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Infant Joint Attention, Temperament, and Social Competence in Preschool Children

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Abstract

Infant joint attention has been observed to be related to social-emotional outcomes in at-risk children. To address whether this relation is also evident in typically developing children, 52 children were tested at 12, 15, 24, and 30 months to examine associations between infant joint attention and social outcomes. Twelve-month initiating and responding to joint attention were related to 30-month social competence and externalizing behavior, even when accounting for 15-month temperament ratings, 24-month cognition and language, and demographic variables. These results suggest that, in addition to associations with language and cognition, infant joint attention reflects robust aspects of development that are related to individual differences in the emergence of social and behavioral competence in childhood.

Understanding the early foundations of social competence is an important issue for developmental science. Social competence contributes to a wide array of adaptive outcomes among children: from school readiness and academic success (Blair, 2002; Raver, 2002), to risk and resilience in the face of vulnerability for developmental psychopathology (Masten &

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Coatsworth, 1998). Previous research on this topic has examined aspects of caregiving, attachment, temperament, and the development of self-regulation, including inhibitory control in infancy (e.g., Calkins & Fox, 2002; Fox, Henderson, Rubin, Calkins, & Schmidt, 2001; Kochanska, Coy, & Murray, 2001; Masten & Coatsworth, 1998; Rothbart, Posner, & Rosicky, 1994), and has provided powerful insights into the nature and development of social competence (Masten & Coatsworth, 1998). Social competence, though, is complex and involves at least three dimensions of behavior: (a) the tendency to express agreeableness, interest in others, and positive emotions with peers, as well as adults, (b) the ability to integrate the behavior of self with others in the dynamic flow of social interaction, and (c) the ability to regulate attention and emotional reactivity, including the ability to self-monitor and correct errors, in positive goal-related activity (Eisenberg et al., 1997; Masten & Coatsworth, 1998; Rothbart & Bates, 1998). In this paper, we examined the hypothesis that the development of joint attention skills in infancy may reflect important aspects of each of these three dimensions, and, therefore, should be considered along with other dimensions of behavior in attempts to understand the early foundation of social competence in children (Mundy & Willoughby, 1996; Mundy & Acra, 2006; Sheinkopf, Mundy, Claussen, & Willoughby, 2004).

Joint attention involves the triadic coordination of attention between self, other, and some third object, event, or symbol (Adamson, 1995; Tomasello, 1995; see Figure 1). In infancy, this is often measured in terms of the social-coordination of *overt* aspects of visual attention, such as when a toddler shows a toy to a parent. Theoretically, though, this capacity eventually becomes elaborated and integral to the social coordination of more *covert* aspects of attention, such as when a child follows the abstract topic discussed by a teacher in a classroom (Mundy & Sigman, 2006), or when social partners share or coordinate attention to psychological phenomena, such as ideas, intentions, or emotions (Adamson, Bakeman, & Deckner, 2004; Tomasello, 1995). Thus, processes that begin with the development of joint visual attention skills in infancy are thought to be important to the subsequent capacity for social learning throughout the life span (Adamson, 1995; Baldwin, 1995; Mundy & Sigman, 2006; Tomasello, 1995).

Behaviors indicative of the capacity for joint attention begin to emerge between 3 and 6 months of age (D'Etemont, Hains, & Muir, 1997; Morales, Mundy, & Rojas, 1998; Scaife & Bruner, 1975). They are then elaborated and differentiated into several functional forms through at least 18 months of age (Bates, 1976; Carpenter, Nagell, & Tomasello, 1998; Seibert, Hogan, & Mundy, 1982). One form involves the ability to follow the direction of gaze, head turn, and/or pointing gesture of another person (Scaife & Bruner, 1975). This behavior may be referred to as Responding to Joint Attention skill (RJA: Seibert et al., 1982). Another type of skill involves the infant's use of eye contact and/or deictic gestures (e.g., pointing or showing) to spontaneously initiate coordinated attention with a social partner. This type of protodeclarative act (Bates, 1976) may be referred to as Initiating Joint Attention skill (IJA: Seibert et al., 1982). These behaviors, and especially IJA, appear to serve social functions, in that the goal and reinforcement of these behaviors revolves around the sharing of experiences with others and the positive valence such early social sharing has for young children (Bates, 1976; Mundy, 1995; Rheingold, Hay, & West, 1976). Alternatively, attention coordination may also be used for less social, but more instrumental purposes. For example, infants and young children may use eye contact and gestures to initiate attention coordination with another person in order to elicit aid in obtaining an object or event. This may be referred to as a protoimperative act (Bates, 1976) or Initiating Behavior Regulation/Requests (IBR: Seibert et al., 1982). These behaviors are illustrated in Figure 1.

Theory suggests that there are several processes involved in the development of infant joint attention that may also contribute to subsequent childhood social competence. First, individual differences in the tendency to engage in joint attention are thought to reflect the degree to which sharing an experience with another person is rewarding for infants (Bates, 1976; Dawson et

al., 2002; Hobson, 1993; Mundy, 1995; Trevarthen & Aitken, 2001). Indeed, infant joint attention, and especially IJA, has been associated with a tendency to share positive affect with others (Adamson & Bakeman, 1985; Bates, 1976; Kasari, Sigman, Mundy, & Yirmiya, 1990; Mundy, Kasari, & Sigman, 1992; Vaughan et al., 2003; Venezia, Messinger, Thorp, & Mundy, 2004; see Figure 1c). This “social-motivation” component of joint attention may be related to the dimension of social competence that involves a tendency to express agreeableness, interest in others, and positive emotions with peers, as well as with adults (Mundy & Sigman, 2006, pp. 313 – 315).

Second, infants’ intentional use of eye contact and gestures in joint attention is thought to mark the early development of social cognition, or the awareness that others have powers of perception and intention that may be affected by social signals (e.g., Bretherton, 1991; Brooks & Meltzoff, 2002; Carpenter et al., 1998, 2001; Tomasello, 1995; Woodward, 2003). Social cognition is also related to social competence in preschool and school-age children (Jenkins & Astington, 2000; Watson, Nixon, Wilson, & Capage, 1999). Therefore, processes associated with early social-cognitive development may forge a significant link between infant joint attention and childhood social competence (Mundy & Acra, 2006; Mundy & Sigman, 2006).

Third, and perhaps less well recognized, is the notion that joint attention may involve aspects of executive attention regulation, inhibitory control, and self-monitoring that are also critical to the subsequent development of social competence (Mundy, 2003; Mundy & Acra, 2006; Mundy & Sigman, 2006). Individual differences in infant RJA and IJA have been related to the frontally mediated capacities for goal-directed behavior, inhibitory control, and correction (Griffith, Pennington, Wehner, & Rogers, 1999; McEvoy, Rogers, & Pennington, 1993), and IJA, specifically, may involve flexible response inhibition based on reward association learning (Dawson et al., 2002; Nichols, Fox, & Mundy, 2005). Imaging and electrophysiological studies also suggest that different types of joint attention behaviors may reflect unique aspects of executive functions. RJA appears to largely be regulated by temporal and parietal systems involved in attention disengagement and orienting, as well as monitoring the behavior of other people (Kingstone, Friesen, & Gazzaniga, 2000; Mundy, Card, & Fox, 2000; Puce, Allison, Bentin, Gore, & McCarthy, 1998; Vaughan Van Hecke & Mundy, in press). Alternatively, imaging, electrophysiological, and behavioral studies suggest that IJA may reflect a multifaceted frontal – temporal – parietal system, presumably involved in initiating goal-directed social behaviors based on motivational constraints, flexibly switching attention between goals, and self-monitoring, as well as other-monitoring, in social interactions (Caplan et al., 1993; Henderson, Yoder, Yale, & McDuffie, 2002; Mundy et al., 2000; Mundy, 2003; Nichols et al., 2005). For example, Nichols et al. observed that IJA, but not RJA, was associated with a measure of self-recognition and an executive function measure of response inhibition based on reward association learning. Few cortical or executive correlates of IBR have been observed in recent studies (e.g., Henderson et al., 2002; Mundy et al., 2000). Thus, recent behavioral and neurodevelopmental research suggests that measures of infant joint attention development reflect inhibitory control and attention regulation processes, as well as the ability to engage in integrated self- and other-monitoring and to correct errors during social interactions. Similar executive and attention regulation facilities are thought to be involved in childhood social skills (Posner & Rothbart, 2000). Consequently, infant joint attention may be especially useful in examining the early executive skill foundations of social competence in children (Mundy & Acra, 2006; Mundy & Sigman, 2006). It is not clear, though, whether all types of joint attention skills are equivalent in this regard.

Theory on joint attention often suggests that all measures of joint attention reflect a common set of processes (Carpenter et al., 1998). This leads to the expectation that different joint attention measures would be equivalent in their relations with social outcomes. Alternatively, a multiprocess model of joint attention development has been proposed, in which different

joint attention behaviors are assumed to reflect distinct constellations of basic processes that include both common and discrete elements (Mundy & Willoughby, 1996; Mundy et al., 2000; Mundy & Sigman, 2006; Vaughan Van Hecke & Mundy, in press). Recent studies have provided some support for the multiprocess model, such as the aforementioned observations that IJA and RJA appear to have both common and distinct neuropsychological correlates (e.g., Mundy et al., 2000). Other observations have indicated that frequency measures of IJA and RJA are not highly correlated in early development (Mundy & Gomes, 1998; Mundy et al., 2000), that IJA may be more highly associated with affective development in infancy than RJA and IBR (Kasari et al., 1990; Mundy et al., 1992; Vaughan et al., 2003), and that RJA, rather than IJA, is more clearly associated with the use of attention disengagement in self-regulation (Morales, Mundy, Crowson, Neal, & Delgado, 2005; Vaughan Van Hecke et al., 2006). IJA, RJA, and IBR also display dissociable paths of development and impairment in autism (Mundy, Kasari, Sigman, & Ruskin, 1995). Thus, different measures of infant joint attention may reflect distinct, as well as common, processes. Therefore, different types of joint attention skills may be expected to display unique paths of association with the development of childhood social competence (Mundy & Sigman, 2006).

Consistent with this possibility, several studies have observed significant, but different, patterns of relations between early joint attention measures (IJA, RJA, and IBR) and childhood social competence in samples of developmentally disordered and “at-risk” children. Sigman and Ruskin (1999) observed that better preschool IJA, but not RJA or IBR, skills predicted the development of the tendency to initiate social interactions in children with autism. Lord, Floody, Anderson, and Pickles (2003) also observed that a measure of IJA bids, but not RJA, in a sample of 2-year-old children with autism was positively and significantly related to reports of social skill development at 9 years of age. Beyond autism, Sheinkopf et al. (2004) reported that better performance on measures of IJA and RJA in the second year made significant and unique contributions to the prediction of lower teacher reports of externalizing behavior problems among cocaine-exposed infants at 36 months. Alternatively, IBR was positively associated with the development of externalizing behaviors in this group of children. Sheinkopf et al. also observed that RJA, but not IJA or IBR, was a significant positive predictor of teacher reports of 36-month prosocial behavior. Thus, research to date suggests that different measures of infant joint attention may display unique paths of association with childhood social outcomes.

A related matter concerns a methodological issue in the measurement of joint attention. Some aspects of joint attention may be measured simply in terms of alternating eye contact between an object of interest and a social partner (see Figure 1). This type of behavior may emerge relatively early in the course of joint attention development (Carpenter et al., 1998), and may have face validity as a marker of interpersonal engagement and social attention regulation (Mundy & Acra, 2006). However, some have reasonably argued that a better indicator of joint attention development and associated aspects of social-cognitive development may be infants’ later developing capacity to coordinate social attention with conventional gestures, such as showing and pointing (Tomasello, 1995). Consequently, it may not only be important to examine the relations of different dimensions of infant joint attention with preschool social outcomes (i.e., IJA vs. RJA vs. IBR) but also to examine the validity of different types of measures, such as “higher-level” conventional gesture measures versus measures that include lower-level eye contact behaviors, in examining the relations of infant joint attention to childhood social development.

In summary, the current literature suggests that infant joint attention skills may be significantly associated with the childhood development of social competence. However, it is not clear from the current empirical literature whether the link between joint attention and social competence is a general developmental phenomenon, or one that is limited only to developmentally

disordered or “at-risk” samples who may display extremes in the development of joint attention and/or social competence. It is also not clear whether the divergent pattern of predictive correlations that have been observed between different dimensions of joint attention and social outcomes in previous research is consistent with a multiprocess view of infant joint attention, or whether this, too, is an artifact of research with atypical samples. Therefore, the current study was undertaken to address these issues. The first goal of this study was to examine the relations between individual differences in the development of infant joint attention and behavior outcomes in a sample of typically developing children. The a priori expectation was that measures of infant joint attention would significantly predict social outcomes in typically developing, not-at-risk children. The second goal of this study was to examine the degree to which different dimensions of joint attention and different types of joint attention measures may have equivalent or unique associations with social outcomes in typically developing children. The expectation here was that different dimensions and different types of measures of infant joint attention would display unique and significant contributions to preschool social outcomes.

A third goal of this study was to examine the possibility that variance shared with several other domains, such as temperament, general aspects of language and cognitive development, or demographic factors, may contribute to, or even explain, the associations between infant joint attention and individual differences in social outcomes. With respect to temperament, some of the processes described in the social-motivation and executive hypotheses of joint attention have also been ascribed to infant temperament and its links to social competence (Kochanska, Murray, & Harlan, 2000; Rothbart, Ahadi, & Hershey, 1994). As previously noted, IJA and/or RJA have been associated with dimensions of temperament, such as inhibitory control (e.g., Griffith et al., 1999), and related aspects of self-regulation (Morales et al., 2005; Vaughan Van Hecke et al., 2006), as well as emotional reactivity (Mundy et al., 1992; Vaughan et al., 2003). Therefore, infant temperament, especially the dimensions of inhibitory control and emotional reactivity, may explain much, if not all, of the association between infant joint attention and subsequent social competence.

In addition, social cognition (Cutting & Dunn, 1999), social competence (Baker & Cantwell, 1987; Beitchman, Hood, & Inglis, 1990), and joint attention (Carpenter et al., 1998; Mundy & Gomes, 1998; Ulvund & Smith, 1996) have all been related to early language and cognitive development. Therefore, variance associated with language development needs to be considered in examining the social cognition hypothesis, or any other hypothesis regarding the associations between infant joint attention and childhood social competence. Previous research has observed significant associations between early joint attention and later social competence after controlling for general language or cognitive development (Lord et al., 2003; Sheinkopf et al., 2004; Sigman & Ruskin, 1999). However, again, the atypical ranges of cognitive and language development in the children in these studies could have affected these observations. Therefore, it was important to reexamine this issue in a study of typical development.

Lastly, it is important to consider that infant social development does not occur in a vacuum, and may, in fact, be affected by various endogenous and demographic variables. Specifically, research (National Institute of Child Health and Human Development Early Child Care Research Network, 2003) has found that child gender and level of maternal education are related to social competence outcomes in childhood and adolescence. Additionally, it is unknown to what extent exposure to multiple languages has an effect on joint attention processes or social-behavioral outcomes. Thus, this study explored the degree to which aspects of temperament, language and cognitive development, and demographic factors contribute to the associations between measures of 12-month measures of infant joint attention and 30-month measures of social competence.

Method

Participants and Research Design

Infant participants were drawn from a sample of 76 infants and families enrolled in a 9- to 36-month longitudinal study of social development. Data available on Language Status at 9 months, joint attention development at 12 months, infant temperament at 15 months, cognitive/language data at 24 months, and social-emotional outcomes at 30 months were examined in this study. This report focused on the data from 12-month joint attention assessments because theory suggested that this is a relatively important period of development for this domain (Tomasello, 1995; Trevarthen & Aitken, 2001). The procedures used in this study were reviewed, approved, and monitored by a university-based Internal Review Board (IRB) for human subjects protection, and the study followed National Institutes of Health guidelines for the protection of human subjects and the inclusion of minorities, women, and children in human research. The inclusion criteria for participation in this study included the following: 5-min APGAR scores ≥ 7 ; no history of major medical, neurological, sensory, congenital, and/or chromosomal abnormalities at intake; and a 24-month Bayley Mental Development Index (MDI) score of >75 , indicative of typical early cognitive/language development. Mothers of infant participants were 18 years of age or older.

Criteria for inclusion in this study also included complete joint attention, temperament, cognitive, and social outcome data at 12, 15, 24, and 30 months. Thus, missing data reduced the sample from 76 children to 52 children with complete data for analysis in this longitudinal study. The 24 excluded infants were different from the included infants in that they were more likely to be male, $t(74) = -2.33, p < .05$, and had, on average, lower 12-month RJA, $M = 39.14$, $t(64.79) = 2.41, p < .03$, and 24-month Reynell Expressive Language scores, $M = 80.74$, $t(71) = 2.53, p < .03$. However, the 24 excluded infants did not significantly differ from included infants on the basis of birth weight, gestation, maternal age, maternal or paternal education, maternal or paternal race, languages heard in the home, or any of the other variables measured in this study (see Table 1). Nevertheless, the “complete case” data may have reflected a selected sample (e.g., a systematic attrition of boys and children with lower RJA and Reynell Expressive Language scores) because unknown, but nonrandom, factors may have been related to missing data in this longitudinal study. To address this possibility, imputation methods were used to estimate the missing data, and analyses were conducted on the full imputed data set of 76 children to check the results of the primary regression analyses conducted on the “complete data” sample of 52 children (see “Results”).

The demographic data for the 52 infants who were the focus of this study were as follows: 34 (65%) of these infants were female, and 18 (35%) were male. The mean infant birth weight was 3,306.7 g (standard deviation [SD] = 541.2) and the mean gestation was 38.8 weeks (SD = 1.8). The average age of the mothers of infants in this sample was 33.6 years (SD = 5.8) and 46% had some graduate or professional school experience, 46% had some college or a college degree, and 8% had discontinued education after completing high school. This study was conducted in the Miami metropolitan area. Therefore, the infants varied with regard to their in-home exposure to languages, with 44% of parents characterizing the home language environments as monolingual English, 13.5% as primarily English with some Spanish, 10% as bilingual or approximately equal English and Spanish exposure, 11.5% as primarily Spanish with some English exposure, and 19% as monolingual Spanish. Only one family (2%) could not characterize the language environment of their home in this manner because of multiple languages. Ninety-two percent of mothers and 96% of fathers of children in this study indicated that they were Caucasian.

Measures

Parents were requested to identify a preferred language for assessment. In all cases, including families with more than two languages in the home, parents reported that either English or Spanish was appropriate for assessment, and testers who were fluent, native speakers in the preferred language administered all measures. Infants were assessed in a child-friendly, carpeted laboratory room decorated with posters, a couch, a testing table, an intercom, and several chairs. Administration of the Early Social Communication Scales was taped through a one-way mirror using Super-VHS Panasonic video equipment and a microphone attached to the ceiling of the laboratory room.

Language Status and Maternal Education—Language Status and Maternal Education were assessed at the inception of this study, when infants were 9 months of age. Parents reported the languages to which their infants were exposed on a 6-point scale: 1 = *monolingual English*; 2 = *bilingual English and Spanish, with English more than 50% of the time*; 3 = *equivalent bilingual English and Spanish*; 4 = *bilingual Spanish and English, with Spanish more than 50% of the time*; 5 = *monolingual Spanish*; and 6 = *other language bilingual or other language majority*. Mothers reported their level of education attained on a 5-point scale: 1 = *high school not completed*; 2 = *high school diploma*; 3 = *some college*; 4 = *college degree*; and 5 = *some graduate school*.

Early Social Communication Scales (ESCS: Mundy et al., 2003)—Joint attention was assessed when infants were 12 months of age, using the ESCS. The ESCS is a 20-min structured interaction that codes children's tendency to initiate and respond to joint attention with a tester. For this assessment, experimenter 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 to the child, was placed to the right of the experimenter, but out of reach of the infant. Posters were placed on the walls 90° to the child's right and left, and 175° behind the child to the right and left (see Figure 1).

Infants were presented with a sequence of three active wind-up toys (three trials each), three hand-operated toys (three trials each), opportunities to play a turn-taking game with a ball and a car (two trials), opportunities to take turns playing with a hat, comb, and glasses (three trials), opportunities to play a tickle game (two trials), and opportunities to look at a book with the tester (one trial). In addition, the tester presented the child with two sets of four gaze-following trials. In these trials, the tester gained the child's attention by calling the child's name, and then the tester turned and visually fixated on a poster located in the room. While visually fixating on the poster, the tester pointed at the poster and said the child's name with increasing emphasis. Left, left-behind, right, and right-behind trials were presented (two trials each). Lastly, the tester also requested toys from the child throughout the assessment.

The ESCS yields scores for Initiates Joint Attention (IJA), High-level IJA (Hi-IJA), Responds to Joint Attention (RJA), Initiates Behavior Requests (IBR), and High-level IBR (Hi-IBR). IJA was coded as the frequency with which a child initiated the following behaviors: makes eye contact while manipulating toy, alternates eye contact between an active mechanical toy and the tester, points to an active mechanical toy or distal objects in the room, and shows objects (raises objects to the tester's face). Hi-IJA reflected only the frequency of use of conventional gestures (pointing and showing), which may provide a more valid index of intentional communication in infancy (Mundy & Gomes, 1998; Tomasello, 1995). RJA was coded as the percentage of gaze-following trials in which the child correctly turned their head and eyes in the direction of the tester's gaze and point. On side trials, the infant's gaze had to shift approximately 45° off midline. On behind trials, the infant's gaze had to shift more than 90° off midline. IBR was coded as the frequency with which a child initiated: eye contact after the

removal of a toy, reaching for a toy that was beyond their grasp, reaching while making eye contact, pointing to a toy that was out of reach, and giving an active toy or a toy sealed in jar to the tester to elicit aid in activating or obtaining the toy. Hi-IBR reflected only the use of conventional IBR gestures, pointing and giving.

ESCS raters were blind to the data collection and hypotheses of this study. Reliability for ESCS measures has been well established in previous studies (e.g., Mundy, Sigman, & Kasari, 1994; Mundy et al., 1995; Mundy & Gomes, 1998). In addition, the intraclass correlation coefficients among four independent coders for 10 sets of ESCS data from children in this study were: IJA = .95, Hi-IJA = .76, IBR = .95, Hi-IBR = .79, and RJA = .91. All the interrater reliability coefficients were significant ($p < .05$).

Temperamental sociability and Inhibitory Control data—At 15 months, child temperament was assessed with a version of the Toddler Behavior Assessment Questionnaire – Revised (TBAQ – R: personal communication, Rothbart, 1999) that was available at the inception of this study. The TBAQ – R was developed to extend the domains addressed in the TBAQ (Goldsmith, 1996). The short version of the TBAQ – R was used in this study; it contained 106 parent-rated items concerning the frequency of certain infant behaviors that occurred within 2 weeks previous to completion of the questionnaire. Frequency was measured on a 7-point scale with an eighth point for “Does Not Apply.” Calculation of the mean ratings on all items in a particular scale, excluding the “Does Not Apply” items, yielded the scaled scores. TBAQ – R Scales include Social Fearfulness, Inhibitory Control, Low Pleasure, and Soothability. The Social Fearfulness Scale includes questions such as, “When your child was approached by a stranger when you and s/he were out, how often did your child show distress or cry?” This scale has 19 items and an internal consistency α of .90 for this study. The Inhibitory Control Scale includes questions such as, “When told “no,” how often did your child stop the activity quickly?” The Inhibitory Control Scale has 21 items and an internal consistency α of .86 for this study. The Low Pleasure Scale includes questions such as, “When being gently rocked or hugged, how often did your child smile?” This scale has 10 items and an internal consistency α of .77 for this study. The Soothability Scale includes questions such as, “Following an exciting event, how often did your child calm down quickly?” This scale has 18 items and an internal consistency α of .83 for this study.

Cognitive and language data—Cognitive status was examined via the Bayley Scales of Infant Development-Second Edition (Bayley, 1993) MDI at 24 months. Items in this assessment include puzzles and language tasks. The MDI at 24 months has shown both good reliability ($\alpha = .92$) and a low standard error of the measurement (4.16 score units) (Bayley, 1993). Language ability was examined via the Reynell Developmental Language Scales (Reynell & Gruber, 1990) Verbal Comprehension and Expressive Language standard scores at 24 months. In this assessment, children are asked to point to items named by the examiner. At 24 months, the Reynell Developmental Language Scales have established reliability and validity as early language measures (Rescorla & Schwartz, 1990; Reynell & Gruber, 1990).

Social-emotional outcome data—Social-emotional outcome data at 30 months of age were examined via parents’ endorsements on the Infant-Toddler Social and Emotional Assessment questionnaire (ITSEA: Carter & Briggs-Gowan, 2000), which is appropriate for 12- through 36-month-old children. Two ITSEA Scales, Externalizing and Social Competence, were examined as the primary social outcome measures in this study. These scales were chosen because both research and theory suggest that infant joint attention may be associated with these dimensions of measures of social outcome in preschool children (Mundy & Sigman, 2006; Sheinkopf et al., 2004). The Externalizing domain has 24 items and comprises the Aggression/Defiance (12 items), Activity/Impulsivity (6 items), and Peer Aggression (6 items) scales. The Social Competence domain has 37 items and comprises the Compliance (8 items),

Empathy (7 items), Imitation/Pretend Play (6 items), Mastery Motivation (6 items), Sustained Attention (5 items), and Prosocial Peer Interactions (5 items) scales. Items on the ITSEA are scored on a 3-point scale: not true/rarely, somewhat true/sometimes, and very true/often. A fourth point is designated for items that do not apply or have not been observable because of opportunity (e.g., peer interactions may not have been observed by a parent). Mean scores are calculated (not including “does not apply” items), and then converted to *T* scores. *T* scores are derived separately for males and females, have a mean of 50 and a *SD* of 10, and are in reference to a healthy birth cohort of 1,000 children from New Haven, Connecticut. The Externalizing Scale has an internal consistency α of .87 and a test – retest correlation of .82, and the Social Competence Scale has an internal consistency α of .90 and a test – retest correlation of .90 (Carter & Briggs-Gowan, 2000). Additionally, internal consistency estimates derived for data in this study were: α s = .85 and .80 for the Externalizing and Social Competence Scales, respectively.

Results

The descriptive data for all variables examined in this study are presented in Table 1. Preliminary examination indicated that none of the variable distributions violated assumptions of normality, except for the Hi-IJA variable, which was significantly positively skewed. Skew may restrict the upper limit of parametric correlation and regression to below 1.0, but bivariate correlations are fairly robust with respect to skew, except under circumstances where variables are skewed in the opposite direction (Cohen, 1977, p. 60). Therefore, the natural (non-transformed) values of all variables, including Hi-IJA, were used in this study.

Zero-Order Correlation Analyses

All correlations reported are Pearson coefficients. Concurrent correlations among the 12-month ESCS scores revealed significant associations between IJA and Hi-IJA, $r(50) = .40, p < .01$, and IBR and RJA, $r(50) = .30, p < .03$. However, the association between Hi-IJA and Hi-IBR was $r(50) = .25 (p = .07, ns)$ and $r(50) = .03 (p = .84, ns)$ between IJA and RJA. Similar to previous research (Mundy & Gomes, 1998; Mundy et al., 2000), these results indicated that infant performance on the different ESCS measures of joint attention reflects some common, but largely unique, sources of variance. Therefore, the ESCS scores were treated as five separate independent variables for analyses in this study.

Data on the correlations between ESCS joint attention variables and temperament, cognition and language, and demographic factors are presented in Table 2. As would be expected from previous research and theory (Carpenter et al., 1998; Mundy & Gomes, 1998; Ulvund & Smith, 1996), the 12-month joint attention measures displayed a significant pattern of associations with 24-month language and cognitive measures. Hi-IJA was significantly related to the Bayley MDI and Reynell Expressive Language scores, and Hi-IBR and RJA were significantly related to the Reynell Comprehension scores. Alternatively, the data revealed few significant associations between the 12-month ESCS variables and 15-month TBAQ measures (2 of 20 possible correlations). Better 12-month RJA was associated with lower Inhibitory Control scores, and more frequent Hi-IBR was associated with lower Soothability scores. Relatively few associations with the demographic variables were apparent, as well (see Table 2). Only IBR and Hi-IBR were significantly related to gender, such that boys tended to score lower on these measures.

Finally, data on the correlations between all variables and the ITSEA social-behavioral outcome measures are presented in Table 3. Consistent with previous research on “at-risk” infants and the primary hypothesis of this study, the data revealed that higher 12-month IJA scores were significantly associated with lower parent report of Externalizing behavior at 30 months. In addition, higher Hi-IJA scores at 12 months were significantly associated with

higher Social Competence scores at 30 months. The association between RJA and Externalizing was not significant at the .05 level, but approached this level at $p < .08$. In addition, none of the cognitive or language variables were also related to outcome scores on the ITSEA at 30 months, but two of the demographic and TBAQ temperament variables were related to the 30-month ITSEA scores (see Table 3). Therefore, regression analyses were conducted to examine the degree to which infant measures of joint attention accounted for significant incremental variance in social outcomes after considering the variance associated with these temperament and demographic variables.

Regression Analyses

Regression equations were computed for each of the ITSEA outcome scales. The number of predictors in each equation was limited to four to exceed the 1:10 predictor variable-to-participants ratio recommended for regression analyses (Harris, 1985). The specific variables chosen for each regression were those that displayed significant or marginally significant ($p < .08$) zero-order correlations with one or both of the 30-month ITSEA outcome scores (see Table 3). Marginally significant variables were included in order to examine more fully the possible effects of multicollinearity among predictor variables. The order to examine the incremental validity of infant joint attention for the prediction of social and behavioral competence in this sample followed an a priori convention of: demographic variables on the first step, followed by 15-month temperament variables on the second step, with joint attention variables on the remaining steps.

Prediction of externalizing behavior (see Table 4)—Based on zero-order correlations, the following set of variables was considered in the prediction of 30-month ITSEA Externalizing scores: Step 1 = *Gender*; Step 2 = *15-month TBAQ Inhibitory Control*; Step 3 = *IJA*; and Step 4 = *RJA*. The regression equation was significant at Step 4, $F(4, 47) = 7.60$, $p < .001$, with $R^2 = .39$. Inhibitory Control ($\beta = -.45$, $p < .001$), IJA ($\beta = -.28$, $p < .03$), and RJA ($\beta = -.40$, $p < .003$) made significant, unique contributions to the prediction of ITSEA Externalizing scores in this equation. Gender did not make a significant contribution to the prediction of Externalizing behavior scores in this sample. Follow-up analyses indicated no significant interactions of IJA and RJA with gender or Inhibitory Control in the prediction of Externalizing scores.

Prediction of social competence (see Table 5)—Based on zero-order correlations, the following set of variables were considered in the prediction of 30-month ITSEA Social Competence: Step 1 = *Maternal Education*; Step 2 = *15-month TBAQ Inhibitory Control*; Step 3 = *15-month TBAQ Low Pleasure*; and Step 4 = *Hi-IJA*. The regression equation was significant at Step 4, $F(4, 47) = 6.03$, $p < .001$, with $R^2 = .34$. Inhibitory Control ($\beta = .35$, $p < .01$) and Hi-IJA ($\beta = .24$, $p < .05$) made significant, unique contributions to the prediction of ITSEA Social Competence scores. Maternal Education ($\beta = .23$, $p = .07$) and TBAQ Low Pleasure ($\beta = .22$, $p = .07$) did not make significant contributions at the .05 level to the prediction of ITSEA Social Competence scores. Follow-up analyses indicated no significant interactions of Hi-IJA with maternal education or the temperament measures in the prediction of Social Competence scores.

Imputation Data Set and Analyses (N = 76)

Although this study found significant predictors for social and behavioral outcomes, it is important to note that data from 24 participants in this study were lost due to attrition or missing information for the various assessments. Of even more concern was the fact that the attrition did not appear to be completely at random, in that children who were male and had lower RJA and Reynell Expressive Language scores were more likely to drop out than children who were female or had higher scores on these variables. Nonrandom attrition is a widespread problem

in longitudinal studies, and popular case-deletion methods disregard natural variability and information in the data set. Moreover, estimates of effects may be biased and unreliable if nonrandom effects were associated with factors that lead to missing data in the study (Schafer & Graham, 2002). Statistical imputation methods offer an attractive alternative to deleting cases with missing data (Enders, 2001), by increasing sample size, maintaining relatively constant estimates of the variability from the original data set, and minimizing any effect biases that might arise due to nonrandom selection of a “complete data” sample. Therefore, in this study the EM algorithm (Dempster, Laird, & Rubin, 1977; Schafer, 1997) in the Missing Value Analysis function in SPSS (2003) was used to estimate missing cognitive, language, temperament, and social-behavioral outcome data in this study, thereby increasing the total available longitudinal data by 24 participants. Imputed data estimates were based on information available from all variables in this study. However, because the primary hypotheses concerned joint attention, none of the ESCS data were imputed in this study.

The regression analyses for the prediction of the ITSEA social-behavioral outcomes were repeated based on the larger imputed dataset. The structure of these regressions was identical to the analyses reported above in the “complete data” set, except that the limit of four variables per equation was relaxed to allow the addition of variables where zero-order correlations of the imputed data set revealed an additional potential predictor. The larger imputation dataset ($N = 76$) revealed that, in addition to the variables identified in the analysis of complete data, 15-month TBAQ Social Fearfulness and 24-month Bayley MDI were marginally related to 30-month Externalizing behavior, respectively, $r(74) = -.20, p < .08$; $r(74) = -.20, p < .08$. Thus, MDI was entered at Step 2 and Social Fearfulness at Step 4. At Step 6, the regression equation was significant, $F(6, 69) = 6.06, p < .001$, with $R^2 = .35$, and $\Delta R^2 = .05, F(1, 69) = 5.57, p < .03$. Inhibitory Control ($\beta = -.42, p < .001$), Social Fearfulness ($\beta = -.23, p < .03$), IJA ($\beta = -.21, p < .05$), and RJA ($\beta = -.24, p < .03$) made significant, independent contributions to the prediction of ITSEA Externalizing scores in this equation. Gender and Bayley MDI did not make a significant or marginally significant contribution to the prediction of Externalizing behavior scores in this sample, after considering variance associated with other predictor variables in the equation.

In terms of Social Competence, the larger imputation dataset ($N = 76$) revealed that, in addition to the variables identified in the analysis of the complete data, Reynell Verbal Comprehension was significantly related to Social Competence, $r(74) = .28, p < .03$. Thus, Verbal Comprehension was added to the equation at Step 2. At Step 5, the regression equation was significant, $F(5, 70) = 8.32, p < .001$, with $R^2 = .37$, and $\Delta R^2 = .07, F(1, 70) = 7.47, p < .01$. Inhibitory Control ($\beta = .27, p < .01$), Low Pleasure ($\beta = .23, p < .03$), and Hi-IJA ($\beta = .27, p < .01$) made significant, independent contributions to the prediction of ITSEA Social Competence scores in this equation. Maternal Education was not a significant predictor at the .05 level of Social Competence scores ($\beta = .19, p = .07$). Reynell Verbal Comprehension did not make a significant or marginally significant contribution to the prediction of Social Competence scores in this sample, after considering variance associated with other predictor variables in the equation. Thus, the results of regression analyses from the imputation data set were consistent with those from the complete cases data set, suggesting that sample biases related to longitudinal attrition did not affect the primary results of this study. In addition, imputation methods were an informative addition to this study, in that temperament constructs that were marginally significant or nonsignificant predictors of outcome in the smaller sample became significant with the increased power of the larger, imputed data.

Discussion

The results of this study indicated that 12-month-old infants who used eye contact and pointing or showing gestures more frequently to share experiences with an unfamiliar tester (IJA), or

who more consistently followed the gaze and pointing of the tester (RJA), received parent reports of more optimal social and behavioral competence at 30 months of age. Specifically, infants with higher 12-month ESCS IJA and RJA scores obtained lower 30-month parent report scores on the ITSEA Externalizing behavior scale. Also, 12-month pointing or showing (Hi-IJA) was positively associated with parent reports of Social Competence. These observations are quite consistent with previous clinical research that has demonstrated significant predictive relations between infant IJA and RJA measures and social outcomes among 36-month-old children with in utero cocaine exposure (Sheinkopf et al., 2004), as well as observations that IJA predicted social development in children and adolescents with autism (Lord et al., 2003; Sigman & Ruskin, 1999). Thus, with the addition of the data in this report, there are now four longitudinal studies that indicate that there is a significant association between individual differences in early joint attention skills and subsequent childhood social outcomes in typical, as well as atypical, development.

These findings raise an important question. What factors contribute to differences in the development of joint attention in infants? Developmental theory often emphasizes the role of social cognition in the development of joint attention in infancy (Carpenter et al., 1998; Elia, Hoerl, McCormack, & Roessler, 2005). However, even though differences in social cognition among children have been observed (Watson et al., 1999), social cognitive theory rarely contains discussions of processes associated with individual differences. Thus, social cognitive theory does not yet provide an explicit account of the factors involved in the range of individual differences that 12-month-old infants exhibited on frequency measures of joint attention in this study. It is also the case that current social cognitive theory makes little distinction between different dimensions of joint attention (e.g., IJA, RJA, and IBR), which are all thought to reflect similar aspects of development (Carpenter et al., 1998; Elia et al., 2005). The results of this study, though, present a challenge to this view. Like the data from other studies (Mundy & Gomes, 1998; Mundy et al., 2000; Sheinkopf et al., 2004; Ulvund & Smith, 1996), this study indicated that different dimensions and measures of infant joint attention skills were correlated with different measures of cognitive and language outcome at 24 months, and that IJA and RJA were not correlated with each other.

One interpretation of this pattern of results is that no single factor alone may explain individual differences in infant joint attention development and their associations with developmental outcomes. Instead, the results of this study may best be considered within a multiprocess model of infant joint attention development (Mundy & Sigman, 2006). This model acknowledges the fundamental role of social cognition in joint attention development, but recognizes that, in order to understand individual differences in infant joint attention development, other processes may need to be considered, as well. Several hypotheses in this regard were briefly described in the introduction. In the following sections, these are reconsidered in light of the results of this study. Moreover, several aspects of the results of this study highlight not only what we know, but, just as importantly, what we still need to know with regard to the contribution of these processes to individual differences in joint attention development.

Processes Associated With Temperament: Executive Inhibitory Control and Prosocial Motivation

Executive inhibitory processes may play an important role in joint attention development and its connections to social outcome. Two neuropsychological studies have reported that differences in performance on ESCS IJA and RJA measures were related to infants' ability to inhibit and avoid perseverative errors on a spatial reversal task that involved finding a hidden object in changing locations (Griffith et al., 1999; McEvoy et al., 1993). In addition, IJA development has been associated with frontal brain activity, also suggesting that executive processes may play a role in joint attention development (Caplan et al., 1993; Henderson et

al., 2002; Mundy et al., 2000). The capacity to inhibit ongoing attention and goal-directed behavior may be necessary for infants to coordinate their attention with a social partner regarding some third object or event (e.g., Griffith et al., 1999; Mundy et al., 2000), and may also be involved in the regulation of behavior necessary for adaptive social development (Rothbart & Bates, 1998). Consistent with the latter possibility, parent reports of 15-month infant inhibitory control were related to their subsequent reports of 30-month social and behavioral outcome in this study. Regression analyses, however, indicated that 12-month joint attention measures were related to social-behavioral outcomes even after considering variance in 15-month inhibitory control. Thus, inhibitory control did not appear to account for the relations between joint attention and social-behavioral outcomes in this study. Nevertheless, just as measures of executive inhibition have made essential contributions to the study of childhood social-cognitive development (Sabbagh, 2006), the use of more precise and objective measures of inhibitory control may prove useful in subsequent studies on infant joint attention and social development.

A related hypothesis is that joint attention development involves the capacity of self-regulation through the goal-directed control and deployment of attention (Mundy, 2005; Mundy & Sigman, 2006). It may well be that infant joint attention measures involve self-regulation in social interaction through attentional control (Morales et al., 2005). Thus, it may be especially important to begin to explore how disengagement of attention (Landry & Bryson, 2004), as well as self-awareness or self-monitoring (Nichols et al., 2005), may be related to typical joint attention development. Furthermore, as attention disengagement deficits and joint attention deficits have both been observed in autism (Landry & Bryson, 2004; Mundy et al., 1994), understanding the role of the former in the development of the latter may be especially important to understanding impediments to the development of social competence in autism.

Prosocial motivation factors may have also played a role in the connections between joint attention and social outcomes. Theory on joint attention has long emphasized that the tendency of infants to initiate bids for joint attention may reflect a prosocial motivation to engage in intersubjectivity or social engagement with others (Hobson, 1993; Mundy, 1995; Trevarthen & Aitken, 2001). Indeed, as noted previously, contemporary theory on social-cognitive development has begun to argue that prosocial motivational factors are an integral part of the human tendency to share experience and intentions with others (Tomasello, Carpenter, Call, Behne, & Moll, 2005). If motivation factors contribute to differences in infant joint attention, it may also be that prosocial motivation may play a role in connections between joint attention and later social development (Mundy & Willoughby, 1996, 1998). This hypothesis may also help explain differences in relations between IJA and RJA with social outcome. IJA involves the self-initiation of behaviors, whereas RJA is a responsive measure. The self-initiation of behavior may be constrained by motivation factors to a greater extent than responsive behavior (Mundy, 2003; Mundy & Sigman, 2006). Hence, IJA measures may be more reflective of motivation factors in social interactions than RJA (Kasari et al., 1990; Mundy et al., 1992; Venezia et al., 2004).

Language and Cognition

Another possibility is that associations with cognitive and language development may explain the connections between infant joint attention and social developmental outcomes. Indeed, all but one of the 12-month ESCS joint attention variables in this study displayed significant or marginally significant correlations with one or more of the 24-month measures of cognitive and language outcomes, similar to previous findings with low-birth weight infants (Smith & Ulvund, 2003; Ulvund & Smith, 1996). These findings likely reflect the role that joint attention plays in self-organizing social information processing and optimizing social learning in infancy (Baldwin, 1995; Mundy & Sigman, 2006). Nevertheless, similar to previous research (e.g.,

Sheinkopf et al., 2004; Sigman & Ruskin, 1999), there was little evidence that performance on standardized measures of early cognitive or language development could explain the associations between 12-month joint attention and 30-month social and behavioral outcomes in this study, similar to the findings of previous research (Rescorla & Achenbach, 2002). It may be that variance in cognition and language only plays a role in individual differences in atypical and older children (e.g., Beitchman et al., 1990), or standardized measures do not provide sufficiently precise measures of the types of cognitive and language skills involved in variability in early social development. The latter possibility suggests the need for additional research on this issue.

Social Environment and Demographic Factors

Lastly, differences in the home social environment (Wachs & Chan, 1986), caregiver responsiveness (Goldsmith & Rogoff, 1997), attachment (Claussen, Mundy, Mallik, & Willoughby, 2002; D'Etemont & Hartung, 2003), cultural background (Chavajay & Rogoff, 1999), or demographic characteristics of the infants in this study may affect infant joint attention, social outcomes, and the connections between measures of these two domains. First, gender effects were notable in this study, in that boys displayed fewer Hi-IBR and IBR bids, and, also, received marginally higher parent-report scores for externalizing behavior at 30 months. Previous research has also observed similar gender relations in research with the ITSEA (Carter, Briggs-Gowan, Jones, & Little, 2003), and with the use of eye contact and referencing among infants (Lutchmaya, Baron-Cohen, & Raggatt, 2002; Rosen, Adamson, & Bakeman, 1992). However, previous studies have not revealed gender differences on joint attention or behavior regulation (e.g., Mundy & Gomes, 1998; Mundy et al., 2003), suggesting that the types of gender differences observed in this study may not be robust. In addition, mothers' education levels marginally contributed to the prediction of social competence, a finding that has been previously reported in a different sample (National Institute of Child Health and Human Development Early Child Care Research Network, 2003). However, there was little evidence that factors associated with gender, maternal education, or language exposure/ethnic background played a substantial role in the predictive associations observed between 12-month joint attention and 30-month social outcomes in this study.

Limitations

We have already touched on some of the limitations of this study. One of these is that it may be important to move beyond standardized measures to understand whether aspects of cognition and language contribute to relations between joint attention and social outcomes. Also, although the present sample of size of 52 children was substantially larger than the samples used in many previous longitudinal studies of joint attention development, it was still too small to bring to bear more precise quantitative techniques (e.g., structural equation modeling) that will likely be needed to fully test models of the processes involved in joint attention development and its relations to childhood outcomes. Furthermore, like many previous studies, well-educated higher SES families were overrepresented in this study's sample. We made a small advance in this regard with the inclusion of bilingual and Spanish-speaking families. However, much more needs to be done to understand the nature of joint attention in diverse samples of children that represent a broader range of racial, ethnic, and cultural backgrounds. Finally, it will be important to go beyond the early preschool period in studies of this kind to examine outcomes in older children and to use multiple convergent measures of social outcome, rather than just parent report. Longer-term longitudinal studies with convergent measurements would increase the reliability and validity of measures of differences in social outcomes of children. Such studies would also enable the inclusion of the types of reliable measures of social cognition, motivation, self-regulation, and executive functions that will be necessary to obtain more precise data on the factors involved in the connection between infant joint attention and child development.

Summary

Underwood (1975) noted that understanding and explaining individual differences was essential to theory development in psychology. The results of this study suggest that infants display a range of individual differences in the development of joint attention skills, and that these differences are associated with variability in preschool social competence, as well as cognitive and language outcomes. Specifically, lower levels of externalizing behaviors at 30 months were uniquely predicted by higher levels of 12-month initiating and responding to joint attention and 15-month inhibitory control. Imputation analyses utilizing data from additional participants confirmed this pattern, and added the observation that lower levels of externalizing were also predicted by higher levels of social fearfulness at 15 months, in addition to the predictors identified above. Observations also indicated that social competence at 30 months was positively, uniquely predicted by 12-month pointing and showing joint attention behavior and by 15-month inhibitory control. Again, imputation analyses confirmed this pattern, while also finding that 15-month ratings of low levels of pleasure also predicted 30-month social competence, in addition to the predictors identified above. These findings were above and beyond any effects of cognition and language, even though pointing and showing joint attention behavior and responding to joint attention were correlated with cognitive and language indices. Thus, a vital challenge for developmental science is to better understand the nature of the processes that give rise to individual differences in the development of different dimensions of infant joint attention, in order to clarify their relations to social, as well as cognitive and language, outcomes in childhood. To meet this challenge, though, it is likely that investigators will need to complement the current focus on the epistemological elements of joint attention development (e.g., social cognition) with research on the executive, motivation, and caregiving factors that also likely play a substantial role in the acquisition of joint attention skills in infancy.

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Figure 1. Illustrations of (a) Responding to Joint Attention; (b) High-level Initiating Joint Attention (Hi-IJA), “pointing”; (c1, c2, c3) IJA, “alternating gaze”; and (d) High-level Initiating Behavior Regulation, “pointing” from the Early Social Communication Scales (Mundy et al., 2003; Seibert et al., 1982).

Table 1
Descriptive Statistics

Variable	<i>M</i>	<i>SD</i>
12-month ESCS measures		
IJA	18.90	10.25
Hi-IJA	2.58	3.62
RJA	51.64	26.87
IBR	26.13	12.35
Hi-IBR	12.15	9.6
15-month TBAQ temperament measures		
Inhibitory Control	3.83	0.80
Soothability	5.71	0.47
Social Fearfulness	3.71	0.84
Low Pleasure	5.78	0.66
24-month cognitive/language measures		
Bayley Mental Developmental Index	96.92	12.95
Reynell Verbal Comprehension	84.42	17.96
Reynell Expressive Language	92.15	17.78
Demographic measures		
Gender	1.35	0.48
Maternal Education	4.13	0.97
Language Status	2.60	1.84
30-month ITSEA social/behavioral outcome measures		
Externalizing	49.56	9.62
Social Competence	50.13	8.21

Note. $N = 52$. ESCS = Early Social Communication Scales. IJA = Initiating Joint Attention; Hi-IJA = Hi-level Initiating Joint Attention; RJA = Responding to Joint Attention; IBR = Initiating Behavior Requests; Hi-IBR = Hi-level Initiating Behavior Requests. TBAQ = Toddler Behavior Assessment Questionnaire. Gender: 1 = *female*, 2 = *male*. Maternal Education: 1 = *high school not completed*; 2 = *high school diploma*; 3 = *some college*; 4 = *college degree*; 5 = *some graduate school*. Language Status: 1 = *monolingual English*; 2 = *bilingual English and Spanish, with English more than 50%*; 3 = *equivalent bilingual English and Spanish*; 4 = *bilingual Spanish and English, with Spanish more than 50%*; 5 = *monolingual Spanish*; 6 = *other language bilingual or other language majority*. IT-SEA = Infant Toddler Social Emotional Assessment.

Table 2

Pearson Correlations of 15-Month Temperament, 24-Month Cognitive/Language, and Demographic Variables with 12-Month ESCS Variables ($N = 52$)

Variable	IJA	Hi-IJA	RJA	IBR	Hi-IBR
15-month TBAQ temperament measures					
Inhibitory Control	.01	.04	-.33*	-.23	-.19
Soothability	.12	.15	-.10	-.10	-.35**
Social Fearfulness	.23	.15	.19	-.04	.01
Low Pleasure	.01	-.05	-.03	.14	.01
24-month cognitive/language measures					
Bayley MDI	.23	.40**	-.01	.15	.21
Reynell Comprehension	.12	.18	.27*	.21	.36**
Reynell Expressive Language	.25 [^]	.36**	-.10	.06	.02
Demographic measures					
Gender	-.05	-.20	.00	-.29*	-.37**
Maternal Education	-.01	.22	-.03	.12	.18
Language Status	-.21	-.22	-.19	-.10	.02

Note. ESCS = Early Social Communication Scales. TBAQ = Toddler Behavior Assessment Questionnaire. ITSEA = Infant Toddler Social Emotional Assessment. IJA = Initiating Joint Attention; Hi-IJA = Hi-level Initiating Joint Attention; RJA = Responding to Joint Attention; IBR = Initiating Behavior Requests; Hi-IBR = Hi-level Initiating Behavior Requests. MDI = Mental Developmental Index.

[^]
 $p < .08$,

*
 $p < .05$,

**
 $p < .01$.

Table 3
 Pearson Correlations of 12-Month ESCS, 15-Month Temperament, 24-Month Cognitive/Language Scores, and Demographic Variables with 30-Month ITSEA Scores ($N = 52$)

12-, 15-, and 24-month variables	30-month ITSEA variables	
	Externalizing Social Competence	
	12-month ESCS measures	
IJA	−.31 [*]	.14
Hi-IJA	−.18	.30 [*]
RJA	−.26 [^]	−.11
IBR	.15	.07
Hi-IBR	.03	.11
	15-month TBAQ temperament measures	
Inhibitory Control	−.34 ^{**}	.40 ^{**}
Soothability	−.10	.04
Social Fearfulness	−.18	.05
Low Pleasure	.07	.25 [^]
	24-month cognitive/language measures	
Bayley MDI	−.23	.18
Reynell Comprehension	−.17	.23
Reynell Expressive Language	.01	.13
	Demographic measures	
Gender	.25 [^]	−.22
Maternal Education	−.16	.32 [*]
Language Status	−.05	−.11

Note. ESCS = Early Social Communication Scales. IJA = Initiating Joint Attention; Hi-IJA = High-level Initiating Joint Attention; RJA = Responding to Joint Attention; IBR = Initiating Behavior Requests; Hi-IBR = Hi-level Initiating Behavior Requests. IT-SEA = Infant Toddler Social Emotional Assessment; MDI = Mental Developmental Index.

[^]
 $p < .08$,

^{*}
 $p < .05$,

^{**}
 $p < .01$.

Table 4Summary of Hierarchical Regression Analysis for Variables Predicting 30-Month Externalizing ($N = 52$)

Variable	<i>B</i>	<i>SE B</i>	β
Step 1			
Gender	4.93	2.74	.25 [^]
Step 2			
Gender	4.30	2.63	.22
Inhibitory Control	-3.86	1.58	-.32 ^{**}
Step 3			
Gender	4.01	2.52	.20
Inhibitory Control	-3.86	1.51	-.32 ^{**}
IJA	-0.28	0.12	-.29 [*]
Step 4			
Gender	3.78	2.23	.19
Inhibitory Control	-5.44	1.45	-.45 ^{**}
IJA	-0.27	0.11	-.28 [*]
RJA	-0.14	0.04	-.40 ^{**}

Note. IJA = Initiating Joint Attention; RJA = Responding to Joint Attention at 12 months.

For Step 1: $R^2 = .06$, $\Delta R^2 = .06$, $F(1, 50) = 3.22$ ($p = .08$). For Step 2: $R^2 = .16$, $\Delta R^2 = .10$, $F(1, 49) = 5.98$ ($p < .03$). For Step 3: $R^2 = .25$, $\Delta R^2 = .09$, $F(1, 48) = 5.52$ ($p < .03$). For Step 4: $R^2 = .39$, $\Delta R^2 = .14$, $F(1, 47) = 11.12$ ($p < .003$).

[^]
 $p < .08$,

^{*}
 $p < .05$,

^{**}
 $p < .01$.

Table 5Summary of Hierarchical Regression Analysis for Variables Predicting 30-Month Social Competence ($N = 52$)

Variable	<i>B</i>	<i>SE B</i>	β
Step 1			
Maternal Education	2.67	1.14	.32 [*]
Step 2			
Maternal Education	2.35	1.06	.28 [*]
Inhibitory Control	3.86	1.29	.38 ^{**}
Step 3			
Maternal Education	2.38	1.04	.28 [*]
Inhibitory Control	3.62	1.27	.35 ^{**}
Low Pleasure	2.61	1.53	.21
Step 4			
Maternal Education	1.94	1.03	.23 [^]
Inhibitory Control	3.55	1.23	.35 ^{**}
Low Pleasure	2.77	1.49	.22 [^]
Hi-IJA	0.55	0.28	.24 [*]

Note. Hi-IJA = Hi-level Initiating Joint Attention at 12-months.

For Step 1: $R^2 = .10$, $\Delta R^2 = .10$, $F(1, 50) = 5.51$ ($p < .03$). For Step 2: $R^2 = .24$, $\Delta R^2 = .14$, $F(1, 49) = 9.01$ ($p < .005$). For Step 3: $R^2 = .28$, $\Delta R^2 = .04$, $F(1, 48) = 2.90$ ($p = .09$). For Step 4: $R^2 = .34$, $\Delta R^2 = .06$, $F(1, 47) = 4.04$ ($p < .05$).

[^]
 $p < .08$,

^{*}
 $p < .05$,

^{**}
 $p < .01$.