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Temperamental precursors of infant attachment with mothers and fathers[☆]

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Abstract

The degree to which parent sensitivity and infant temperament distinguish attachment classification was examined. Multilevel modeling was used to assess the effect of parent sensitivity and infant temperament on infant–mother and infant–father attachment. Data were collected from mothers, fathers, and their infants ($N = 135$) when the infant was 3-, 5-, 7-, 12-, and 14-months old. Temperament was measured using the Infant Behavior Questionnaire-Revised (Gartstein & Rothbart, 2003); parent sensitivity was coded during the Still Face Paradigm (Tronick, Als, Adamson, Wise, & Brazelton, 1978); attachment was coded using the Strange Situation (Ainsworth, Blehar, Waters, & Wall, 1978). Results indicate that mothers and fathers were less sensitive with insecure-avoidant infants. Whereas only one difference was found for infant–mother attachment groups and temperament, five significant differences emerged for infant–father attachment groups, with the majority involving insecure-ambivalent attachment. Infants classified as ambivalent with fathers were higher in perceptual sensitivity and cuddliness and these infants also showed a greater increase in low-intensity pleasure over time compared with other infants. Results indicate the importance of both parent sensitivity and infant temperament, though operating in somewhat different ways, in the development of the infant–mother and infant–father attachment relationship.

Keywords

Infant temperament; Attachment; Parent sensitivity; Fathers

1. Introduction

It is well known that infants of more sensitive parents are more likely to develop secure rather than insecure attachment relationships (de Wolff & van IJzendoorn, 1997). A number of studies have also examined the degree to which infant temperament predicts attachment security, and while broad temperamental dimensions such as negative reactivity do not appear to distinguish secure from insecure attachment (Vaughn, Bost, & van IJzendoorn, 2008), less research has been conducted examining specific temperamental characteristics which may also relate to the quality of the attachment relationship.

A large body of literature in the 1980s and 1990s proposed that attachment as measured by the Strange Situation (Ainsworth, Blehar, Waters, & Wall, 1978; Ainsworth & Wittig, 1969)

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actually measured an infant's underlying temperament, and in doing so reflected parent responses to infant temperamental characteristics, not an affective bond (e.g., Fox, Kimmerly, & Schafer, 1991; Kagan, 1982). Sroufe (1985), however, argued that while temperamental variation may affect the expression of attachment behaviors, the underlying relational construct of affective attachment, a result of quality of care, is still accurately depicted in the Strange Situation. Supporting this idea, previous research has found that parent sensitivity is related to secure versus insecure ratings of attachment (Vaughn et al., 2008). And when temperamental dimensions such as autonomic stability (amount of startle response) and fear are related to attachment, they predict subcategory classification (e.g., A, B1–B2 vs. B3–B4, and C), not security (Belsky & Rovine, 1987; Mangelsdorf, McHale, Diener, Goldstein, & Lehn, 2000; Thompson, Connell, & Bridges, 1988).

Much of this research, however, has involved infant–mother dyads but not infant–father dyads. It has been posited that the development of the infant–mother and infant–father relationship differs (Braungart-Rieker, Garwood, Powers, & Wang, 2001). Thus, it is possible that the role infant temperament plays in the infant–mother attachment relationship differs from that in the infant–father attachment relationship and an in-depth examination of temperament and attachment with both mothers and fathers is required. The current study assessed parent sensitivity and multiple dimensions of temperament in relation to infant–mother and infant–father attachment in early infancy.

1.1. Attachment

Ainsworth and colleagues (1978) originally identified three attachment categories using a Strange Situation Procedure, based chiefly on the behaviors of infants during separations and reunions with their caregivers (A, B, or C). Typically, secure (B) infants seek visual or physical contact with the caregiver and engage in more exploration and play. Infants classified as avoidant (A) avoid proximity with the caregiver upon reunion and also show little distress during a separation. Ambivalent (C) infants display both anger and proximity seeking after a separation, and are typically less able to explore in the presence of the caregiver as well. A fourth classification of organization (D, disorganized) was later identified and added to the traditional patterns of attachment literature (Main & Solomon, 1986). Infants classified as D display a variety of attachment behaviors exhibiting a lack of organization in their behaviors. These infants also often have a secondary A, B, or C classification.

1.1.1. Attachment and parent sensitivity—Ainsworth and colleagues (1978) posited that the quality of the attachment relationship was determined by a mother's warm, responsive parenting. Those mothers who are consistently warm and responsive to the infants' needs are more likely to develop a secure attachment relationship with their infant. The infant then looks to the mother as a secure, reliable source of care. Those mothers who exhibit more intrusive, or inconsistent parenting, or who are unresponsive or rejecting, are more likely to develop an insecure attachment relationship with their infant (Bretherton & Munholland, 2008). Parent sensitivity, or the ability of the caregiver to appropriately perceive and respond to the infant's emotional cues, appears to be an accurate measure of these parenting qualities, and is moderately related to infant–parent attachment for both mothers (see de Wolff & van IJzendoorn, 1997, for a review) and fathers (Lucassen et al., 2011; van IJzendoorn & de Wolff, 1997).

1.1.2. Infant–father attachment—Interestingly, little research has been conducted that measures infant attachment with both mothers and fathers. Fox and colleagues (1991) suggest that even if mothers and fathers are measured separately, concordance rates are high and attachment with the father may in fact depend on attachment with the mother.

Specifically, infant–mother and infant–father attachment as measured by the Strange Situation has high concordance when using both A, B, C classification (Notaro & Volling, 1999), as well as continuous coding systems (Brown, Schoppe-Sullivan, Mangelsdorf, & Neff, 2010). Conversely, other research concludes that while there is some evidence of dependence across dyads, infant attachment relationships develop relatively independently with multiple caregivers (Braungart-Rieker et al., 2001; Steele, Steele, & Fonagy, 1996; Wong, Mangelsdorf, Brown, Neff, & Schoppe-Sullivan, 2009). Additionally, in a meta-analysis of infant–mother and infant–father attachment, those studies which have examined mothers and fathers separately indicate that while the percentage of infants who are secure with mothers and fathers is similar (67% secure), dependence of attachment security across dyads is modest ($\Phi = .17$; van IJzendoorn & de Wolff, 1997). Furthermore, the effect size for the relation between mother sensitivity and infant–mother attachment ($r = .24$) is higher than the effect size for father sensitivity and infant–father attachment ($r = .13$; van IJzendoorn & de Wolff, 1997), suggesting that factors in addition to father sensitivity may be salient in the development of the infant–father attachment relationship.

Traditionally, mothers have served as primary caregivers and tend to be more involved in the caregiving of infants and young children (Parke, 2000); fathers have traditionally been seen as playmates, and spend overall less time with infants than mothers (Pleck, 2010). Therefore, it is not surprising that infant–parent attachment may be more directly related to mothers' sensitivity than fathers' sensitivity. It follows, then, that the infant–father attachment relationship may develop in a different manner than the infant–mother attachment relationship. It is possible that the infant–father relationship is more susceptible to infant characteristics such as temperament than the infant–mother relationship (Cummings, Davies, & Campbell, 2000; Pleck, 2010).

1.2. Attachment and temperament

Previous research has found that temperament characteristics, defined as biologically based individual differences in reactivity and regulation (Rothbart & Bates, 2006), do not generally distinguish secure from insecure attachment (Marshall & Fox, 2005; Vaughn et al., 2008). For example, Pauli-Pott, Havercock, Pott, and Beckmann (2007) examined infant negative emotionality and later attachment classification (B vs. not B; D vs. not D) and found no temperament differences between attachment groups. Marshall and Fox (2005) looked at infant negative reactivity and found no differences for secure versus insecure groups, or between A vs. B vs. C classifications.

A number of studies, however, have found that broad factors such as temperamental negative reactivity are related to sub-classifications A1, A2, B1, B2 versus B3, B4, C1, C2 rather than secure (B) versus insecure (A + C) classifications (e.g., Belsky & Rovine, 1987; Marshall & Fox, 2005; van IJzendoorn & Bakermans-Kranenberg, 2004). Belsky and Rovine (1987) found that mothers reported infants later classified as A1–B2 as less temperamentally difficult at 3 months than B3–C2 infants. Braungart-Rieker and colleagues (2001) found a similar attachment sub-classification split in relation to observed infant affective regulation. Infants who were classified as A1–B2 with mothers at 12 months showed more affective regulation at 4 months than infants who were classified as B3–C4 with mothers.

Temperamental variables other than broad negative reactivity and regulation may also predict attachment. Karrass and Braungart-Rieker (2004) found that secure infants were rated higher in distress to novelty at 4 months than insecure infants. In contrast, Mangelsdorf and colleagues (2000) found that insecure infants were rated higher in distress to novelty at 4 months than secure infants. Another study found that avoidant infants were rated higher on a temperament scale measuring duration of orienting (Bradshaw, Goldsmith, & Campos,

1987). Additionally, in Belsky and Rovine's (1987) study, infants later classified as A1–B2 were more oriented to visual and auditory cues three days postpartum. Taken together, results from these studies suggest that temperament does not necessarily distinguish security from insecurity, but is related to how security or insecurity is expressed. These studies, though, either did not include fathers (Bradshaw et al., 1987; Karrass & Braungart-Rieker, 2004; Mangelsdorf et al., 2000; Marshall & Fox, 2005; Pauli-Pott et al., 2007), did not examine temperament in relation to infant–father attachment independent of infant–mother attachment (Belsky & Rovine, 1987), or did not find significant results for infant–father attachment (Braungart-Rieker et al., 2001). In addition, many studies have been limited to examining a single or broad dimension of temperament rather than adopting a more comprehensive approach of examining multiple specific components of temperament. The mixed results of previous research indicate the need to further examine infant–father attachment in relation to infant temperamental characteristics.

The study of temperamental trajectories is often neglected as well. While temperamental constructs are thought to reflect biologically based differences in frequency, duration, and intensity of emotional expressions (Rothbart & Bates, 2006), there is some evidence that temperament is not stable until early childhood (Denham & Lehman, 1995; Lemery, Goldsmith, Klinnert, & Mrazek, 1999). Moreover, Rothbart and Bates (2006) assert that temperament should actually show some developmental changes over time, and that studying such changes will lead to a better understanding of child development. Further, a child's behaviors may sometimes evoke certain reactions from parents, which in turn can affect the developing parent–child relationship. In fact, some have suggested that the level of positive or negative affectivity an infant expresses may directly relate to the developing attachment relationship (Belsky, Fish, & Isabella, 1991). Specifically, Belsky and colleagues (1991) found that those infants who changed from high positive temperament at 3 months to low positive temperament at 9 months were more likely to be insecure with mothers than those infants who were high positive at both time points. Interestingly, they did not find that negative temperament related to infant–mother attachment, nor did they examine infant–father attachment. Therefore, examining changes in temperamental reactivity and regulation over time in relation to attachment adds to existing literature on the development of both infant–mother and infant–father attachment.

1.3. The current study

The current study examined three classifications of attachment (avoidant, secure, and ambivalent) with mothers and fathers as they relate to the more fine-tuned aspects of temperament, such as anger, fear, smiling and laughter, perceptual sensitivity, and vocal reactivity. We examined both mean level and change in temperament over time in relation to attachment style. Differing bodies of previous research have asserted that (1) attachment styles are actually a reflection of parent responses to infant temperament (Fox et al., 1991), or (2) the affective attachment bond is unrelated to temperament, but the expression of insecurity may be related to infant temperamental negativity and reactivity (Sroufe, 1985). Most of this research, however, has looked at infant–mother dyads and not infant–father dyads. The current study adds to the literature by examining both mothers and fathers with their infants. Additionally, whereas overall negativity, fear and anger proneness, and startle response have been examined in relation to attachment (e.g. Belsky & Rovine, 1987; Mangelsdorf et al., 2000; Marshall & Fox, 2005), the current study systematically explored all aspects of temperament, including both level and trajectory, as measured by the Infant Behavior Questionnaire-Revised (Gartstein & Rothbart, 2003) in relation to attachment with mothers and fathers. Furthermore, in order to assess whether parent sensitivity predicts attachment in our sample, we also examined the relation between attachment and parent sensitivity in infancy.

2. Method

2.1. Participants

The current study was part of a larger longitudinal study exploring socio-emotional development in 135 families with infants. Participants were recruited in multiple ways: flyers from a local hospital, announcements during birth classes, business cards and an informational booth at community events. Families attended six laboratory visits when the infants were 3-, 5-, 7-, 12-, 14-, and 20-months old (± 14 days). Only mothers and infants attended the 12-month visit, and only fathers and infants attended the 14-month visit. In the full sample, 52.6% ($n = 71$) infants were girls, and parents were predominantly Caucasian (90.4% mothers, 87.4% fathers) and middle class (average income \$45,000–\$59,999). Approximately 3% of mothers and 5.2% of fathers did not complete high school, and 8% of mothers and 13% of fathers completed high school. Over half of the parents had completed some college (59.3% mothers and 53.7% fathers), with approximately a fifth of participants having earned a post-graduate degree (20% mothers, 20.1% fathers). Parent age ranged from 17 to 44 for mothers ($M = 29.34$, $SD = 5.32$) and 18 to 44 for fathers ($M = 30.79$, $SD = 5.62$).

Attrition analyses indicated that of the original 135 families in the sample, 130 returned for the 5-month visit, 125 returned for the 7-month visit, 124 mothers and infants returned for the 12-month visit, and 117 fathers and infants returned for the 14-month visit. Statistical comparisons between the full sample ($n = 135$) and the sample used in analyses ($n = 124$ for mothers, $n = 117$ for fathers) indicated that the remaining sample was older, had higher education levels, higher incomes, and were more likely to be European American.

2.2. Procedures

Before each laboratory visit, parents completed a packet of questionnaires, which included demographic questions as well as a measure of infant temperament.

2.2.1. 3-, 5-, and 7-month visits—During the laboratory visits at 3, 5, and 7 months, each parent participated in the Still-Face Paradigm (SFP; Tronick et al., 1978) with parent order counterbalanced. The first parent was instructed to place the infant in a booster seat and then sit down facing the infant. The SFP involved three 90-s episodes—play, still-face, and reunion, with a soothing episode between parents to allow the child to revert to a neutral or positive state. For the first episode, parents were instructed to interact with their infant doing as they normally would do while maintaining the infant in the seat, for example talking, singing, or touching. During the still-face episode, parents stopped interacting with their infant and were instructed to display a blank face. For the last episode, parents resumed interacting with their infant as they did during the first episode. Once the SFP was complete with one parent, the second parent completed the same procedure. The current study uses only interactions coded during the play and reunion episodes of the SFP.

2.2.2. 12- and 14-month visits—Attachment security was measured using Ainsworth and Wittig's (1969) Strange Situation, conducted at 12 months with mothers and 14 months with fathers. The SSP is a well-known assessment involving seven 3-minute episodes designed to elicit attachment behaviors in infants through a series of separations and reunions with a caregiver. Parent order was not counterbalanced, as previous research has indicated that order effects do not exist when laboratory visits involving the SSP have at least a 4-week separation in between (Belsky, Rovine, & Taylor, 1984).

2.3. Measures

2.3.1. Infant temperament—Infant temperament at 3, 5, and 7 months was measured using the Infant Behavior Questionnaire-Revised (IBQ-R; Gartstein & Rothbart, 2003), a 191-item measure with 14 scales: activity level, approach, cuddliness, distress to limitations, duration of orienting, fear, high intensity pleasure, low intensity pleasure, perceptual sensitivity, reactivity (i.e., falling affectivity/rate of recovery from distress), sadness, smiling and laughter, soothability, and vocal affectivity. Mothers were asked to rate their infant's behavior on a seven-point scale, ranging from 'never' to 'always' engaging in a behavior. Scores from each item of a scale were then averaged to yield a mean score ranging from one to seven. Descriptions and scale reliabilities can be seen in Table 1. Reliability assessments around .7 are considered acceptable (Nunnally, 1978).

2.3.2. Parental sensitivity—During the laboratory visits at 3, 5, and 7 months, parent sensitivity was assessed by coding sensitivity and intrusiveness during the play and reunion episodes of the SFP (Braungart-Rieker et al., 2001). *Sensitivity* was defined as the parent's apt response to the infant's state and the ability to appropriately alter their own behavior as the infant's state changes (Braungart-Rieker et al., 2001). For example, a sensitive parent follows their infant's behavioral cues; if the parent is engaging with a distressed infant, a sensitive parent is able to identify the source of distress and soothe or calm the infant appropriately. *Intrusiveness* was defined as the parent inappropriately responding to an infant's cues by following his or her own agenda instead of soothing the infant properly. For example, if the parent is playing with the baby's hands making the baby clap and the baby enjoys it that is not intrusive; however, if the infant does not enjoy the play and exhibits anger or distress but the parent continues with the same behavior, it is intrusive.

Sensitivity and intrusiveness were coded separately on five-point Likert scales every 10-s during the play and reunion episodes of the SFP and for each parent. To maintain objectivity, coders did not code mothers and fathers of the same family within the same time-point. Gold standard coders coded approximately 25% of the episodes in order to assess inter-rater reliability. Inter-class correlations (ICCs) obtained during the play and reunion episodes across all three time points for mothers (sensitivity: $M = .94$, range = .88–.96; intrusiveness: $M = .93$, range = .88–.96) and for fathers (sensitivity: $M = .92$, range = .90–.95; intrusiveness: $M = .91$, range = .84–.95) indicate high reliability for sensitivity. In addition, sensitivity and intrusiveness (intrusiveness was reverse scored such that low scores indicate high intrusiveness) were highly related at each infant age (3 months: $n = 132$, $r = .77$, $p < .001$; 5 months: $n = 126$, $r = .82$, $p < .001$; 7 months: $n = 122$, $r = .73$, $p < .001$ for mothers; 3 months: $n = 132$, $r = .69$, $p < .001$; 5 months: $n = 124$, $r = .80$, $p < .001$; 7 months: $n = 120$, $r = .70$, $p < .001$ for fathers). Therefore, a composite score for parental sensitivity was calculated by averaging sensitivity and intrusiveness for mothers and fathers, such that higher scores indicate higher levels of sensitivity and lower levels of intrusiveness.

2.3.3. Infant–parent attachment—Attachment, coded from the Strange Situation, is classified based on an infant's responses to separation from a caregiver. Initially, infants were classified into one of four categories: insecure-avoidant (A), secure (B), insecure-ambivalent (C), or disorganized (D) with a secondary A–B–C classification with each parent (Ainsworth et al., 1978; Main & Solomon, 1986). For the purposes of the current study, however, and to increase power and sample size per group, only A–B–C classifications were used. Therefore, those infants identified as D were reclassified into their secondary traditional attachment categories. Two infant–father pairs were classified as D/A/C, and therefore had no single secondary classification, and were removed from analyses, resulting in 115 infant–father pairs.

Infants classified as B seek contact with their caregiver during reunion, whether physical or emotionally. Infants classified as A avoid contact or ignore their caregivers during the reunion episodes. Infants classified as C tend to not explore their environment in the presence of the caregiver prior to separation, and following separations these infants show both anger (e.g., pushing caregiver away) and contact seeking behaviors toward their caregivers.

Videos of the procedure with infant–mother and infant–father dyads were sent to the University of Minnesota to be coded by a two-person coding team, led by Dr. Elizabeth Carlson. Inter-rater reliability was assessed on 16% of the infant–mother and 17% of the infant–father tapes, yielding a 90% agreement with a Cohen's kappa = .84 for infant–mother dyads, and an 80% agreement with a Cohen's kappa = .71 for infant–father dyads. Frequencies of attachment classification with mothers and fathers can be seen in Table 2, along with concordance rates of attachment with mothers and fathers.

3. Results

Results are organized into two sections. First, descriptive results for the study variables are presented. Second, growth curve modeling results are presented for each infant temperament scale and factor, as well as mother and father sensitivity. Growth curve modeling is an effective method for studying change with repeated-measures data as well as for testing possible categorical predictors of such change (Boyle & Willms, 2001; Willett, Ayoub, & Robinson, 1991). Growth curve estimates for infant temperament and parental sensitivity trajectories are presented as well as estimates of how levels and trajectories of the aforementioned constructs relate to attachment classification with mothers and fathers.

3.1. Descriptive statistics and correlations

Frequencies and percentages of infant–mother and infant–father attachment groups are presented in Table 2. Chi-square analyses were conducted examining frequencies of attachment classification across parent dyads (see Table 2 for concordance frequencies) and indicated that attachment security was partially independent across secure versus insecure (B vs. not B, $\chi^2(1) = 2.09, p = .16$) and attachment style (A vs. B vs. C, $\chi^2(4) = 9.19, p < .10$). Therefore, it is appropriate to examine predictors of infant–mother and infant–father attachment separately.

To determine the degree to which demographic variables (infant gender, parent age, parent ethnicity, parent education, cohabitation status, and income) were related to attachment, ANOVAs or chi-square analyses were conducted depending on variable scaling. Parent age, cohabitation status, parent education level, father ethnicity, and income were unrelated to attachment. Infant gender and mother ethnicity, however, were significantly related to mother–infant attachment status. Female infants were more likely to be rated insecure-ambivalent, and male infants were more likely to be rated insecure-avoidant with mothers ($\chi^2(2) = 6.69, p < .05$). Additionally, European American mothers were more likely than minority mothers to be rated secure with their infants ($\chi^2(2) = 6.23, p < .05$) so we included infant gender and mother minority status as covariates in further analyses involving mothers.

In addition, we conducted correlation analyses for each of the 14 temperament dimensions in order to determine whether discriminant validity existed between each scale. Correlations within each time-point and between each scale are presented in Table 3. While there were several large correlations above .5 (Cohen, 1988), only laughter and smiling and vocal affectivity were strongly related at all three time-points ($r > .60$). Therefore, in order to maintain the current study's comprehensive examination of temperament and attachment, we used all 14 scales in further in analyses.

3.2. Multi-level modeling

Analyses for the current study used SAS PROC MIXED (Singer, 1998) to fit multilevel models (MLM; Singer & Willett, 2003) for parent sensitivity, as well as each temperament scale. This allows us to examine individual change, average change, and predictors of change over time (e.g., Boyle & Willms, 2001; Willett et al., 1991). Moreover, MLM is appropriate to use when conducting multiple comparisons because such analyses are not as susceptible to Type I error as are other analytical methods (Gelman, Hill, & Yajima, 2012).

3.2.1. Unconditional models—Unconditional models were conducted to assess mean level variation (differences from zero) and individual variation for infant temperament and parental sensitivity. One model was conducted for each outcome variable and infant age was entered as a predictor of infant temperament and parental sensitivity over time. Age was centered on age of the infant at the initial laboratory visit (3 months). Variance parameter estimates and solutions for fixed effects from the unconditional models are presented in Table 4. Tests for average linear slopes indicated that mother sensitivity and nine individual temperament scales showed significant increases over time. Cuddliness showed significant decreases over time, whereas distress to limitations, sadness, falling reactivity, and soothability did not show significant change.

In terms of individual variation, parameter estimates for intercepts, but not linear slopes of parental sensitivity were significant, indicating that there was significant variability within mothers and fathers at 3 months but not in changes in sensitivity over time. Parameter estimates assessing individual variability in infant temperament were also significant, indicating that there is sufficient variation in each temperament scale intercept to further examine attachment classification as a predictor of the intercept. Individual variation in linear change, however, was significant for infant approach behaviors, vocal affectivity, distress to limitations, fear, sadness, falling reactivity, duration of orienting, and low intensity pleasure. There was not sufficient variation across individuals, however, for linear change in high intensity pleasure, activity level, laughter and smiling, perceptual sensitivity, cuddliness, or soothability. Consequently, conditional models were subsequently tested for those parameters that showed significant variation in their respective unconditional models.

3.2.2. Conditional models—Conditional models were conducted to test for associations between attachment and parent sensitivity, and attachment and infant temperament. These models included dummy coded variables for attachment groups, such that we were able to compare B vs. A, B vs. C, and A vs. C groups. Attachment was treated as a fixed effect given that it was assessed at only one time-point per infant–parent dyad. Again, infant age was centered at the initial laboratory visit to allow the intercept to provide a meaningful estimate of level of temperament or sensitivity at the initial laboratory visit (Raudenbush & Bryk, 2002). As mentioned above, either a no change or linear change model was used to examine temperament trajectories in relation to attachment only when unconditional models indicated sufficient variation to include predictors in the model. Thus, intercepts and linear change estimates that were significantly different between attachment groups are interpreted (see Table 5).

For models examining the prediction of parent sensitivity, results indicated that mothers were significantly less sensitive at 3 months with infants later classified as insecure-avoidant than infants classified as secure, but not insecure-ambivalent. Fathers were also initially less sensitive with insecure-avoidant infants than both secure and insecure-ambivalent infants.

In terms of infant temperament, infants rated as avoidant with mothers were significantly higher in initial levels of cuddliness than infants rated secure. No other significant differences in temperament trajectories were detected for infant–mother dyads. Five

significant models examining temperamental differences emerged for infant–father attachment dyads. Infants later rated insecure-avoidant with fathers had higher initial levels of vocal reactivity than secure infants but did not increase in vocal reactivity over time as did infants later classified as secure. Infants rated as insecure-ambivalent with fathers showed higher initial levels of perceptual sensitivity and cuddliness, and showed greater increases in low intensity pleasure over time than did secure infants.

4. Discussion

The current study examined trajectories of parent sensitivity and infant temperament during early infancy in relation to attachment classification with mothers and fathers. Although previous research has linked parent sensitivity and infant–parent attachment (de Wolff & van IJzendoorn, 1997; van IJzendoorn & de Wolff, 1997), as well as negative emotionality and infant–parent attachment subclassification (Belsky & Rovine, 1987) the current study adds to existing literature by being the first to our knowledge to examine the degree to which a variety of temperamental scales, both in terms of initial levels and patterns of change over time, are related to infant–mother and infant–father attachment.

4.1. Attachment and sensitivity

As expected, sensitivity was related to infant–parent attachment for mothers and fathers. The attachment relationship develops through the continued warm, responsive, and sensitive caregiving behaviors of parents (Ainsworth et al., 1978; Bretherton & Munholland, 2008); therefore, it follows that sensitivity would be important in differentiating between secure versus insecure-avoidant relationships. It is possible that parents are less sensitive with avoidant infants because avoidant infants exhibit fewer attachment behaviors than do secure or ambivalent infants. If this is, in fact, the case, we would also expect that various temperamental characteristics during early infancy would differ for future avoidant infants compared with future secure or ambivalent infants. Alternatively, infants may develop adaptive coping strategies such as avoidance to help manage a less sensitive caregiving environment (Cassidy & Berlin, 1994). In this case, infants may have learned not to expect fathers to exhibit sensitive responses to their emotional signals and have adopted a more self-regulated and avoidant way of coping with relational and emotional issues (Braungart-Rieker et al., 2001).

Interestingly, mothers and fathers were not less sensitive with insecure-ambivalent infants. With the relatively small counts of insecure infants, the current study may not have had sufficient power to detect differences in insecure-ambivalent attachment and sensitivity, even though previous studies have done so (Bretherton & Munholland, 2008; de Wolff & van IJzendoorn, 1997). Additionally, ambivalent infants are often both preoccupied with and resistant to their caregiver, which can result from inconsistent parenting or lack of availability and responsivity (Cassidy & Berlin, 1994). Parents who were rated as more sensitive during the relatively brief SFP task may in fact show inconsistent parenting at home. Future research should examine sensitivity for longer periods of time to determine whether differences truly exist in parental sensitivity and later attachment classification. Additionally, sensitivity should be rated in multiple contexts within the home and laboratory environments to assess consistency in parenting across context and time.

4.2. Attachment and temperament

Previous research has found that an infant's temperament may help differentiate attachment classifications as well (e.g., Belsky & Rovine, 1987; Mangelsdorf et al., 2000; Thompson et al., 1988). The current study found differences between attachment groups for various

temperamental dimensions for both mothers and fathers. For the most part, dimensions of temperament distinguished infant–mother vs. infant–father attachment groups differently.

4.2.1. Cuddliness—To our knowledge, this is the first study to examine temperamental dimensions such as cuddliness in relation to infant–parent attachment. This is somewhat surprising, given that cuddling infants is an important caregiving behavior that promotes physical closeness and should enhance attachment security. Interestingly, different findings emerged depending on which infant–parent dyad was examined.

For infant–mother attachment, avoidant infants were initially higher in cuddliness than secure infants. For infant–father attachment, however, ambivalent infants were initially higher in cuddliness than secure infants. At 3-months of age, infants who are rated higher in cuddliness may want or benefit more from heightened levels of responsiveness, perhaps especially in the form of close physical contact. If this need is not adequately met, infants can develop an insecure attachment with parents. Thus, either a strategy of developing a dismissing, avoidant attachment style or a more preoccupied, ambivalent style of attachment may help infants better manage the conflict (Cassidy & Berlin, 1994). Future studies should more closely examine how aspects of caregiving not addressed in the present study, such as holding the infant and the amount of physical comfort used to help soothe infants further explains linkages between temperamental cuddliness and infant–parent attachment.

4.2.2. Vocal reactivity—Interestingly, infants rated insecure-avoidant with fathers had higher initial levels of vocal reactivity, but did not increase in vocal reactivity over time, as did secure infants. In conjunction with the finding that fathers were also less sensitive with insecure-avoidant children, this supports the possibility that infant characteristics could affect their caregiving environment. It is possible that avoidant infants do not attract their father's attention as much as other infants, and in so doing, develop an avoidant style of behavior with their fathers.

It is interesting that even though two temperament dimensions, laughter and smiling and vocal reactivity, were highly correlated, they were differentially related to infant attachment status. Laughter and smiling was unrelated to infant–father attachment, whereas vocal reactivity was initially higher, but did not increase at the same rate for insecure avoidant infants. This highlights the need for future studies to examine individual dimensions of temperament, particularly in relation to the infant–father relationship.

4.2.3. Infant–father ambivalent attachment and temperament—Several additional results emerged for infant–father attachment, particularly for infants later identified as insecure-ambivalent, that did not distinguish infant–mother attachment groups. For fathers, increased levels of perceptual sensitivity were related to the development of insecure-ambivalent attachment with infants. Perceptual sensitivity refers to the detection of slight, low intensity stimuli in the external environment (Gartstein & Rothbart, 2003), and seems to capture more subtle characteristics of an infant's attention to environmental stimuli. It appears that perceptually sensitive infants are more acutely aware of and impacted by their caregiving environment. For example, an infant rated high in perceptual sensitivity may notice that a caregiver's touch feels insensitive or intrusive rather than warm and comforting more so than an infant rated lower in perceptual sensitivity. Thus, infants who have high perceptual sensitivity may be at greater risk for developing an ambivalent relationship with their father when aspects of the environment (e.g., less positive parenting, stress in the home, less stable non-parental care, etc.) are problematic.

One finding that is rather curious in the current study is that infants rated insecure-ambivalent with fathers increased in their level of low-intensity pleasure over time more so

than secure infants, even though initial levels of low-intensity pleasure did not differ between the three attachment groups. Coupled with the finding that infants who develop an ambivalent style of attachment with fathers are also higher in perceptual sensitivity, our results suggest that such infants are engaging in a relatively cautious way of interacting with one's environment. This perhaps reflects a developing strategy that enables infants to engage with their environment without becoming over-stimulated.

Additionally, it is possible that measuring temperament at multiple ages shows us different pieces of the puzzle. For example, Belsky and Rovine (1987) examined newborn temperament and 12 month attachment; Braungart and Stifter (1991) examined concurrent relations between temperament and attachment at 12 months; Marshall and Fox (2005) examined temperament at 4 months and later (14 month) attachment classification; finally, Thompson and Lamb (1984) examined concurrent relations at 12 and 19 months, yet none of these studies examined trajectories of temperament. To our knowledge, this is the first study to examine temperament trajectories in infancy over three time points (3, 5, and 7 months) so that both level and change in infant behaviors may be assessed in relation to attachment security with parents. In this way, we can see how trajectories of temperament unfold while the attachment system is developing.

4.3. Limitations and future research

Several limitations exist in the current study. First, sensitivity was studied in a semi-structured context under conditions that typically elicit mild distress. Assessing sensitivity in more emotionally distressing contexts might reveal stronger links with attachment (McElwain & Booth-LaForce, 2006) and possibly different relations with infant temperament. In addition, while we constrained our literature review to those studies that used the Strange Situation to assess attachment, differences in definitions of temperament and in methodology could partly explain differential findings across studies (e.g., negative reactivity vs. difficult temperament, temperament assessed neonatally vs. at 3–7 months, observational vs. parent report, etc.). Future studies would benefit from applying a multi-method approach to the study of both temperament and parenting to more fully understand the development of infant–mother and infant–father attachment in relation to these concepts. Third, families in our study were relatively low-risk in terms of socio-economic and psychosocial dimensions. Thus, the generalizability of our results is restricted to a fairly high functioning population whose majority (65%) is securely attached with both parents.

4.4. Conclusions

Previous research has suggested that the infant–parent attachment relationship develops in response to an infant's temperament, and therefore, that infant–mother and infant–father attachments are qualitatively and quantitatively similar (e.g., Fox et al., 1991; Kagan, 1982). The current study shows that not only are mother and father–infant attachment relationships independent of each other, but it is possible that the infant–mother and infant–father attachment relationship develops differently. Similar to previous work (e.g., Cummings et al., 2000; Volling & Belsky, 1991), the current study indicated that father behaviors tend to be more affected by infant factors than mother behaviors. Specifically, we found that infant temperament was related to attachment much more so for fathers than mothers, thus infant temperament may be more salient in the developing infant–father than infant–mother attachment relationship.

In conclusion, the present study adds to the literature on infant–parent attachment in two ways: firstly, and similar to previous work, parent sensitivity was related to infant–parent avoidant attachment (e.g., van IJzendoorn & de Wolff, 1997). Secondly, by including additional attachment figures such as fathers, we learn more about how temperament, parent

sensitivity, and attachment are related. It is clear that the quality of care an infant receives from mothers and fathers is related to attachment to caregivers (Ainsworth et al., 1978), yet, infant temperament was associated with infant–father ambivalent attachment even when father sensitivity was not. It is possible that since fathers often take on a secondary caregiving role (Parke, 2000), infant characteristics play a particularly important part in the development of fathers' parenting behaviors and attachment relationships. This reflects the complex relationship that exists between infants and fathers and highlights the need for further research on the development of infant–father attachment.

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Table 1

Infant Behavior Questionnaire-Revised, Scales and Reliability at 3-, 5-, and 7 months.

Scale	Definition	Average reliability
High intensity pleasure	Amount of pleasure or enjoyment related to high stimulus intensity, rate, complexity, novelty, and incongruity	.83 (range: .81-.87)
Activity level	Baby's gross motor activity, including movement of arms and legs, squirming, and locomotor activity	.74 (range: .69-.76)
Approach	Rapid approach, excitement, and positive anticipation of pleasurable activities	.85 (range: .83-.90)
Smiling and laughter	Smiling or laughter from the child in general caretaking and play situations	.81 (range: .81-.82)
Vocal affectivity	Amount of vocalization exhibited by the baby in daily activities	.80 (range: .71-.89)
Perceptual sensitivity	Amount of detection of slight, low intensity stimuli from the external environment	.81 (range: .76-.86)
Distress to limitations	Baby's fussing, crying or showing distress while (a) in a confining place or position; (b) involved in caretaking activities; (c) unable to perform a desired action	.77 (range: .72-.80)
Fear	The baby's startle or distress to sudden changes in stimulation, novel physical objects or social stimuli; inhibited approach to novelty	.88 (range: .79-.90)
Sadness	General low mood; lowered mood and activity specifically related to personal suffering, physical state, object loss, or inability to perform a desired action	.79 (range: .78-.80)
Falling reactivity	Rate of recovery from peak distress, excitement, or general arousal; ease of falling asleep	.86 (range: .85-.87)
Duration of orienting	The baby's attention to and/or interaction with a single object for extended periods of time	.82 (range: .81-.83)
Low intensity pleasure	Amount of pleasure or enjoyment related to low stimulus intensity, rate, complexity, novelty, and incongruity	.82 (range: .71-.88)
Cuddliness	The baby's expression of enjoyment and molding of the body to being held by a caregiver	.84 (range: .82-.86)
Soothability	Baby's reduction of fussing, crying, or distress when soothing techniques are used by the caretaker	.81 (range: .76-.85)

Table 2

Distribution of infants classified as secure, insecure-avoidant, or insecure-ambivalent with mothers and fathers: primary and secondary classifications.

Classification	Mothers (n =124)		Fathers (n =115)	
	N	%	N	%
Insecure-avoidant(A)	12	9.84	11	9.65
Primary classification	5	4.10	8	7.18
Disorganized/avoidant (D/A)	7	5.74	3	2.63
Secure (B)	96	77.42	92	80.00
Primary classification	90	72.58	81	70.43
Disorganized/secure (D/B)	6	4.84	11	9.57
Insecure-ambivalent (C)	16	12.90	12	10.53
Primary classification	10	8.06	7	6.14
Disorganized/ambivalent (D/C)	6	4.84	5	4.39

Mother-father concordance (n =115)	N	%
A _{mother} -A _{father}	2	1.74
A _{mother} -B _{father}	6	5.22
A _{mother} -C _{father}	2	1.74
B _{mother} -A _{father}	9	7.83
B _{mother} -B _{father}	75	65.22
B _{mother} -C _{father}	6	5.22
C _{mother} -A _{father}	0	0
C _{mother} -B _{father}	11	9.57
C _{mother} -C _{father}	4	3.48

Table 3

Zero-order correlations among temperament variables at each time point.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. High intensity pleasure														
3-month	-													
5-month		-												
7-month			-											
2. Activity level														
3-month	.05	-												
5-month	.01		-											
7-month	.05			-										
3. Approach														
3-month	.38*	.06	-											
5-month	.33*	.12		-										
7-month	.36*	.24*			-									
4. Laughter and smiling														
3-month	.49*	.19*	.24*	-										
5-month	.56*	.09*	.34*		-									
7-month	.44*	.19*	.37*			-								
5. Vocal affectivity														
3-month	.37*	.36*	.28*	.60*	-									
5-month	.39*	.30*	.39*	.66*		-								
7-month	.41*	.27*	.39*	.64*			-							
6. Perceptual sensitivity														
3-month	.19*	.18*	.44*	.23*	.38*	-								
5-month	.07	.03	.40*	.09	.14		-							
7-month	.20*	.22*	.49*	.28*	.29*			-						
7. Distress to limitations														

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
3-month	-.08	.21*	-.08*	-.23*	-.07	.0004	-							
5-month	-.01	.34*	.09*	-.02	.22*	.03	-							
7-month	-.04	.36*	.01*	-.19*	.10	-.01	-							
8. Fear														
3-month	.08	.24*	.27*	.27*	.37*	.28*	.05	-						
5-month	-.05	.18*	.16*	.05	.18*	.18*	.27*	-						
7-month	-.04	.20*	.16*	.06	.13	.20*	.16	-						
9. Sadness														
3-month	-.02	.18*	-.10	-.11	-.10	.09	.57*	.04	-					
5-month	-.23*	.27*	.04*	-.10	.06	-.03	.48*	.31*	-					
7-month	-.06	.32*	.10*	-.10	.20*	.07	.48*	.28*	-					
10. Falling reactivity														
3-month	.23*	-.24*	.13	.12	.13	.04	-.59*	.01	-.51*	-				
5-month	.20*	-.25*	.07	.01	-.11	.05	-.56*	-.18*	-.58*	-				
7-month	.20*	-.20*	.10	.11	-.07	.11	-.47*	-.06	-.36*	-				
11. Duration of orienting														
3-month	.29*	.06	.34*	.27*	.35*	.33*	-.13	.23*	-.19*	.28*	-			
5-month	.31*	-.14	.28*	.34*	.34*	.27	-.08	.09	-.01	.06	-			
7-month	.39*	.08	.29*	.53*	.36*	.36	-.13	.04	-.09	.07	-			
12. Low intensity pleasure														
3-month	.29*	.09	.23*	.18*	.32*	.19*	-.2	.11	-.19*	.39*	.55*	-		
5-month	.52*	-.12	.24*	.32*	.26*	.19*	-.22*	-.10	-.33*	.23*	.48*	-		
7-month	.52*	-.01	.34*	.37*	.26*	.27	-.28*	-.04	-.23*	.27	.52*	-		
13. Cuddliness														
3-month	.27*	-.28*	.20*	.14	.07	.07	-.30*	-.08	-.26*	.30*	.14	.26*	-	

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
5-month	.34 [*]	-.22 [*]	.01	.15	.11	.05	-.26 [*]	-.22 [*]	-.32 [*]	.28 [*]	.15	.42 [*]	-	-
7-month	.40 [*]	-.25 [*]	.06	.31 [*]	.19 [*]	.06	-.22 [*]	-.18 [*]	-.20 [*]	.21 [*]	.35 [*]	.43 [*]	-	-
14. Soothability														
3-month	.26 [*]	-.24 [*]	.30 [*]	.15	.19 [*]	-.01	-.36 [*]	-.01	-.37 [*]	.55 [*]	.20 [*]	.30 [*]	.42 [*]	-
5-month	.35 [*]	.02	.18 [*]	.04	.06	.20 [*]	-.15	-.07	-.22 [*]	.33 [*]	.12	.25 [*]	.18 [*]	-
7-month	.33 [*]	-.02	.20 [*]	.26 [*]	.06	.14	-.15	-.02	-.06	.40 [*]	.09	.27 [*]	.31 [*]	-

Notes: Correlations for within each time-point (3,5, and 7 months) appear in each box of correlation table. Table does not include longitudinal correlations. According to Cohen (1988), .1 indicates a small correlation, .3 indicates a moderate correlation, and .5 indicates a large correlation.

*
p < .05.

Table 4

Unconditional parameter estimates for parental sensitivity, temperament scales, and temperament factors.

Model	Individual variation: covariance parameter estimate			Means: solutions for fixed effects		
	Estimate	SE	P	Estimate	SE	P
Mother sensitivity						
Intercept	.04	.03	.04	4.12	.05	<.0001
Linear change	.56	.76	.23	.46	.19	.02
Father sensitivity						
Intercept	.13	.04	<.001	4.07	.05	<.0001
Linear change	0	.000	.000	.24	.18	.18
High intensity pleasure						
Intercept	.50	.09	<.0001	4.79	.07	<.0001
Linear change	0	.000	.000	3.50	.23	<.0001
Activity level						
Intercept	.27	.07	<.0001	3.72	.06	<.0001
Linear change	.43	1.02	.34	2.80	.22	<.0001
Approach						
Intercept	.91	.18	<.0001	3.46	.10	<.0001
Linear change	5.23	2.34	.01	5.66	.35	<.0001
Laughter and smiling						
Intercept	.79	.14	<.0001	4.07	.09	<.0001
Linear change	1.43	1.37	.15	1.98	.26	<.0001
Vocal affectivity						
Intercept	.87	.14	<.0001	3.82	.09	<.0001
Linear change	2.80	1.23	.01	2.67	.25	<.0001
Perceptual sensitivity						
Intercept	.78	.14	<.0001	2.89	.09	<.0001
Linear change	2.14	1.60	.09	3.80	.28	<.0001
Distress to limitations						
Intercept	.32	.08	<.0001	3.49	.07	<.0001
Linear change	2.67	1.21	.01	.42	.25	.10
Fear						
Intercept	.29	.07	<.0001	2.07	.06	<.0001
Linear change	3.87	1.20	.001	1.08	.26	<.0001
Sadness						
Intercept	.49	.09	<.0001	3.29	.07	<.0001
Linear change	2.05	1.15	.04	.36	.24	.13
Falling reactivity						
Intercept	.68	.12	<.0001	5.04	.08	<.0001
Linear change	2.10	1.16	.04	.08	.24	.75
Duration of orienting						
Intercept	.74	.16	<.0001	3.77	.09	<.0001

Model	Individual variation: covariance parameter estimate			Means: solutions for fixed effects		
	Estimate	SE	P	Estimate	SE	P
Linear change	3.85	2.08	.03	.97	.33	.004
Low intensity pleasure						
Intercept	.45	.10	<.0001	4.93	.08	<.0001
Linear change	2.40	1.45	.049	.57	.27	.04
Cuddliness						
Intercept	.19	.04	<.0001	6.08	.05	<.0001
Linear change	.75	.49	.06	-1.69	.16	<.0001
Soothability						
Intercept	.34	.08	<.0001	4.84	.07	<.0001
Linear change	.98	1.02	.17	.43	.22	.06

Table 5

Intercepts and linear change estimates (when applicable) of study variables by attachment category.

	Infant-mother attachment			Infant-father attachment		
	Insecure-avoidant (A)	Secure(B)	Insecure-ambivalent (C)	Insecure-avoidant (A)	Secure (B)	Insecure-ambivalent (C)
Parent sensitivity						
Intercept	4.08 (.12) ^b	4.31 (.12) ^a	4.16 (.14)	3.71 (.11) ^a	4.18 (.04) ^b	4.09 (.10) ^b
High intensity pleasure						
Intercept	5.75 (.27)	5.72 (.26)	5.65 (.30)	5.46 (.20)	5.33 (.07)	5.53 (.19)
Activity level						
Intercept	3.93 (.25)	4.29 (.24)	4.25 (.28)	4.33 (.19)	4.18 (.06)	3.88 (.18)
Approach						
Intercept	3.60 (.40)	3.59 (.32)	4.05 (.41)	3.59 (.35)	3.32 (.12)	3.95 (.32)
Linear change	4.98 (1.18)	5.94 (.41)	4.71 (1.00)	5.51 (1.27)	5.86 (.42)	4.43 (1.22)
Laughter and smiling						
Intercept	4.57 (.36)	4.83 (.35)	4.84 (.40)	4.54 (.27)	4.36 (.09)	4.46 (.26)
Vocal affectivity						
Intercept	3.94 (.37)	3.99 (.31)	3.98 (.39)	4.37 (.31) ^b	3.73 (.10) ^a	3.86 (.28)
Linear change	2.31 (.85)	2.59 (.29)	3.19 (.71)	.50 (.88) ^b	2.90 (.29) ^a	2.26 (.85)
Perceptual sensitivity						
Intercept	3.43 (.34)	3.58 (.33)	3.83 (.38)	3.36 (.26)	3.42 (.09) ^a	4.01 (.25) ^b
Distress to limitations						
Intercept	3.48 (.28)	3.41 (.25)	3.47 (.30)	3.35 (.24)	3.49 (.08)	3.39 (.22)
Linear change	-.13 (.86)	.54 (.30)	.40 (.72)	1.45 (.90)	.39 (.30)	.81 (.88)
Fear						
Intercept	1.75 (.26)	1.85 (.24)	2.01 (.28)	2.14 (.21)	1.98 (.07)	2.15 (.19)
Linear change	1.17 (.85)	.93 (.30)	2.01 (.72)	.13 (.89)	1.23 (.30)	1.24 (.88)
Sadness						
Intercept	3.07 (.32)	3.00 (.28)	2.66 (.34)	3.01 (.26)	3.30 (.09)	3.15 (.24)
Linear change	1.02 (.80)	.33 (.28)	.49 (.67)	-.47 (.84)	.44 (.28)	.86 (.83)
Falling reactivity						
Intercept	4.82 (.36)	4.82 (.32)	4.84 (.39)	5.28 (.30)	5.01 (.10)	5.11 (.28)
Linear change	1.11 (.79)	-.13 (.27)	.12 (.66)	.16 (.85)	-.0004 (.28)	-.89 (.82)
Duration of orienting						
Intercept	4.06 (.38)	3.84 (.32)	3.79 (.41)	3.79 (.34)	3.73 (.11)	4.00 (.31)
Linear change	1.42 (1.10)	.93 (.38)	.81 (.94)	.98 (1.16)	.77 (.38)	.88 (1.12)
Low intensity pleasure						
Intercept	4.52 (.32)	4.63 (.28)	4.24 (.34)	5.04 (.28)	4.95 (.09)	4.71 (.25)
Linear change	1.58 (.91)	.33 (.32)	.97 (.76)	-.03 (.94)	.26 (.31) ^a	2.49 (.92) ^b
Cuddliness						
Intercept	5.79 (.18) ^b	5.41 (.18) ^a	5.44 (.21)	5.77 (.14) ^a	5.78 (.05) ^a	6.20 (.13) ^b
Soothability						
Intercept	4.90 (.25)	4.96 (.25)	4.91 (.28)	5.04 (.19)	4.90 (.06)	4.95 (.17)

Notes. Different superscripts within a row for mothers or fathers indicate significantly different slopes or intercepts between attachment groups. Analyses for differences between mother attachment classifications included infant gender and minority status in analyses.