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Individual Differences in Infants' Joint Attention Behaviors With Mother and a New Social Partner

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Relations between infant–mother attachment security at 15 months and infants' ($N = 206$) joint attention behaviors (a) with an experimenter at 8 and 15 months, and (b) with their mothers at 15 months were investigated. No concurrent or longitudinal relations were observed between attachment security and infants' tendency to respond to an experimenter's bids for joint attention. Higher levels of initiating joint attention with an experimenter at 15 months were associated with insecure-avoidant attachment. Insecure-avoidant attachment was also associated with lower scores for initiating high-level joint attention behaviors (pointing, showing, and giving) with the mother at age 15 months. The fact that security-related differences in initiating joint attention with an experimenter were observed only once the attachment relationship was consolidated suggests that (a) attachment security may

influence infants' active engagement with new social partners, and (b) insecure-avoidant infants may compensate for reduced social contact with the caregiver by initiating more interaction with other social partners.

Infants' ability to coordinate attention with a social partner undergoes rapid development during the last quarter of the first year of life. During this "revolution" (Tomasello, Kruger, & Ratner, 1993) in development, infants begin to interpret a person's behavior as goal-directed (Woodward, 2003), become capable of evaluating the rationality of behavior directed at achieving a goal (Gergely, Nádasdy, Csibra, & Bíró, 1995), and can even use a person's emotional expression as a cue for determining which object will be targeted (Phillips, Wellman, & Spelke, 2002). Joint attention abilities have been implicated as precursors of language development (e.g., Carpenter, Nagell, & Tomasello, 1998; Delgado et al., 2002; Morales, Mundy, & Rojas, 1998) and theory of mind (Baron-Cohen, 1995; Tomasello et al., 1993), with problems in establishing joint attention being associated with developmental risk for autism (Dawson, Carver, Meltzoff, Panagiotides, & McPartland, 2002). Despite the growing understanding of early attention abilities and their potential role in subsequent development, there has been little research to date into individual differences in the development of these capacities within typically developing populations.

Joint attention skills are typically characterized in terms of infants' (a) ability to respond to another person's vocal cue, or to follow their gaze or pointing gesture; (b) tendency to initiate attention purely for the purpose of social sharing by looking at a social partner, or pointing, showing, or giving objects; (c) ability to respond to behavioral requests (e.g., a "give it to me" gesture); and (d) tendency to initiate joint attention in order to elicit help to achieve a goal. These abilities have been studied using the Early Social Communication Scales (ESCS; Mundy, Hogan, & Doehring, 1996; Seibert, Hogan, & Mundy, 1982), a structured paradigm assessing infants' ability to coordinate attention with an experimenter. Mundy et al. (2007) reported on longitudinal change in joint attention abilities in the ESCS. Infants' abilities to respond to bids for object-based joint attention or behavioral requests and their tendency to initiate joint attention to elicit help in achieving a goal all showed steep increases between 9 and 12 months, before leveling off between 12 and 18 months. By contrast, infants' initiations of joint attention for the purpose of social sharing were static between 9 and 12 months, with a marginally significant decrease between 12 and 15 months, before a marginally significant recovery between 15 and 18 months. The 9- and 18-month levels of this type of initiation of joint attention were virtually identical.

Research has not yet addressed potential reasons for the developmental divergence in these different aspects of joint attention. In this study, we

investigated whether differences in infant–mother attachment security may help to explain the unique developmental trajectory of initiation of joint attention for social sharing. Attachment security is typically assessed using the strange situation procedure (Ainsworth, Blehar, Waters, & Wall, 1978), in which infants are exposed to social contact with a female experimenter and then undergo two short separations from the caregiver. These experiences activate the attachment system, enabling one to observe the infant's attachment behaviors. On the basis of their response when reunited with the caregiver, infants are placed into one of four categories: secure, insecure-avoidant, insecure-resistant (the three original organized attachment strategies identified by Ainsworth et al., 1978), and insecure-disorganized (Main & Solomon, 1986, 1990). Securely attached infants react positively to the mother on reunion and return to using her as a secure base for exploring the environment once any separation distress has been overcome. Insecure-avoidant infants appear indifferent toward the mother on reunion, showing little tendency to approach or interact, and may actively avoid the mother if she attempts to initiate contact or interaction. By contrast, insecure-resistant infants are overly focused on the mother, but contact is ineffective in assuaging distress. Insecure-disorganized attachment involves a diverse range of reunion behaviors that appear odd, contradictory, overtly conflicted, or fearful, and are likely to impede interaction with the mother due to a lack of coherence in the infant's response to attachment distress.

Claussen, Mundy, Mallik, and Willoughby (2002) conducted the only previous study to investigate whether attachment security relates to infants' joint attention abilities during the ESCS. Claussen et al. assessed joint attention abilities at 12 and 18 months, and attachment security was assessed in the strange situation at 15 months. No security-related differences were found in infants' responses to the experimenter's bids for joint attention. By contrast, Claussen et al. reported that insecure-disorganized attachment was related to subsequent (but not previous) difficulties in initiating joint attention.

However, it is difficult to draw clear conclusions from this study. Their small sample size and unusual attachment distribution meant that Claussen et al. (2002) were able to compare joint attention only between the disorganized versus pooled organized (secure, avoidant, and resistant) categories. Only five infants (9%) in their sample were secure, whereas 50% were disorganized, in comparison with standard rates of 62% secure and 15% disorganized (Van IJzendoorn, Schuengel, & Bakermans-Kranenburg, 1999). Thus, these analyses cannot tell us whether securely attached infants score more highly than their insecure counterparts, or whether the three insecure groups differ from one another. Moreover, Claussen et al.'s sample consisted of infants from very low socioeconomic status (SES) backgrounds who had

been prenatally exposed to cocaine. As these authors acknowledged, without suitable control groups for comparison, it is impossible to know whether the observed relation between disorganized attachment and poor initiation of joint attention is merely artifactual.

Data from studies relating early attachment to children's later engagement with social partners are also useful in helping shed light on potential relations between attachment and joint attention. A seminal study by Sroufe, Fox, and Pancake (1983) reported that children who had been classified as insecure-avoidant in infancy were more likely than their secure and insecure-resistant peers to seek help from their teachers in relation to social interactions during large-group activities when they began school. More recently, Corriveau et al. (2009) reported that 5-year-olds classified as insecure-avoidant as infants tended to turn their attention to new social partners when seeking information about the object world (e.g., providing a label for an unknown object), relying more on information provided by an experimenter than by the mother. This preference for information provided by the experimenter rather than the mother was specific to insecure-avoidant children, and was not seen in children in any of the other three attachment groups. Taken together, these findings support Bowlby's (1969/1982) argument that the need for contact is biologically inbuilt, and Sroufe et al.'s conclusion that "when a later opportunity arises for contact with a nurturant adult . . . [insecure-avoidant] children show their underlying dependency needs" (p. 1625).

These findings suggest that focusing on the insecure-avoidant group in addition to disorganized attachment may be fruitful in understanding how attachment and joint attention are related. In conjunction with Claussen et al.'s (2002) findings, they also suggest that attachment-related differences are likely to be most obvious when infants are actively initiating joint attention rather than responding to another's bid for joint attention. There are two main questions to be addressed in exploring the potential link between attachment security and infants' joint attention abilities. First, are the individual differences in infant-caregiver engagement that are observed when the attachment system is activated during the strange situation also seen when there is no attachment stress? For example, is insecure-avoidant infants' tendency to avoid contact with the caregiver during periods of attachment stress typical of their interactions with the caregiver in general? The key markers of avoidance described by Ainsworth et al. (1978) in their coding criteria include "turning the head away; averting the gaze; avoidance of meeting the person's eyes; hiding the face; or simply ignoring the person" (p. 353). If such behaviors are typical of insecure-avoidant infants' general mode of interaction with their caregivers, one would predict that avoidant attachment will be associated with lower levels of joint attention with

the caregiver across situations, regardless of whether or not the infant is experiencing attachment stress. The fact that avoidant attachment has been found to be associated with caregiver rejection (Ainsworth et al., 1978) is further grounds for predicting that infants with insecure-avoidant attachments may develop a generalized tendency to refrain from initiating social interaction with caregivers: Such a strategy will minimize the chances of further rejection.

The second question concerns whether infants' attachment security relates only to their engagement with the caregiver, or also determines how they interact with people other than the caregiver. Attachment theory suggests that the latter alternative is more likely. For example, Bowlby (1969/1982, 1973, 1980) argued that the child's early experiences with attachment figures influence how they approach new social encounters. This assumes that the attachment relationship plays a causal role in determining the nature of subsequent social interactions, leading one to predict that security-related differences in joint attention with a new social partner will only be observed once the attachment relationship is consolidated. However, the proposal that the attachment relationship determines future social interaction does not lead to the conclusion that the type of social engagement observed with the caregiver will precisely match that seen in new social encounters. Given the findings of Sroufe et al. (1983) and Corriveau et al. (2009), it seems reasonable to assume that avoidance toward the caregiver when the attachment system is activated does not entail that insecure-avoidant children will avoid contact with adults in general. Indeed, it might be the case that these infants compensate for their avoidance of the primary caregiver by initiating more social contact with other adults.

The Present Study

Our longitudinal design enabled us to investigate whether differences in joint attention with a new social partner predicted subsequent infant–mother attachment security, or whether attachment-related differences in joint attention were only evident once the attachment relationship was established. This study also explored whether attachment security related to infants' concurrent initiations of attention for social sharing with the mother when the attachment system was not activated. As well as investigating how attachment security related to infants' joint attention behaviors with the mother or an experimenter in separate dyadic observations, the study reported here investigated security-related differences in infants' tendency to initiate joint attention with the mother versus an experimenter when both were present and equally available for interaction. We assessed infants' use of low-level (e.g., gaze checking) and more overt (pointing, showing, and giving) behaviors to initiate joint attention with mother versus experimenter

to explore whether attachment security relates not only to infants' overall tendency to initiate joint attention but also to the precise types of behavior used to gain engagement with the social partner.

We predicted that any security-related differences in infants' joint attention abilities would be seen only once the attachment relationship had been consolidated. We investigated whether attachment security related to infants' joint attention behaviors when interacting with an experimenter, to establish how an infant's pattern of attachment with the mother relates to their mode of engagement with a new social partner. If insecure-avoidant infants compensate for avoiding contact with the mother by engaging in more social contact with other individuals, one would predict that (a) avoidant infants will score more highly compared with infants in the other attachment groups for initiating joint attention with a new social partner, and (b) avoidant infants will initiate more joint attention with a new social partner than with the mother. We also investigated whether attachment security related to infants' concurrent initiation of joint attention with the mother for the purpose of social sharing under conditions of low attachment stress. If insecure-avoidant infants' tendency to avoid the mother when the attachment system is activated is typical of their more general engagement with the mother, one would predict that, compared with their peers in the secure, insecure-resistant, and insecure-disorganized groups, insecure-avoidant infants would initiate less joint attention with the mother in low-stress conditions. Finally, we explored whether there is concordance across different observational contexts in infants' initiation of joint attention with a new social partner.

METHOD

Participants

Participants were 206 (108 girls) mother–infant dyads from north-east England, recruited through baby clinics, health visitors, and playgroups. The vast majority of mothers ($n = 203$) were White, and English was the main language spoken in all families. Maternal age was $M = 28.08$ years, $SD = 5.48$, range = 16–41. Participants' SES scores (Hollingshead, 1975) ranged from 11 to 66. Around half of the sample ($n = 90$) fell into the lowest two categories (unskilled/menial and semiskilled/manual). At Phase 1, infants were 8 months old ($M = 8.52$, $SD = 0.48$, range = 7.0–10.2); at Phase 2 infants were age 15 months ($M = 15.50$, $SD = 0.60$, range = 13.7–17.3). Three infants were diagnosed with significant health problems (Turner's syndrome,

ectodermal dysplasia, and profound hearing loss) during the course of the study. These three infants were excluded from the analyses, although including them was found to make no difference to the pattern of results.

Overview of Testing Procedure

Infants' attention abilities with an experimenter were assessed at Phases 1 and 2 in the ESCS. Initiation of joint attention for the purpose of social sharing with the mother was assessed at Phase 2 from the preseparation episode of the strange situation procedure. Infants' tendency to initiate joint attention with an experimenter versus the mother when both were present was also assessed from the strange situation at Phase 2 (see below).

We chose to observe infants' initiations of joint attention with the mother in the more naturalistic context of the strange situation for a number of reasons. First, requiring caregivers to take the place of the experimenter in a structured paradigm, such as the ESCS, is problematic due to the fact that caregivers are likely to vary in their ability to comply with the demands of the procedure, causing problems in the validity and reliability of the data. Training mothers to elicit joint attention with their infants in specific ways during a structured paradigm also presents problems due to the possibility that training might influence their behavior with their infants in other contexts. Second, we sought to assess how infants and mothers engage in joint attention during commonplace activities that are representative of the infant's everyday experience. Third, research comparing joint attention with mother versus an experimenter typically employs naturalistic observations for infant–mother interaction and structured paradigms for infant–experimenter interaction (e.g., Brune & Woodward, 2007; Vaughan et al., 2003). Finally, the fact that infants' joint attention behaviors with an experimenter were additionally assessed in the strange situation procedure at Phase 2 enabled us to compare how infants engaged with different social partners in the same social context. This also meant that joint attention with the experimenter was not always assessed in a different observational context to the assessment of joint attention with the mother.

Infants' Attention Abilities in the ESCS

The infant sat on the mother's lap at a table directly opposite the female experimenter. Mothers were asked to sit very still, and to look down or close their eyes to avoid affecting infants' responses. The total procedure lasted between 5 and 10 min. The session was video-taped using a split-screen format with one view showing the infant, experimenter, and testing table,

whereas the other showed a close-up view of the infant's face. The former provided a side-on view of the testing arena; the latter showed a front-on view of the infant's face.

Response to joint attention. Response to joint attention (RJA) trials were always administered first, in the following order: four gaze-following trials (based on Butterworth & Cochran, 1980), in which the experimenter first obtained eye contact with the child, then turned her head toward a target on the wall (two left, two right) without any pointing gesture; eight trials in which the experimenter made eye contact followed by a proximal point to an object on the testing table (two left, two right), or a distal point to an object suspended from the ceiling 40 cm from the infant (two left, two right). A successful response was scored if the infant oriented both head and eyes toward the target object during the 6 sec for which the experimenter maintained the head-turn or pointing gesture. Scores were the percentage of trials on which infants responded successfully.

Initiates joint attention. Following immediately after the RJA trials, infants' initiations of joint attention were assessed during a separate 1-min session in which the infant played with a rattle. The experimenter did not actively initiate any social interaction during the time when initiating behaviors were recorded, and looked in an unfocused manner slightly to the side of the child. If the infant initiated a look to the experimenter's face, the experimenter made eye contact and then looked away again to give the infant further opportunities for initiating joint attention. The experimenter's expression was emotionally neutral throughout the task. Initiates joint attention (IJA) was defined, in accordance with the ESCS manual, as any one of the following behaviors: (a) spontaneous pointing or showing, or (b) initiating eye contact with the experimenter while manipulating or touching the toy. Spontaneous gaze checking toward the experimenter while the infant was not manipulating the toy was not included in this scoring. Infants received a frequency score for the total number of initiations produced.

All sessions were coded from the video-taped sessions by a trained coder, unaware of all other measures and the study's hypotheses, and a randomly selected 25% of sessions was coded for each category of joint attention by a second trained coder also unaware of all other measures and hypotheses. Interrater reliability was calculated using intraclass correlations. Reliabilities for 8-month measures were: RJA = .74, IJA = .96; and for 15-month measures, RJA = .86, IJA = .93.

Attachment Security

Infant–mother attachment security was assessed at 15 months using the strange situation procedure (Ainsworth et al., 1978). This procedure was conducted in a separate room at the end of the testing session when all other assessments had been completed. Attachment security was assessed by a trained, reliable coder who was unaware of all other measures, and a randomly selected 25% of the strange situations was coded by a second reliable coder who was also unaware of all other data; interrater agreement across the four attachment categories was $\kappa = .82$.

Infants' Joint Attention With Mother During the Strange Situation

We obtained joint attention data from the first 3 min of the strange situation procedure. In this first episode, the mother and infant are alone in a room with a range of age-appropriate toys, and the attachment system has not yet been activated. The strange situation provides an ideal context for assessing infants' initiations of joint attention because the mother is instructed to sit and read a magazine, and refrain from taking the initiative in engaging the infant. The coding scheme thus focused exclusively on infants' initiations of joint attention for the purpose of social sharing, and did not assess infants' responses to the mother's bids for joint attention.

Infants received a frequency score for the number of initiations of joint attention with the mother. The coding scheme was modeled on the ESCS criteria for initiations of joint attention for the purpose of social sharing. In order to be coded as an initiation, behaviors must not follow any action, noise, or vocalization (including involuntary behaviors such as sneezing or coughing) by the mother in the preceding 1.5 sec. There were five ways in which infants could initiate joint attention: (a) single gaze check with object—infant looks once toward the eye region of the mother's face while holding/manipulating an object or in response to an object making a noise or behaving in a surprising or interesting manner (e.g., a ring rolling round the floor). Note that this category did not include gaze checks when infants were leaning against or standing with their hand on a table, chair, or sofa; (b) alternate gaze check—infant alternates looks between the eye region of the mother's face and an object; (c) point—infant points to an object; (d) show—infant holds out an object to mother or raises an object to the mother's face without the mother taking the object from the child; and (e) give—infant places an object in the mother's lap or offers an object to the mother until she takes it. These behaviors were combined to form two categories: low-level initiations of joint attention (single gaze check with

object + alternate gaze check) and high-level initiations of joint attention (point + show + give).

Joint Attention With Mother Versus Experimenter in the Strange Situation

Infants' tendency to initiate joint attention with the mother versus an experimenter when both were present and equally available for interaction was assessed from the second episode of the strange situation procedure. After the first 3-min episode of the strange situation, a female experimenter enters the room and sits quietly reading a magazine on the other side of the room to the mother for 1 min. (Note that the experimenter begins talking to the mother and attempts to engage the infant in play after this point.) The fourth minute of the strange situation (which is the first minute when both mother and stranger are present) thus enables one to compare how the infant initiates joint attention with the mother versus a new social partner when neither is seeking the infant's attention. The experimenter in the strange situation was not the same person who was involved in the ESCS at this phase.

For the fourth minute of the strange situation, infants received separate frequency scores for their initiations of joint attention with the mother and the experimenter. The coding criteria were identical to those described above for initiation of joint attention with the mother during the first 3 min of the strange situation. (Note that looks prompted by the experimenter entering the room and walking to sit on her chair were not classified as initiations.)

Coding. Initiations of joint attention with both mother and experimenter were coded by a researcher who was unaware of all other data, with a randomly selected 20% of sessions being coded by a second researcher who was unaware of other data. Note that neither of these researchers was involved with coding either the 8-month or the 15-month ESCS. Interrater reliability was calculated using intraclass correlations. For initiations with mother in the first 3 min: single gaze check with object = .97, alternate gaze check = 1.00, point = 1.00, show = .92, give = .97. For initiations with mother in the fourth minute: single gaze check with object = .95, point = 1.00, show = .95, give = .96. For initiations with experimenter in the fourth minute: single gaze check with object = .95, point = 1.00, show = .96, give = 1.00. (Note that no alternate gaze checks were observed with either social partner during the fourth minute.)

Cognitive and Language Development

Given that previous research has identified links between linguistic and cognitive development and (a) infants' attention abilities (e.g., Delgado et al., 2002; Morales et al., 2000; Mundy et al., 2007), and (b) infant–mother attachment security (e.g., Bretherton, Bates, Benigni, Camaioni, & Volterra, 1979; Meins, 1998), it was important to control for these variables. Infants' general cognitive development was assessed at Phase 1 using the Bayley Mental Development Index (Bayley, 1993). At Phase 2, infants completed the Preschool Language Scale (PLS; Lewis & Boucher, 1997), and an additional parental report measure of infant language (MacArthur Communication Index; MCI; Fenson et al., 1993) was obtained. Children received a standardized total score that indexed both receptive and productive language for the PLS, and a mean percentile score for language production and comprehension for the MCI.

RESULTS

Preliminary Analyses

Some infants became upset or overly distracted during the ESCS which led to them failing to complete certain blocks of trials. At Phase 1, all attention data were missing for two infants, RJA data were missing for one infant, and IJA data were missing for three infants. At Phase 2, all attention data were missing for one infant, two infants had missing RJA data, and three infants had missing IJA data. The attachment security of two infants could not be classified because the strange situation procedure was terminated owing to undue distress. The attachment distribution of the 201 infants was as follows: 36 (18%) insecure-avoidant, 136 (68%) secure, 11 (5%) insecure-resistant, 18 (9%) insecure-disorganized. MCI data were not available for 20 children due to mothers failing to complete the questionnaire.

Infants with missing attention data were distributed across the four attachment groups, with no suggestion that failing to complete the attention paradigm was linked to a specific type of attachment relationship. Of the infants with missing data, 23% were insecure-avoidant, 53% were secure, 12% were insecure-resistant, and 12% were insecure-disorganized.

Table 1 shows the mean scores for the control variables with respect to attachment security. One-way analyses of variance (ANOVAs) showed that

TABLE 1
Descriptive Statistics for Joint Attention With an Experimenter and Control Variables as a
Function of Attachment Security

	<i>Avoidant</i>	<i>Secure</i>	<i>Resistant</i>	<i>Disorganized</i>	<i>Total</i>
ESCS 8-month joint attention					
Response joint attention	0.52 (0.21)	0.53 (0.22)	0.49 (0.23)	0.51 (0.19)	0.53 (0.21)
Initiate joint attention	5.31 (2.30)	4.83 (2.54)	4.90 (2.28)	5.47 (2.84)	4.98 (2.51)
High-level initiation	0.03 (0.17)	0.01 (0.09)	0.18 (0.60)	0.25 (0.91)	0.05 (0.34)
ESCS 15-month joint attention					
Response joint attention	0.76 (0.17)	0.73 (0.17)	0.68 (0.17)	0.75 (0.18)	0.73 (0.17)
Initiate joint attention	8.26 (4.47)	5.58 (3.46)	4.36 (3.93)	5.42 (4.13)	5.97 (3.87)
High-level initiation	2.09 (2.24)	0.86 (1.40)	1.00 (1.28)	0.55 (1.54)	1.06 (1.65)
Strange situation 15-month joint attention					
Low-level initiate joint attention	1.53 (1.34)	1.34 (1.48)	1.45 (1.44)	2.22 (1.90)	1.46 (1.51)
High-level initiate joint attention	1.03 (1.40)	0.22 (0.66)	0.18 (0.41)	0.56 (0.92)	0.39 (0.91)
Control variables					
Hollingshead index (SES)	32.75 (15.71)	33.86 (13.25)	33.09 (14.34)	39.33 (16.91)	34.11 (14.11)
Bayley MDI	95.00 (7.75)	95.65 (7.83)	92.64 (6.39)	92.50 (10.35)	95.09 (8.01)
PLS standardized score	92.56 (10.76)	93.80 (12.65)	85.00 (10.77)	91.39 (10.64)	92.88 (12.16)
MCI mean percentile score	45.61 (18.73)	44.53 (20.94)	46.92 (25.86)	41.66 (20.31)	44.63 (20.61)

Notes. Standard deviations are in parentheses. ESCS = Early Social Communication Scales; SES = socioeconomic status; MDI = Mental Development Index; PLS = Preschool Language Scale; MCI = MacArthur Communication Index.

four-way attachment security was unrelated to all control variables ($F_s < 1.93, ns$).

Attachment Security and Attention Abilities in the ESCS

Mean attention scores are shown in Table 1 as a function of attachment security. A series of mixed design analyses of covariance (ANCOVAs) was conducted to investigate relations between attention abilities and attachment security. Each ANCOVA was a 2 (testing age) \times 4 (attachment security) design, with scores for SES, Bayley's Mental Index, PLS, and MCI entered as covariates.

For RJA, the effect of testing age approached significance, $F(1, 171) = 3.33, p = .070, \eta^2 = .019$, but there was no main effect of attachment security, $F(3, 171) = 0.30, \eta^2 = .005$, and no interaction, $F(3, 171) = 0.54, ns, \eta^2 = .009$. As Figure 1 shows, the trend was for higher RJA scores at 15 months than at 8 months across all four attachment categories.

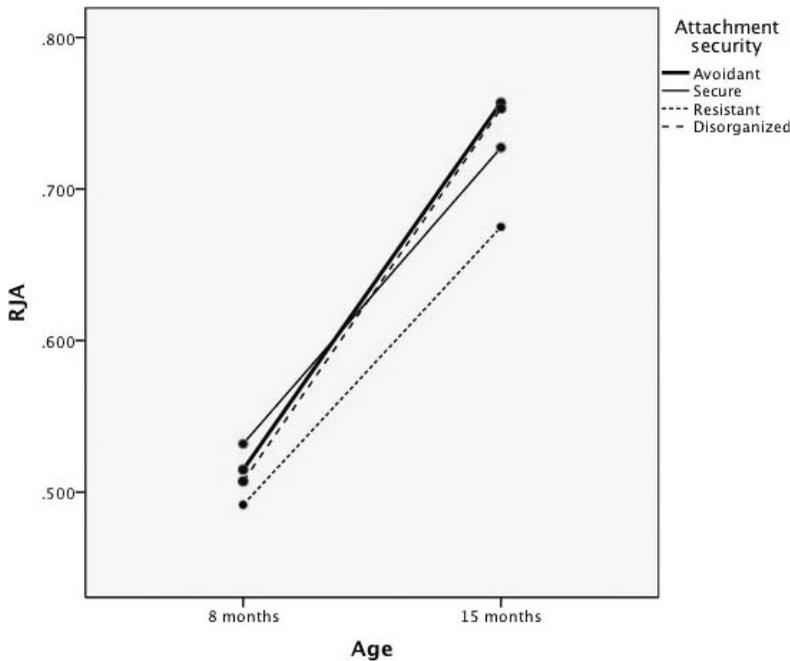


Figure 1 Mean response joint attention (RJA) scores with experimenter in the Early Social Communication Scales at 8 and 15 months as a function of attachment security.

A post hoc repeated measures analysis of variance (ANOVA), pooling data from all four attachment groups, showed a main effect of testing age, $F(1, 197) = 119.63, p < .001, \eta^2 = .607$. Thus, there were no attachment-related differences in infants' tendency to respond to the experimenter's joint attention bids, but for the whole group, infants were more likely to respond to such bids at the older age.

For IJA, there was no main effect of testing age, $F(1, 168) = 0.68, ns, \eta^2 = .004$, but there was a main effect of attachment security, $F(3, 168) = 3.80, p < .01, \eta^2 = .068$, and the Attachment Security \times Testing Age interaction was significant, $F(3, 168) = 2.81, p < .05, \eta^2 = .050$. As Figure 2 shows, insecure-avoidant infants showed a sharp increase in IJA from 8 to 15 months.

Post hoc one-way ANOVAs showed that there were no security-related differences in infants' IJA scores at 8 months, $F(3, 197) = 0.64, ns, \eta^2 = .010$, but the effect of security was significant at 15 months, $F(3, 197) = 5.45, p < .001, \eta^2 = .078$. Pairwise contrasts showed that insecure-avoidant infants obtained higher IJA scores at 15 months than those in the secure ($p < .001$) and insecure-resistant ($p < .025$) groups, with a trend for higher

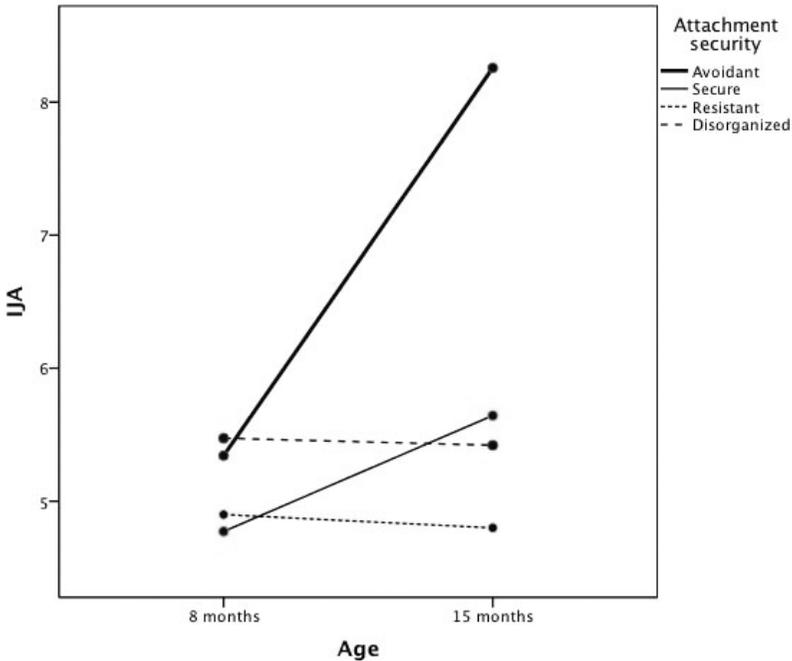


Figure 2 Mean initiates joint attention (IJA) scores with experimenter in the Early Social Communication Scales at 8 and 15 months as a function of attachment security.

IJA scores in the avoidant group compared with the insecure-disorganized group ($p = .07$). There were no other significant pairwise comparisons.

Post hoc paired t tests for each of the four attachment groups showed a significant increase in IJA between 8 and 15 months in both the insecure-avoidant, $t(34) = 3.73$, $p < .001$, $d = 0.86$, and secure, $t(129) = 2.65$, $p < .01$, $d = 0.31$, groups, but no age-related difference in the insecure-resistant, $t(9) = 1.08$, ns , $d = 0.03$, or insecure-disorganized, $t(17) = 0.05$, ns , $d = 0.01$, groups.

To explore the relation between IJA and attachment in greater detail, we disaggregated scores for low-level (eye contact with toy) and high-level (showing, pointing) IJA (see Table 1). For low-level IJA, there was no main effect of testing age, $F(1, 168) = 0.48$, ns , $\eta^2 = .003$, or of attachment security, $F(3, 168) = 1.76$, ns , $\eta^2 = .031$, and no Attachment Security \times Testing Age interaction, $F(3, 168) = 1.17$, ns , $\eta^2 = .021$. For high-level IJA, there was no main effect of testing age, $F(1, 168) = 0.68$, ns , $\eta^2 = .003$, but there was a main effect of attachment security, $F(3, 168) = 5.18$, $p < .005$, $\eta^2 = .091$, and the Attachment Security \times Testing Age interaction was sig-

nificant, $F(3, 168) = 6.19, p < .001, \eta^2 = .109$. As the means in Table 1 show, the high-level IJA scores for the avoidant-group infants were higher than for their counterparts in the secure, resistant, and disorganized groups specifically at the later testing age. These analyses clarify that the relation between IJA and attachment security is stronger for high-level than for low-level initiating behaviors.

Attachment Security and Initiating Joint Attention With Experimenter in the Strange Situation

Infants' mean scores for initiating attention with the experimenter during the first minute of the second episode of the strange situation (mother-child-experimenter) are shown in Table 1. Relations between infant-mother attachment security and infants' initiation of joint attention with the experimenter for the purpose of social sharing using low-level (single gaze check with object) or high-level (point, show, and give) behaviors were investigated using one-way ANCOVA with scores for SES, Bayley's Mental Index, PLS, and MCI entered as covariates.

For low-level initiations of joint attention, there was no main effect of attachment security, $F(3, 175) = 1.54, ns, \eta^2 = .024$. For infants' high-level initiations of joint attention, there was a main effect of attachment security, $F(3, 175) = 6.93, p < .001, \eta^2 = .103$. Post hoc pairwise comparisons showed that infants in the insecure-avoidant group initiated more high-level joint attention with the experimenter than did their counterparts in the secure ($p < .001$) and insecure-resistant groups ($p < .025$), with no other significant pairwise comparisons.

Attachment Security and Initiating Joint Attention With Mother in the Strange Situation

Table 2 shows the mean scores for infants' initiations of joint attention with mother for the purpose of social sharing during the first episode of the strange situation procedure. Relations between attachment security and (a) low-level, and (b) high-level initiations of joint attention with mother were investigated using one-way ANCOVAs with scores for SES, Bayley's Mental Index, PLS, and MCI entered as covariates.

For low-level initiations of joint attention during the first episode of the strange situation (mother-child alone), there was no main effect of attachment security, $F(3, 175) = 1.64, ns, \eta^2 = .027$. For high-level initiations of joint attention, there was a main effect of attachment security, $F(3, 175) = 2.99, p < .05, \eta^2 = .048$. Post hoc pairwise comparisons showed that insecure-avoidant infants were less likely to initiate high-level joint attention

TABLE 2
Descriptive Statistics for Joint Attention With Mother and Control Variables as a Function of Attachment Security

	<i>Avoidant</i>	<i>Secure</i>	<i>Resistant</i>	<i>Disorganized</i>	<i>Total</i>
<i>Strange situation joint attention</i> (<i>mother-child alone</i>)					
Low-level initiate joint attention	2.17 (1.78)	3.28 (2.60)	2.73 (2.28)	2.83 (2.18)	3.02 (2.44)
High-level initiate joint attention	1.25 (1.50)	2.78 (3.05)	2.36 (2.77)	1.56 (1.95)	2.37 (2.79)
<i>Strange situation joint attention</i> (<i>mother-child-experimenter</i>)					
Low-level initiate joint attention	0.44 (0.65)	0.84 (1.02)	1.27 (1.19)	1.11 (1.67)	0.82 (1.07)
High-level initiate joint attention	0.42 (0.77)	0.85 (1.14)	0.56 (0.82)	0.17 (0.51)	0.70 (1.04)

Note. Standard deviations are in parentheses.

with the mother than were their secure-group counterparts ($p < .025$), but there were no other significant pairwise comparisons.

Initiating Joint Attention With Mother Versus Experimenter in the Strange Situation

Paired t tests for each of the four attachment groups were used to investigate whether infants initiated more joint attention behaviors with the mother or with the experimenter during the fourth minute of the strange situation procedure (see Tables 1 and 2 for relevant mean scores). Avoidant-group infants scored more highly for initiating joint attention with the experimenter than with the mother for both low-level, $t(35) = 4.78$, $p < .001$, $d = 1.10$; and high-level joint attention behaviors, $t(35) = 2.62$, $p < .01$, $d = 0.56$. Secure-group infants initiated more low-level behaviors with the experimenter than with the mother, $t(133) = 3.62$, $p < .001$, $d = 0.39$, but the direction of effect was reversed for high-level behaviors, with infants initiating more high-level joint attention behaviors with the mother than with the experimenter, $t(133) = 5.54$, $p < .001$, $d = 0.71$. Resistant-group infants did not differ in their initiations of joint attention with experimenter versus mother for either low-level, $t(10) = 0.41$, *ns*, $d = 0.14$, or high-level joint attention behaviors, $t(10) = 1.49$, *ns*, $d = 0.60$. Disorganized-group infants also did not differ between experimenter versus mother in their initiation of low-level, $t(17) = 1.66$, *ns*, $d = 0.61$, or high-level joint attention behaviors, $t(17) = 1.44$, *ns*, $d = 0.55$. However, although nonsignificant, these results for the disorganized group indicate medium-sized effects (Cohen, 1988).

Initiating Joint Attention With Experimenter in Different Contexts

Correlational analyses were used to explore concordance in infants' initiations of joint attention with an experimenter for the purpose of social sharing across the ESCS and strange situation contexts. IJA in the ESCS was positively correlated with infants' concurrent (a) single gaze checks with object in the strange situation, $r(196) = .14, p = .05$, and (b) high-level initiations of joint attention in the strange situation, $r(196) = .25, p < .001$. These associations were maintained when scores for SES, Bayley's Mental Index, PLS, and MCI were partialized out: for IJA and single gaze checks, $r(170) = .16, p < .05$; for IJA and high-level initiations of joint attention, $r(170) = .20, p < .01$. These findings suggest that there is moderate concordance in infants' initiations of joint attention with an experimenter in structured paradigm (ESCS) and more naturalistic (strange situation) observational contexts.

DISCUSSION

The main aim of the study reported here was to investigate security-related differences in infants' joint attention abilities with a new social partner over the period in which the attachment relationship is consolidated. It is important to note that all reported relations were independent of SES and infants' general cognitive and language abilities. As we hypothesized, differences in joint attention were only seen at 15 months, at a time when the attachment relationship had been consolidated. With respect to joint attention behaviors with an experimenter in the ESCS, there were no differences among the four attachment groups at 8 months, but insecure-avoidant infants were more likely than their peers in each of the three other attachment groups to initiate joint attention for social sharing with an experimenter at 15 months. Insecure-avoidant infants also showed the biggest increase in initiating joint attention between 8 and 15 months, in contrast to a significant but modest increase over this time in secure-group infants, and nonsignificant declines in the insecure-resistant and insecure-disorganized groups. These differences over time appeared to be driven by an increase in avoidant-group infants' high-level initiation of joint attention using pointing and showing behaviors. A very similar pattern of findings emerged for infants' initiations of high-level joint attention behaviors (pointing, showing, and giving) with the experimenter in the context of the strange situation. Avoidant-group infants were more likely than their counterparts in the secure and insecure-resistant groups to initiate high-level joint attention with the experimenter. Moreover, across the sample as a whole, there were modest but significant positive asso-

ciations between initiations of joint attention with an experimenter in the ESCS and strange situation contexts, suggesting that these observations provide a valid picture of infants' general mode of engagement with a new social partner.

By contrast, when the social partner was the child's mother, the direction of effect was reversed. Insecure-avoidant infants obtained the lowest scores for initiating high-level joint attention with their mothers in the preseparation episode of the strange situation, scoring significantly lower than their secure-group counterparts. Perhaps most striking of all was the finding that, when mother and experimenter were present and equally available for engagement, insecure-avoidant infants were more likely to initiate both low- and high-level joint attention with the experimenter than with the mother. Conversely, secure-group infants initiated more high-level joint attention with their mothers than with the experimenter.

Interestingly, like their avoidant-group counterparts, secure-group infants were more likely to initiate low-level joint attention behaviors with the experimenter than with the mother during the fourth minute of the strange situation. This suggests that securely attached infants show social interest in a new person while tending not to express this interest using the overt types of behavior (showing, pointing, and giving) characteristic of their avoidant-group peers. However, it is also possible that, in the absence of high-level initiations of joint attention with the experimenter, low-level initiations may index wariness of a new person. Future research could investigate this possibility by exploring in greater detail the precise circumstances under which infants engage in low-level initiations with the experimenter. For example, such initiations when the infant is in close proximity to the mother may indicate social wariness, whereas low-level initiations when the child is more distant from the mother might index social interest. Another possibility is that infants' facial expression while engaged in low-level initiations can help to clarify whether the behavior is indicative of social interest or wariness.

Unlike for initiations of joint attention, there were no security-related differences in infants' tendency to respond to bids for joint attention at either 8 or 15 months. We did, however, replicate Mundy et al.'s (2007) finding that infants' tendency to respond to an experimenter's bids for object-based joint attention increased between 8 and 15 months. This suggests that the ability to respond to bids for joint attention may be a universal marker of early cognitive development rather than an indicator of infants' social interest in others.

Although the study reported here found attachment-related differences in infants' initiations of joint attention with an experimenter for the purpose of social sharing in the ESCS, we failed to replicate Claussen et al.'s (2002)

reported deficit in this behavior specifically in insecure-disorganized infants. It may be Claussen et al.'s finding is an artifact of the unusual nature of their sample, which consisted exclusively of very low SES families, with all infants having been prenatally exposed to cocaine. For example, prenatal exposure to cocaine may have directly affected infants' joint attention abilities given that such exposure has been found to impact on early regulation of arousal and attention (Mayes, Grillon, Granger, & Schottenfeld, 1998; Singer et al., 1999). In addition, high rates of disorganized attachment in infants of drug-using mothers were reported in Van IJzendoorn et al.'s (1999) meta-analysis, with 43% of infants in this group being classified as disorganized. Thus, maternal drug use may account for Claussen et al.'s findings, rather than these results indicating any specific link between disorganization and maladaptive initiation of joint attention. Given our null findings, there appears to be no strong evidence that problems in coordinating joint attention with an experimenter are linked with disorganized attachment in community samples.

By contrast, our findings are suggestive of a potential link between disorganization and decreased levels of initiating joint attention specifically with the mother. Although nonsignificant, the pattern of findings for insecure-disorganized infants' initiations of joint attention in the fourth minute of the strange situation was the same as that observed for the avoidant group: Disorganized-group infants were more likely to initiate both low- and high-level joint attention with the experimenter than with the mother, with medium-sized effects for these relations. Given that this assessment of joint attention was taken concurrently with attachment security, our results cannot speak to whether the tendency to favor new social partners in initiating joint attention is predictive of disorganized attachment. Future research to address this issue may shed light on the notoriously complex origins of attachment disorganization (Bernier & Meins, 2008; Van IJzendoorn et al., 1999).

The potential implications of the findings reported here are worthy of further discussion. Mundy et al. (2007) reported that initiations of joint attention purely for the purpose of social sharing in the ESCS showed an unusual pattern of development, with no age-related increase between 9 and 18 months of age. Our results show that the developmental trajectory of this type of initiation of joint attention varies widely as a function of infant-mother attachment security. This apparent lack of change over time in Mundy et al.'s study may thus be because data on initiations of joint attention for social sharing on the population as a whole mask important security-related individual differences in children's joint attention.

The fact that attachment security was associated only with concurrent initiations of joint attention with a new social partner and not infants' earlier

joint attention abilities suggests that infants' tendency to initiate engagement with individuals other than the caregiver does not determine the security of the attachment relationship that is formed. By contrast, our finding that attachment security relates to infants' social engagement with the caregiver under conditions of low attachment stress suggests that behaviors seen when the attachment system is activated may characterize infants' general mode of interaction with the caregiver. For example, our results showed that insecure-avoidant infants were the least likely of all of the attachment groups to initiate high-level joint attention with the caregiver during the preseparation episode of the strange situation. To our knowledge, these are the first findings showing that the avoidance of the caregiver that typifies these infants when the attachment system is activated can also be observed during a low-stress naturalistic observation.

As well as suggesting that avoidance of the caregiver generalizes to contexts in which there is no attachment stress, the findings reported here are in line with the argument that the attachment relationship influences infants' engagement with new social partners (e.g., Bowlby, 1969/1982). Specifically, our results suggest that once the attachment is consolidated, the security of this relationship relates to infants' tendency actively to engage new social partners in their interactions with the object world. Moreover, the distinct pattern of findings associated with insecure-avoidant attachment supports the notion that, rather than avoiding social contact in general, avoidant infants appear to compensate for the lack of interaction with the caregiver by tending to initiate more interaction with a new social partner. Given that no security-related differences were observed in infants' tendency to respond to the experimenter's bids for attention, general lack of interest in the experimenter in the secure-, resistant-, and disorganized-group infants seems an unlikely explanation for the pattern of findings observed for initiations of joint attention. These results are thus consistent with the view that all infants, including those who are insecure-avoidant, have a biologically inbuilt need for social contact (Bowlby, 1969/1982; Sroufe et al., 1983).

The findings presented here, together with those of previous studies, suggest that there is longitudinal continuity in insecure-avoidant infants' tendency to initiate engagement with adults other than the attachment figure. As discussed in the Introduction, Sroufe et al. (1983) reported avoidance in infancy was associated with children being more likely to seek help from their teachers in relation to social interactions during large-group activities when they began school. Similarly, 5-year-olds classified as insecure-avoidant as infants were found to rely more on information provided by an experimenter than by the mother (Corriveau et al., 2009). Our results showed that insecure-avoidant infants were more likely to initiate joint attention with an experimenter compared with their secure-,

resistant-, and disorganized-group peers. Early behavioral measures of avoidance thus appear to relate to greater engagement with new social partners both concurrently and predictively.

Finally, it is important to consider whether the observed differences in infants' joint attention abilities might result in infants representing the caregiver and other social partners in different ways as a function of the security of the attachment relationship. Tomasello et al. (1993) argued that infants' understanding of others as intentional agents underlies their ability to engage in joint attention, accounting for the proposed role of joint attention in predicting theory of mind. Individual differences in infants' tendency to initiate joint attention with the mother versus other social partners will give infants comparatively more or less exposure to the mother's perspective. If this is the case, one possibility is that attachment security may differentially impact on infants' understanding of the internal states of their caregivers versus those of other social partners. This proposal may help explain why findings on relations between attachment security and theory of mind are equivocal, with some studies suggesting positive associations between early secure attachment and superior theory of mind performance (Meins, Fernyhough, Russell, & Clark-Carter, 1998; Steele, Steele, Croft, & Fonagy, 1999) while others report null findings (Meins et al., 2002; Ontai & Thompson, 2008).

The "attachment-relevance" of the theory-of-mind task may thus be crucial in understanding the relation between attachment security and mentalizing abilities (Repacholi & Trapolini, 2004). Children with secure attachments may show superior understanding of mental states specifically in relation to the caregiver, rather than to people in general. By contrast, insecure-avoidant children might show superior theory of mind in relation to adults other than the caregiver. Future longitudinal research on relations among joint attention, attachment security, and theory of mind should address these possibilities to shed light on the complex interplay between early social-cognitive and social-emotional factors and children's later social understanding.

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