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BRIEF REPORTS

The Development of Anticipatory Smiling

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When do infants begin to communicate positive affect about physical objects to their social partners? We examined developmental changes in the timing of smiles during episodes of initiating joint attention that involved an infant gazing between an object and a social partner. Twenty-six typically developing infants were observed at 8, 10, and 12 months during the Early Social-Communication Scales, a semistructured assessment for eliciting initiating joint attention and related behaviors. The proportion of infant smiling during initiating joint attention episodes did not change with age, but there was a change in the timing of the smiles. The likelihood of infants smiling at an object and then gazing at the experimenter while smiling (anticipatory smiling) increased between 8 and 10 months and remained stable between 10 and 12 months. The increase in the number of infants who smiled at an object and then made eye contact suggests a developing ability to communicate positive affect about an object.

The onset of initiating joint attention, which we define as an infant coordinating visual attention between an object and a social partner, is a crucial milestone in the development of intentional communication. Clarification of the role positive affect plays in the onset and early development of initiating joint attention is important to understanding the origins of voluntary communication (Adamson & Bakeman,

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1985; Jones & Hong, 2001; Messinger & Fogel, 1998). We designed a longitudinal study to examine the changing role of infant positive affect when initiating joint attention at 8, 10, and 12 months of age. The focus of the study is the development of anticipatory smiles in which infants smile at an object and then gaze at a social partner while smiling (see Figure 1).

In the period between 8 and 12 months of age, infants become more intentionally communicative. Their use of discrete nonverbal communication behaviors during social interactions becomes increasingly apparent (Mundy & Willoughby, 1996). Infants also tend to display positive affect more frequently during bouts of initiating joint attention than during other types of nonverbal interactions (Adamson & Bakeman, 1985; Kasari, Sigman, Mundy, & Yirmiya, 1990; Messinger & Fogel, 1998; Mundy, Kasari, & Sigman, 1992). Adamson and Bakeman suggested that affective displays support infants' early attempts to communicate with others about objects. They documented a developmental increase in a broad measure of affective expressions during periods of initiating joint attention, although different modalities of affective expression showed different developmental effects. Messinger and Fogel found that gazes at mother and smiles tended to co-occur when infants offered objects to mother, an instance of initiating joint attention. However, there was no developmental change in the likelihood of offers involving gazes at mother and smiles. In sum, although prototypic displays of positive affect such as smiles often occur during initiating joint attention, it is not clear how this association changes developmentally.

One possibility is that there are developmental changes in infants' specific sequencing of smiles and gazes. Jones, Collins, and Hong (1991) documented anticipatory smiles in which 10-month-olds gaze at an object, smile, and then turn an already smiling face to look at the mother. In a subsequent study, infants who showed greater means–ends understanding were more likely to engage in anticipatory smiling (Jones & Hong, 2001). This research, however, did not examine how anticipatory smiling developed. We are not aware of research that reports how the timing of smiles within episodes of initiating joint attention changes longitudinally.

FIGURE 1 Example of an anticipatory smile. A 12-month-old infant gazes at an object (left), smiles at the object (middle), and gazes at the experimenter while continuing to smile (right).

METHOD

Participants in this study included 26 mothers and their typically developing infants (13 boys and 13 girls) who were part of a broader longitudinal study of infant social development. All mothers were volunteers identified using Florida State Health Department birth records and recruited by mail. Recruited infants were all healthy full-term infants with routine pre- and postnatal medical histories. Fifteen of the 26 mothers identified themselves as Hispanic, 9 as non-Hispanic White, 1 as African American, and 1 as other. Seventeen mothers spoke primarily English, 6 mothers spoke primarily Spanish, and the remaining 3 mothers spoke English and Spanish in roughly equal proportion.

All infants were assessed at 8, 10, and 12 months of age, with the exception of 1 infant who was absent from the 10-month session, and 1 infant who was absent from the 12-month session. At each of the three visits, participants were administered the abridged version of the Early Social-Communication Scales (ESCS; Mundy et al., 2003; Seibert, Hogan, & Mundy, 1982), a measure of nonverbal communication behaviors. The ESCS is a semistructured child–experimenter assessment that elicits initiating joint attention and related behaviors. During the assessment, an adult experimenter and the infant sat facing one another at a small table, with the infant seated on a caregiver's lap. The experimenter systematically presented the infant with an array of novel toys (five active wind-up toys and three hand-operated toys) to generate nonverbal communication behaviors (Mundy et al., 1992). In each presentation, the tester activated the toy on the table in front of, but out of reach of, the child. The toy was wound up enough to remain active for approximately 6 to 10 sec. After the toy ceased moving, the tester placed the toy within reach of the child. The child was then allowed to play with the toy for approximately 10 sec. Each toy was presented for a minimum of three trials and a maximum of five trials, in accordance with the administration standards outlined in the abridged ESCS manual (Mundy et al., 2003). Although an attempt was made to follow a specific task administration order, variation in presentation was acceptable provided that the experimenter presented all specified toys during the course of an administration.

The full-length ESCS was administered at 8 months ($M = 14.14$ min, $SD = 2.41$) and 12 months ($M = 17.39$ min, $SD = 3.10$). An abbreviated version of the ESCS was administered at the 10-month session ($M = 10.76$ min, $SD = 0.80$). The mean number of toy presentations was 24.00 ($SD = 1.62$), 15.83 ($SD = 2.35$), and 24.17 ($SD = 3.33$) at 8, 10, and 12 months, respectively. There was a tendency for the proportion of initiating joint attention with smiles to be associated with the number of toys presented at 10 months ($r = .38$, $p = .071$). All other measures showed no correlation with session length or the number of toys presented (rs $< .33$, ps $> .125$). In trial analyses using only the first 9.5 min of all ESCS sessions at all ages to compute behavioral variables, we replicated the developmental patterns reported in the remainder of the article in which the entire session was used to calculate behavioral variables.

ESCS sessions were videotaped using two cameras, one positioned to give a full-frontal view of the infant, and one placed to give a three-quarter profile of the infant. The two pictures were mixed on a split screen and recorded on a JVC Super VHS videocassette recorder with superimposed time code. There were two phases of coding. Tapes were first coded for episodes of initiating joint attention occurring during the ESCS assessment (Mundy et al., 2003). Initiating joint attention was coded when an infant initiated eye contact with the experimenter while manipulating a static toy or alternated eye contact between a distal, active mechanical toy and the experimenter. If an infant was gazing at an active wind-up toy which then became inactive, initiating joint attention episodes were only coded if the infant gazed at the experimenter within 2 sec of the toy becoming inactive (Mundy et al., 2003). This was done to ensure that the infant's behavior was related to the object's activity and not a request to reactivate the toy. Episodes in which the experimenter's talking or movement preceded the infant's eye contact and thus may have elicited the infant's attention were not coded. An episode of initiating joint attention began when the infant gazed at an object that was not being touched by the experimenter. The episode ended when the infant broke eye contact with the experimenter. The end of an episode was also coded if the experimenter talked to or moved toward the infant.

We next determined whether or not initiating joint attention episodes included smiles and, if they did, the sequence of infant gazes and smiles during these episodes. Initiating joint attention episodes either involved no smile (gaze at object, then gaze at experimenter), a reactive smile (gaze at object, gaze at experimenter, then smile), an indeterminate smile (gaze at object, then a simultaneous or ambiguously timed smile and gaze at the experimenter), or an anticipatory smile (gaze at object, smile, then gaze at experimenter; see Figure 1). Anticipatory smiles were coded only when the order of the smile and gaze was clear. In all initiating joint attention episodes involving smiles, the smile and gaze at the experimenter had to overlap in time. Smiles were identified by the presence of lip-corner raising due to zygomatic major contraction (Action Unit 12 at a minimum b/x intensity level in Ekman & Friesen's, 1978, Facial Action Coding System [FACS]).

The 76 sessions from 26 infants were coded by one primary observer who had previously trained to reliability in coding the ESCS (intraclass correlation over 10 tapes equaled .85 for initiating joint attention). Tapes were coded in a randomized order using a Hi-Fi Super VHS editing VCR (JVC BR–S800U). This equipment allowed observers to play the tapes in real time as well as in various slow-motion speeds to facilitate accurate coding. Interobserver agreement for instances of initiating joint attention interactions was assessed for a random subsample of 17% (13 sessions) of the tapes coded by a second observer trained in scoring the ESCS. The proportion of initiating joint attention episodes for which the two coders agreed equaled 86%. Cohen's kappa was calculated to assess the reliability of agreement on the number of seconds in which initiating joint attention did or did not occur (Cohen, 1960). The mean kappa across sessions was .87 (98% average agreement). Interobserver agreement for the sequencing of smiles and eye contact was assessed for 17% of the sessions scored by a second coder who was FACS certified. The mean kappa across sessions was .89 (94% average agreement).

RESULTS

We first examined whether the rate of initiating joint attention and the prevalence of smiles within episodes of initiating joint attention changed between 8, 10, and 12 months of age. We next examined the specific patterns into which infants sequenced smiles and eye contact during episodes of initiating joint attention to determine whether infants' use of anticipatory smiles during these episodes changed with age. All analyses were run using version 11.0 of SPSS (SPSS, Inc., 2001).

Descriptive statistics for the rate of initiating joint attention and the proportion of initiating joint attention episodes involving smiles can be found in Table 1. Repeated measures analyses of variance with contrasts between adjacent ages were used to test the developmental trajectories of these behaviors. Twenty-four infants were present for all three sessions. There was no developmental change in the rate of initiating joint attention, $F(2, 46) = 1.58$, $p = .217$, or in the contrasts between 8 and 10 months, $F(1, 23) = 1.04$, $p = .318$, or between 10 and 12 months $F(1, 23) =$

TABLE 1
Descriptive Statistics

	Age								
	8 Months			*10 Months*			*12 Months*		
Measure	*M*	*SD*	*n*	*M*	*SD*	*n*	*M*	*SD*	*n*
Rate of IJA episodes[a]	6.70	4.57	24	8.11	5.80	24	6.11	3.19	24
Proportion of IJA episodes with smiles[b]	0.27	0.24	22	0.35	0.32	22	0.32	0.23	22
IJA Smile Patterns	*No.*	*%*	*n*	*No.*	*%*	*n*	*No.*	*%*	*n*
Anticipatory smiles	7	32	22	15	68	22	16	73	22
Reactive smiles	16	73	22	10	46	22	13	59	22
Indeterminate smiles	7	32	22	4	18	22	6	27	22

Note. IJA = initiating joint attention.
[a]Rate is per 10 min. [b]Twenty-two of the 24 infants present at all three sessions showed IJA at all three ages.

3.92, $p = .060$ (see Table 1). Twenty-two of the 24 infants initiated joint attention at all three ages. These infants showed no significant developmental change in the overall proportion of initiating joint attention interactions involving smiles, $F(2, 42) = 0.65$, $p = .529$, or in the contrasts between 8 and 10 months, $F(1, 21) = 1.44$, $p = .243$, or between 10 and 12 months, $F(1, 21) = 0.18$, $p = .675$ (see Table 1).

To assess developmental changes in the timing of smiles, we first analyzed whether the number of infants showing a particular timing pattern changed with age. Table 1 shows the number of infants who displayed anticipatory smiles, reactive smiles, and indeterminate smiles. McNemar tests using an exact binomial distribution were conducted separately with the 22 infants who had complete data at all three ages.

There were changes in the timing of smiles that occurred during initiating joint attention episodes. Nine infants who did not show anticipatory smiling at 8 months showed anticipatory smiling at 10 months; only 1 infant showed the opposite pattern, $p = .021$. At 10 months, in fact, more than twice as many infants showed anticipatory smiling (15 infants) than at 8 months (7 infants). There was no significant difference between the number of infants who engaged in anticipatory smiling between 10 and 12 months (16 infants), $p = 1.000$.

The rise in the number of infants using anticipatory smiles did not extend to reactive smiling. There was no change in the number of infants showing reactive smiles between 8 (16 infants) and 10 months (10 infants), $p = .180$, or between 10 and 12 months (13 infants), $p = .508$. There was also no change in the number of infants showing indeterminate smiles between 8 (7 infants) and 10 months (4 infants), $p = .453$, or between 10 and 12 months (6 infants), $p = .727$.

We next examined the rate of anticipatory smiling, reactive smiling, and indeterminate smiling among the subset of the sample that showed the smiling pattern in question (see Table 2). Paired-sample *t* tests were conducted in which infants who did not display the particular smile at adjacent ages were excluded from the analyses. Although there was an increase in the number of infants who displayed

TABLE 2
Rates of Different Patterns of Smiling Among Infants Who Showed at Least One Instance of the Smile Pattern in Question at Each Age

	Age								
	8 Months			*10 Months*			*12 Months*		
Measure	*M*	*SD*	*n*	*M*	*SD*	*n*	*M*	*SD*	*n*
Anticipatory smiles	1.58	1.76	7	2.59	2.71	16	1.43	1.15	16
Reactive smiles	1.35	0.74	16	2.66	1.79	10	1.30	0.58	13
Indeterminate smiles	0.73	0.14	7	1.12	0.35	4	0.51	0.03	6

Note. Rates are per 10 min.

anticipatory smiling between 8 and 10 months, there was no significant increase in the frequency of anticipatory smiling among the small number of infants who showed anticipatory smiling at both ages, $t(6) = 0.64$, $p = .548$ (see Table 2). There was also no change in the rate of anticipatory smiling between 10 and 12 months, $t(12) = 1.68$, $p = .118$. Among infants that showed reactive smiles, and, separately, indeterminate smiles, there was also no significant change in the rate at which infants displayed these smiling patterns, ps > .300.

DISCUSSION

This longitudinal study examined the development of smiling in episodes of initiating joint attention with an unfamiliar adult. Between 8 and 12 months, anticipatory smiling became a more likely feature of initiating joint attention episodes. There was a developmental increase in the number of infants using anticipatory smiles during episodes of initiating joint attention. Later, we examine the possibility that this increase reflects a developing ability to communicate positive affect about an object.

The rise in anticipatory smiling occurred in the absence of developmental increases in initiating joint attention episodes. Corroborating the results reported here, Bakeman and Adamson (1984) did not find a substantial increase in coordinated joint attention before 12 months of age. The study reported here also did not reveal a general developmental increase in the overall likelihood of initiating joint attention episodes involving smiling. This parallels previous findings. Messinger and Fogel (1998) found no change in the proportion of initiating joint attention episodes surrounding infant offers of an object that involved smiling. Within episodes of coordinated joint attention, Adamson and Bakeman (1985) found a rise in the proportion of emotional vocalizations but a decrease in the proportion of an aggregate measure of motoric and facial affective expressions. The evidence reported here indicates that it is the timing of the smile during the initiating joint attention interaction that changes developmentally.

Possible explanations for the growing prevalence of anticipatory smiles include a reduction in potential stranger anxiety and infants' increasing familiarity with the ESCS assessment (in which they experienced friendly and receptive testers). However, these interpretations would suggest a general rise in smiling between 8 and 12 months. This did not occur. It is also possible that infants may have developed specific expectations of attaining a reciprocated smile from the experimenter, which would suggest a rise in reactive smiling between 8 and 12 months (see Jones & Hong, 2001). This was not the case. Certainly the positive emotional climate created by the responsive examiner in the ESCS facilitates anticipatory smiling, but it does not seem to explain its developmental trajectory.

The developmental evidence suggests that anticipatory smiles index a unique communicative achievement. Before 6 months of age, infants are substantially less likely to smile and then gaze at their interactive partner than one would expect by chance (Yale, Messinger, Cobo-Lewis, & Delgado, 2003). Smiling in this period typically occurs after a gaze at the social partner. This appears to still be the case at 8 months when infants tend to engage in reactive but not anticipatory smiling. In reactive smiles, the infant gazes at an object, then gazes at the experimenter, and then smiles. Reactive smiles may suggest a communication about the toy just gazed at ("Wasn't that funny!"). A simpler explanation, however, is that reactive smiles are triggered by gazing at the social partner. More generally, reactive smiles do not provide evidence of preexisting positive affect.

In episodes of initiating joint attention without smiling, only the infant's gaze from the object to the social partner indexes his or her intentional stance. During anticipatory smiling, however, infants gaze at the object, smile, and then, while continuing to smile, gaze at the experimenter. In anticipatory smiling, it is possible that the infant's maintenance of the smile while gazing from the object to the social partner indexes the infant's awareness of these two features of the environment and the relation between them. For this reason, anticipatory smiles may be a more reliable measure of social understanding and self–other awareness than reactive smiles or initiating joint attention episodes alone.

In this study, the mean of the proportions of infants who exhibited anticipatory smiles at 8, 10, and 12 months was 58%. This is similar to the Jones and Hong's (2001) cross-sectional finding in which 53% of a combined sample of 8-, 10-, and 12-month-olds engaged in anticipatory smiling. Jones and Hong found that those infants who used anticipatory smiling between 8 and 12 months were also likely to engage in object-oriented and socially oriented means–ends behaviors. These researchers noted, however, that one cannot be certain of the degree to which infants are reflectively aware of their own positive emotion and the degree to which they are intentionally attempting to communicate positive affect to another.

Anticipatory smiles are a clear social approach behavior in which preexisting positive affect is communicated—whether intentionally or not—with another (Mundy, 1995). During anticipatory smiles, infants appear to communicate something specific—positive emotion about an object—to another. Anticipatory smiling may also involve an element of social referencing in which infants gaze toward another to confirm that their emotional response is appropriate or shared (Source, Emde, Campos, & Klinnert, 1985). Whether used to indicate ("This toy is funny!") or to confirm ("Isn't this toy funny?"), anticipatory smiles suggest a new social awareness. Anticipatory smiling may index an intersubjective sense of the social partner as someone with whom experiences can be shared. Even if this is not the case, anticipatory smiling provides an interactive structure in which infants can learn that experiences can be shared with others (Mundy et al., 1992).

One limitation of the data is the low mean rates of target behaviors. For example, in approximately half of the sessions, infants did not show anticipatory smiling. This also illustrates a key developmental finding in that the proportion of infants who began to show anticipatory smiles increased between 8 and 10 months. Interestingly, there was no evidence that infants who had begun to engage in anticipatory smiling did so more frequently with age. A larger sample observed monthly between 6 and 15 months would shed additional light on the developmental trajectory and communicative significance of anticipatory smiling.

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