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Anticipatory smiling: Linking early affective communication and social outcome

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ABSTRACT

In anticipatory smiles, infants appear to communicate pre-existing positive affect by smiling at an object and then turning the smile toward an adult. We report two studies in which the precursors, development, and consequences of anticipatory smiling were investigated. Study 1 revealed a positive correlation between infant smiling at 6 months and the level of anticipatory smiling at 8 and 10 months during joint attention episodes, as well as a positive correlation between anticipatory smiling and parent-rated social expressivity scores at 30 months. Study 2 confirmed a developmental increase in the number of infants using anticipatory smiles between 9 and 12 months that had been initially documented in the Study 1 sample [Venezia, M., Messinger, D. S., Thorp, D., & Mundy, P. (2004). The development of anticipatory smiling. *Infancy, 6*(3), 397–406]. Additionally, anticipatory smiling at 9 months positively predicted parent-rated social competence scores at 30 months. Findings are discussed with regard to the importance of anticipatory smiling in early socioemotional development.

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How do children come to understand the social world and develop into competent participants in social interactions? The ability to coordinate social attention, commonly referred to as joint attention, is an essential component of successful interactions and complex social competencies at any age (Mundy & Sigman, 2006; Van Hecke et al., 2007). Joint attention behaviors emerge in early infancy (D'Entremont, Hains, & Muir, 1997; Morales, Mundy, & Rojas, 1998; Scaife & Bruner, 1975), and continue to develop through the second year of life (Bates, 1976; Carpenter, Nagall, & Tomasello, 1998). One form of joint attention involves infants' spontaneous *initiation* of social attention coordination. Initiating joint attention (IJA) refers to the ability to use direction of gaze and conventional gestures (e.g., pointing and showing) to spontaneously share experiences with a social partner (Bates, 1976; Seibert, Hogan, & Mundy, 1982). There is also extensive evidence to show that infants frequently display positive affect during bouts of joint attention (Adamson & Bakeman, 1985; Kasari, Sigman, Mundy, & Yirmiya, 1990; Messinger & Fogel, 1998; Mundy, Kasari, & Sigman, 1992). Although the spontaneous display of positive affect during episodes of IJA has long been considered an important feature of infant social interaction (Adamson & Bakeman, 1985; Adamson & Russell, 1999; Hobson, 1993; Mundy, 1995; Tomasello, Carpenter, Call, Behne, & Moll, 2005; Trevarthen

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Fig. 1. Example of an anticipatory smile. A 15-month-old infant looks at an active object (left), smiles at the object (middle), and makes eye contact with the experimenter while continuing to smile (right).

& Aitken, 2001; Venezia, Messinger, Thorp, & Mundy, 2004), this constellation of behaviors has yet to be examined in any study of social outcome.

Different types of joint attention behaviors may exhibit different patterns of association with outcomes such as preschool social competence (Mundy et al., 2007; Mundy, Card, & Fox, 2000; Mundy & Gomes, 1998; Mundy & Sigman, 2006). In this paper, we investigated two specific types of IJA – anticipatory smiles and reactive smiles – characterized by distinctive patterns of communicating positive affect (Jones, Collins, & Hong, 1991; Jones & Hong, 2001, 2005; Venezia et al., 2004). Anticipatory smiles occur when an infant gazes at an object, smiles, and then turns an already smiling face to look at a social partner. The smile, then, anticipates the social contact in time (see Fig. 1). In reactive smiles, the infant gazes at an object, then gazes at the social partner, and then smiles. Here, the smile may be a reaction to gazing at the social partner.

Anticipatory smiles were first observed by Jones et al. (1991) during unstructured mother–child toy play sessions. They found anticipatory smiles to be relatively rare among 8-month-olds but common among 10-month-olds. Venezia et al. (2004) examined anticipatory smiles and reactive smiles in the context of joint attention episodes occurring during a semi-structured play-based assessment. They found that while the number of infants engaging in anticipatory smiles increased from 8 to 12 months, there was no corresponding increase in reactive smiles or overall IJA episodes. Similarly, Kuroki (2007) demonstrated that 12-month-old infants were more apt than 6- or 9-month-old infants to engage in a similar sequence of behaviors: shifting their attention from a toy of interest to their caregiver while in a positive emotional state.

Anticipatory smiles appear to reflect a tendency to communicate emotionally positive information about the world with a social partner (Venezia et al., 2004). This early motivation to engage one's partner in emotionally positive interactions may support the development of prosocial behaviors related to sharing one's feelings and understanding the reaction of others. In contrast, reactive smiles suggest communication about the toy just gazed at but do not provide evidence of pre-existing positive affect. Although infants' use of anticipatory and reactive smiling has been documented in 8- to 12-month-old infants, to date, only one longitudinal study investigating the developmental trajectory of anticipatory smiling exists. Further, little is known about the precursors of anticipatory smiling in early infancy, and the role of anticipatory smiling in later development.

Early social interaction often takes place within the context of dyadic situations or face-to-face exchanges with social partners. By 6 months of age, infants engage in finely tuned interactions with their caregivers that are characterized by turn-taking and mutually shared positive affect (Fogel, 1993; Stern, 1985). By 9 months of age, infants begin to display clear social initiatives in face-to-face interaction; that is, infants do not merely smile in response to the emotional displays of the caregiver, but produce a smile in an attempt to actively engage the caregiver (Cohn & Tronick, 1987). Given that joint attention behaviors also begin to develop around 9 months of age and that many IJA episodes are comprised of gaze and affect, it is likely that these dyadic behaviors may be precursors to later triadic communication (Adamson & Bakeman, 1985; Bakeman & Adamson, 1984). Likewise, anticipatory smiles may have their roots in earlier caregiver–child interactions. In the still-face paradigm (Adamson & Frick, 2003; Tronick, Als, Adamson, Wise, & Brazelton, 1978), the mother becomes unresponsive after a period of normal social play. Infants' affective response to this sudden change in social contingency may mark individual differences in children's social initiative. That is, the tendency to express social smiles during the still-face may signify an attempt on the part of the infant to re-engage an unresponsive caregiver. Indeed, infants who exhibit high levels of smiling and other social engagement behaviors during the still-face procedure are also those who demonstrate high levels of joint attention behaviors (Striano & Rochat, 1999). Previous work also indicates that infants who smile during the still-face, relative to other infants who do not smile, are more likely to be securely attached at 12 months of age (Cohn, Campbell, & Ross, 1991) and are perceived by their parents as showing lower levels of externalizing behaviors at 18 months of age (Moore, Cohn, & Campbell, 2001). Therefore, if the tendency to express social smiles during the still-face signifies a propensity to initiate positive interactions, it is possible that smiling during the still-face is a dyadic precursor to later forms of infant-initiated positive triadic communication.

Further, joint attention skills may be one of the first behavioral markers of social understanding in infants, and as such serve as the foundations for the development of later social skills (e.g., Bates, Benigni, Bretherton, Camaioni, & Volterra, 1979; Moore & Corkum, 1994; Mundy & Sigman, 2006). Several studies have demonstrated a unique association between IJA and childhood social competence. For example, investigations of "at-risk" children (Sheinkopf, Mundy, Claussen, & Willoughby, 2004) and children with developmental delays (Lord, Floody, Anderson, & Pickles, 2003; Sigman & Ruskin, 1999; Travis, Sigman, &

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Ruskin, 2001) have indicated that IJA is positively related to later measures of prosocial behavior, as well as significantly associated with reduced risk for disruptive behaviors in preschool children. Studies investigating the link between joint attention in infancy and the subsequent development of social competence in typically developing children, however, have been less common.

Van Hecke et al. (2007) investigated the association between individual differences in infant joint attention skills and later social-behavioral outcome in typically developing children. The authors addressed methodological issues in the measurement of initiating joint attention. Initiating joint attention can be measured simply in terms of alternating eye contact between an object of interest and a social partner, or through the use of deictic gestures such as pointing or showing (Mundy et al., 2007). Van Hecke et al. (2007) found that IJA involving gestures at 12 months of age was positively related to caregiver ratings of social competence at 30 months of age. To extend these findings the current study focuses on additional measures of IJA, that is, IJA accompanied by different patterns of smiling, rather than IJA accompanied by gestures.

The overall aim of this investigation was to explore the predictors of anticipatory and reactive smiles and to examine the relationship between these socially expressive behaviors and later social emotional outcome. The goal of Study 1 was to identify precursors and sequelae of anticipatory smiles in a sample in which the development of anticipatory smiling had previously been documented (see Venezia et al., 2004). Based on the evidence reviewed above, we predict that smiling to engage an unresponsive caregiver in early infancy will be related to the subsequent likelihood of engaging an unfamiliar social partner in an affectively positive way as indexed by anticipatory smiling. Both are a measure of children's initiation of positive communication during a social interaction with an adult. By contrast, reactive smiling is a skill that is already present during face-to-face interactions and is likely to be contingent on the social partner's smile; hence, no associations are expected between reactive smiling and infant-initiated smiling during the still-face when the parent is not smiling. Furthermore, we predict that individual differences in the production of anticipatory smiles will be associated with parents' reports of pre-school social competence with adults and peers. We believe that anticipatory smiles, but not reactive smiles, reflect an early motivation to engage others in emotionally positive interactions which may in turn support the development of a range of behaviors related to social skills with adults and children, social knowledge, and behaviors related to positive emotions and self-control.

Study 2 replicates and extends Study 1 by investigating the development and sequelae of anticipatory and reactive smiling in a larger sample of infants using a more recent measure of preschool social emotional functioning. As most studies investigating anticipatory smiling have been cross-sectional, it was important to conduct a second longitudinal assessment of these associations. Further, Study 2 allowed the assessment of the relationship between anticipatory and reactive smiling and later social emotional outcome with a newer, more comprehensive outcome measure. This was central to establish the predictive validity of anticipatory smiles, an essential goal for predicting social competence.

1. Study 1

1.1. Methods

1.1.1. Participants

Sample 1 was comprised of 26 caregivers and their typically developing infants (13 males) recruited as part of a longitudinal investigation of early infant communication. All caregivers 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. Approximately 38% of caregivers identified themselves as Hispanic, 58% as non-Hispanic European American, and 4% as African American. Seventeen caregivers spoke primarily English, six caregivers spoke primarily Spanish, and the remaining three caregivers spoke English and Spanish in roughly equal proportion. Approximately 4% of mothers had attended high school only, 73% had attended at least 2 years of college, and 23% had attended some graduate school. Twenty-two infants had complete data for both early (6, 8, 10, and 12 months) and later (30 month) time points and were used in subsequent analyses. One infant was absent from the 10-month session; one infant was absent from the 12- and 30-month sessions, and two infants were absent from the 30-month session. Of the three families who did not return for the 30-month session, one did not return because the family relocated and two were unable to schedule due to time conflicts. Infants who did and did not return for all observations did not differ significantly on any of the variables measured (still-face smiling, rate of IJA, proportions of anticipatory or reactive smiles, scores on the ASBI), $ps > 0.1$.

1.1.2. Procedure

Infants and caregivers were observed in the laboratory when infants were 6, 8, 10, 12, and 30 months of age. The views from two cameras, one offering a full-frontal view of the infant's face and one offering a three-quarter frontal view of the adult's face, were combined in a split screen format and recorded on a Super VHS videorecorder.

The Face-to-Face/Still-Face Procedure (*FFSF*, Adamson & Frick, 2003; Tronick et al., 1978). The FFSF was administered at 6 months. The caregiver sat in a chair facing the infant while the infant was placed in a high chair. The experimenter provided instructions to the parent before beginning the protocol. During administration of the protocol, an experimenter sat in a chair, behind the caregiver and out of the infant's view. Each session began with a 3-min face-to-face play segment in which the experimenter instructed the caregiver to, "play with your infant as you normally would do at home." The second episode was a 1-min still-face episode in which the caregiver was instructed to sit back, look at a picture which was above and behind

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the infant, and maintain an expressionless face without responding to him/her (Delgado, Messinger, & Yale, 2002). For this study, data were analyzed from the still-face episode only in order to minimize the impact of maternal behavior.

Infant smiles were coded using Ekman and Friesen's (1978) anatomically based Facial Action Coding System (FACS) as adapted to infants in Oster's (2000) BabyFACS. 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). The still-face smiling variable equaled the proportion of time spent in the still-face that involved smiling. Proportion of time spent smiling was used in place of the overall frequency or rate of smiling because it is a more stable measure; however, a Pearson's correlation revealed a highly significant association between these two measures, $r = .94$, $p < 0.001$. Gaze direction was not coded because previous work has shown that infants at this age tend to initiate smiles only while gazing at their caregivers (Yale, Messinger, Cobo-Lewis, & Delgado, 2003). Inter-observer reliability for coding of facial actions was assessed for 20% of the sessions. The average Cohen's kappa (Cohen, 1960) for smiling was .70, with an average agreement of 90%.

Early Social Communication Scales (*ESCS*, Mundy et al., 2003). At 8, 10, and 12 months of age, infants were administered the ESCS, a 20-min semi-structured interaction that codes children's tendency to initiate coordinated joint attention with a tester. Multiple trained examiners administered the ESCS. For this assessment, tester and child were seated facing each other at a small table, with the infant seated on a caregiver's lap. A set of toys, which was visible but out of reach to the child, was placed to the right of the tester. The tester systematically presented the infant with an array of novel toys (five active wind-up toys and three hand-operated toys) in accordance with the administration standards outlined in the abridged ESCS manual (Mundy et al., 2003). 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 6–10 s. 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 s. Each toy was presented for a minimum of three trials and a maximum of five trials. Throughout the testing session, only one toy was present on the table at a time. While 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. As outlined by the ESCS manual, testers were instructed to administer each toy presentation with natural but minimized verbal interaction with the child. The tester was encouraged to speak to the child only during transitions in the testing procedure (e.g., while activating a toy or selecting a new toy), but otherwise remain silent but attentive during actual task presentation. However, if a child initiated a bid for joint attention, the tester was instructed to provide a natural but brief response (e.g., by smiling and nodding, or by saying "mmm hmmm," or "Yes, I see!").

The ESCS was coded continuously to identify episodes of IJA, defined as the frequency with which the infant: (1) made eye contact while manipulating a toy, (2) alternated eye contact between an active mechanical toy and the tester, (3) pointed to an active mechanical toy or distal objects in the room, or showed objects (raising objects to the tester's face). Episodes in which the experimenter's talking or movement preceded the infant's eye contact and thus elicited the infant's attention were not coded. An episode of IJA 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. The intra-class correlation coefficient of two independent coders of IJA for approximately 20% (15 sessions) of the ESCS data sets was .93 (cf., Mundy & Gomes, 1998; Mundy, Kasari, Sigman, & Ruskin, 1995; Mundy, Sigman, & Kasari, 1994).

After identifying IJA episodes, we determined whether or not the episodes involved smiles in which the smile and gaze at the experimenter overlapped in time. Those that did were classified into one of two smiling patterns: reactive smile (gaze at object, gaze at experimenter, then smile), or anticipatory smile (gaze at object, smile, then gaze at experimenter). Anticipatory smiles were only coded when the order of the smile and gaze was clear. As we were interested in cases in which a smile was formed in anticipation of gazing at the experimenter, in the rare cases in which a single smile extended across two discrete IJA episodes (approximately 1% of all IJA episodes), only the first episode qualified as an instance of anticipatory smiling. Smiles were identified according to the FACS criteria described above (Ekman & Friesen, 1978; Oster, 2000). Inter-observer reliability (Cohen's kappa) of smiling pattern classifications for approximately 17% of the sessions was .89 (94% average agreement).

The Adaptive Social Behavior Inventory (*ASBI*, Hogan, Scott, & Bauer, 1992). At 30 months of age, parents were asked to complete the ASBI, a 30-item measure of adaptive and maladaptive social skills. If primarily Spanish-speaking caregivers had any difficulty interpreting questionnaire items on the ITSEA, they were given assistance by our bilingual staff. The ASBI was developed in response to the relative absence of developmentally appropriate standardized measures of adaptive or prosocial behaviors for young children. It samples a range of behaviors related to toddlers' social skills with adults and children (Greenfield, Wasserstein, Gold, & Jorden, 1997; Hogan et al., 1992) and has been utilized previously to investigate the relationship between joint attention behaviors and social competence (Sheinkopf et al., 2004). The ASBI is designed for use with preschool children and yields three subscale scores: "Comply," "Express," and "Disrupt." Internal consistency scores (alpha coefficients) were .72 and .81 for the "Comply" and "Express" subscales, respectively, comparable to those initially reported by Hogan et al. (1992). The alpha for the 7-item "Disrupt" subscale was .28 and we did not include this subscale in our analyses.

1.2. Results

Levels of anticipatory smiling and reactive smiling were calculated as proportions of total IJA episodes at each age. Data were screened for outliers with values two or more standard deviations above the mean. One identified outlier was

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Table 1
Descriptive statistics for Study 1.

Variable	Age ($n = 22$)													
	6 Months			8 Months			10 Months			12 Months			30 Months		
	M	*SD*	No.	*M*	*SD*	No.	*M*	*SD*	No.	*M*	*SD*	No.	*M*	*SD*	No.
SF Smiling	14.38	10.82	14												
Rate of IJA Episodes[a]				6.64	4.73	22	8.52	5.84	20	5.95	3.18	22			
Anticipatory Smiling				0.07	0.15	5	0.20	0.19	13	0.17	0.17	15			
Reactive Smiling				0.15	0.16	14	0.11	0.15	10	0.11	0.14	11			
ASBI-Express													33.64	3.85	22
ASBI-Comply													23.46	3.10	22

Note. No. = number of infants who displayed behaviors at least once. SF Smiling = percentage of time spent in still-face procedure that involved smiling; IJA = initiating joint attention; Anticipatory Smiling = proportion of IJA episodes involving anticipatory smiles; Reactive Smiling = proportion of IJA episodes involving reactive smiles; ASBI-Express = social expressivity scores on the ASBI; ASBI-Comply = compliance scores on the ASBI.

[a] Rate per 10 min.

replaced with a value one percent larger than the next most extreme score in the distribution (Tabachnick & Fidell, 1996), a procedure that had no impact on significance levels. The means and standard deviations for still-face smiling, rate of IJA episodes, IJA episodes involving anticipatory smiling, IJA episodes involving reactive smiling, and ASBI subscales are presented in Table 1. Descriptive statistics for the "Express" and "Comply" subscales of the ASBI were virtually identical to normative samples (Hogan et al., 1992). Very few infants produced anticipatory smiles at 8 months while the majority of participants produced anticipatory smiles at 10 and 12 months. The opposite pattern was observed with reactive smiles.

Pearson *r*s were calculated to determine the correlation between still-face smiling, rate of IJA, anticipatory smiling, reactive smiling, and scores from the ASBI. As can be seen in Table 2, smiling during the still-face at 6 months was positively correlated with the proportion of anticipatory smiling at 8 and 10 months, but not at 12 months. Still-face smiling was not, however, correlated with the rate of IJA or the proportion of reactive smiling at any age. Anticipatory smiling at 8 and 10 months only was, in turn, positively correlated with 30-month ASBI social expressivity scores. Neither reactive smiling nor rate of IJA was associated with scores on the ASBI. Results were equivalent when trial composite variables were developed using the average of only the 8 and 10-month measures. There was some negative skew to the distribution of anticipatory smiling and reactive smiling. Consequently, we corroborated all significant findings using Spearman's rho, which yielded identical results. In sum, there was an association between still-face smiling and later anticipatory smiling, and between anticipatory smiling and later social expressivity. It is of note that the rate of IJA was not significantly related to the proportion of anticipatory smiling at any age ($ps > 0.1$).

Next, correlation analyses were conducted to determine the stability of individual differences in infants' propensity to initiate joint attention, anticipatory smiling, and reactive smiling. These data are presented in Table 3. Inspection of the data showed moderately stable inter-age correlations of anticipatory smiling, which were significant between 8 and 10 months. The rate of IJA showed significant associations between 10 and 12 months, while reactive smiling showed marginally significant inter-age correlations between 10 and 12 months.

Table 2
Study 1 correlations among still-face smiling at 6 months, ESCS variables at 8, 10, and 12 months, and ASBI variables at 30 months.

Variable	SF Smiling	ASBI-Express	ASBI-Comply
8-Month ESCS measures			
IJA	−0.23	−0.37	−0.22
AS	0.58**	0.43*	−0.03
RS	0.23	0.33	0.26
10-Month ESCS measures			
IJA	−0.24	−0.16	−0.01
AS	0.50*	0.63**	0.31
RS	0.22	0.04	−0.11
12-Month ESCS measures			
IJA	−0.06	0.06	−0.04
AS	0.16	0.16	0.13
RS	0.25	−0.15	−0.25

Note. $n = 22$; SF Smiling = proportion of time spent in still-face procedure that involved smiling; IJA = rate of initiating joint attention; AS = proportion of IJA episodes involving anticipatory smiles; RS = proportion of IJA episodes involving reactive smiles; ASBI-Express = social expressivity scores on the ASBI; ASBI-Comply = compliance scores on the ASBI.

* $p < 0.05$.

** $p < 0.01$.

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Table 3
Pearson's correlations (r) for initiating joint attention, anticipatory smiling, and reactive smiling, at each age.

	Study 1 ($n = 22$)			Study 2 ($n = 39$)
	8–10 Months	10–12 Months	8–12 Months	9–12 Months
Rate of IJA Episodes[a]	0.17	0.58**	0.12	0.43**
Anticipatory Smiling	0.56*	0.23	0.28	0.04
Reactive Smiling	−0.05	0.46	−0.14	0.14

Note. IJA = initiating joint attention; Anticipatory Smiling = proportion of IJA episodes involving anticipatory smiles; Reactive Smiling = proportion of IJA episodes involving reactive smiles.

[a] Rate per 10 min.

* $p < 0.05$.

** $p < 0.01$.

1.3. Discussion

There was an association between still-face smiling and anticipatory smiling, and between anticipatory smiling and social expressivity. The tendency of infants to initiate smiling bids with a familiar social partner (i.e., caregiver) during the still-face was related to infants' use of anticipatory smiles to engage an unfamiliar adult in sharing reference to an object of interest. There was an association between still-face smiling and anticipatory smiling at 8 and 10 months and between anticipatory smiling at 8 and 10 months and later pro-social behavior. All significant correlations had a large effect size (Cohen, 1988). We note, however, that various nonsignificant correlations – e.g., between reactive smiling at 8 months and the ASBI expressivity scale at 30 months – involved mid-level effect sizes (Cohen, 1988). Studies using larger sample sizes may show significant associations between these variables. The current findings illustrate both precursors to and developmental consequences of anticipatory smiling. The goal of our second study was to corroborate the developmental trajectories of anticipatory smiling and other joint attention behaviors (Venezia et al., 2004), as well as to further investigate the sequelae of anticipatory smiles, in a larger sample of typically developing infants, using a more recent measure of preschool social competence.

2. Study 2

2.1. Methods

2.1.1. Participants

The 60 infants (27 males) and caregivers included in Study 2 were drawn from a larger sample of children (Van Hecke et al., 2007).[1] Approximately 40% of caregivers in this sample self-identified as Hispanic, 58% as non-Hispanic European American, 2% as African American, and 2% as Asian American. All 60 caregivers spoke primarily English. Five percent of mothers had attended high school only, 50% had attended at least 2 years of college, and 45% had attended some graduate school. Thirty-nine infants had complete data for both early (9 and 12 months) and later (30 month) time points. Of the 21 families who did not return for the 30-month session, 7 did not return because the family relocated, 5 families stated they did not have the time to continue to participate, and 9 families were unable to be reached to schedule despite multiple phone calls and messages from our staff. Infants who did and did not return for the follow-up 30 month visit did not differ on any of the variables measured (rate of IJA, proportions of anticipatory or reactive smiles, scores on the ITSEA), $ps > 0.1$.

2.1.2. Procedure

Infants and caregivers were observed in the laboratory when infants were 9, 12, and 30 months of age.

ESCS (Mundy et al., 2003). This assessment, taped through a one-way mirror using Super-VHS equipment, was conducted when infants were 9 and 12 months of age in the same manner as in Study 1.

The coding procedures for IJA episodes and the smiling patterns during IJA were identical to those utilized in Study 1. The intra-class correlation coefficient of two independent coders identifying IJA episodes in 15 ESCS sessions was .96. In addition, mean Cohen's kappa, calculated for approximately 16% of the sessions to assess the reliability of agreement on the classification of smiling patterns, was .75 (85% agreement).

The Infant-Toddler Social and Emotional Assessment Questionnaire (*ITSEA*, Carter & Briggs-Gowan, 2000). Social communicative outcome was evaluated at 30 months of age via parents' endorsements on the ITSEA, a 166-item questionnaire

[1] The Van Hecke sample of 52 infants from 12 to 30 months of age overlaps the sample reported in the current paper's Study 2. Thirty of the 52 infants examined in the Van Hecke study were present in Study 2. Of the 39 infants included in the Study 2 analyses, 30 infants were observed in the Van Hecke study. As noted, The Van Hecke study predicted socioemotional outcome using a 12-month measure of IJA involving gestures whereas the current study predicts outcome using a variety of affectively positive IJA measures at 9 and 12 months. The sample described in Study 2, but not the Van Hecke et al. sample, was limited to infants from English-speaking homes to avoid potential group differences due to differences in language exposures. Additionally, the Van Hecke sample was restricted to infants with 24-month Bayley Mental Development Index (MDI; Bayley, 1993) scores of greater than 75. The present Study 2 did not exclude participants on the basis of 24-month MDI scores, which ranged from 66 to 122, with a mean of 96.54. Supplementary analyses indicated that the correlations documented in Study 2 are not altered when the five infants earning an MDI score of below 75 are dropped from the analyses.

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Table 4
Descriptive statistics at each age for Study 2.

Measure	Age ($n = 60$)								
	9 Months			12 Months			30 Months		
	M	*SD*	No.	*M*	*SD*	No.	*M*	*SD*	No.
Rate of IJA Episodes[a]	8.15	4.96	59	8.06	4.37	60			
Anticipatory Smiling	0.17	0.21	40	0.25	0.19	51			
Reactive Smiling	0.14	0.14	41	0.13	0.13	43			
ITSEA-Competence[b]							49.49	10.18	39
ITSEA-Externalizing[b]							44.87	07.54	39
ITSEA-Internalizing[b]							49.44	07.33	39
ITSEA-Dysregulation[b]							49.49	10.18	39

Note. No. = number of infants who displayed behaviors at least once; IJA = initiating joint attention; Anticipatory Smiling = proportion of IJA episodes involving anticipatory smiles; Reactive Smiling = proportion of IJA episodes involving reactive smiles.

[a] Rate is per 10 min.

[b] Values reflect *T*-scores with a mean of 50 and a standard deviation of 10.

assessing social and emotional problems and competencies in infants 12–36 months of age. Similar to the ASBI, the ITSEA was developed in response to the relative absence of developmentally appropriate standardized measures of adaptive or prosocial behaviors for young children and has been utilized previously to investigate the relationship between joint attention behaviors and social competence (Van Hecke et al., 2007). However, the ITSEA samples a broader range of behaviors related to toddlers' social skills with adults and children, including social knowledge, and behaviors related to positive emotions and self-control (Carter & Briggs-Gowan, 2000). The ITSEA includes "Dysregulation," "Externalizing," "Internalizing," and "Social Competence" domains. The "Dysregulation" domain (34 items) is comprised of the Negative Emotionality, Eating, Sensory Sensitivity, and Sleep scales. The "Externalizing" domain (24 items) is comprised of the Aggression/Defiance, Activity/Impulsivity, and Peer Aggression scales. The "Internalizing" domain (30 items) is comprised of the General Anxiety, Depression/Withdrawal, Separation Distress, and Inhibition to Novelty scales. The "Social Competence" domain (37 items) is comprised of the Sustained Attention, Compliance, Empathy, Imitation/Pretend Play, Mastery Motivation, and Prosocial Peer Interactions scales. All domain raw mean scores were converted to *T*-scores; *T*-scores have a mean of 50 and a standard deviation of 10 (Carter & Briggs-Gowan, 2000). Internal consistency estimates (alphas) for this study were: .76, .89, .67, and .81 for the "Dysregulation," "Externalizing," "Internalizing," and "Social Competence" domains, respectively (see Carter & Briggs-Gowan, 2000 for comparable values).

2.2. Results

As in the first study, levels of anticipatory smiling and reactive smiling were calculated as proportions of IJA episodes at the ages observed. Three outliers were replaced to reduce their influence (Tabachnick & Fidell, 1996), a procedure that had no impact on significance levels.

2.2.1. Developmental trajectories

Descriptive statistics for the rate of IJA, the proportion of IJA episodes involving anticipatory and reactive smiles, and the ITSEA subscales can be found in Table 4. The number of infants producing anticipatory smiles increased from 9 to 12 months while the number of infants producing reactive smiles remained relatively unchanged from 9 to 12 months. A repeated-measures ANOVA used to test the developmental trajectory of the rate of IJA episodes indicated no change between 9 and 12 months, $F(1, 59) = 0.12$, $p = 0.73$. As the frequencies of anticipatory and reactive smiles were not normally distributed, nonparametric statistical tests were utilized. A Wilcoxon matched-pairs signed ranks test revealed greater anticipatory smiling at 12 months than at 9 months, $z = -2.49$, $p = 0.01$. However, there was no change in level of reactive smiling between 9 and 12 months, $z = -0.36$, $p = 0.72$.

2.2.2. Developmental associations

Pearson *r*s were calculated to determine the correlation between the rate of IJA episodes, IJA episodes involving anticipatory smiling, and IJA episodes involving reactive smiling, and scores from the ITSEA. As in Study 1, the rate of IJA was not significantly related either to the proportion of anticipatory smiling or to the proportion of reactive smiling ($ps > 0.1$). There was a positive correlation between the proportion of anticipatory smiling at 9 months of age and parent-reported social competence scores on the ITSEA at 30 months of age (see Table 5). The association between 12 month anticipatory smiling and ITSEA social competence was not significant. There were no significant findings between reactive smiling and social competence. The ITSEA "Dysregulation," "Externalizing," and "Internalizing" subscales were not significantly correlated with any of the IJA or smiling variables ($rs < 0.19$, $ps > 0.1$). Due to some negative skew to the distribution of anticipatory smiling and reactive smiling, we corroborated all significant findings using Spearman's rho. The results remained unchanged.

As in Study 1, Pearson correlations were conducted to determine the stability of individual differences in infants' propensity to initiate joint attention, anticipatory smiles, and reactive smiles. As can be observed in Table 3, there was a strong

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Table 5
Study 2 correlations between ESCS variables at 9 and 12 months and ITSEA variables at 30 months.

Variable	ITSEA-Comp	ITSEA-Intern	ITSEA-Extern	ITSEA-Dysreg
9-Month ESCS measures				
IJA	0.06	0.01	0.11	−0.10
AS	0.48**	−0.17	−0.15	−0.14
RS	0.09	0.06	0.28	0.13
12-Month ESCS measures				
IJA	0.04	−0.12	−0.26	−0.19
AS	0.28	0.04	−0.08	−0.22
RS	0.01	−0.04	−0.16	−0.07

Note. $n = 39$; IJA = rate of initiating joint attention; AS = proportion of initiating joint attention episodes involving anticipatory smiles; RS = proportion of initiating joint attention episodes involving reactive smiles; ITSEA-Comp = social competence scores on the ITSEA; ITSEA-Intern = internalizing scores on the ITSEA; ITSEA-Extern = externalizing scores on the ITSEA; ITSEA-Dysreg = dysregulation scores on the ITSEA.
** $p < 0.01$.

association between the rate of IJA at 9 months and the rate of IJA at 12 months. There was not a significant correlation between anticipatory smiling at 9 and 12 months, or between reactive smiling at 9 and 12 months.

2.3. Discussion

The second study indicates that from 9 to 12 months of age, anticipatory smiling became a more common feature of IJA episodes, with an increase in the proportion of anticipatory smiles from 0.17 to 0.25. This developmental increase in the number of infants using anticipatory smiles corroborated the developmental pattern seen in the Study 1 sample (Venezia et al., 2004). In addition, anticipatory smiles at 9 months were associated with social competence scores on the ITSEA, $r = .48$ (a large effect size; Cohen, 1988). Reactive smiles did not show this association and effect sizes were small. In sum, anticipatory smiles, smiles that the infant forms in anticipation of social contact, are uniquely associated with later social competence.

3. General discussion

This research was designed to explore the predictors of anticipatory smiles and to examine the hypothesized relationship between this socially expressive behavior and measurements of later social emotional outcome. In addition to documenting an increase in infants' use of anticipatory smiles from 9 to 12 months of age in Study 2, we uncovered positive associations between early social smiling (6 months) and anticipatory smiles (8 and 10 months) in Study 1, and between anticipatory smiles (8, 9 and 10 months) and preschool measures of prosocial behavior (30 months) in both studies.

In Study 2, we found that infants engaged in higher levels of anticipatory smiling during social interactions with a tester at 12 months than at 9 months. These results corroborate earlier documentation of a developmental increase in the proportion of infants using anticipatory smiles between 8 and 10 months, a proportion which did not change between 10 and 12 months (Venezia et al., 2004). Striano and Bertin (2005) found that the proportion of infants who engaged in joint attention looks during play that involved a smile increased between 5 and 9 months of age, but did not examine the temporal pattern of this smiling. Kuroki (2007), found an increase in initiating looks to the caregiver while smiling between 9 and 12 months of age. Further, Jones and Hong (2005) found that joint attention looks involving smiling to an attentive, responsive mother occurred immediately following active toy play. These results indicate an early integration of affect into joint attention episodes, which has stabilized by 12 months of age (Adamson & Bakeman, 1985; Adamson & Russell, 1999; Hobson, 2006; Mundy & Sigman, 2006).

In Study 1, infants who engaged in higher proportions of smiling in the still-face procedure subsequently displayed higher levels of anticipatory smiling. That is, infants who used smiling to attempt to regain the attention of a familiar, unresponsive partner (the parent) tended to communicate positive affect about an object spectacle to an unfamiliar social partner (the tester). This demonstrates continuity between early dyadic (two people) and later triadic (two people and an object) positive emotional communication (see Striano & Rochat, 1999). As there was a correlation between face-to-face and still-face smiling ($r = .47$, $p = 0.03$), it is possible that the infant's still-face smiling could in turn reflect the influence of an emotionally positive mother (Weinberg & Tronick, 1994; Cassel et al., 2007). Thus, an unknown continuity in caregiving could have led infants to smile more at 6 months and to engage in more anticipatory smiling. However, while early smiling was observed with the mother, anticipatory smiling was measured with an unfamiliar adult. Furthermore, there was a significant inter-age correlation between anticipatory smiling at 8 and 10 months of age. Taken together, this suggests stable individual differences in the propensity to initiate positive affective communication with different partners.

Recent evidence indicates that highly sensitive maternal caregiving predicts later infant joint attention initiations involving a smile (Hane & Fox, 2006). A potential explanation for the association between joint attention smiling and caregiving behavior is that infants' relative degree of experience with early rewarding social stimuli may contribute to a continued predilection to initiate positive social interactions with others (Goldsmith & Rogoff, 1997; Vaughan et al., 2003; Wachs & Chen, 1986). Another explanation is that anticipatory smiling reflects a temperamental proclivity toward

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exuberance, sociability, positive affective response to novelty, and approach behaviors (Fox, Henderson, Rubin, Calkins, & Schmidt, 2001; Mundy, 1995; Mundy & Willoughby, 1996). There is, in fact, also support for an association between maternal ratings of infant positive temperament and joint attention episodes accompanied by smiles (Nichols, Martin, & Fox, 2005).

Both Study 1 and Study 2 document the predictive validity of anticipatory smiling. In Study 1, anticipatory smiles were positively correlated with infants' scores on the ASBI "Express" subscale, a preschool measure of emotional expressivity, which is a component of social competence (Hogan et al., 1992). In Study 2, anticipatory smiling predicted scores on the ITSEA "Competence" subscale, a widely used measure that assesses a combination of childhood characteristics deemed important in achieving successful social interactions. Many of the items in the ASBI "Express" subscale are similar to items in the ITSEA "Competence" subscale (e.g., "Plays games and talks with other children," versus "Plays well with other children," and "Understands feelings, like when they are happy, sad, or mad," versus "Talks about other people's feelings (like 'Mommy mad')").

Variability in the capacity to engage in anticipatory smiling with others may be affected by a motivational imperative to share positive experiences. Anticipatory smiling, then, may reflect or support a proclivity to engage prosocially and sympathetically with others. Episodes in which positive affect is experienced with regard to a shared object of reference may provide an interactive structure in which infants are able to learn that affective experiences can be shared with others (Mundy et al., 1992; Mundy & Willoughby, 1996). This is consistent with the finding that 12-month-old infants do not only seem to expect adults to joint their attentional focus to an object but also to share their interest in relation to that object (Liszkowski, Carpenter, Henning, Striano, & Tomasello, 2004). Therefore, it seems that infants who come to expect emotional intersubjectivity in social interactions may engage in more infant initiated affect sharing (i.e., anticipatory smiling). However, this scenario is most likely only if infants experience consistent contingent positive responsiveness to their anticipatory smiling bids.

As expected, there was no association between reactive smiling and social outcome. Reactive smiling – smiling produced while gazing at an adult – is an established feature of an infants' communicative repertoire from early infancy (Yale et al., 2003). It is possible that joint attention involving reactive smiling actually captures an interpersonal event that is temporally connected to, but distinct from, the act of IJA. That is, perhaps the gaze shift from the object to the social partner reflects a bid for joint attention but the smile that occurs afterward is merely indicative of a dyadic social exchange, one that comprises most early face-to-face interactions.

As in similar studies of typically developing infants (Van Hecke et al., 2007; Sheinkopf et al., 2004), we found no association between IJA frequency and parent-rated social competence. IJA, however, has been associated with reduced risk for externalizing behavior in studies of typically developing and at-risk children (Sheinkopf et al., 2004; Van Hecke et al., 2007). Anticipatory smiling was the only joint attention variable that showed a relationship – at any age – with still-face smiling at 6 months and ASBI or ITSEA scores at 30 months. These associations reached significance at the 8- and 10-month observations in Study 1 and the 9-month observation in Study 2. These data taken together with an earlier report demonstrating an increase in infants' use of anticipatory smiling specifically between 8 and 10 months (Venezia et al., 2004) support the notion that this time period is one that reflects early differences between infants in the development of social engagement.

We found a positive association between anticipatory smiles and social outcome indicating that anticipatory smiling may capture a particular aspect of referential communication that more reliably relates to optimal social outcome than overall IJA. Van Hecke et al. (2007) documented a positive relationship between higher-level joint attention behaviors (i.e., IJA with conventional gestures) at 12 months of age and later parent-reported social competence on the ITSEA. The similarity between this finding and the positive association found between anticipatory smiling and social competence in the current study speaks to a potential social-cognitive dimension or pathway. The emergence of infants' gestures during episodes of IJA may signify an awareness that others have intentions that may be affected by the infants' social-signals (e.g., Bretherton, 1991; Carpenter et al., 1998; Charman et al., 2000; Tomasello, 1995). Likewise, Jones and Hong (2001) found that infants who showed evidence of intentional gestural/vocal communication were more likely to use anticipatory smiles. Conventional gestures, such as those measured in Van Hecke et al. (2007), comprised only .5% and 3.9% of the current sample of IJA episodes at 9 and 12 months, respectively, while anticipatory smiles occurred in 17% and 25% of the episodes, respectively. Therefore, anticipatory smiles may reflect one aspect of social-cognitive development in infancy, evident even before infants' consistent use of gestural communication.

Taken together, the findings reported here illustrate a developmental progression. Positive emotion expressed during the still-face was related to anticipatory smiling; anticipatory smiling (and not still-face smiling or reactive smiling) was associated with later social outcomes. These associations suggest a line of continuity between infants' emotional expressivity during early social situations and later adaptive relatedness with others. Anticipatory smiles may signify an awareness of the separate attentional state and affective availability of the other (Mundy & Sigman, 2006; Venezia et al., 2004), which may or may not imply a cognitive awareness of others' intentionality. It is likely that the acquisition and development of anticipatory smiles in infancy reflect a multitude of processes (e.g., caregiver/scaffolding, social-cognitive, social-motivational) that together contribute to childhood social and emotional competencies. This would be consistent with the notion that different dimensions of joint attention (e.g., IJA with eye contact only, IJA with conventional gestures, IJA with anticipatory smiles, and IJA with reactive smiles) may reflect unique, as well as common, processes (Mundy et al., 2000; Mundy & Sigman, 2006; Mundy & Van Hecke, 2008). Likewise, as the multifaceted nature of joint attention skills is increasingly recognized and understood, it becomes important to consider the unique contributions of each type to child outcome.

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Overall, the initial evidence gathered from the two studies presented in this report suggests that anticipatory smiles may be a fruitful area of study. Future investigations attempting to examine early determinants of social competence and affective expressivity would do well to move beyond parent-report questionnaires and include larger samples of children. This report extends prior research by providing initial evidence that speaks to the role of anticipatory smiles in early socioemotional development. Anticipatory smiles are positive social bids that are associated with earlier expressive initiations and later social competence.

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