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Attachment Security and Temperament in Infancy and Early Childhood: Some Conceptual Clarifications

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Relations between attachment security and temperament were studied in 6 samples. Ages at temperament assessments ranged from 5 to 42 months and attachment security was assessed between 12 and 45 months. Attachment security was assessed using the Waters and Deane Attachment Behavior Q-set. Principal component analyses were used with the temperament data, and scores for the first component (Emotional Reactivity) served as correlates of attachment security. Analyses revealed significant associations between temperament and attachment at all ages when mothers completed both instruments, and when Q-sorts were independent from maternal temperament perceptions, temperament and attachment security correlations reached significance for older children. These results may help clarify relations between the domains of attachment and temperament, rather than affirm distinctions between them.

Within the Bowlby/Ainsworth framework (e.g., Ainsworth, 1982; Bowlby, 1982), patterns of attachment established early in life are expected to play roles in the expression and control of affect and in later personality organization (e.g., Bretherton, Ridgeway, & Cassidy, 1990; Main, Kaplan, & Cassidy, 1985; Sroufe & Fleeson, 1986, 1988). Although coherence of affective and behavioral patterning is predicted and observed from infancy to childhood, attachment security is conceptualized as a relational construct (Ainsworth, 1982; Ainsworth, Blehar, Waters, & Wall, 1978; Bowlby, 1982; Bretherton, 1985; Hinde, 1982). Consequently, while attachment security may be congruent across relationships (e.g., Easterbrooks, 1989; Fox, Kimmerly, & Schafer, 1991), such congruence is not presumed or required by theory (e.g., Belsky & Rovine, 1987; Main & Weston, 1981). Furthermore, temporal consistency for patterns of attachment behavior (e.g., Waters, 1978) is interpreted as evidence of stability within the dyadic relationship rather than as evidence of temperamental trait stability. In the strongest statement of this position, Sroufe (1985) argued that attachment and temperament dimensions are "fundamentally different constructs" that refer to "different domains" operating at "different levels of analysis" (p. 12).

Despite this conceptual division of psychological domains, the nature and basis of relations between attachment security and temperament remains controversial, both in theory and in practice (e.g., Belsky & Rovine, 1987; Chess & Thomas, 1982; Goldsmith & Alansky, 1987; Kagan, 1987; Thompson, Connell, & Bridges, 1988; Vaughn, Lefever, Seifer, & Barglow, 1989; Weber, Levitt, & Clark, 1986). The core dispute in this controversy is whether factors regulating the expression of affect are intrinsic to the child (temperament) or are emergent properties of the child-adult relationship (attachment). Ainsworth's Strange Situation (Ainsworth et al., 1978), the most frequently used procedure for evaluating attachment quality, clearly entails aspects of novelty, separation, distress, and comforting—cir-

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cumstances in which traitlike individual differences are often noted and measured for both human and nonhuman subjects (e.g., Connell, 1985; Gunnar, Manglesdorf, Larson, & Hertsgaard, 1989; Suomi, 1987). From the temperament perspective, if intrinsic factors predispose a child to respond with distress to environmental stressors, such as separation from the primary caregiver, then there is little reason to invoke a relationship variable to account for the same phenomena.

Attachment theorists counter by noting that the relationship itself is a source of positive and negative feelings that does not depend on characteristic mood or threshold for responding to stress. Bowlby (1982, p. 209) writes that "no form of behavior is accompanied by stronger feelings than is attachment behavior. The figures toward whom [attachment behavior] is directed are loved and their advent is greeted with joy. A threat of loss creates anxiety, actual loss, sorrow; both, moreover, are likely to arouse anger." Thus, an infant might be expected to show positive mood in the context of interaction with a caregiver with whom she enjoys a secure attachment (see Vaughn & Waters, 1990, p. 1970). Furthermore, despite the fact that temperamental negativity may be associated with crying and resistance in the Strange Situation (see Goldsmith & Alansky, 1987; Vaughn et al., 1989), researchers have failed repeatedly to detect significant associations between commonly used infant temperament measures and the secure–insecure distinction derived from the Strange Situation classifications (e.g., Belsky & Rovine, 1987; Egeland & Farber, 1984; Gunnar et al., 1989; Vaughn et al., 1989; Weber et al., 1986).

Finally, attachment researchers argue that "temperament interpretations" of attachment security seem to concern the Strange Situation per se more than either attachment theory or the attachment behavioral system. This is unfortunate because the value of the Bowlby/Ainsworth perspective need not be confused with the validity of the Strange Situation procedure. As Vaughn et al. (1989) demonstrated, certain attachment behaviors observed in the Strange Situation, such as separation crying, may be correlates of rated temperament. But these attachment behaviors do not necessarily reflect the security of the attachment between infant and caregiver. And so the controversy festers, as neither temperament nor attachment theorists have been prepared to yield conceptual ground. (However, see Goldsmith, Bradshaw, & Rieser-Danner, 1986, or Rothbart & Derryberry, 1981, for discussions concerning the location of possible common ground between these domains.)

We believe that the strong versions of both the temperament and the attachment positions are flawed, and that with only slight modifications in each, a common and acceptable solution to the question of attachment–temperament relations can be found. As a prerequisite, contestants from both camps should acknowledge the necessary conflation of relationship and temperament variance in the context of assessment. However much one might value the conceptual purity of his or her constructs, they overlap in their measurement. That is, child behavior and affect regulation occur within a social context. Indeed, the most commonly used temperament questionnaires include items that explicitly reference child behavior in the context of parent–child interactions (e.g., McDevitt & Carey, 1977, Items 4, 16, 21, 34, and others). Thus, whenever a parent is asked to provide temperament ratings of her or his child, one should anticipate the influence of the parent–child relationship on the temperament scores. Furthermore, one might expect that the magnitude of such influences could increase with age, as the child–parent relationship becomes more clearly established and accessible to in(tro)spection on the part of the parent (e.g., Lefever, 1987).

Similarly, assessments of attachment quality cannot take place in a temperamental vacuum. As observers and as parents, we recognize that a child may be characteristically active or lethargic, shy or outgoing, and so forth. And we understand that these characteristic differences may be captured by assessment procedures designed to evaluate attachment security, such as the Strange Situation (e.g., Belsky & Rovine, 1987; Vaughn et al., 1989). The question, therefore, is whether instruments for assessing both attachment variability and temperament variability can capture the necessarily overlapping variance associated with affect regulation while maintaining adequate discrimination between domains (Goldsmith & Campos, 1982), and not whether a given behavior, behavioral constellation, or assessment technique primarily reflects temperament or attachment variance.

We shall, therefore, address the empirical question "Can attachment security be assessed with acceptable discriminant validity vis-à-vis temperament?" independently from the ongoing debate over the meaning of Strange Situation behaviors by examining correlations between the recently developed Q-sort measure for attachment security (Waters & Deane, 1985) and conventional rating scale measures of temperament. The Q-sort tool is of recent origin and continues to evolve (see Waters, Kondo-Ikemura, Posada, & Richters, 1991); however, it has been shown to be reliable (Waters & Deane, 1985) and is a valid indicator of attachment security for infants (i.e., the Q-sort security score is coordinated with Strange Situation classifications of attachment security, as are specific items reflecting the functioning of the attachment system in terms of secure-base behavior and the balance of attachment and exploration) (Vaughn, 1985; Vaughn & Waters, 1990). Indeed, Vaughn and Waters (1990) demonstrated that the Q-sort attachment security score maintained its association with Strange Situation classifications of attachment security even when the potential influences of a temperament-like trait (sociability) were controlled statistically. Although Van Dam and Van IJzendoorn (1988) reported that mothers in their sample did not provide valid Q-sort descriptions of toddlers, both Belsky and Rovine (1990) and Waters et al. (1991) have found that this Q-sort can produce valid indexes of attachment security for infants and for older children, even when mothers, rather than trained observers, provide the Q-sort descriptions.

In this article, we present data analyses from six different samples of normally developing children, recruited from private obstetric practices, birth registers, day care center waiting lists, advertisements in local newspapers, and so forth. In most cases, our analyses are secondary to the primary purposes motivating the original studies; consequently some of the samples we describe represent subsets from larger samples of subjects (i.e., Samples 1, 3, and 4). However, tests on demographic variables suggest that the subsamples used here do not differ significantly from the larger populations of subjects in the original studies. The samples differ with respect to age, thus affording

the opportunity to examine relations between attachment and temperament in a cross-sectional sequence. Examining such relations cross-sectionally affords possibilities of testing the speculative hypothesis offered by Lefever (1987, 1989) that temperament and attachment domains will show increasing overlap as children develop, because of the influences of each domain on personality dimensions that emerge as stable traits during the fourth and fifth years of life (e.g., Block & Block, 1980).

The samples also differ with respect to the instrument used to assess temperament. We note that there is at present no strong consensus among temperament researchers and theorists concerning which behavioral and psychological indicators a measure must survey when making an assessment of "temperament" (Goldsmith et al., 1987). The fact that the several investigators represented in this article employed different instruments in their research reflects the diversity of thought among temperament theorists. However, most of the parent report measures cover common behavioral territory (see Bates, 1989), and previous comparisons across different scales indicate that core dimensions from the domain of temperament are assessed by each of them (e.g., Goldsmith & Rieser-Danner, 1986). Although using different instruments across samples might not be seen as a strength in our study design, we are inclined to view this circumstance as an asset rather than a liability because we can evaluate the similarity of relations between temperament and attachment security across the several measures. Finding similarity, in the face of different research designs, purposes, and measurement tools, would increase our confidence in the overall set of results.

Finally, the samples differ with respect to the nature of informants for attachment and temperament measures. In two samples, observers completed the Attachment Behavior Q-sorts, and mothers completed the temperament questionnaire. In three samples, mothers were the informants for both domains. And, in one sample, mothers completed the Attachment Q-sort, and fathers completed the temperament questionnaire. Although none of these studies could, by itself, answer the question of discriminant validity, or clarify definitively the issue of relations between attachment security and temperament, as a group they offer opportunities for comparison across instruments, across informants, and across ages. These comparisons can provide important information relevant to the question of cross-domain relations and to the question of discriminant validity of measurement. This article also represents the first attempt of which we are aware to evaluate temperament and attachment correlations for children over a wide range of ages. Because most temperament measures were designed to capture "typical" or "characteristic" features of child behavior, the home observation format of the Attachment Behavior Q-sort data should provide a more ecologically valid test of cross-domain relations. The Strange Situation was designed to assess infant behavioral adaptations in challenging, rather than in typical, circumstances, and behavioral adjustments observed in such circumstances may not characterize the day-to-day profiles of behavior shown by the baby.

Because this report presents secondary analyses from samples that have already been described in the literature and because the temperament measures are well known, for the most part, we only briefly present information concerning demographic characteristics of the samples and the temperament measures used. The reader is referred to relevant publications (cited in the following section) for more complete sample descriptions and procedural details. In Table 1 we have presented a descriptive summary of the subjects and procedures used in each of the six samples.

Method

Subjects

Sample 1 consisted of 35 infants (19 boys and 16 girls) from the Michael Reese Infant–Mother Research Program whose mothers had completed the Carey and McDevitt (1978) Infant Temperament Questionnaire (ITQ) when their infants were between 5 and 6 months of age, and who were observed at home by trained observers at 12 to 14 months of age for the purposes of completing the Attachment Q-sort (Waters & Deane, 1985). All families included in the present sample would be considered as middle to upper-middle socioeconomic status by the standards of the Chicago metropolitan area, on the basis of job titles of fathers and the educational attainments of both parents. The sample and measures have been described elsewhere (Joffe, Vaughn, Barglow, & Ben Veniste, 1985; Vaughn et al., 1989; Vaughn & Waters, 1990).

Sample 2 consisted of 98 infants (63 boys and 35 girls) constituting the third cohort of the Pennsylvania Infant and Family Development Project (Belsky & Rovine, 1990; Belsky, Rovine, & Fish, 1989). Families in this sample represented a broader range of socioeconomic levels and degrees of educational attainment than was true for the Chicago sample, but the majority would be considered middle class by the standards of their community (Belsky et al., 1989). For this sample, mothers completed the 24-item Infant Characteristics Questionnaire (ICQ; Bates, Freeland, & Lounsbury, 1979) when their babies were 9 months old. When the infants were 12 months of age, mothers completed the Waters and Deane (1985) Attachment Q-sort, after first being familiarized with the items and then spending several days observing their infants before completing the final sort (Belsky & Rovine, 1990).

Sample 3 consisted of 89 children (55 boys and 34 girls) who were 24 (n = 49), 30 (n = 20), or 36 (n = 20) months of age. The families were recruited from two larger, longitudinal projects concerned with the growth of social and cognitive competence during the toddler period that were taking place in the Chicago metropolitan area (Hron-Stewart, 1989; Molitor, 1987). Most of these children came from middle to upper-middle socioeconomic backgrounds, by the standards of the larger metropolitan area. Mothers completed the Toddler Temperament Scales (Fullard, McDevitt, & Carey, 1977) prior to a laboratory visit scheduled during the child's 24th, 30th, or 36th month of life. Also prior to the laboratory visit, trained observers provided Attachment Q-sort data using the 100-item sort described by Waters and Deane (1985). For one of the studies, two observers made a total of three visits (as suggested by Waters & Deane, 1985), prior to formulating Q-sort descriptions. For the other study, two observers made a total of two visits to the home before making Q-sorts. In both studies, the majority of cases were described by consensus, after reviewing notes taken by both observers (see Hron-Stewart, 1989, for details).

Sample 4 consisted of 74 children (37 boys and 37 girls) from French-speaking families who resided in the city of Montreal. The sample was broadly characterized as middle-class, by conventional standards of Quebec, but with a wide range of educational attainments and annual family incomes (Trudel, 1988; Vaughn, Strayer, Trudel, Jacques, & Seifer, 1991). The present sample is a subset of a larger sample involved in a longitudinal study of the effects of rearing environments on social and intellectual competence. All children with both temperament and

Table 1
Summary of Respondent Characteristics for Six Samples

Sample	Temperament assessment: Child age (in months)	Respondent	Temperament instrument	Attachment Q-sort: Child age (in months)	Respondent
1	5–6	Mother	Carey ITQ-R	12–14	Observer
2	9	Mother	Bates ICQ	12	Mother
3	24–36	Mother	Carey TTS	24–36	Observer
4	18	Mother	Carey TTS (modified)	24	Mother
5	30	Father	Carey BSQ	30	Mother
6	39	Mother	Rothbart CBQ	42	Mother

Note. ITQ-R = Infant Temperament Questionnaire–Revised; ICQ = Infant Characteristics Questionnaire; TTS = Toddler Temperament Scales; BSQ = Behavioral Style Questionnaire; CBQ = Child Behavior Questionnaire.

attachment assessments were included in this report. Temperament dimensions were assessed using an abbreviated version of the TTS (Fullard et al., 1977). This modified instrument contained 63 items (7 for each of the 9 New York Longitudinal Study dimensions), which had been identified as the most reliable item indexes of each temperament scale (Trudel, 1988). Prior to its use here, the modified TTS had been translated into French and back-translated to ensure that item content and connotation did not change across this sociolinguistic boundary. The TTS was completed by the mother when the child was 18 months of age. Mothers were initially familiarized with the Q-sort items when their child was 21 months of age. When the child was 24 months of age, mothers completed the Attachment Q-sort according to the distribution of items recommended by Waters and Deane (1985), using a fully equivalent French translation of the items (see Vaughn et al., 1991).

Sample 5 consisted of 80 children (40 boys and 40 girls), constituting the first cohort of the Madingley Shyness Project (Stevenson-Hinde, 1987; Stevenson-Hinde & Shouldice, 1990). In all cases, families consisted of the 2.5-year-old subject, both parents, and an older sibling. Families lived in Cambridge, England, or in neighboring villages, and socioeconomic statuses ranged from professional to semiskilled or unskilled manual workers. The Behavioral Style Questionnaire (BSQ) for 3- to 7-year-olds (McDevitt & Carey, 1978) was used to assess temperament. Fathers (N = 80) filled out the BSQ after the mother and child had been observed in a set of laboratory assessments. At the end of the laboratory visit, each mother was instructed on how the Attachment Q-set was to be completed and was given a set of Q-items to sort (modified from Waters & Deane, 1985; see below).

Sample 6 consisted of 179 boys who were approximately 39 months old (range = 36 to 42 months) when their families were recruited to a longitudinal study of personality development (Waters et al., 1991). The sample was broadly middle-class, by the standards of the communities from which cases were drawn, with a wide range of income and education levels. Families had been recruited from public records, birth announcements, and advertisements placed in local nursery schools. To assess child temperament, mothers completed the Child Behavior Questionnaire (CBQ; Rothbart, 1987) when the family enrolled in the study. Approximately 3 months after enrollment, mothers were provided copies of Waters recent revision of the Attachment Q-set (Waters et al., 1991). Before initiating the observations of her child, each mother read through the Q-items to clarify their meanings, as necessary. Then, keeping the item contents in mind, she observed her child for 2 weeks before making her Q-sort description. The items were sorted into nine categories according to a rectangular distribution (i.e., 10 items in each of the nine categories). Each sort was *scored for attachment* security by correlating the mother's Q-sort description of her child with the revised criterion sort for attachment security (Waters et al., 1991). Waters et al. (1991) provided data indicating that this revision of the Attachment Behavior Q-set measures the functioning of the attachment behavioral system, as described by Bowlby, in a manner consistent with the original version of the Q-sort instrument.

Procedure

Temperament measures. Assessments of temperament were accomplished using the age-appropriate versions of scales devised by Carey and associates in four of the samples (Samples 1, 3, 4, and 5). For Sample 4, the Toddler Temperament Scale (Fullard et al., 1977) items were translated into French prior to administering the instrument. In Sample 5, fathers completed the temperament questionnaire. Because the nine scales derived from these questionnaires are known to be redundant (Matheny, Wilson, & Nuss, 1984; Vaughn et al., 1989), principal-component analyses were calculated for each sample,[1] and component scores from these analyses were used as our indexes of temperament.

The Infant Characteristics Questionnaire (ICQ; Bates et al., 1979) used for Sample 2 has been described by Bates and associates and provides reliable assessments of four dimensions of parental perceptions of temperament (i.e., fussiness, unadaptability, dullness, and unpredictability), for infants in the age range of 3 to 12 months. Although the ICQ scales were originally derived on the basis of factor loadings, they are somewhat redundant, and we elected to analyze these scales using the same principal-component algorithms as for the Carey scales. This analysis yielded an interpretable two-component solution with three of the scales loading on the first component. Component scores from this analysis were used in subsequent statistical tests.

The third temperament measure (used for Sample 6) is less well known to many researchers and needs greater description. The CBQ (Rothbart, 1987) is a 327-item instrument designed to identify enduring, constitutionally based dimensions of behavioral variability (i.e., temperament) for preschool-age children. Respondents rate the relative intensity of specific child behaviors as they have occurred over the previous 6 months on a scale from 1 (*extremely untrue for this child*) to 7 (*extremely true for this child*). Unlike the temperament measures used

[1] When possible (Samples 1, 3, and 4), principal-components analyses were conducted with larger samples than are included in this article, because many cases with temperament data did not have Q-sort data as well. Factor scores were derived on the basis of these larger samples. Sample sizes for the principal-components analyses of temperament data were 137, 167, and 123 for Samples 1, 3, and 4, respectively.

in Samples 1–5, the CBQ scales are not keyed such that higher scale scores necessarily are interpreted as evidence of "temperamental difficulty," and some scales (e.g., Impulsivity and Inhibitory Control) are negatively correlated. Consequently, data reduction via factor or principal-components analysis will likely produce strongly bipolar dimensions with both positive and negative loadings.

Alpha reliabilities for the 17 CBQ temperament scales were calculated for this sample and were judged acceptable (Kotsaftis, 1989). However, these scales showed substantial redundancy in a principal-components analysis, and they can be efficiently reduced to four interpretable dimensions. The first principal component contains strong positive loadings (i.e., greater than .50) for the CBQ scales Impulsivity, Motor Activation, Anger, Activity Level, and High Intensity Pleasure and strong negative loadings for the scales Soothability, Inhibitory Control, Attentional Focusing, and Low Intensity Pleasure (see Table 2). The four component scores derived from this analysis were retained for later statistical tests. Alpha reliabilities for the scales loading on the first component ranged from .71 to .87, with a median value of .76.

Attachment Q-sort. The mechanics and advantages of Q-methods have been described in detail by Block (1961) and by Waters and Deane (1985). In each of the six samples included for this report, Q-sort descriptions were provided either by trained observers or by mothers. In each sample, the Q-sort description of a given child (whether provided by observers or by the mother of the child) was correlated with a Q-sort description of the "hypothetical most secure child" to derive a Q-sort score for attachment security. For most of the samples here (Samples 1–4), the Q-set used was the one described by Waters and Deane (1985). For the two remaining samples, different versions of the Q-set were used. In the following paragraphs, we provide brief descriptions of the observational procedures and methods of deriving both the Q-sort descriptions themselves and the Q-sort scores for each sample.

For Sample 1, observers visited the infants at home when the infants were between 12 and 14 months of age. Observations were made by two observers over a total of three visits (between 8 and 12 observer hours per child). After completing the visits, the infant was described by the two observers, either independently or by consensus. The descriptions were averaged across observers for each item, and this composite description was correlated with the Waters and Deane (1985) criterion sort for a 12-month-old secure child (see Vaughn & Waters, 1990, for details of sorting and scoring) to derive the attachment security score for each subject.

For Sample 2, mothers were familiarized with the Q-set items and their distribution at a laboratory visit, and then were requested to observe the infant's behavior for a period of about 7 days. After 7 days, the Q-items (each on separate slips of paper) were mailed to the mothers, and the mother was asked to complete the Q-sort according to a rectangular distribution (eight categories of 11 items, with the middle category receiving 12 items). Mothers returned their Q-sorts by mail. The Q-sort descriptions were then correlated with the Waters and Deane (1985) criterion for the "hypothetical 12-month-old secure child," to derive an attachment security score for each infant.

For Sample 3, observers made either two or three visits to the child's home for the purpose of completing the Attachment Q-sort. For subjects receiving three visits (n = 45), children were seen for 8 to 12 observer hours. For subjects receiving only two visits (n = 44), observer hours were reduced to between 6 and 8 for each child. For the majority of subjects, Q-sort descriptions were completed by consensus of the two observers, after a review of the notes taken by each one, using the distribution prescribed by Waters and Deane (1985). Attachment security scores were derived by correlating the observer-based description of the "empirical" child with the expert-based description of the "hypothetical secure 36-month-old child" provided by Waters and Deane.

For Sample 4, the 100 items were translated (and back-translated to ensure equivalence across sociolinguistic groups) into French. Mothers previewed the items and practiced sorting them into a three-category distribution during a laboratory visit that took place 3 months prior to their final Q-sort descriptions. At the lab visit, the mothers were told that they would be using the items to describe their child at the next home visit (i.e., 3 months hence), but they did not receive a list of items to take home. At the home visit, mothers were given the Q-sort deck and were requested to sort them into the standard (Waters & Deane, 1985) nine-category distribution. These Q-sort descriptions were then correlated with a criterion sort for attachment security, derived by averaging the item values for the 12- and 36-month attachment security criterion sorts provided by Waters and Deane (1985). Details of the sorting protocol are described by Vaughn et al. (1991).

Mothers in Sample 5 provided Q-sort descriptions of their children. However, the mothers in this sample found the original 100-item Attachment Q-set overly technical and difficult to understand. With guidance provided by E. Waters, the technical wording of items from the Q-set was amended to everyday wording. To reduce the time demands of the Q-sorting procedure and to further simplify the task for mothers, 25 of the original items were removed and the distribution of items to categories was adjusted as follows: Using the criterion sorts for attachment security, dependency, and sociability in 36-month-olds (Waters & Deane, 1985), those nondiscriminating items (i.e., items be-

Table 2
Loadings for Temperament Variables on First Principal Component in Six Analyses[a]

Rank of temperament variable[b]	Sample					
	1	2	3	4	5	6[c]
1	Mood	Unpredictable	Mood	Activity	Approach	Inhibitory Control (−)[d]
2	Distractible	Fussy/difficult	Adaptable	Intensity	Adaptable	Impulsivity (+)
3	Approach	Unadaptable	Approach	Distractible	Mood	Activity level (+)
4	Persistence		Intensity	Mood		Motor activation (+)
5	Adaptable		Rhythmic			Low intensity pleasure (−)
6						Attentional focusing (−)
7						Anger (+)
8						High intensity pleasure (+)
9						

[a] Variables are listed in the order of magnitude of their loadings on the first principal component. All loadings above .40 are included in the table.
[b] Rank refers to the magnitude of the component/factor loading for temperament variables.
[c] Because the sample size was quite large for this analysis, only variables loading above .50 are included.
[d] Signs in parentheses indicate direction of variable loading for this component.

tween the top and bottom quartiles, 3.5–6.4 on the nine-category scale) for all three sorts were eliminated. Twenty-one items met this criterion, and an additional 4 items that were close to criterion also were omitted from the amended Q-sort. Mothers sorted the items into a seven-category distribution (with 5, 8, 12, 25, 12, 8, and 5 items placed into Categories 1 through 7, respectively), instead of the nine-category distribution prescribed by Waters and Deane (1985). Attachment security scores were derived by correlating the item placements with the placements for the 75 homologous items from the Waters and Deane (1985) 36-month criterion sort (see Stevenson-Hinde & Shouldice, 1990, for further details).

In Sample 6, mothers provided attachment security descriptions for their children using a revision of the original Attachment Q-set (Waters, 1986; Waters et al., 1991). This revision was prompted by the awareness (viz. Samples 2, 4, and 5) that nonprofessionals were often asked to provide Q-sort descriptions of children, and that these nonprofessionals often reported the task to be onerous. Consequently, the vocabulary for the revision is less technical, and complex grammatical constructions are avoided. Parents and observers less familiar with the Bowlby/Ainsworth perspective find this version of the Q-sort easier to comprehend and complete than was true for the original item set.

Mothers in Sample 6 were explicitly instructed that the Q-sort was to be completed after a 2-week period of observations, which were to be made with the item contents in mind. After completing their observations, mothers sorted the 90 items from the revised Q-sort into a nine-category, rectangular distribution (i.e., 10 items per category). These individual descriptions were correlated with the revised criterion sort for attachment security (Waters, 1986) to derive the final attachment security scores used in our analyses. Detailed descriptions of the Q-sorting procedure and validity criteria for the revised Attachment Q-sort may be found in Waters et al. (1991).

Results

In order to describe and communicate our results more efficiently, they are presented in three sections. First, the results of the principal-components analyses of the temperament measures are presented and discussed. Second, correlational analyses relating the Q-sort attachment security scores and temperament scores are reported. Finally, these correlations are presented as a function of the age of the child.

Principal-Component Analyses

A total of six principal-components analyses were run for these data. Analyses of the Carey measures (ITQ-R, TTS, BSQ) yielded interpretable three-component solutions (eigenvalues for each component > 1, varimax or equimax rotations). As noted above, the ICQ (Bates et al., 1979) yielded a two-component solution, and the CBQ (Rothbart, 1987) yielded a four-component solution (eigenvalues for each component > 1, varimax rotation). As is usually the case for such analyses, the first component accounted for the largest portion of common variance after rotation in all of the analyses. These results are summarized in Table 2. For each sample (excepting Sample 6, see Note c for Table 2), all variables with loadings greater than .40 on the first principal component are identified.

In each analysis, temperament scales referring to affect regulation (i.e., Mood and Adaptability and/or Intensity for the Carey scales; Fussy/Difficult, Unadaptable, and Unpredictable for the Bates scales; Impulsivity, Activity Level, Anger, High Intensity Pleasure, etc., for the Rothbart scales) loaded on this first principal component. Two other temperament dimensions (i.e., Distractibility and Approach/Withdrawal) also appeared on this component in three of the four analyses of the Carey scales. While it may seem incongruous to find different clusters of temperament dimensions from sample to sample, this has been the rule rather than the exception with the Carey scales (e.g., Matheny et al., 1984; Wilson & Matheny, 1983; Vaughn et al., 1989), and our findings are consistent with current empiricism with this instrument. We identified this component as *negative reactivity* to indicate the presence and direction of the loading for the Mood scale in each of the first five samples. The loadings for Sample 6 indicate that emotional expressivity, both negative and positive, is central to the temperament scales from the CBQ. However, in this sample (and perhaps more generally for this instrument), scales reflecting arousal/activation also loaded strongly on the first principal component. We identified this component as *affective activation* to indicate the contributions of both arousal and emotionality to the underlying dimension. The second and third components from all of these analyses were idiosyncratic across samples and did not yield a common element for identifying them. In the analyses to follow, we present results for these additional components but recognize that they may have limited generality.

Correlations Between Temperament and Attachment Security Scores

Our primary analyses concern the correlation between the temperament component scores and the Q-sort score for attachment security. Because most of the temperament measures used in these analyses yield dimensions with negative emotionality or intensity of arousal anchoring the high ends, we anticipated that relations between the temperament and attachment security scores would be signed negatively. As is shown in Table 3, our expectation was met.

Table 3
Temperament and Attachment Security Correlations in Six Samples

	Temperament component			
Sample	1 (negative reactivity/ affective activation)	2[a]	3	4
1 (N = 35)	−.04	.04	−.08	
2 (N = 98)	−.23*	−.09		
3a (N = 49)[b]	−.16	−.18	−.13	
3b (N = 40)	−.35*	−.04	.16	
4 (N = 74)	−.29**	−.04	−.09	
5 (N = 80)	−.29**	−.03	−.13	
6 (N = 179)	−.48***	.05	.11	.11

[a] Note that the dimensional composition of Components 2 and 3 differs across samples.
[b] Because the subjects in Sample 3 span a wide range of ages, we grouped all 24-month-old children (n = 49) and analyzed them separately from the older children (n = 40), as was done by Lefever (1987) in her dissertation analyses.
* $p < .05$. ** $p < .01$. *** $p < .001$.

In five of the six samples, a significant (negatively signed) correlation was obtained between the Q-sort attachment security score and the temperament score for negative reactivity (affective activation for Sample 6). In all cases, the association was of modest to moderate magnitude, with the largest association (Sample 6, $r = -.48$) indicating an overlap of only about 24% of the variance between measures. For Sample 1, no significant associations were obtained in the analyses of temperament and attachment security scores. This may be due to the fact that the two measures were completed by different informants (mothers for temperament, observers for Q-sorts), to the time lag between assessments (6 months from temperament to Q-sort assessment), or to the age of the child at the time of assessment (first year of life). We note, however, that the 3-month time lag between temperament and attachment assessments in Sample 2 did not obscure a significant association between the two domains, when mothers provided both Q-sort and temperament descriptions (using the Bates ICQ rather than the ITQ-R). A nonsignificant correlation was obtained also for the younger subjects (i.e., 24-month-olds) in Sample 3 (identified as Sample 3a in Table 3). As for Sample 1, observers provided the Q-sort data in this group and mothers provided temperament data.

Age Differences in Relations Between Temperament and Attachment Security

The results reported in Table 3 indicate that measures of attachment security and temperament show consistent, albeit modest, relations across the range of ages from 12 to 42 months. However, the results reported thus far do not indicate the presence of an age effect in relations between attachment security and temperament. A plot of the data presented in Table 3 (correlation value by mean age for each sample) is shown as Figure 1. As can be seen in Figure 1, there is a strong association between age of child and magnitude of the correlation between temperament and attachment security. For older children the magnitude of the correlation between the first temperament component and the attachment security score appears to be substantially greater than for younger toddlers and infants. This increasing association is observed for all combinations of informants (i.e., different or the same across measures of attachment and temperament).

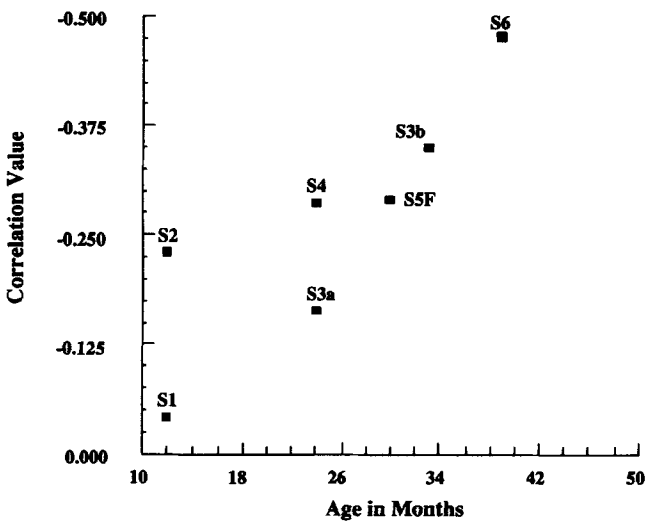

Figure 1. Plot of age (in months) against the correlation values for temperament and attachment security scores. (For all samples the correlation values refer to relations between attachment and scores for the first temperament component. For Sample 3, a = 24-month-old children and b = the group of 30- and 36-month-olds.)

Discussion

We have characterized the current debate over relations between attachment security and temperament as focusing on the number of psychological domains required to explain the behavioral variability reflected in attachment assessments. Adherents to a strong temperament position argue that one domain is sufficient, whereas proponents of the strong attachment position suggest that relationship and temperament constructs refer, in principle, to nonoverlapping domains of experience. Neither of these two extreme positions is supported by data reported here. Although our data provide evidence of overlap between temperament and attachment domains, the degree of association between measures of temperament and attachment constructs is not high enough to suggest more than a modest redundancy. Even in samples of older children for whom the mother provided both Q-sort and temperament data, the correlation analyses indicate that less than 25% of the variance in the attachment scores is held in common with temperament dimensions. These results offer only the weakest support for the speculation that temperamental differences are primary causes of individual differences with respect to attachment security. And the increasing cross-domain associations observed for older children could be as easily interpreted as an attachment to temperament perception influence as the opposite.

On the other hand, the consistent, and developmentally increasing, associations between attachment security and a temperament dimension reflecting negative emotionality and/or affective activation indicate that the empirical overlap between these behavioral domains is greater than might have been anticipated from prior empiricism (e.g., Belsky & Rovine, 1987; Egeland & Farber, 1984; Weber et al., 1986) or by theorists arguing for virtual independence of constructs from the two domains (e.g., Sroufe, 1985). We are inclined to interpret our findings as evidence that the routine, day-to-day functioning of the attachment behavior system is responsive to a range of inputs from both exogenous and endogenous sources that is broader than the range of inputs sampled in the context of the Strange Situation. Because the observational data from which the Q-sort descriptions are derived encompass this wider range of inputs, the Q-sort scores are likely to yield a broader range of correlates than are scores from the Strange Situation. We note that both the Strange Situation classifications and the Q-sort security scores are predictive of harmonious child–parent relationships (Ainsworth et al., 1978; Waters et al., 1991). Consequently, we would not find it surprising if infancy period security scores for both measures predicted later temperament perceptions by the parent, even though concurrent associations may be low and not significant. We suggest, therefore, that the seeming incon-

sistency between our findings and the prior empiricism is more apparent than real. When attachment security is operationalized in terms of Strange Situation classifications, temperament assessments typically will not covary with attachment. However, when attachment security is operationalized with reference to the salience and effectiveness of attachment behavior over an extended period of observation, as with Q-sort assessments, modest overlap between domains is likely to be obtained.

There are, of course, caveats and alternative interpretations that may be entertained for our findings. We recognize, for example, that the magnitude of observed correlations between any two measures is constrained by the internal consistency (reliability) of the measures. If the reliability of, say, the temperament measures had been particularly low in the samples reported here, then the true correlation between domains may have been suppressed. While accepting the possibility that such a circumstance could affect our results, we note that in Sample 6 the alpha reliabilities of the temperament scales loading on the first component range from .71 to .87, with a median value of .76. By way of comparison, the alpha reliabilities for the Bates ICQ scales loading on the first principal component for Sample 2 are .75, .77, and .58. These estimates are similar, and we are not persuaded that the difference in the magnitude of the temperament and attachment security correlation between the older and younger groups could be due to attenuation of the correlation in the younger sample. Additionally, Goldsmith and Gottesman (1981) and others have reported that certain aspects of temperament become increasingly stable and heritable with age, and it may be the case that temperament measures from infancy and early childhood represent dynamic trajectories of growth that overlap only briefly the more stable patterns of behavior reflecting attachment security (e.g., Main & Weston, 1981; Waters, 1978). In this case, developmental instability of temperament rather than reliability of measurement could account for the modest correlations between temperament and attachment obtained at younger ages in these samples.

It is also possible that the associations we obtained between domains are influenced by the methods we used to acquire the basic data. We have alluded to the possibility that the Q-sort, by virtue of its sampling a broad range of inputs to the attachment system, may be more likely than Strange Situation classifications to detect relations across behavioral domains. In addition, for three samples, mothers were informants for both attachment and temperament measures. Of course, the fact that mothers served as dual informants does not explain the developmentally increasing associations between attachment and temperament domains, nor does this explain why similar associations were found when fathers (Sample 5) or observers (Sample 3b) served as the second informant. Consequently, we are not inclined to interpret our findings in terms of method variance because of the nature of the informant for either attachment or temperament. It is also possible that additional cross-domain variance could be discovered if the measurement methods were more similar. That is, if we had validated Q-sets for the measuring temperament (or validated rating scales for attachment security), additional overlap between construct domains might be revealed in parental or observer data. This issue should be addressed in future research.

We also understand that it will be important to add new cross-sectional and longitudinal samples to our data base before reifying the developmentally increasing relation between attachment security and central dimensions of temperament. Although our data suggest such an interpretation, they do not confirm it. We hope that, as a consequence of our explorations of these data sets, other investigators studying social–emotional development will be encouraged to obtain comparable information. We would be especially interested in finding samples studied longitudinally for which both temperament measures and attachment Q-sort data were available.

It would also be of special interest to find samples in which both mothers and less biased observers contributed attachment and temperament data. Our findings suggest that correspondences across domains may be found at an earlier age when mothers are the observers for both domains than will be the case when data across domains are contributed by independent observers. This is an important methodological point because maternal reports on infant–child temperament, despite their potential biases (see Rothbart & Goldsmith, 1985), are still the most common temperament instruments used in developmental research, because investigators believe that the information available to mothers about their babies is (at least) as useful for understanding behavioral development as the information obtained using laboratory protocols. Likewise, many investigations of attachment behavior at home will rely on parent report data (using the Attachment Behavior Q-sort), because parents (perhaps especially mothers) are in a position to observe the behavior of their children in ways that cannot be available to independent observers. While researchers will require information about differences in the nature of information obtained from multiple sources, such as parents and research staff, it would be most unfortunate if pretensions to methodological rigor forced investigators to ignore sources of relevant developmental information.

We have argued that both extreme positions on the "ownership" of affect regulation variance are untenable given the constraints of assessment in both temperament and attachment domains. Our findings are consistent with this interpretation. Consequently, we have suggested that the question of how relations between measures of temperament and attachment are best interpreted should be answered from the perspective of discriminant validity of measurement, rather than in terms of distinctions between conceptual domains. From this perspective, our findings are informative and may be seen as congruent with recent meta-analyses of temperament and attachment associations (e.g., Fox et al., 1991; Goldsmith & Alansky, 1987). For example, Fox et al. (1991) reported that there is a nonrandom association between Strange Situation classifications for mothers and fathers accounting for about 7% of cases identified as either secure or insecure. They speculate that the nonrandom congruence may be attributable to aspects of infants' behavioral styles that are expressed similarly with both fathers and mothers. It is intriguing to note that the 7% figure reported by Fox et al. is about equivalent to the amount of variance overlapping temperament and attachment domains at 12 to 24 months of age in our samples (i.e., rs ranging from $-.26$ to $-.28$, across studies, when mothers are informants for both domains). Thus, our findings complement Fox et al.'s (1991) interpretation that a

small proportion of the variability in cross-parent congruence for attachment classifications may be attributable to temperament variance that overlaps attachment security assessments with each parent.

Adopting our interpretation of necessary overlap between these two domains also affords an opportunity to address questions that are not central to this report but that emerged from our data analyses. Specifically, we can consider the underlying structure of temperament, as illustrated by the principal-components analyses for the Carey instruments that are presented in Table 2. Even though we were able to discern a common theme in the first component from each analysis of these data, the components are not identical across samples. The diversity of theoretical approaches to the domain of temperament notwithstanding (Goldsmith et al., 1987), were we to adopt a strong position regarding the "necessary" relations among variables defining the structure of temperament, these various principal-components solutions could be seen as negative evidence regarding the construct validity of the Carey instruments used across developmental periods. However, if temperament and attachment domains are understood to overlap with respect to affect modulation, then we can expect the structure of temperament to vary, depending on the nature of the relationship between the adult rater and the child whose temperament is being rated. Indeed, we might expect that the temperament descriptions provided by different adults who are rating the same child could be rather different, when the relationship differs across adult–child pairs (e.g., Billman & McDevitt, 1980). Because mother–child and father–child relationships are known to differ across a variety of behavioral domains (e.g., Belsky, Gilstrap, & Rovine, 1984; Parke, 1979; Pedersen, Anderson, & Cain, 1980), we should not be surprised to find differences in temperament descriptions by mothers and fathers (e.g., Fagot, 1985).

In our view, these data provide a sufficient rationale for abandoning positions that conceptualize attachment and temperament in ways that force them into qualitatively different psychological regions or behavioral domains. Instead, we prefer to characterize the behavioral domains governed by temperament and attachment concepts as falling along a bipolar continuum of assessment possibilities that ranges, at one extreme, from assessments capturing variability that is primarily intrinsic to the person to, at the opposite extreme, measures capturing only relationship variability (Stevenson-Hinde, 1988). Typically, temperament measures will lie closer to the intrinsic end of this continuum, but some temperament constructs will be further from this extreme than others. Likewise, attachment-related constructs will fall toward the relationship end of the continuum, but some of these concepts (e.g., dependency) may lie closer to the center of the continuum than others (e.g., security). More important, neither temperament nor attachment constructs will be located at the theoretical extremes of this hypothesized continuum, because both conceptual domains hold patterns of behavior in common. If researchers accept the reality of a common boundary between attachment and temperament construct domains, then the futility of attempts to explain individual differences along dimensions from one domain in terms of dimensions from the other domain becomes obvious. Both domains contribute to the control and expression of affect, and both contribute to later personality development.

We have argued that the advantages of interpreting attachment–temperament relations along a continuum arise from the recognition that, unlike the theoretical constructs they are designed to assess, measures inevitably refer in some degree both to individual characteristics and to interactions among persons. Constructs such as negative reactivity and dependency may lie so close to the midpoint of our conceptual continuum as to defy logical classification under the "discrete domain of influence" view of personality development. Just as drawing sharp distinctions between inborn and acquired characters has proved fruitless (see Oyama, 1985, for a reprise), so have attempts to draw conceptual boundaries between relationship and individual domains raised more problems than have been resolved. To date, spirited defense of territorial claims, though entertaining, has not been productive in terms of theory development or empirical advance.

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