classic SR by 8 months. Additionally, young infants may use unsolicited parental affect to appraise events, and may come to understand that caregivers are sources of affective information about events.

Furthermore, Nishida and Lillard (2007) point out that SR research employs strange or confusing situations (e.g., visual cliff, confronting a stranger), and propose that researchers should investigate whether SR is used in “situations that are not entirely novel and ambiguous, but slightly ‘out-of-the-ordinary’” (p.206). For example, although numerous studies have shown that infants use SR to interpret ambiguity as threatening, none have examined whether they use it to interpret ambiguity as humorous. Taken together two gaps exist in the SR research: first, whether younger, non-ambulatory infants also engage in SR when confronting ambiguity; and second, whether SR is employed in situations that present a lower threshold of ambiguity, such as those involving humor.

Infant humor development itself is a little-understood process. Humor generally refers to the perception, expression, and creation of amusement, and has been understood from a social theoretical perspective as a fundamentally interpersonal experience (Provine & Fischer, 1989; Reddy, 2008), and from a cognitive framework as recognition of incongruity (Rothbart, 1973). In infants, humor perception is most apparent in smiling and laughing, universal behaviors that appear very early from 0-6 weeks and 3-4 months, respectively (Ruch & Ekman, 2001; Wolff, 1963). Humor involves the complex convergence of neural (Wild, Rhodden, Grodd, & Ruch, 2003), cognitive (Forabosco, 1992), behavioral (Lockard, Fahrenbruch, Smith, & Morgan, 1977), emotional (Panksepp, 2005), and social (Chapman, 1983) responses. Yet, infants show a high capacity for humor, laughter, and play in the first year of life (Hill, 1996). For example, babies between 7 and 12 months of age laugh in response to the incongruous pairings of familiar materials and actions (Loizou, 2005), like putting a bowl on one's head. Infants this age also attempt to elicit laughter in others and try to maintain humorous interactions that are in progress (Loizou, 2005). These observations of infant humor have implications for understanding theory of mind (Hoicka & Akhtar, 2011; Hoicka & Gattis, 2008; Reddy, 2008), attachment (Mireault, Sparrow, Poutre, Perdue, & Macke, 2012), and spectrum disorders (Reddy, Williams, & Vaughan 2002). For example, Reddy (2001) reports that 8- to 11-month-olds engage in simple teasing like offering and withdrawing an object, an early form of deception and an indication that infants may hold more understanding of others' minds than is typically assumed. Thus, studying humor can help provide a developmental account of early social understanding (Stack & Lewis, 2008).

The scant research on infant humor from an interpersonal perspective suggests that humor emerges in – and in fact, *requires* - the important interpersonal contexts of infancy (Loizou, 2005). In these contexts infants may come to rely on others' affective cues to interpret an ambiguous event as humorous. In fact, Reddy (2008) argues that even the earliest consistent stimulus of laughter in babies – tickling – requires a “social wrapping” (p. 201) to define it as funny. In support of this, Mireault, Poutre, Sargent-Hier, Dias, Perdue, and Myrick (2012) found that parents consistently used cues of smiling and laughter when engaging in absurd actions (i.e., odd faces and voices) with their 3- to 6-month-old infants, which may explain why these absurdities were not perceived as threatening and why they became more humorous to babies over time. Similarly, Hoicka & Gattis (2012) report that acoustic cues

help listeners distinguish between humorous and other types of communication and, when paired with laughing and smiling, may contribute to humor perception.

Although Mireault et al. (2012) did not directly investigate the role of SR in infants' perception of humor, it is possible that parental affect is influential in these exchanges, at least inadvertently. Consistent with this, Campos (1983) noted that affective communication can be imposed on others, and Walden (1993) reports that although younger infants may not intentionally refer to their parents to interpret ambiguous situations, parents provide these emotional messages anyway, and infants tend to match their affect as a result. In addition, although their study employed older infants, Nishida and Lillard (2007) demonstrated that 18-month-olds use their mothers as a social referent to understand pretend play, a situation that is closer to humor than threat.

The purpose of the present study was to examine whether young infants employ social referencing to interpret an ambiguous event as humorous and to track the emergence of SR longitudinally from 6- to 12-months with regard to humor perception. Thirty 6-month-old infants were videoed at home while they watched a researcher present one of their parents with ordinary and ambiguous-absurd events, during which parents' affective cues were manipulated (neutral or laughing) in a within-subjects counter-balanced design, a procedure that was repeated when infants were 12 months old. We made the following predictions: 1) infants at both ages would distinguish ordinary from absurd events, 2) infants at both ages would not find an event humorous (i.e., smile/laugh at the absurd event) unless the event was accompanied by parental affective humor cues, 3) infants would reference the parent more often during absurd vs. ordinary events, especially at 6-months, as those events should be more ambiguous for younger infants, and 4) at both ages infants' would exhibit classic social referencing (i.e., their smiles and gazes at the event would be more likely to sequentially follow their references to parents' smiles).

1.1 Method

1.1.1 Participants

Thirty infant-parent dyads participated at 6- and again at 12-months of age. Infants (16 males, 14 females) had at least one older sibling ($n=20$). Most participating parents were mothers ($n=28$). Parents of infants tended to be married ($n=28$) with mothers ranging from 25 to 43 years ($M=33.40$, $SD=5.33$) and fathers from 24 to 51 years ($M=35.33$, $SD=6.54$). Most infants' mothers ($n=21$) and fathers ($n=28$) worked fulltime hours ($M_M=36.07$, $SD_M=10.59$; $M_F=42.86$, $SD_F=8.90$), with combined annual incomes ranging widely from \$7,300 to \$250,000 ($M=\$85,643$, $SD=\$45,976$). Parental education ranged from 12 to 20 years for mothers ($M=16.45$, $SD=1.87$) and 10 to 23 years for fathers ($M=16.57$, $SD=2.73$).

1.1.2 Apparatus

Two ordinary items likely to be familiar to 6-month-olds were selected: a vinyl picture book and a red foam ball (1.5" in diameter). These materials were used as intended for the ordinary events and in novel and potentially amusing ways for the ambiguous-absurd events. No other materials were used in the procedure.

1.1.3 Measures

Two teams of trained research assistants worked in dyads to code discrete, non-overlapping infant behaviors from the videoed experimental procedure. Frequency and duration (in seconds) of each behavior were measured, and proportions were calculated to control for variability in length of exposure to the event (i.e., because of human error, the researcher sometimes performed the event for slightly more or less than 45 seconds). Inter-rater reliability based on a random selection of 25% of the videos across behaviors and ages ranged from .73 to .94.

Smiling and laughing—Positive affect was defined as smiling and/or laughing. Due to the low frequency of laughter in this small sample of behavior, as well as their non-mutual exclusivity; smiling and laughter were collapsed into a single category and coded specific to its target: at parent, at event, or while looking away. Smiling/laughing were likely of low frequency due to the short duration of the experimental conditions (45 seconds) and the fact that the infant, despite being in a familiar environment, still had to adjust to the novelty of the experimenter and situation.

Social looking and social referencing—In accord with studies on this phenomenon (Nishida & Lillard, 2007; Sorce et al., 1985; Vaish & Striano, 2004), social looking was defined as infants' looks towards the parent. If infants were smiling during the look, then this behavior was coded as “baby smiles at parent” instead of social looking. This was done in order to preserve the discrete categories of behaviors and to be able to analyze the target of infant smiling/laughing in addition to the frequency and duration of smiling. Smiling at the parent was also differentiated from looking at the parent, as the former is both affective and behavioral, whereas the latter is behavioral. Social looking is differentiated from social referencing (SR) in that the latter involves a change in the infant's behavior or affect consistent with and subsequent to a social look to the parent's affective message. Social looking is also not necessarily in itself a solicitation of information. Thus, SR was examined as a classic sequence of behaviors consistent with previous studies (e.g., Rosen et al., 1992): 1) infant gazes at event, 2) infant looks at parent, who is neutral or smiling, 3) infant gazes back at the event (if parent is neutral) or smiles at the event (if parent is smiling).

Gazes at event—Gazes were coded when infants' eyes were directed at the experimental event in the absence of infant smiling. If the infant smiled while gazing, this was coded as “smiles at event”. Again, this was to preserve the discrete nature of the behaviors and to be able to analyze the target of infants' smiles and gazes. The experimenter presented the events, therefore gazes at the experimenter were coded as gazes at the event.

Look away—When infants averted their gaze from the event, regardless of the subsequent direction of their gaze (unless it was toward the parent, which was coded as a social look), it was coded as “look away”. Look away was coded for frequency and duration, as well as the length of time that elapsed (i.e., latency) before the infant looked away.

1.1.4 Procedure

Flyers were mailed to parents whose names appeared in the birth announcements of five area newspapers. The flyer indicated that the study was exploring “how babies figure out what is funny.” Interested parents called or e-mailed the PI who provided details about the procedure and obtained informed consent. Eligibility criteria included full-term, singleton delivery, and living within a 50-mile radius of the research site in one of three counties.

One week in advance of the experimental procedure, parents received a packet in the mail containing a demographic questionnaire, a copy of the informed consent, and \$5.00 compensation. A researcher visited participants in their homes within one week of infants' 6-month birthdays. Infants were seated in a high chair between the researcher and the parent in a triangular configuration with approximately three feet between each member. This seating arrangement allowed the infant to see both the parent and the event presented by the researcher, and required infants to slightly turn their heads so that coding the target of infants' looking behavior was clear. The parent and researcher sat directly opposite each other, and parents were instructed to look at and direct their affect toward the event, not at the infant, for the duration of the procedure. The effect of this configuration was to place the infant in the role of observing the event and the parent's reaction to it. A video camera on a tripod was set up opposite the infant so that the complete triad could be captured in the frame.

The researcher presented three events with each of two objects (ball and book) to parents while infants observed. Objects were initially presented as they are ordinarily used (i.e., the book was read to the parent, the ball was tossed hand to hand and described to the parent), and parents were instructed to act as they normally would during these ordinary events. The objects were then used to create ambiguous-absurd events (i.e., the opened book was repeatedly placed upside down on the researcher's head while she said “joop joop”; the ball was worn as a clown nose and poked with her finger while she said “beep beep”). Experimenters followed a standard script during the ordinary condition to maintain standardization of the procedure. For example, in the ordinary ball condition they manipulated the ball between their hands while repeating three times, “This is a ball. The ball is red. I can squish it. I can roll it. I can toss it hand to hand.” Ordinary and absurd events were designed to be as similar as possible with regard to length, script, vocal presentation, and movement. Experimenters remained affectively neutral across all three conditions, and looked exclusively at parents, not at infants. During the ambiguous-absurd events parents were instructed to remain affectively expressionless with a neutral, “still face” (control condition) and to point and laugh at the event (cued condition); these affective conditions were counterbalanced.

Our procedure differed from the classic SR paradigm in one important way: parental affective cues were not contingent upon infants' solicitation of affective information. Instead, we examined whether infants are influenced by unsolicited parental affect under conditions of humor. Our decision to deviate from the classic SR paradigm was based on the following reasons: 1) We were concerned about the developmental and methodological sensitivity of studying non-ambulatory 6-month-olds using a procedure designed for ambulatory 8-to-12-month-olds; 2) our procedure was necessarily brief given the attention-

span of such young infants, such that waiting for them to solicit affective information would potentially undermine the entirety of the procedure; and 3) we wanted to employ a more externally valid procedure. Thus we were guided by Campos' (1983) finding that affect can be imposed on others and by Walden's (1993) observation that parents tend to provide unsolicited emotional information that influences infants' responses. Similarly, Mireault et al. (2012) found that in naturally occurring humorous exchanges, parents smile and laugh in conjunction with absurd behavior (clowning). For these reasons, we designed a procedure that would allow us to determine if parental affect influenced young infants' response toward an absurd event.

Several investigators (Campos, 1983; Kim, Walden, & Knieps, 2010) have suggested that the affective communication involved in social referencing involves facial, vocal, and gestural cues, and Vaillant-Molina and Bahrack (2011) found that this "intersensory redundancy" (p. 7) was required for 5½ month-olds to detect a relationship between an adult's affective display and a corresponding toy. Thus, parents were instructed to use facial, vocal, and gestural cues in the cued condition and to deliver these cues continuously to insure that parents' emotional message about the event were obvious to these young infants. Parents were provided with examples of what they could say (e.g., "That is so silly!" "Isn't that funny!"), but were allowed to deviate from the script as long as they did not instruct the infant on what to do (e.g., "Get the ball!") nor touch the infant or the object. Parents occasionally glanced at their infants, but, as instructed, parental affect was directed at the event, not at the infant, to avoid the possibility of infant distress in the neutral face condition.

Thus there were three conditions (ordinary, ambiguous-absurd with neutral/no affective cues, and ambiguous-absurd with smiling/laughing affective cues) for each of two objects (book and ball). All six events were timed to last approximately 45 seconds in duration ($M = 38.2$, $SD = 8.2$, $Mdn = 40$). Parents were compensated an additional \$25.00 upon completion of the procedure, which was repeated when infants were 12-months-old, at which time parents were compensated an additional \$40.00. Two researchers conducted the experiment over the course of the study, and typically the same researcher conducted the experiment on the same infants at 6- and 12-months. Similarly, the same parent participated at both time points.

1.1.5 Analyses

To reduce the number of comparisons in this small sample, we combined dependent measures from both ordinary conditions, both ambiguous-absurd neutral conditions, and both ambiguous-absurd cued conditions for all infant behaviors. Due to some variability in length of the events, raw frequencies and durations of behavioral measures were converted to proportions to standardize them for analyses. Paired sample t-tests were used to compute differences between the ordinary and ambiguous-absurd (neutral) conditions in infants' latency to look away, smiling at the event, and social looking. Paired sample t-tests were also used to compare social looking and smiling/laughing between the ambiguous-absurd neutral and ambiguous-absurd cued conditions and between ages. Holm-Bonferroni corrections were used to maintain a family-wise error rate of .05 within each age group.

Finally, sequential analyses (using GSEQ; Bakeman & Quera, 1995; 2011) were used to see if a sequence consistent with SR occurred. Sequential analyses (using GSEQ; Bakeman & Quera, 1995; 2011) examined the extent to which infant affect (smiling/laughing) and visual approach (i.e., gazing back at the event) was contingent upon parental affect (smiling/laughing vs. neutral). If infants use social referencing to interpret ambiguity, then a sequence of behaviors consistent with SR should occur at higher than chance levels. The SR sequence was specified as follows: the experimenter presents the ambiguous event, the infant looks at the event, the parent displays positive facial, gestural and vocal cues (or neutrality, as appropriate to the condition), the infant looks at the parent, the infant smiles/laughs and/or gazes back at the event. GSEQ computes frequencies of the specified sequences and estimates expected frequencies for each sequence based on the number of occurrences of each behavior within the data set; sequences with commonly occurring behaviors have higher expected frequencies than sequences with unusual behaviors. Chi-square analysis was then used to compare expected to observed frequencies of behaviors (Nishida & Lillard, 2007).

1.2 Results

Group comparisons—As expected, six-month-old infants took significantly longer to look away from ambiguous-absurd versus ordinary events, indicating that they distinguished the two types of events (Oakes, 2010). This effect was also found at 12-months, but was negated subsequent to the Holm-Bonferroni adjustment. However and contrary to the hypotheses, both six- and 12-month-olds smiled longer at the event, and 12-month-olds also smiled more frequently at ambiguous-absurd than ordinary events, despite parental affective neutrality, indicating that both age groups did indeed distinguish between ordinary and absurd events and perceived them as humorous without affective guidance. Also unexpected, 6-month-olds smiled significantly more often and longer at the absurd events when parents remained neutral instead of providing cues, but by 12-months there was no difference in smiling between the affective conditions. Similarly unexpected, infants at both ages failed to engage in more social looking during ambiguous-absurd versus ordinary events, meaning they were no more likely to solicit information from their parents during these unusual events than during ordinary events, perhaps because they had disambiguated the events independently or because they found both events novel given the involvement of a stranger or because parents refrained from ostensive cues (e.g., pointing) during both events. However, not all 6-month-olds found the events amusing ($n=14$), and this group of infants employed more social looking ($M = .15$, $SD = .17$), appearing to solicit parental guidance, than their laughing counterparts ($M = .05$, $SD = .07$) who appeared to have resolved the ambiguity, $t(26) = 2.16$, $p < .05$. Finally, when parents smiled and laughed during the ambiguous-absurd events, both 6- and 12-month-olds used more and longer social looking, but contrary to the prediction, 6-month-olds smiled significantly less at the event, both in duration and frequency, and by 12-months exhibited no differences in smiling across conditions. (See Table 1).

Sequential analysis—Sequential analysis was conducted to explore sequences of parent- (i.e., affect or no affect) infant (i.e., smiling/laughing, gazing, and social referencing)

behavior, illuminating the dynamic social interaction instead of static measures of specific behaviors whose sequence is unknown. In essence, sequential analysis preserves the sequential nature of the data, which is assessed via follow-up chi-square inferential analyses and examination of adjusted residuals (Bakeman & Gottman, 1997; Bakeman & Quera, 2011). Infants' smiles were coded according to their target (i.e., at event, at parent as a social look, and/or while looking away) in each condition. The predicted social referencing sequence was specified for the hypothesis, and GSEQ (Bakeman & Quera, 1995) was used to compute the joint frequency of the specified sequence and the expected frequency for that sequence based on the number of occurrences of each behavior within the data set. Chi-square analysis was then used to compare expected to observed frequencies of behaviors (Bakeman & Quera, 2011; Nishida & Lillard, 2007). We expected infants would use social referencing to interpret ambiguity as positive when cued by parents, consistent with the following sequence: the experimenter presents the ambiguous-absurd event, the parent exhibits positive facial, gestural and vocal cues, the infant looks at the parent, the infant exhibits positive affect toward the event or gazes back at the event.

Sequential analyses revealed that infants at both 6- and 12-months were *less* likely to smile at the ambiguous-absurd event after looking at a smiling parent, with 6-month-olds more likely to smile at the parent and 12-month-olds less likely to do so. Figure 1 depicts the pattern of the adjusted residuals, which represent the degree to which the observed frequencies deviate from chance as z-scores (Bakeman & Quera, 2011, pp. 109-110). The residuals analysis indicates that infants at both ages were more likely to gaze at the absurd event after observing their parents' smiling, laughter and pointing toward it, suggesting parental affect influenced infants' gaze behavior toward the event. Calculation of odds ratios, however, indicated that these differences were not significant between the neutral and cued conditions for 6-month-olds (OR = .86, 95% CI [.44, 1.69], $p > .05$), and for 12-month-olds (OR = 1.25, 95% CI [.60, 2.60], $p > .05$), although the trend is apparent. Table 2 shows the individual results of the sequential analysis chi-squares for each of the event types by age.

When all looks toward the parent (i.e., “social looking” and “baby smiles at parent”) were collapsed into a single category, parental affect was shown to influence infant affect toward the event. Specifically, when 12-month-olds were compared across conditions, they were significantly more likely to immediately and subsequently smile at the event after looking at a smiling vs. a neutral parent, an effect not observed for 6-month-olds (see Figure 2). It is possible that, in the cued condition infants many have been smiling prior to looking at their smiling parent. However, the sequence was significant by condition suggesting that at the very least parental affect influenced 12-month-olds to maintain positive affect toward the event.

1.3 Discussion

Research has consistently shown that by the second half of the first year of life, infants rely on caregivers as emotional referents in ambiguous situations (Walden, 1993), a phenomenon known as social referencing (SR). Since studies of SR typically require ambulation as part of the dependent measure, younger, non-ambulatory infants (i.e., 8 mos) have been largely overlooked with the resulting assumption that they do not engage in SR. Our study deviated

from classic studies of SR in four important ways: first, we included six-month-old infants and followed them longitudinally to track the emergence of SR and its main component, social looking. Second, we used a protocol that does not require mobility. Third, we employed ambiguous-absurd instead of ambiguous-threatening events. Finally, our protocol deviated from classic SR studies in that we did not wait for infants to solicit affective information, but instead had parents provide unsolicited cues that included facial, vocal and gestural signals (Vaillant-Molina & Bahrick, 2011; Vaish & Striano, 2004) consistent with their natural behavior when engaging in absurd behavior with infants (Mireault et al., 2012).

When parents provided unsolicited affective cues, infants at both ages exhibited more frequent and longer social looks toward parents, suggesting parental affect was a salient feature of the event even though infants did not actively solicit it. This combination of paying close attention to ambiguous-absurd events and to others' affective expression toward those events might explain how infants come to see others as referents in ambiguous situations later on in development, so that by 8 months of age they actively solicit emotional information from others and regulate accordingly. This is consistent with Walden's (1993) assertion that although younger infants may not intentionally refer to their parents to interpret ambiguous situations, parents provide emotional messages anyway and infants tend to match their affect as a result.

In fact, sequential analyses of the data showed this very effect for 6-month-olds. That is, following a social look to a smiling parent, 6-month-olds were more likely to smile at the parent, although not at the event. The fact that infants in our study looked at parents more often and for longer when they provided positive affective cues essentially replicates Walden and Baxter's (1989) earlier finding. It appeared that parents' emotional cues became more salient than the event itself and influenced 6-month-olds toward affect sharing, which is part of the social experience of humor. It is important to note that parents provided cross-modal affective cues (i.e., facial, vocal, gestural) that they are likely to give under natural conditions, and that other researchers have been found to be necessary to observe referencing in young infants (Vaillant-Molina & Bahrick, 2011). Consequently, infants' social looks may not have been attempts to gather information, but artifacts of parental ostensive cues.

By 12-months, parental affect had a different effect on infants, who were less likely to smile at the event or the parent (See Figure 1) than when parents remained neutral. It is possible that parental affect distracted infants from the event, and/or that they relied upon the neutral experimenter for their affective interpretation. Stenberg (2009) found that infants tend to look more toward an experimenter than a familiar caregiver, as though infants understand that the former has more expertise with regard to the novel situation the experimenter is presenting. Similarly, eye-tracking studies have shown that 9-month-olds' looking behavior can be influenced by an experimenter's behavior (Senju et al., 2008). In this study, when both parent and experimenter were neutral, infants may have seen the lack of affect as part of the absurdity, or smiled and laughed to engage either or both parties. In either case, this finding should be replicated prior to additional interpretation.

Social referencing, as described by Campos (1983) specifically includes the parent's affect becoming contagious to the infant toward an ambiguous event. We did not observe this effect, although we did observe some evidence for the emergence of SR in this young sample under conditions of humor. Importantly, we found that 6-month-olds who did not laugh at the event engaged in significantly more social looking, suggesting that they may have been attempting to glean affective information about the event from their parents. In addition, sequential analysis revealed a non-significant trend for the finding that parental affect influenced infant gazing behavior at both ages, such that infants' directed more gazes at the event subsequent to observing a parent smile and laugh at it. Although it is possible that parental gestures toward the event (i.e., pointing) were responsible for this trend. This supports the possibility of an early and more subtle SR response among infants as young as 6-months, and is consistent with prior research showing that 5½-month-olds (Vaillant-Molina & Bahrick, 2012) and 6-month-olds (Walden & Baxter, 1989) were more likely to touch a toy toward which an adult had expressed positive emotion. However, when social looking was more broadly defined as any look toward the parent, 12-month-olds, but not 6-month-olds, aligned their affect toward the event with their parents' cues, an observation that is more consistent with classic SR. It is important to note that 12-month-olds only demonstrated this effect in the cued condition, meaning that even if they had been smiling when looking at the parent, they only smiled back at the event when the parent was also smiling at it. This effect may reflect affect sharing instead of information gathering by the infant, but the parent's affect clearly impacted the infant's likelihood to continue to interpret the absurd event as amusing.

We generally found that six- and 12-month-olds did not use SR in the classic sense in these situations, meaning they did not actively solicit affective information from their parents during the ambiguous-absurd events. There are several explanations for this. First, infants at both ages found the ambiguous-absurd events amusing even when their parents provided no emotional cues, suggesting they did not need to use SR as they had disambiguated the events independently. Second, Stenberg (2009) found that 12-month olds preferred to look to an experimenter rather than a parent for information about a novel event, which may explain their low likelihood of referring to parents. Third, the necessity of SR in absurd situations may be lower than when an infant is faced with threat, an explanation consistent with evolutionary theory and with the observation that fear cues hold more significant signal value (Walden, 1993).

The events employed in this study involved a social exchange wherein one person presented ordinary and ambiguous-absurd events to the infant's parent while the infant watched.

Six- and 12-month-olds clearly distinguished ordinary from ambiguous-absurd events, with the former group taking longer to look away from it and both groups finding absurd events more amusing than ordinary ones. The tendency for infants to stare longer at novel, unexpected events is widely used by researchers as an indicator of infants' understanding of the physical world (Colombo & Mitchell, 2009). Walden, Kim, McCoy, and Karrass (2007) suggest that looking time is also an appropriate dependent measure of infants' understanding of social events and is a ripe area for continued research. It is possible that infants have expectations of the social world that when violated produce the absurd experience that

underlies most humor perception (Louizou, 2005). Interesting in itself is the finding that infants at both ages demonstrated more mature humor perception than predicted, smiling at the absurd events regardless of parental affect and suggesting sophisticated radar for the absurd.

Although social referencing is a universal developmental phenomenon, the current study employed a fairly small and unrepresentative sample, included only two ambiguous-absurd and ordinary events, and used restrictive dependent measures of infant affect and behavior. Future research should employ behavioral (e.g., reaching toward or touching the objects used in the event or the person presenting them) and physiological (e.g., heart rate) measures in addition to affective ones, particularly as smiling and laughing can be expected to occur at low frequency in the unusual context of a brief research study.

These findings begin to illustrate the emergence of social referencing beginning at 6 months of age. Six-month-olds who have not independently disambiguated an event appear to engage in information-seeking references toward parents. In addition, regardless of whether they have disambiguated an event, 6-month-olds pay close attention to unsolicited positive affective cues from parents. This information appears to influence infants in two ways. First, parents' positive emotion becomes contagious to the infants prompting them to smile more at parents, although not at the event. Second, parents' positive affect influences 12-month-olds to smile or continue smiling at the event. Thus, the progression appears to be from information-seeking and affect-sharing between infant-and-parent at 6-months, to joint affect-sharing toward the event at 12-months.

Infants' emerging understanding of social ambiguities such as those involved in humor is a unique and potentially rich direction for studying social, emotional, and cognitive development. Understanding how humor develops may shed light on important developmental milestones including social referencing.

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Highlights

- At both 6- and 12-months, infants showed sophisticated humor perception, even when parents remained affectively neutral.
- 6-month-olds who did not independently disambiguate an absurd event as humorous were more likely to employ social looks at parents.
- 12-month-olds continued to interpret an absurd event as amusing only when their parents did as well.
- 6-month-olds attended to parental affect vs. events; this may explain how they eventually perceive them as referents.

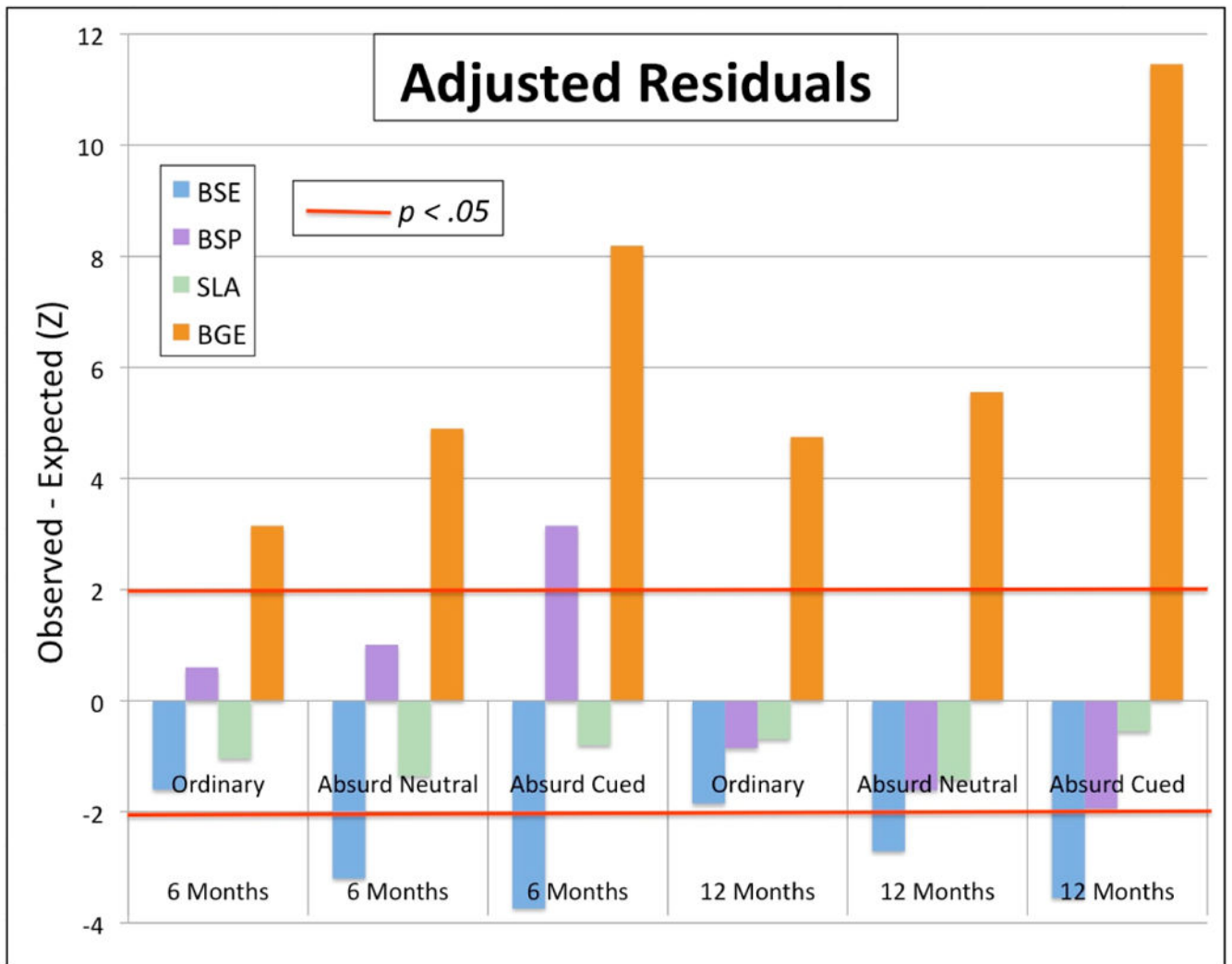


Figure 1. Adjusted residual analysis of smiling events following social looking. The red lines represent observed frequencies greater than or less than chance, respectively ($p < .05$). BSE = baby smiles at event; BSP = baby smiles at parent; SLA = baby smiles and looks away; BGE = baby gazes at event

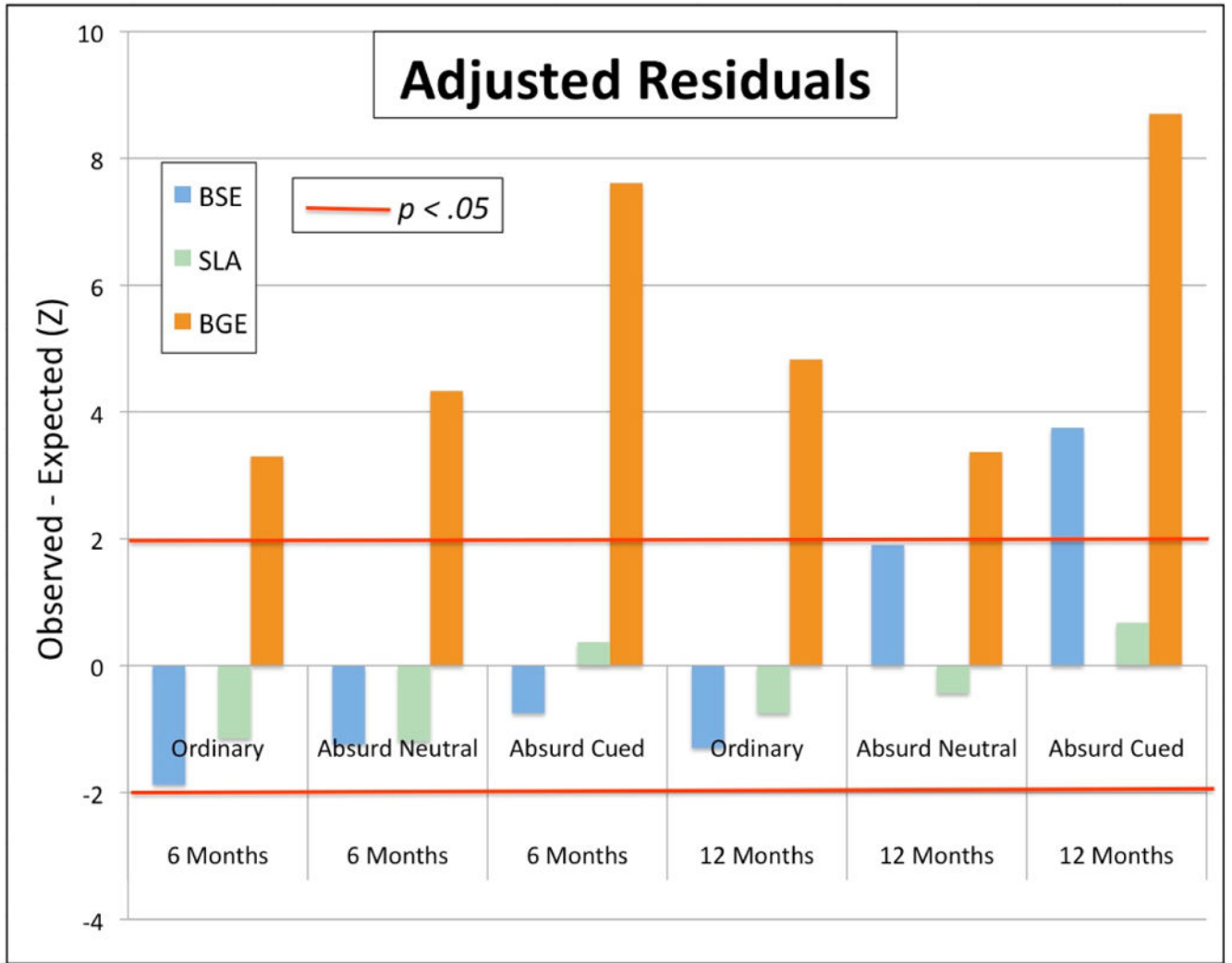


Figure 2. Adjusted residual analysis of smiling events following any reference to the parent (i.e., Social Looking and/or Baby Smiles at Parent). The red lines represent observed frequencies greater than or less than chance, respectively ($p < .05$). BSE = baby smiles at event; SLA = baby smiles and looks away; BGE = baby gazes at event

Table 1
Descriptive Statistics and t-Test Analyses for 6- and 12-month-old Comparisons

DV	Age Tested					
	6 months			12 months		
	M (SD)	t(28)	p	M (SD)	t(28)	p
Latency to look away						
<i>Ordinary</i>	19.88(10.17)			18.14(6.03)		
<i>Absurd-neutral</i>	28.64(11.93)	-3.06	.005*	22.74(10.47)	-2.29	.030
Smiles/Laugh: Frequency						
<i>Ordinary</i>	.12(.13)			.07(.11)		
<i>Absurd-neutral</i>	.15(.17)	-1.20	.240	.15(.15)	-3.04	.005*
Smiles/Laugh: Duration						
<i>Ordinary</i>	.05(.09)			.03(.04)		
<i>Absurd-neutral</i>	.14(.20)	-2.81	.009*	.18(.20)	-4.49	.001*
Smiles/Laugh: Frequency						
<i>Absurd-neutral</i>	.15(.17)			.15(.15)		
<i>Absurd-cued</i>	.09(.10)	3.18	.004*	.14(.14)	.35	.730
Smiles/Laugh: Duration						
<i>Absurd-neutral</i>	.14(.20)			.18(.20)		
<i>Absurd-cued</i>	.08(.13)	2.63	.014*	.14(.19)	.97	.341
Social Looking: Frequency						
<i>Ordinary</i>	.11(.13)			.13(.15)		
<i>Absurd-neutral</i>	.11(.14)	0.07	.942	.15(.13)	-.59	.560
Social Looking: Frequency						
<i>Absurd-neutral</i>	.11(.14)			.15(.13)		
<i>Absurd-cued</i>	.28(.13)	-5.60	.001*	.24(.14)	-3.75	.001*
Social Looking: Duration						
<i>Absurd-neutral</i>	.04(.06)			.06(.07)		
<i>Absurd-cued</i>	.21(.17)	-5.71	.001*	.14(.12)	-4.03	.001*

Note. The Holm-Bonferroni (Holm, 1979) method for multiple comparisons was used to maintain the Familywise error rate of .05 within each age group.

Significance values designated with * indicate statistically significant differences based on this procedure.

Table 2
Sequential Analysis of Smiling & Gazing Event Frequencies Following Social Looking

		6 months				12 months			
		<i>O</i>	<i>E</i>	χ^2	<i>p</i>	<i>O</i>	<i>E</i>	χ^2	<i>p</i>
Ordinary:									
BSE	1	3.68	11.46	0.02	0	2.46	22.72	<.01 [†]	
BSP	1	0.58			0	0.57			
SLA	0	0.92			0	0.38			
BGE	18	10.58			19	9.27			
Absurd-Neutral:									
BSE	2	10.51	29.01	<.01	2	8.70	32.96	<.01	
BSP	4	2.55			1	3.79			
SLA	1	3.15			0	1.68			
BGE	33	17.72			33	16.14			
Absurd-Cued:									
BSE	3	14.31	92.50	<.01	5	16.46	132.36	<.01	
BSP	18	9.93			8	13.81			
SLA	3	4.38			1	1.59			
BGE	90	50.53			88	37.97			

Note. BSE = baby smiles at event; BSP = baby smiles and looks away; BGE = baby smiles and looks away; SLA = baby smiles at parent; *O* = observed values; *E* = expected values; χ^2 (df = 4; n = 58)

[†]The marginal frequencies for the BSP and SLA events were small in this condition, so the statistical significance of this analysis is not being emphasized (R. Bakeman, personal communication, August 31, 2012).