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Infant negative emotionality and attachment: Implications for preschool intelligence

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This longitudinal study examined the extent to which dimensions of infant negative temperament in the first year predicted IQ at age 3, and whether these associations depended on the quality of the infant–mother attachment relationship. In a sample of 63 infant–mother dyads, mothers completed Rothbart’s (1981) IBQ when infants were 4 and 12 months, mothers and infants participated in Ainsworth and Wittig’s (1969) Strange Situation at 12 months, and children completed the Stanford-Binet (Thorndike, Hagen, & Sattler, 1986) when they were 36 months of age. Hierarchical multiple regression analyses indicated that 4- or 12-month distress to limitations was not predictive of later IQ, but infants with greater distress to novelty at 4 months had higher IQs at 36 months. Furthermore, greater distress to novelty at 12 months predicted higher IQs but only for infants whose attachment was insecure. Differential implications of temperamental fear versus anger for social influences on cognitive development are discussed.

Introduction

Relations between infant and child emotionality and cognition have been well documented (Bloom, 1993; Dixon & Smith, 2000; Karrass & Braungart-Rieker, 2003; Matheny, 1989; Slomkowski, Nelson, Dunn, & Plomin, 1992). In general, relations between dimensions of positive emotionality and cognition have been consistently found whereas relations between negative emotionality and cognition have not. The current study investigates relationships between negative emotionality in infancy and intelligence in preschool as well as the possible moderating effect of the mother–infant attachment relationship. The main goal of the present study is to examine the implications of individual differences in temperament for cognitive development in the context of the mother–infant attachment relationship. That is, to what extent does infant temperament affect later cognitive outcomes and does this relation depend on the extent to which an infant is securely attached?

Temperament encompasses individual differences in reactivity (emotional, motor, and attentional) and self-regulation (behavioural and attentional) (Putnam, Sanson, & Rothbart, 2002). In other words, there are individual differences between children in the valence and intensity of emotional responses to stimuli as well as in motoric and attentional responses. Children can choose behavioural responses, such as leaving the presence of the arousing stimulus, or attentional responses, such as visually focusing on some nonarousing aspect of the environment. Therefore, individual differences in temperament will be likely to affect the infant’s and child’s engagement with the social and physical environment. In addition, the expression of temperament may be lessened or heightened by contextual experiences such as parenting (Goldsmith & Rieser-Danner, 1986).

Both theory and empirical findings suggest that multiple dimensions of temperament are associated with early cognition. Positive mood and longer attention spans have both been found to be associated with multiple measures of infant and child cognition, such as childhood intelligence (Matheny, 1989; Palisin, 1986), infant mental abilities (Matheny, 1989; Matheny, Dolan, & Wilson, 1974), and early language development (Dixon & Smith, 2000; Karrass, Braungart-Rieker, Mullins, & Lefever, 2002; Slomkowski et al., 1992). Findings relating cognition and dimensions of negative emotionality have been less consistent and less robust. Matheny and colleagues found that infants with more negative mood displayed less advanced mental development and lower IQ scores in preschool and childhood (Matheny, 1989; Matheny et al., 1974). However, in a study of the relations between temperament and language in infancy, Dixon and Smith (2000) found only 2 significant correlations between negative affect and language out of 36 that were tested.

Temperament and cognition

Temperament and cognition

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Specifically, distress to limitations at 10 months and distress to novelty at 12 months were positively related to concurrent language. Furthermore, the meaning and implications of heightened distress may depend on the child’s age (Lewis, 1993). Given infants’ limited communicative and motoric abilities, heightened negativity during infancy may serve to bring a caregiver closer, which in turn may impact cognitive growth. Furthermore, depending on the type of emotionality being expressed, proneness to exhibit fear or anger may operate in different ways—not only within the infant, but also with the infants’ caregivers.

Bronfenbrenner’s (1993) person–process–context model of development suggests that environmental influences might moderate the outcomes associated with specific child characteristics such as negative emotionality. For example, attachment theorists postulate that negative temperament is unrelated to attachment classification (secure vs. insecure) because mothers are differentially sensitive and responsive to their child’s cues (Ainsworth, Blehar, Waters, & Wall, 1978), although there is still much debate over the relation between temperament and attachment. Empirically, emotionality has been found to distinguish insecure-avoidant (A) and two of the secure groups (B1 and B2) from insecure-resistant groups (C) and the remaining two secure subgroups (B3 and B4), such that the former infants display less distress during the Strange Situation than the latter (Braungart & Stifter, 1991; Frodi & Thompson, 1985; Thompson, Connell, & Bridges, 1988; Thompson & Lamb, 1984). Moreover, maternal ratings of difficulty at 3 months were significantly lower for A, B1, and B2 infants than for C, B3, and B4 infants (Belsky & Rovine, 1987). However, in these studies, negative affect was not found to distinguish between securely and insecurely attached infants. Thus, even if the child is highly negatively reactive, a sensitive mother can respond appropriately and thus foster a secure attachment. Therefore, the emotionality of an infant who is often and highly distressed might be managed by a sensitive, responsive mother to a degree that the infant can resume interaction with the environment, thereby fostering cognitive development. On the other hand, a highly negatively reactive infant and an insensitive mother might exacerbate each other (Campbell, 1995), resulting in an infant who is unable to engage with the environment and a mother who is unable and/or unwilling to foster cognitive development.

It may also be important, however, to distinguish between types of negative emotionality. Rothbart’s Infant Behavior Questionnaire (IBQ; Rothbart, 1981) and Goldsmith’s Toddler Behavior Assessment Questionnaire (TBAQ; Goldsmith, 1996)—an age extension of Rothbart’s IBQ—make the distinction between distress to limitations (frustration/anger) versus distress to novelty (fear). Psychometric assessments of these dimensions indicate adequate discriminant validity in that distress to limitations and distress to novelty tend to be only modestly correlated (i.e., $r = .36$ at 6 months and .29 at 12 months; Rothbart, 1981). In other words, an infant who is easily frustrated is not necessarily one who is fearful in new situations. Moreover, discrete emotions theorists have identified both anger and fear as basic, or primary, emotions, present from birth or early infancy (Izard, 1977). Furthermore, which emotion regulation strategies are effective in calming infant distress depend on whether the distress involves fear or anger (Buss & Goldsmith, 1998).

From a functionalist perspective, anger and fear serve different purposes (Campos, Barrett, Lamb, Goldsmith, & Stenberg, 1983). Infants are likely to experience fear when they perceive that their environment (e.g., something very novel) is potentially dangerous. In turn, their distress would serve to elicit increased caretaking so that they are protected. Anger, on the other hand, is experienced when infants’ goals have been blocked (e.g., can’t play with an attractive breakable object). Depending on the reasons for the anger, however, caregivers may or may not respond to the infant in a way that the infant appreciates (e.g., not allowing the infant to play with a breakable object). Thus, emotions serve to regulate both intr-and inter-personal behaviours (Campos et al., 1983). For example, parents report different responses to their preschooler depending on whether the child expresses anger or fear; they are more likely to report affirming demonstrations of fear and negating, either actively or passively, demonstrations of anger (Stricklin, 2000). Moreover, individual differences in infants’ proneness to exhibit anger or fear has interesting long-term implications—in terms of influencing infants’ own development as well as their interpersonal relationships with significant others.

Empirical evidence suggests that the caregiving environment does moderate the relation between negative affect and cognitive abilities. For example, Karrass and Braungart-Rieker (2003) found that maternal responsiveness (defined as highly sensitive, affectively warm parenting during free play) moderated the relation between 12-month distress to novelty and 16-month language. Specifically, infants who were less fearful and who were parented by more responsive mothers had the best language abilities. No statistically significant relations were found between distress to limitations and language, and distress to limitations did not interact with maternal responsiveness to predict language. Thus, differential relations were found for fear versus anger in predicting language.

Attachment

The attachment relationship with the parents is thought to be a central basis for development in other areas of the child’s life, such as cognitive functioning and learning (Bowlby, 1969). Attachment theory asserts that infants have an attachment behavioural system that keeps attachment figures in close proximity, thus ensuring the safety and survival of the infant (Bowlby, 1969). Additionally, these attachment relationships are thought to foster the infant’s learning of skills necessary for survival through interactions with these attachment figures. Indeed, meta-analysis of empirical studies has found a small but statistically significant effect of attachment on IQ, indicating that securely attached children are more intelligent and have greater language skills than insecurely attached children (Van IJzendoorn, Dijkstra, & Bus, 1995).

In a secure attachment relationship, the attachment behavioural system is optimally functional regardless of the infant’s temperament; an infant’s attachment behaviours readily keep the caregivers in proximity and the caregivers are appropriately responsive to the infant’s cues (Ainsworth et al., 1978). However, a caregiver who does not show sensitive responses to the infants’ emotional needs—by responding infrequently, inconsistently, intrusively, or in a rejecting way—is more likely to foster an insecure attachment relationship (Ainsworth et al., 1978; Cassidy, 1994; DeWolff & Van IJzendoorn, 1997). Goldberg, Grusec, and Jenkins (1999a) have argued that the caregiver’s responses to the negative emotions that the infant displays might be more indicative of
attachment relations than positive displays of emotion. Some mothers of highly negative infants seem better able to deal with this parenting challenge than others, and their responses to these demonstrations of negative emotionality might be more informative about the quality of their parenting and their relationship with their infant than their responses to their infant's positive emotions.

In secure attachment relationships, the sensitive caretaker should be able to tailor the environment for the unique needs and temperamental style of the child to ensure that the child has the support needed for cognitive growth. In an insecure attachment relationship, however, the caretaker may be less capable of fostering cognitive development in the child. In such a situation, temperamental and other innate characteristics of the child may become vital in determining the outcome of the child. Moreover, different types of emotionality might interact differently with attachment. Bowlby (1969) theorised that infant displays of fear activate the attachment system, due to the potential threat to infant safety, whereas anger would not activate the attachment system because it does not signal to the parent a threat to the infant's safety (see also Goldberg, Grusec, & Jenkins, 1999b). Thus, insecure infants with high fear versus insecure infants with high anger might have different developmental outcomes.

The present study investigates the relations among infant age, temperamental fear and anger, attachment security, and later cognitive development—specifically IQ. Fear and anger were measured at 4 and 12 months, attachment security was measured at 12 months, and IQ was assessed at 36 months. The association between fear in infancy and later IQ is expected to show a pattern distinctly different from the association between anger in infancy and later IQ because of their different interpersonal effects. Furthermore, it is expected that the links between temperamental fear or anger and later IQ depend on the quality of the mother–infant attachment relationship. Specifically, negative emotionality is predicted to negatively impact later IQ, but only in insecurely attached dyads.

**Method**

**Participants**

Participants were 63 full-term infants (36 girls and 27 boys) and their mothers recruited by mail from a middle-sized city in the midwestern United States. These mother–infant dyads were part of a larger study that also examined fathers, marital relationships, and the development of compliance. Infants came from predominately white (all but one dyad) middle-class homes. Parents and infants visited the laboratory when the infants were 4, 12 (mother and infant only), 13 (father and infant only), 20, 28, and 36 months old (plus or minus 14 days). For the purposes of the present study, the data collected at 4-, 12-, and 36-month visits were examined. The sample sizes for these were 105, 97, and 70 respectively. Only the 63 infants who had complete data (questionnaire and laboratory assessments) at all ages were included in the analyses. Tests of demographic differences (family income, parent education, and parent age) between infants with missing data versus the final sample used in the present study were not statistically significant.

**Procedure**

One week prior to each visit, a reminder letter and questionnaires were sent home to be completed by the mother. Laboratory visits at 4 months consisted of a demographic interview, a 4-minute free play with the infant and both parents, a 4.5-minute structured task with one parent, a 4.5-minute structured task with the other parent (counterbalanced over parent), and administration of the Bayley Scales of Infant Development. Only the mother participated with the infant at the 12-month visit; the Ainsworth Strange Situation procedure was performed, followed by a 4.5-minute structured task and the administration of the Bayley Scales. The 36-month visit consisted of a 5-minute child free play while the parents filled out forms, a 4-minute father–child free play, a 5-minute mother–child free play, and a series of structured tasks (e.g., eliciting compliance) with either or both parents that totalled approximately 20 minutes. Then the Stanford-Binet Intelligence Scale was administered. The procedures of interest to the present study include data from the 4- and 12-month temperament questionnaires and Bayley Mental Scale scores, the 12-month Strange Situation procedure, and the 36-month intelligence test.

**Measures**

**Infant temperament.** The Infant Behavior Questionnaire (IBQ; Rothbart, 1981) was filled out by the mother at 4 and 12 months. The IBQ is a 94-item questionnaire that asks about the relative frequency of specific behaviours such as crying loudly while waiting to be fed. Parents rate items on a Likert scale from 1 (never) to 7 (always). Because the questions are more specific rather than general, the IBQ is thought to allow mothers to rate actual infant characteristics more objectively. The IBQ consists of six subscales, two of which are considered to reflect negative reactivity dimensions: distress to limitations and distress to novelty. Convergence between maternal IBQ ratings and both home observations (Rothbart, 1986) and laboratory ratings (Bridges, Palmer, Morales, Hurtado, & Tsai, 1993) have been reported, though they tend to be in the low to moderate range. For the present sample, distress to limitations and distress to novelty were found to have adequate internal consistencies, as .79 and .76 at 4 months and .82 and .80 at 12 months, respectively.

**Attachment.** Attachment to the mother was measured at the 12-month assessment based on infants' responses during the Strange Situation (Ainsworth et al., 1978). Infants were classified as either insecure-avoidant (A), secure (B), or insecure-resistant (C) and subgroups. Three coders were trained to reliability in Alan Sroufe's laboratory; interrater reliability on 15% of the sample among the coders was .87 (Cohen's K = .80). For the purposes of the present study, infants in the A or C categories were combined into one group (insecurely attached) and compared to infants in the B group (securely attached).

Because the sample was a low-risk group, the disorganised (D) category was not included due to the belief that this category is more appropriate for infants at risk (Carlson, Cicchetti, Barnett, & Braunwald, 1989). Recently, however, newer evidence suggests that the D category may be somewhat relevant to middle-class samples (Van IJzendoorn, Schuengel, & Bakermans-Kranenburg, 1999).
Cognitive development. The Bayley Scales of Infant Development (Bayley, 1969) were conducted and the total score from the Mental Development Index (MDI) was used to measure cognitive development at 4 and 12 months. The MDI consists of 163 items that capture sensation, perception, cognition, language, memory, and social behaviour in infants. MDI scores obtained during the first year of life are often found to be unrelated to childhood tests of intelligence (Bornstein & Sigman, 1986; Fagan & Singer, 1983).

Intelligence. The Stanford-Binet Fourth Edition (SBIV; Thorndike et al., 1986) was used to measure intelligence at 36 months. The SBIV is based on a triarchic, hierarchical theory of intelligence. Only 8 of the 15 subtests are used with 3-year-olds: vocabulary, bead memory, quantitative, memory for sentences, comprehension, absurdities, pattern analysis, and copying, as well as a total IQ score. Only the total IQ score was used in this study.

Results

Results of the analyses are presented in four sections. First, descriptive statistics are presented. Second, relations between demographic variables and IQ are examined. Third, for descriptive purposes, mean differences and correlations among predictors are examined. Finally, two hierarchical regression analyses will be performed to test hypotheses of the study.

Descriptive analyses

Table 1 presents the descriptive statistics for the variables assessed in the present study as well as demographic characteristics. As can be seen from the means, standard deviations, and ranges for emotionality dimensions, the present sample is similar to those reported by others using low-risk, middle-class samples. In addition, two repeated measures ANOVAs involving distress to limitations and distress to novelty at 4 and 12 months with age as the repeated factor were significant, indicating that infants significantly increased in distress to limitations, $F(1, 62) = 13.92, p < .001$, and distress to novelty from 4 to 12 months, $F(1, 62) = 90.95, p < .001$. Others have reported similar increases in distress to novelty during the first year and a U-shaped pattern in distress to limitations (e.g., Denham, Lehman, Moser, & Reeves, 1995; Rothbart, 1986). Likewise, the percentage of secure versus insecure infants is similar to those reported by others using middle-class, low-risk samples (e.g., Frodi & Thompson, 1985; Owen, Easterbrooks, Chase-Lansdale, & Goldberg, 1984). In addition, the average IQ was significantly higher than the standardisation sample mean of 100.1, $t (62) = 3.85, p < .001$ (Thorndike et al., 1986). Also notable is that there were no significant gender differences for distress to limitations, distress to novelty, attachment security status, IQ, or any of the demographic variables.

Demographics, emotionality, attachment, and IQ

Given that other studies have found relations between demographic variables and IQ, we examined correlations between demographic variables (mother’s age, mother’s education, and family income) and distress to limitations, distress to novelty, and IQ (see Table 2). Distress to limitations was related to family income at both ages, such that families with higher incomes had infants who displayed less distress to limitations at both 4 and 12 months. Distress to novelty at 12 months was related to both maternal age and education such that infants who were rated as higher in distress to novelty at 12 months had older, more educated mothers. Finally, only maternal education was related to IQ at 36 months; more educated mothers had children with higher IQ scores.

Additionally, three independent samples $t$-tests were performed to test for demographic differences between securely versus insecurely attached infants. The two attachment groups were not significantly different on maternal age, $F(1, 61) = -0.88, p = .38$, maternal education, $F(1, 61) = 0.47, p = .64$, or family income, $F(1, 61) = 1.19, p = .24$.

Relations among predictors

For descriptive purposes, mean differences in emotionality were tested across time and by attachment status. To

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>SD</th>
<th>Range</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maternal age</td>
<td>29.87</td>
<td>5.08</td>
<td>21–44</td>
<td>62</td>
<td></td>
</tr>
<tr>
<td>Maternal education$^a$</td>
<td>3.40</td>
<td>1.28</td>
<td>1–6</td>
<td>62</td>
<td></td>
</tr>
<tr>
<td>Family income$^b$</td>
<td>4.00</td>
<td>1.00</td>
<td>1–5</td>
<td>62</td>
<td></td>
</tr>
<tr>
<td>Distress to limitations</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 months</td>
<td>3.07</td>
<td>0.63</td>
<td>1.58–4.47</td>
<td>62</td>
<td></td>
</tr>
<tr>
<td>12 months</td>
<td>3.43</td>
<td>0.76</td>
<td>1.90–5.52</td>
<td>62</td>
<td></td>
</tr>
<tr>
<td>Distress to novelty</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 months</td>
<td>1.93</td>
<td>0.66</td>
<td>1.00–4.06</td>
<td>62</td>
<td></td>
</tr>
<tr>
<td>12 months</td>
<td>2.78</td>
<td>0.70</td>
<td>1.41–4.53</td>
<td>62</td>
<td></td>
</tr>
<tr>
<td>MDI: 4 months</td>
<td>123.03</td>
<td>13.60</td>
<td>96–150</td>
<td>62</td>
<td></td>
</tr>
<tr>
<td>MDI: 12 months</td>
<td>118.79</td>
<td>12.51</td>
<td>94–142</td>
<td>62</td>
<td></td>
</tr>
<tr>
<td>IQ: 36 months</td>
<td>104.51</td>
<td>9.09</td>
<td>83–128</td>
<td>62</td>
<td></td>
</tr>
<tr>
<td>Attachment: 12 months</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Secure</td>
<td>48</td>
<td>76.2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Insecure</td>
<td>15</td>
<td>23.8</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

$^a$ 3 = some college, 4 = college degree.

$^b$ 4 = $40–49,000.
determine whether 4- and 12-month emotionality dimensions differed as a function of 12-month attachment status, a 2 (Attachment) × 2 (Emotionality Dimension) × 2 (Age) repeated measures ANOVA was performed. Attachment served as the between-subjects factor, whereas emotionality dimension and age served as within-subject factors. Table 3 presents the means and standard deviations for each emotionality dimension for secure and insecure infants. The main effect for attachment status was not significant, $F(1, 61) = 1.69$, $p = .20$; in addition, interactions involving attachment were not significant: Attachment × Age, $F(1, 61) = 0.39$, $p = .53$, Attachment × Emotionality Dimension, $F(1, 61) = 0.59$, $p = .44$, and Attachment × Age × Emotionality Dimension, $F(1, 61) = 2.13$, $p = .15$. For the sake of descriptive purposes, attachment differences were tested at the univariate level: As can be seen in Table 3, insecure infants were reported to show less distress to novelty at 4-months than secure infants, $F(1, 61) = 4.80$, $p = .03$. This significant mean difference, however, should be interpreted with caution given that the overall effects involving attachment were not significant. These findings are consistent with previous literature suggesting that temperament and security of attachment are not directly related to each other (e.g., Braunsgart & Stifter, 1991).

Also for descriptive purposes, correlations among distress to limitations and distress to novelty were tested. It is notable that both emotionality dimensions were significantly and moderately stable from 4 to 12 months (distress to limitations $r = .42$, $p < .001$, and distress to novelty $r = .47$, $p < .001$). Furthermore, several relations across emotionality dimensions were significant. Infant 4-month distress to limitations was not significantly correlated with 4- or 12-month distress to novelty ratings. Infant 12-month distress to limitations, however, was significantly related to distress to novelty: Infants who were rated as higher in distress to limitations at 12-months had higher distress to novelty scores at 4 and 12 months, $r_s = .38$ and .35, respectively, $p < .01$. These findings are consistent with past research that has found modest correlations between distress to limitations and distress to novelty (Rothbart, 1981).

Table 2
Correlations among demographic variables, distress to limitations, distress to novelty, and IQ

<table>
<thead>
<tr>
<th>Variable</th>
<th>Maternal age</th>
<th>Maternal education</th>
<th>Family income</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distress to limitation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 months</td>
<td>-.10</td>
<td>.08</td>
<td>-.31*</td>
</tr>
<tr>
<td>12 months</td>
<td>-.04</td>
<td>.19</td>
<td>-.30*</td>
</tr>
<tr>
<td>Distress to novelty</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 months</td>
<td>.01</td>
<td>.11</td>
<td>-.12</td>
</tr>
<tr>
<td>12 months</td>
<td>.25*</td>
<td>.31*</td>
<td>-.05</td>
</tr>
<tr>
<td>IQ at 36 months</td>
<td>.11*</td>
<td>.31*</td>
<td>.13</td>
</tr>
</tbody>
</table>

* $p < .05$.

To further determine the nature of the significant interaction, we examined the correlations between 12-month distress to novelty and IQ separately for secure versus insecure infants (Aiken & West, 1991), controlling for maternal education. The correlations for each group were: $r (47) = .03$, $p = .85$ for secure infants, and $r (14) = .73$, $p < .01$ for insecure infants. Thus, this pattern of results indicates that distress to novelty’s effect on IQ was only important for insecure infants. More specifically, insecure infants whose distress to novelty scores were higher at 12 months had higher IQs at 36 months compared to insecure infants whose distress to novelty scores were lower. Variation in distress to novelty did not significantly predict later IQ for secure infants.

To explore the distinction between distress to novelty and distress to limitations in predicting preschool IQ, the main effects of both 4- and 12-month emotionality dimensions were regressed onto IQ in the same equation. Again, the effects of maternal education on child IQ were

**Table 3**
Means and standard deviations for distress to limitations and distress to novelty by attachment status

<table>
<thead>
<tr>
<th>Temperament dimension</th>
<th>Secure</th>
<th>Insecure</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td>Distress to limitations</td>
<td>4 months</td>
<td>3.09</td>
</tr>
<tr>
<td></td>
<td>12 months</td>
<td>3.47</td>
</tr>
<tr>
<td>Distress to novelty</td>
<td>4 months*</td>
<td>2.03</td>
</tr>
<tr>
<td></td>
<td>12 months</td>
<td>2.80</td>
</tr>
</tbody>
</table>

* Means for secure versus insecure groups significantly ($p < .05$) different.
statistically controlled. The interactions between attachment classification and emotionality were not tested in this equation, because the large number of predictors in relation to the sample size would seriously weaken statistical power (i.e., 10 predictors with a sample size of 63). The results of the main effects comparison are presented in Table 5. Again, when tested simultaneously with distress to limitations, only 4-month distress to novelty significantly predicted 36-month IQ.

**Discussion**

Two compelling main findings emerged in the present study. First, distress to novelty but not distress to limitations during early infancy was associated with later intelligence. More specifically, infants rated higher in distress to novelty at 4 months had higher IQs at age 3 years. Second, infants with greater distress to novelty at 12 months were also found to have higher IQ scores at age 3 years, but only if they were insecurely attached to their mothers.

**Table 4**

Hierarchical regression model for predicting IQ at 36 months

<table>
<thead>
<tr>
<th>Step &amp; predictors</th>
<th>df</th>
<th>F</th>
<th>Adj. R²</th>
<th>β</th>
<th>F</th>
<th>Adj. R²</th>
<th>β</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maternal education</td>
<td>1,61</td>
<td>6.25*</td>
<td>.08</td>
<td>.31*</td>
<td>6.25*</td>
<td>.08</td>
<td>.31*</td>
</tr>
<tr>
<td>MEd + Emo</td>
<td>3,59</td>
<td>2.29</td>
<td>.06</td>
<td>.32*</td>
<td>5.06**</td>
<td>.16</td>
<td>.29*</td>
</tr>
<tr>
<td>MEd</td>
<td>4-mth Emo</td>
<td>–.07</td>
<td>.37**</td>
<td>.05</td>
<td>–.09</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MEd</td>
<td>12-mth Emo</td>
<td>–.07</td>
<td>.37**</td>
<td>.05</td>
<td>–.09</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MEd</td>
<td>12-mth Att</td>
<td>.17</td>
<td>.37**</td>
<td>.05</td>
<td>–.09</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MEd</td>
<td>4-mth Emo × Att</td>
<td>.09</td>
<td>.37**</td>
<td>.05</td>
<td>–.09</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MEd</td>
<td>12-mth Emo × Att</td>
<td>.09</td>
<td>.37**</td>
<td>.05</td>
<td>–.09</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| MEd = maternal education; Emo = emotionality; Att = attachment. |

Early displays of distress to novelty (e.g., at 4 months) may reflect a more precocious cognitive level. On a scale of 1–7, the average 4-month-old infant’s distress to novelty score was 1.93—between “never” and “very rarely”. By 12 months, however, distress to novelty significantly increased for the average infant; fear of new situations, then, becomes a more typical response at this age. In accordance with cognitive-developmental theory (Hebb, 1946, 1949), an infant who is distressed by novelty at 4 months might be more cognitively advanced in that he or she recognises that a stimulus is discrepant from those encountered before (Kagan, 1971, 1974; R. McCall & McGhee, 1977). Research with both children and adults indicates that if one does not notice the novel aspect of an event, one either does not experience any emotion or does not experience the same intensity of emotion as those who do notice novelty (Stein & Trabasso, 1989). Additionally, studies of infant information processing have found that better performance on recognition memory tasks during infancy predicted higher IQ scores during early childhood (e.g., Colombo, Mitchell, O’Brien, & Horowitz, 1987; R.B. McCall & Carriger, 1993; Rose & Feldman, 1995; Rose, Feldman, Wallace, & Cohen, 1991). Perhaps the ability to detect common features in a recognition memory task at the early age of 4 months reflects recognition of (and even distress to) novelty as well as advanced cognitive ability.

Interestingly, distress to novelty at 12 months did not directly predict later IQ—perhaps because fear to new situations is a more normative response by this age, and not indicative of individual differences in intellectual functioning. Rather, the effect of 12-month distress to novelty on later IQ depended on attachment status. Infants with higher distress to novelty and who had an insecure infant–mother attachment had higher IQ scores at age 3 years. At first glance, this finding may seem counterintuitive, given that others have found attachment security, by itself, to be associated with higher

**Table 5**

Hierarchical regression model comparing main effects of distress to limitations and distress to novelty for predicting IQ at 36 months

<table>
<thead>
<tr>
<th>Predictors</th>
<th>df</th>
<th>F</th>
<th>Adj. R²</th>
<th>β</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maternal education</td>
<td>5,57</td>
<td>3.96**</td>
<td>.19</td>
<td></td>
</tr>
<tr>
<td>Emotionality</td>
<td>4-mth distress to novelty</td>
<td>.32*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12-mth distress to novelty</td>
<td>.44**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4-mth distress to limitations</td>
<td>–.04</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12-mth distress to limitations</td>
<td>–.11</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

† p < .10; * p < .05; ** p < .01.
cognitive functioning (Van Ijzendoorn et al., 1995). Why would fearful infants living in less than optimal caregiving environments show higher cognitive functioning?

From a functionalist perspective, heightened emotionality serves to regulate one’s own behaviours as well as others (Campos et al., 1983). Thus, an infant who is prone to react in a fearful manner to new situations should elicit caretaking behaviours from significant others. According to attachment theory, infants whose mothers sensitively respond to their emotional needs will develop a positive internal working model of the infant–mother relationship, which in turn, fosters a secure attachment relationship (Ainsworth et al., 1978; DeWolff & Van Ijzendoorn, 1997). Thus, for secure infants, temperamental differences such as proneness to become upset to novel stimuli will neither be particularly adaptive nor maladaptive for cognitive growth because sensitive mothers will provide the necessary environment for their infants to achieve felt-security. In contrast, those infants whose mothers do not respond sensitively to their emotional needs may learn not to depend on their mother as a reliable source of comfort (Cassidy, 1994; Main, 1990). Perhaps such infants compensate by sustaining heightened levels of attention to their environment. Indeed, research with young adults suggests that those who report having been raised in a less optimal parenting environment (i.e., less authoritative and respectful) may be highly attentive to novel stimuli, assessed through tests of latent inhibition and contingency perception (Stricklin, 2000).

In this case, this increased attention might foster cognitive growth, as is seen in studies of temperamental attention in infancy and relations with language and cognitive development in later infancy and early childhood (Bee et al., 1982; Karrass et al., 2002; Matheny, 1989; Slomkowski et al., 1992). Another explanation is that perhaps insecure/fearful infants are parented differently from insecure/nonfearful infants. Distress to novelty, if it is intense enough, might serve to keep an inconsistent parent close in proximity—thereby fostering cognitive growth. An insecure/nonfearful infant, however, might not receive the same amount of caregiver interaction. In this case, then, having a fearful temperament protects the infant from the potential negative effects of having an insecure attachment relationship—at least with respect to cognitive outcomes. Clearly, more intensive research that looks at parent–child interactions could be an important moderator (as in the present study) or mediator of bidirectional relations between negative emotionality and cognition. Future studies involving repeated assessments of emotionality, cognition, and parental responses to negative emotionality, as well as attachment, would illuminate the processes through which emotionality and cognition are related in infancy and early childhood.

One limitation of the current study is the exclusion of the disorganised D attachment classification. Recent theoretical and empirical work links disorganised attachment to cognitive development through the flickering switch hypothesis (Koos & Gergely, 2001). Young infants who later develop disorganised attachment relationships are thought to experience episodes of control over their caregivers’ behaviours followed by episodes of loss of control, adversely affecting their ability to detect contingent relationships in the world. Consequently, it is theorised, these infants fail to make the normative maturational shift from an attentional bias for perfectly contingent stimulation at 3 months to an emerging bias for imperfect social contingencies, which could impact both social and cognitive development. Additionally, recent empirical investigation of differences in the development of fear and anger between the four attachment groups (i.e., A, B, C, and D) indicate complex and differing trajectories and mean differences in expression of negative emotions (Kochanska, 2001). Thus, an investigation of relations between negative emotionality, attachment, and intellectual functioning that includes the disorganised classification is needed to more fully understand relations between negative emotionality and cognition and the processes through which the mother–infant relationship affects these relations.

In sum, findings from this study indicate that certain aspects of temperamental negative emotionality (fear) but not others (anger) serve as predictors of later intellectual functioning. Furthermore, the quality of the caregiving environment is also an important factor to consider because it yields information about the context in which infants’ emotional and cognitive growth occurs. Our study, however, is limited. First, our findings can only be generalised to a fairly well-functioning, low-risk population. It is quite possible that insecure infants who are temperamentally fearful yet who live in more deprived
environments with limited physical resources would show lower, not higher, cognitive functioning during early childhood. Thus, future research should examine such relations among temperament, attachment, and cognitive abilities in different types of samples. Future research should also examine children’s intelligence beyond age 3 years. It is possible that fearful children who do not learn how to cope effectively with their negative feelings to new situations eventually show cognitive problems—particularly once they enter the school system. Indeed, research involving school-aged children has found that children with a current low tendency to approach new situations also had lower academic potential and IQ scores (Gordon & Thomas, 1967). Future studies should also more closely examine specific parenting behaviors in response to infants’ and children’s emotional reactions. As Goldberg et al. (1999a) suggest, parental antecedents of attachment are too often studied in the play context. Mothers’ responses to their infants’ fear and anger need to be studied to better understand the relations among aspects of temperament, attachment, and intelligence. Despite the limitations of our study, however, our results suggest that multiple dimensions of negative temperamental need to be considered because they appear to have different implications—not only for intellectual functioning, but also for how the caregiving system might operate and impact children’s lives.

References


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