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Attachment and Temperament in the Early Life Course: A Meta-Analytic Review

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This meta-analytic review examines the association between early attachment (assessed at 1–5 years) and child temperament (assessed at birth–12 years), and compares the strength of this association with recently documented meta-analytic associations between early attachment and social competence, externalizing behavior, and internalizing symptoms. Based on 109 independent samples (N = 11,440) of diverse socioeconomic and ethnic backgrounds, temperament was weakly associated with attachment (in)security (d = .14, CI [0.08, 0.19]) but modestly associated with resistant attachment (d = .30, CI [0.21, 0.40]). Temperament was not significantly associated with avoidant (d = .10, CI [−0.02, 0.19]) or disorganized (d = .11, CI [−0.03, 0.25]) attachment. Across developmental domains, early attachment security was more strongly associated with social competence and externalizing behaviors than internalizing symptoms and temperament.

Within the Bowlby–Ainsworth attachment framework (e.g., Ainsworth, 1982; Bowlby, 1969/1982), individual differences in early attachment security are expected to have enduring implications for children's socioemotional development but are not expected to be shaped by child temperament characteristics (see Weinfield, Sroufe, Egeland, & Carlson, 2008). However, as early evidence for the predictive significance of attachment security began to emerge, questions arose concerning precisely what individual differences in infant attachment reflected. Although some scholars maintained that individual differences in infant temperament were of little import in determining attachment classifications (Sroufe, 1985), others contended that infant attachment security was the product of temperamental characteristics (Chess & Thomas, 1982; Kagan, 1982). This decades-long debate led to numerous investigations that have produced mixed findings on the link between attachment and temperament. Accordingly, this study presents a meta-analytic review of this literature aimed at addressing enduring questions about the empirical overlap of infant attachment and temperament.

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The present review also extends a series of meta-analyses on the developmental significance of early attachment security. Findings from these meta-analyses indicate that early attachment security is positively associated with children's social competence with peers (d = .39; Groh et al., 2014) and negatively associated with children's externalizing (d = .31; Fearon, Bakermans-Kranenburg, Van IJzendoorn, Lapsley, & Roisman, 2010) and (to a lesser extent) internalizing (d = .15; Groh, Roisman, Van IJzendoorn, Bakermans-Kranenburg, & Fearon, 2012) psychopathology, suggesting that establishing a secure attachment relationship in infancy promotes children's interpersonal functioning and mental health. Although these meta-analyses provide insight into the implications of early attachment security for children's socioemotional development, without a comparable meta-analysis on attachment and temperament, questions remain concerning the developmental origins of early attachment variation. To be sure, given claims made by attachment scholars that children's endogenous characteristics play little role in shaping the quality of the parent–child attachment relationship (Sroufe, 1985), it would be expected, from an attachment perspective, that attachment and temperament would be weakly associated developmental constructs *and* that early attachment security would be more strongly related to children's subsequent developmental adaptation than it would to infant temperament. This latter point is critical because if attachment–temperament associations were of comparable magnitude to attachment–outcome associations, this could cast doubt over the extent and specificity of attachment's role in children's adjustment. Here, we present a meta-analytic review of the literature on early attachment and infant temperament to empirically evaluate these claims. Because this meta-analysis is the fourth in the series, it is uniquely positioned to address this latter claim, as we are able to compare the meta-analytic association between attachment and temperament with the recently reported meta-analytic associations between attachment and children's social competence, externalizing symptomatology, and internalizing symptomatology.

Central to attachment theory is the idea that individual differences in infant attachment security originate in the early caregiving environment (Ainsworth, Blehar, Waters, & Wall, 1978), a point that has been strongly contested by temperament scholars (Chess & Thomas, 1982; Goldsmith, Bradshaw, & Reiser-Danner, 1986; Kagan, 1982). Although diverse theories of temperament have been more recently unified under one psychobiological theory of temperament (e.g., Rothbart, 2011), temperament scholars have over time proposed several distinct theories of temperament (see Goldsmith et al., 1987; Shiner et al., 2012). Vaughn and Bost (1999) and Vaughn and Shin (2011) have characterized these theories as falling into one of four main theoretical perspectives on temperament, including (a) *temperament as behavioral style* (Thomas & Chess, 1977), (b) *temperament as emergent personality* (Buss & Plomin, 1975, 1984), (c) *temperament as a social co-construction* of the infant's endogenously organized attributes and the caregiver's perception of the infant's attributes (Bates, 1980), and (d) *temperament as emotional reactivity and regulation* (Rothbart, 1989). Despite differences between these perspectives in terms of the characterization of dimensions of temperament, each of these perspectives includes dimensions reflecting negative (e.g., fussy, inhibited, fearful) and positive (e.g., sociable, adaptable, rhythmic) affect. Common to these perspectives is the notion that such temperamental characteristics are biologically based, endogenously organized traits that emerge early in the life course. Importantly, scholars from these theoretical traditions have asserted that individual differences in infant attachment are the result of temperamental variation rather than characteristics of the specific parent–child relationship (Chess & Thomas, 1982; Goldsmith et al., 1986; Kagan, 1982). For example, Kagan (1982) argued that infant attachment security can be attributed to variation in specific aspects of infant negative temperament, such as infants' proneness to distress when confronted with novelty or when separated from the parent.

Attachment scholars have provided a decidedly different perspective on the relation between attachment and temperament. Specifically, according to Sroufe (1985), infant temperament and parent–child attachment security are orthogonal constructs situated at different levels of analysis. According to this view, infant temperament is construed as a set of individual constructs determined by endogenous factors, whereas infant attachment is a relational construct with its origins in the history of the parent–child relationship. Within the parent–child relationship, parents' sensitive responsiveness to infant attachment signals is believed to be the principal organizing force shaping the quality of the early attachment relationship. Thus, from an attachment perspective it should be possible, and indeed expected, that infants develop different patterns of attachment to different caregivers depending on the quality of care received from a specific caregiver.

Although this prediction would be considered paradoxical from a temperament perspective, it is entirely compatible with attachment theory. In short, infant temperamental characteristics are considered of little consequence to determining individual differences in the quality of the parent–child attachment relationship.

Despite these theoretical arguments concerning the relation between attachment and temperament, findings from studies examining the empirical overlap of temperament and attachment have not clearly distinguished between these two opposing perspectives. For example, in support of the argument that infant attachment classifications are determined by infant temperament, scholars have highlighted evidence from studies demonstrating that neonatal behavior predicts subsequent attachment classification (e.g., Grossmann, Grossmann, Spangler, Suess, & Unzer, 1985; Waters, Vaughn, & Egeland, 1980). Conversely, to refute claims that attachment security is essentially redundant with infant temperament, other scholars have drawn on evidence from studies demonstrating that parental reports of infant temperament are not significantly associated with attachment classifications (Belsky, Rovine, & Taylor, 1984; Egeland & Farber, 1984).

Attempts have been made to reconcile views on the relation between attachment and temperament, and at the broadest level, such rapprochements contend that attachment and temperament might be related but in an oblique manner (Van IJzendoorn & Bakermans-Kranenburg, 2012). For example, some have suggested that although temperament does not directly determine infant security status, it might shape the *type* of insecure relationship an infant establishes with an insensitive parent (e.g., Vaughn, Bost, & Van IJzendoorn, 2008). Specifically, because insecure-resistant infants typically become emotionally overwhelmed and insecure-avoidant infants exhibit minimal overt distress during the strange situation procedure (SSP), an infant with a more negative temperament might be more likely to establish a resistant attachment relationship, whereas an infant with a less negative temperament might be more likely to establish an avoidant attachment relationship in the context of insensitive caregiving.

Similarly, Belsky and Rovine (1987) have suggested that infant temperament might shape emotional reactivity, but not the organization of attachment behavior, in the SSP. Importantly, in addition to being classified into one of the three organized categories (i.e., secure [B], avoidant [A], resistant [C]), infants are usually assigned to subclassifications (Ainsworth et al., 1978). As originally noted by Frodi and Thompson (1985), the emotional reactivity of secure B1 and B2 infants is comparable to that of avoidant A1 and A2 infants in that they exhibit minimal separation distress during the SSP, whereas the emotional reactivity of secure B3 and B4 infants is similar to that of resistant C1 and C2 infants, as they exhibit relatively high levels of separation distress. Belsky and Rovine (1987) hypothesized that this distinction in emotional reactivity might be attributed to temperamental differences, with A1–B2 infants expected to have a less negative temperament and B3–C2 infants expected to have a more negative temperament.

Despite efforts to reconcile the attachment–temperament debate, these alternative interpretations of the relation between attachment and temperament have received mixed empirical support. Although some studies have found that temperament distinguishes patterns of attachment insecurity (e.g., Fagot & Kavanagh, 1993; Susman-Stillman, Kalkoske, Egeland, & Waldman, 1996), others have not (e.g., Emery, Paquette, & Bigras, 2008; Nachmias, Gunnar, Mangelsdorf, Parritz, & Buss, 1996). Moreover, the initial empirical support provided by Belsky and Rovine (1987) for their proposed link between temperament and emotional reactivity in the strange situation has been followed by replication (e.g., Susman-Stillman et al., 1996) as well as failures to replicate (e.g., Seifer, Schiller, Sameroff, Resnick, & Riordan, 1996).

Further obscuring a clear understanding of the relation between attachment and temperament, many studies differ methodologically in key ways. Beyond the more obvious differences between studies in terms of the type of attachment and temperament assessments administered, there are more subtle research design-related differences that might influence the link between attachment and temperament. For example, some studies have attempted to assess temperament within the context of the SSP (e.g., Crugnola et al., 2011). Such studies might overestimate the association between attachment and temperament by conflating the measurement of these constructs. Studies have also differed in terms of the temporal order of the assessment of attachment and temperament. Timing of the temperament assessment relative to the attachment assessment is important to consider, because, according to attachment theory, infants' emotional reactivity and regulation is shaped by parent–child relationships (Cassidy, 1994; Sroufe & Fleeson, 1988). Thus, it might be expected that measures of attachment and

temperament would not be closely related in the 1st year of life but would overlap increasingly over time, a prediction that has garnered some empirical support (Sherman, Stupica, Dykas, Ramos-Marcuse, & Cassidy, 2013; Vaughn et al., 1992).

In addition to such methodological variation, studies have differed with respect to how temperament has been operationalized. For example, although many studies have focused on negative temperamental characteristics, some have developed sample-specific composites of negative temperament based on aggregated item analysis (e.g., principal component analysis) from parental reports of temperament, whereas others have operationalized negative temperament with respect to one of the four main temperament theoretical traditions (i.e., Thomas and Chess's [1977] difficulty dimension, Buss and Plomin's [1975, 1984] emotionality dimension, Bates's [1980] fussy/difficult dimension, and Rothbart's [1989] negative affectivity dimension). Such idiosyncrasies might undermine the consistency and replicability of findings across the literature. Furthermore, in many studies researchers cast a wide net, examining a large variety of individual temperament dimensions in relation to attachment absent a priori hypotheses, which might ultimately increase the risk for identifying spurious associations between attachment and temperament.

Despite these complexities, several cogent narrative reviews of the literature on attachment and temperament have been produced (Mangelsdorf & Frosch, 1999; Van IJzendoorn & Bakermans-Kranenburg, 2012; Vaughn & Bost, 1999; Vaughn et al., 2008). These reviews have served to advance thinking regarding the relation between attachment and temperament. Notwithstanding such contributions, these narrative reviews did not attempt to provide a precise estimate of the association between attachment and temperament. Although an estimate of the association between temperament and attachment does not ultimately provide direct evidence regarding whether there is a causal relation between temperament and attachment, as has been suggested by some temperament scholars (Chess & Thomas, 1982; Kagan, 1982), it does provide evidence regarding the extent to which attachment and temperament empirically overlap, which might ultimately shed light on this central question in the attachment–temperament debate. To be sure, if temperament and attachment are only weakly associated, it would suggest that although temperament and attachment share some common variance, attachment quality is not determined by temperamental variation or vice versa. An estimate of the association between attachment and temperament is also crucial for testing the assumption that early security is more strongly related to children's subsequent adaptation than to infant temperament that is implied by attachment scholars' claim that attachment and temperament are distinct developmental constructs, as the comparison of the association between attachment and temperament with previously established meta-analytic associations between early attachment and children's socioemotional outcomes can be made.

Meta-analysis provides a structured methodology for addressing these outstanding questions. To date, one meta-analysis specifically focused on the relation between temperamental proneness to distress and resistant attachment has been published (Goldsmith & Alansky, 1987). Findings from this meta-analysis of 18 samples (N = 1,127) provided evidence for a significant, yet modest, association between proneness to distress and resistance (d = .32). In addition, within the context of a broader meta-analysis examining the reliability and discriminant validity of disorganized attachment, the relation between temperament and disorganization was examined (Van IJzendoorn, Schuengel, & Bakermans-Kranenburg, 1999). Consistent with the idea that the origins of disorganization are not constitutionally based, the combined meta-analytic association across 13 samples (N = 2,028) was almost precisely zero. Although these findings are informative, due to the specific focus of these reports on particular dimensions of temperament or patterns of attachment, important questions remain concerning the extent to which attachment security more broadly, and avoidant attachment more specifically, are related to temperament and the extent to which potential moderators, such as those referred to above, influence the association between attachment and temperament. In addition, without a broad meta-analysis of all patterns of attachment, the relative associations between each pattern of attachment and temperament compared to each pattern of attachment and children's socioemotional outcomes cannot be examined. Thus, the field awaits a more comprehensive and updated meta-analytic review of the literature on attachment and temperament.

Toward that end, we conducted a meta-analysis of 131 samples (N = 13,018) that estimated the association between early negative temperament including dimensions of temperament reflective of negative (vs. positive) emotional reactivity and attachment using standardized observational procedures of attachment quality in early childhood. In

doing so, we set out to test four interrelated hypotheses. First, we tested the competing hypotheses that negative temperament and attachment (in) security are substantially overlapping versus relatively independent constructs with the expectation that early attachment insecurity would be weakly associated with negative temperament. Second, we tested the hypothesis that temperament is associated with specific patterns of insecurity, with the expectation that negative temperament would be weakly negatively associated with avoidant attachment and positively associated with resistant attachment. Third, we hypothesized that negative temperament would be trivially associated with infant disorganization. Fourth, we tested Belsky and Rovine's (1987) hypothesis that temperament would be associated with attachment subclassifications according to infants' expression of emotion during the SSP (i.e., A1–B2 vs. B3–C2), with the expectation that negative temperament would be associated with the B3–C2 (vs. A1–B2) grouping of subclassifications.

We also examined several methodological factors that might moderate the association between attachment quality and negative temperament, including (a) type of measure and identity of the rater used to assess attachment, (b) type of temperament assessment, (c) measurement of temperament in relation to attachment (temperament assessed within vs. independent of the attachment assessment), and (d) temporal relation of attachment and temperament assessments (attachment before temperament, concurrent, attachment after temperament). We also studied the potential moderating role of several demographic factors, including (a) child sex, (b) country in which the study was conducted, (c) child ethnicity, (d) socioeconomic status of the cohort, and (e) contextual risk of the cohort. Finally, we examined the moderating role of the operationalization of temperament with respect to (a) theoretical tradition and (b) dimension. Regarding theoretical tradition, we included the negative temperament dimensions from each of the four main theoretical traditions of temperament (Thomas and Chess's *difficulty*, Buss and Plomin's *emotionality*, Bates's *fussy/difficult*, and Rothbart's *negative affectivity*) and examined whether the magnitude of the association between attachment and temperament varied according to the theoretical tradition used to operationalize temperament. Regarding dimensions of temperament, we included those hypothesized to be relevant to attachment variation, including *fearful distress* (hypothesized to be negatively associated with security and avoidance and positively associated with resistance; e.g., Kagan, 1982), *irritable distress* (hypothesized to be positively associated with resistant attachment; e.g., Goldsmith et al., 1986), and *positive emotionality* (hypothesized to be positively associated with security; e.g., Lewis & Feiring, 1989), and then compared the magnitude of the associations between attachment and each of these temperament dimensions.

To test assumptions about the association between attachment and temperament relative to associations between attachment and children's subsequent socioemotional outcomes, we compared the magnitude of meta-analytic associations tested here with estimates established in our prior meta-analyses on attachment and social competence (Groh et al., 2014), externalizing behavior (Fearon et al., 2010), and internalizing symptoms (Groh et al., 2012) with the hypothesis that early insecurity would be more strongly associated with lower levels of social competence and greater levels of externalizing and internalizing symptomatology than with negative temperament. As in those prior meta-analyses, where there were sufficient data, we examined the association between father–child attachment and temperament, with the hypothesis that—similar to mother–child attachment—insecure father–child attachment would be weakly associated with negative temperament.

Method

Literature Search

A corpus of relevant published articles and dissertations was compiled by searching the electronic databases PsycInfo and Web of Science between January and April 2014 with the keywords inhibition, harm avoid*, shy*, irritable*, frustrate*, difficult*, distress*, anger prone*, temperament, behavior* style, easy, emotionality, activity level, motor activity, attention span, sociabl*, Neonatal Behavioral Assessment Scale, Infant Behavior Questionnaire, Infant Characteristics Questionnaire, fussy, negative reactivity, positive reactivity, negativity, positivity, soothability, reactivity, positive affect*, negative affect*, adaptability, withdraw, distractibility, intensity, mood, persistence, sensory threshold, self regulation, slow to warm up, Infant Temperament Questionnaire, fear, inhibitory control, attention focusing, pleasure, perceptual sensitivity, manageab*, affiliation, sad*, surgency, extraversion, effortful control, negative emotionality, positive emotionality, falling reactivity, sensory sensitivity, attentiveness, threshold, orienting,

regularity, rhythmicity, predictable, and dull (asterisks indicate that the search contained the word or word fragment). To further narrow the search, the articles were also required to contain the keyword attachment. The search returned 1,574 and 29,495 articles from PsycInfo and Web of Science, respectively. The abstracts of these articles that were written in English or another language understood by the authors or their collaborators (French, German, Japanese, Spanish, Korean) were reviewed, and a large number of irrelevant articles were discarded (e.g., nonempirical articles, studies of adults), resulting in a total of 249 remaining articles. The authors examined each of these articles according to the criteria described below. Additionally, 30 relevant articles were obtained by searching the reference lists of the obtained empirical articles and narrative reviews of the literature (e.g., Mangelsdorf & Frosch, 1999; Van IJzendoorn & Bakermans-Kranenburg, 2012; Vaughn & Bost, 1999; Vaughn et al., 2008).

Inclusion and Exclusion Criteria

Studies were included in the meta-analysis if they reported on the relation between attachment and temperament. Temperament was defined as individual differences in emotion, motor, and attentional reactivity and regulation that are constitutionally based but also shaped by experience (Rothbart & Bates, 1998). The purpose of the current meta-analysis was to provide a comprehensive quantitative review of the literature on attachment and temperament. For that reason, all dimensions of temperament that have been examined in relation to attachment were included in this meta-analysis.

An additional goal of the current meta-analysis was to compare the meta-analytic association between attachment and temperament with the meta-analytic associations in our prior work between attachment and (a) social competence with peers—defined as social skills, peer interaction quality, and social status (see Groh et al., 2014); (b) externalizing symptomatology—defined as aggression, oppositional problems, conduct problems, and hostility (see Fearon et al., 2010); and (c) internalizing symptomatology—defined as depression, anxiety, social withdrawal, and somatic complaints (see Groh et al., 2012). To ensure that outcomes included in these prior meta-analyses were not included in the current meta-analysis, the following outcomes were excluded from the current meta-analysis: (a) peer competence (e.g., positive affect expressed within interactions with peers), (b) externalizing behavior (e.g., aggression), or (b) internalizing symptoms (e.g., social withdrawal). Because the vast majority of studies reporting on attachment and internalizing symptomatology employ the Child Behavior Checklist (Achenbach, Edelbrock, & Howell, 1987) and social withdrawal is one of the key internalizing constructs derived from this questionnaire, social withdrawal was included in the prior meta-analysis on attachment and internalizing symptoms, and excluded from the present review. Behavioral inhibition, shyness, and sociability are core temperament dimensions that are assessed via several temperament questionnaires and observational procedures, and thus, were included in this meta-analysis.

Temperament was assessed using questionnaires completed by parents and observations rated by trained observers, nurses, and pediatricians. In two cases, temperament questionnaires were completed by teachers in addition to mothers (Badanes, 2010; Kemple, 1990). Because these were the only two studies employing teacher reports, only the mother-reported temperament data were included in analyses. Articles were only included if they used observational assessments of attachment security, such as the SSP (Ainsworth et al., 1978), the Cassidy and Marvin Preschool Attachment system (Cassidy, Marvin, & the MacArthur Working Group on Attachment, 1989), the Attachment Q-Sort (AQS; Waters & Deane, 1985), the Main and Cassidy system (Main & Cassidy, 1988), or the Preschool Attachment System (Crittenden, 1992). Among studies employing the AQS, one report drawing on data from the Early Childhood Longitudinal Study–Birth Cohort—a nationally representative sample of children born in 2001 in the United States—employed a short version of the observer-reported AQS comprising 45 cards (Rispoli, McGoey, Koziol, & Schreiber, 2013). This study was included in the meta-analysis because similar to other observer-reported AQS studies, trained observers completed sorts after two or more hours of in-home observations and attachment security as measured with this version of the AQS has been found to be associated with maternal sensitivity (Roisman & Fraley, 2008). In cases where more than one attachment assessment was used (e.g., SSP followed by AQS at a later age), the earliest assessment was selected. In cases when the SSP or a modified version of the SSP was administered at the same time point as the AQS (e.g., Stevenson-Hinde & Shouldice, 1990), the SSP or modified SSP was selected because they provide information on insecurity subtypes and the AQS does not.

Several studies presented data on (partly) overlapping samples (e.g., Egeland & Farber, 1984; Susman-Stillman et al., 1996; Waters et al., 1980). Because participants can be included in a meta-analysis only once, the publication that reported on the temperament assessment that was completed closest in time to the attachment assessment was included in our meta-analysis (e.g., Susman-Stillman et al., 1996). The same procedure was followed for studies that reported longitudinal data in which temperament was assessed several times over the course of development (e.g., Planalp & Braungart-Rieker, 2013). If more than one type of temperament assessment was administered at the same time point (e.g., questionnaire and observation; Mangelsdorf, McHale, Diener, Goldstein, & Lehn, 2000), these data were combined.

Some studies reported results separately for boys and girls. In these cases, we calculated separate effect sizes for each sex, and the subsamples were treated as independent samples in analyses. Some studies reported on data from twins (e.g., Bokhorst et al., 2003). For these studies, one member of the twin dyad was selected to ensure independent data. Seven articles also reported on outcome data for father–child attachment security. These articles were included in a separate meta-analysis on the association between father–infant attachment and temperament.

In total, after excluding reports involving overlapping samples, 129 studies were identified yielding 131 independent samples comprising 18,968 children that could be included in the meta-analyses, with sample sizes ranging from 10 to 6,850 (see Table 1). We winsorized (Tabachnik & Fidell, 2001) the sample size of the largest study (Rispoli et al., 2013) to $N = 900$ to avoid excessive influence of this study, resulting in an effective total of 13,018 children included in the meta-analyses. Some studies used the AQS to measure attachment, which does not yield data on the different subtypes of insecurity. As a result, these studies only appear in the meta-analyses involving the overall contrast between security and insecurity. In addition, some studies only reported on data for specific attachment classifications (e.g., resistant vs. not-resistant attachment; Fagot & Kavanagh, 1993). In such cases, data from these studies are only represented in analyses for which relevant data were reported.

Coding System

A coding system for describing the characteristics of the sample and study design was developed based on the system presented in the meta-analyses on attachment and social competence, externalizing behavior, and internalizing symptoms (Fearon et al., 2010; Groh et al., 2012, 2014). Attachment was coded based on the observational measure used, and all of the studies included one of several well-known attachment assessments (SSP, AQS, Preschool Attachment Assessment, Cassidy et al., 1989; Main & Cassidy, 1988). For each type of attachment measure, when possible, we extracted data at the level of the individual attachment classification (i.e., A, B, C, ,and D). For the AQS, the informant who completed the sort (observer, mother) was coded, because the mother-reported AQS has been shown to be problematic in terms of validity (Van IJzendoorn, Vereijken, Bakermans-Kranenburg, & Riksen-Walraven, 2004). In addition, to test the claim that emotional responding, but not attachment security, within the context of the SSP might be associated with temperament, when available coders extracted data at the level of attachment subclassifications grouped according to the Belsky and Rovine split (i.e., A1–B2 vs. B3–C2). In some cases, either the mean, standard deviation, or number of children in attachment categories was not reported. To obtain such crucial data, authors were contacted for 15 studies. In 11 cases, the authors were able to provide the relevant information. As in Fearon et al. (2010) and Groh et al. (2012, 2014), we analyzed (publicly available) raw data pertinent to the aims of this meta-analysis from the NICHD Study of Early Child Care and Youth Development to examine associations between attachment and temperament within subsamples (e.g., low vs. higher socioeconomic status [SES] groups).

Several potential moderators related to the sample were coded, including (a) child sex, (b) country in which the study was conducted (North America vs. Europe vs. other), (c) child ethnicity (Caucasian vs. not Caucasian), (d) socioeconomic status (SES; high/middle vs. low; a default of high/middle class was applied when SES was not reported), (e) risk status (not at-risk vs. at-risk child [e.g., premature birth status] vs. at-risk mother [e.g., clinical levels of depression]), (f) type of attachment assessment (SSP vs. MSSP vs. AQS), (g) type of temperament assessment (questionnaire vs. observation vs. questionnaire/observation combined), (h) measurement of temperament in relation to attachment (temperament assessed within vs. independent of attachment assessment), (i) temporal relation between attachment and temperament assessments (attachment before temperament vs. concurrent vs. attachment after temperament). To

Table 1
Sample Characteristics for Studies

Source	Sample description[a]	Belsky-Rovine split	Att measure[b]	Temp measure[c]	Age of att (months)[d]	Age of temp (months)	*N*
Abe and Izard (1999)		Y	SSP	Report	18	42	45
Ackerman (1988)			M-AQS	Report	12	4	10
Ahnert sample							
Ahnert et al. (2004)	FearDis		SSP	Report	15	15	70
Ahnert and Rickert (2000)	Effect for B/A/C/D; T&C-Diff		SSP	Report	15	15	70
Badanes (2010)			M-AQS	Report	48	48	98
Barnett et al. (1999)	Low socioeconomic status (SES); Mixed risk; IrrDis; TempInAtt	Y	SSP	Obs	13	13	44
Bates sample							
Bates et al. (1985)	Effect for B; Bates-F/D; FearDiss; IrrDis; PosEmo		SSP	Obs; Report	13	13	64
	T&C-Diff		SSP	Report	13	6	68
Frankel and Bates (1990)	Effect for A/C; IrrDis		SSP	Obs	13	24	41
Belsky Pennsylvania Development Study							
Belsky and Isabella (1988)	Cohort 2; Effect for B		SSP	Obs	12	0	51
Belksy and Rovine (1987)	Cohort 2	Y	SSP	Obs	12	0	51
	Cohort 3	Y	SSP	Obs	12	0	96
Belsky et al. (1984)	Cohort 1; Effect for B; IrrDis		SSP	Obs	13	9	53
Vaughn et al. (1992)	Cohort 3; Effect for B		M-AQS	Report	12	9	98
Volling and Belsky (1992)	F–C att		SSP	Report	13	9	113
Belsky Terrible Twos Study							
Belsky et al. (1996)	Males; F–C att		SSP	Report	13	10	126
Belsky et al. (1995)	Effect for B; Males		SSP	Obs	12	13	70
Berry (1981)	T&C-Diff		SSP	Report	15	15	34
Bohlin sample							
Bohlin et al. (2005)	Effect for B; FearDis		SSP	Obs; Report	16	14	81
Hagekull and Bohlin (2003)	B&P-Emo; PosEmo	Y	SSP	Report	16	20	85
Bokhorst et al. (2003)			SSP	Report	13	11	138
Bouvette-Turcot et al. (2013)	FearDis; IrrDis		O-AQS	Report	24	24	60
Braungart-Rieker sample							
Braungart-Rieker et al. (2001)	Effect for B/A/C; M–C att; IrrDis; PosEmo	Y	SSP	Obs	12	4	94
	F–C att		SSP	Obs	13	4	84
Karrass and Braungart-Rieker (2004)	FearDis		SSP	Report	12	12	63
Buchanan (1981)	Effect for BvA only; FearDis; IrrDis; PosEmo		SSP	Obs; Report	15	15	40
Burgess et al. (2003)	FearDis		SSP	Obs	14	24	172
		Y	SSP	Obs	14	24	171
	B&P-Emo; PosEmo		SSP	Report	14	48	144
Calkins and Fox (1992)	FearDis; IrrDis		SSP	Report	14	14	48
	PosEmo		SSP	Report	14	5	48
Cassidy sample							
Sherman et al. (2013)	Effect for B/A/C; Low SES; At-risk child; IrrDis		SSP	Obs	12	12	84
Stupica et al. (2011)	Low SES; At-risk child; FearDis		SSP	Obs	12	24	84
Cintas (1990)			M-AQS	Report	18	18	32
Colman and Thompson (2002)			M-AQS	Obs	58	58	36
Connell (1977)	Effect for BvA only; IrrDis		SSP	Obs	12	14	41

Table 1
Continued

Source	Sample description[a]	Belsky-Rovine split	Att measure[b]	Temp measure[c]	Age of att (months)[d]	Age of temp (months)	*N*
Crockenberg (1981)	IrrDis		SSP	Obs	13	0	48
Crugnola et al. (2011)	FearDis; PosEmo; TempInAtt		SSP	Obs	13	13	39
Cusson (1990)	Low SES; At-risk child; Bates-F/D; IrrDis		SSP	Obs; Report	13	7	40
De Schipper et al. (2012)	At-risk child; FearDis		MSSP	Report	57	57	59
Del Carmen et al. (1993)	PosEmo		SSP	Obs	13	3	52
Diener et al. (2002)	M–C att; IrrDis; PosEmo		SSP	Obs	13	13	93
	F–C att		SSP	Obs	12	12	85
Diener et al. (2003)			M-AQS	Report	33	33	101
Donovan et al. (2007)			SSP	Obs	12	24	62
Emery et al. (2008)	Low SES, At-risk mother; Bates-F/D; IrrDis		SSP	Obs; Report	15	4	131
Endriga (1995)	IrrDis; PosEmo		SSP	Obs; Report	12	3	67
Fagot and Kavanagh (1993)	Effect for C only; Low SES; T&C-Diff		SSP	Report	15	15	137
Fagot and Leve (1998)			SSP	Report	18	18	122
Fuertes sample							
Fuertes et al. (2006)	At-risk child; PosEmo		SSP	Obs	12	3	31
Fuertes et al. (2009)	Effect for B/A/C; At-risk child; IrrDis		SSP	Report	12	2	48
Frodi (1983)	Mixed risk; T&C-Diff; FearDis		SSP	Obs; Report	12	12	40
Frodi et al. (1985)	Effect for C only		SSP	Obs	12	12	41
Frodi et al. (1989)	T&C-Diff		SSP	Report	12	4	45
Ganiban et al. (2000)	At-risk child; FearDis; TempInAtt		SSP	Obs	19	19	30
		Y	SSP	Obs	19	19	23
Gibson et al. (2000)	IrrDis		SSP	Report	13	13	126
Gilliom et al. (2002)	Low SES; Bates-F/D; IrrDis		SSP	Report	18	18	310
Goldberg et al. (1994)	FearDis; PosEmo; TempInAtt		SSP	Obs	12	12	30
Hadadian and Merbler (1996)			M-AQS	Report	42	42	33
Harris (2007)	Mixed risk; FearDis; PosEmo		MSSP	Obs	31	31	90
Heckman (1994)			MSSP	Report	30	30	55
Heikamp et al. (2013)			M-AQS	Other	66	66	82
Higley and Dozier (2009)	FearDis; IrrDis; PosEmo		SSP	Report	13	13	44
Hill (1998)	T&C-Diff; FearDis		O-AQS	Report	15	15	50
Hong (1993)			MSSP	Report	66	66	32
Hong and Chung (1995)	FearDis		MSSP	Report	60	60	76
Hudson et al. (2011)	FearDis		MSSP	Report	48	48	196
Ispa et al. (2002)			M-AQS	Report	14	11	82
Izard et al. (1991)			SSP	Report	13	8	81
Jin (2005)	Effect for BvC only; FearDis; IrrDis; PosEmo		SSP	Report	15	15	90
Kalinauskiene et al. (2009)	At-risk mother; PosEmo		O-AQS	Obs	12	6	54
Kemp (1987)	T&C-Diff; FearDis		SSP	Report	12	8	28
Kemple (1990)	Effect for BvC only; PosEmo		SSP	Report	18	26	28
	Effect for AvC only; PosEmo		SSP	Report	18	26	12
Kochanska (2001)	FearDis; IrrDis; PosEmo		SSP	Obs	14	14	108
Kowalski (1986)	Effect for BvA only; Mixed risk; IrrDis		SSP	Report	12	6	30
Krupka (1995)	Low SES, At-risk mother, T&C-Diff		O-AQS	Report	13	13	60

Table 1
Continued

Source	Sample description[a]	Belsky-Rovine split	Att measure[b]	Temp measure[c]	Age of att (months)[d]	Age of temp (months)	*N*
Laible (2004)			M-AQS	Report	49	49	51
Laible et al. (2008)			M-AQS	Report	30	30	64
Leerkes and Wong (2012)			SSP	Obs	16	16	98
Lefever (1987)	T&C-Diff; FearDis	Y	SSP	Report	12	6	149
Lewis and Feiring (1989)	IrrDis; PosEmo		MSSP	Obs	12	3	174
Manassis et al. (1995)	At-risk mother; FearDis		Other	Obs	36	36	20
Mangelsdorf and Frosch (1999)	Mixed risk; Bates-F/D; FearDis; IrrDis		O-AQS	Report	14	19	79
Mangelsdorf et al. (1990)			SSP	Obs	13	9	58
Mangelsdorf et al. (2000)	FearDis; IrrDis; PosEmo		SSP	Obs; Report	12	8	92
Martinez-Fuentes et al. (2000)	FearDis		MSSP	Obs	12	3	41
Matas et al. (1978)	IrrDis		SSP	Obs	18	24	48
McElwain et al. (2012)	IrrDis		MSSP	Report	33	33	120
Mills-Koonce et al. (2007)	Low SES; IrrDis		SSP	Obs	12	6	148
Moran and Pederson (1998)	Mixed risk		MSSP	Report	12	8	88
	Mixed risk; Bates-F/D; IrrDis		MSSP	Report	12	18	88
Morrell and Steele (2002)	Effect for C only; Bates-F/D; IrrDis		SSP	Report	15	15	100
Moser (1989)			SSP	Report	12	9	37
Nachmias (1996)	FearDis; IrrDis		SSP	Obs	18	18	73
Nair and Murray (2005)			M-AQS	Report	53	53	58
Neyer et al. (1998)	FearDis		MSSP	Obs; Report	46	46	53
NICHD sample	Effect for B/A/C/D; Males; Low SES		SSP	Report	12	6	78
	Effect for B/A/C/D; Males; High/Middle SES		SSP	Report	12	6	518
	Effect for B/A/C/D; Females; Low SES		SSP	Report	12	6	84
	Effect for B/A/C/D; Females; High/Middle SES		SSP	Report	12	6	497
	Males; Low SES: FearDis; IrrDis		SSP	Report	12	54	49
	Males; High/Middle SES; FearDis; IrrDis		SSP	Report	12	54	457
	Females; Low SES; FearDis; IrrDis		SSP	Report	12	54	46
	Females; High/Middle SES; FearDis; IrrDis		SSP	Report	12	54	469
North German Longitudinal Study							
Grossmann et al. (1985)	Effect for B/A/C; M–C att; IrrDis		SSP	Obs	12	0	49
Lütkenhaus et al. (1985)	FearDis		SSP	Obs	12	36	41
O'Connor et al. (1992)	IrrDis		SSP	Obs	12	12	44
O'Connor and Croft (2001)	Cohort 1; B&P-Emo; PosEmo		MSSP	Obs; Report	43	43	55
	Cohort 2; B&P-Emo; PosEmo		MSSP	Obs; Report	43	43	55
O'Connor et al. (2002)	Low SES; At-risk child; IrrDis		O-AQS	Obs	57	57	42
Oosterman and Schuengel (2007)	FearDis; TempInAtt		O-AQS	Obs	55	55	50
Park (2001)			M-AQS	Report	12	12	47
Pauli-Pott et al. (2007)	IrrDis		SSP	Obs	18	8	58
Payne (2001)			M-AQS	Report	15	15	97
Pederson et al. (1990)			O-AQS	Report	12	12	40
Pierrehumbert et al. (2000)	T&C-Diff; FearDis	Y	SSP	Report	21	60	39

Table 1
Continued

Source	Sample description[a]	Belsky-Rovine split	Att measure[b]	Temp measure[c]	Age of att (months)[d]	Age of temp (months)	*N*
Planalp and Braungart-Rieker (2013)	M–C att; Roth-NegAff; FearDis; IrrDis; PosEmo		SSP	Report	12	7	124
	F–C att		SSP	Report	14	7	115
Plunkett et al. (1998)	At-risk child; FearDis		SSP	Obs	15	36	48
Radtke (2009)			O-AQS	Obs; Report	48	48	681
Rellinger (1994)	Low SES, At-risk mother		SSP	Report	12	9	125
Rispoli et al. (2013)	IrrDis		O-AQS	Obs	24	24	6,850[e]
Roque et al. (2013)	FearDis; IrrDis; PosEmo		O-AQS	Obs	21	21	55
Sakin (1997)	Bates-F/D; FearDis; IrrDis; PosEmo		MSSP	Report	23	23	161
Schedle and Reicherts (1997)	Bates-F/D; IrrDis		SSP	Report	12	12	29
Scher and Mayseless (2000)	Effect for BvC only; Bates-F/D; FearDis; IrrDis		SSP	Report	12	9	97
Seifer et al. (1996)	T&C-Diff; B&P-Emo; Bates-F/D; FearDis; IrrDis	Y	SSP	Obs; Report	12	12	48
Seifer et al. (2004)	LowSES; Mixed risk; FearDis; IrrDis; PosEmo		SSP	Report	18	4	860
Shamir-Essakow et al. (2005)	FearDis		MSSP	Obs	46	46	104
Shaw sample							
Shaw et al. (1996)	Effect for D; Low SES; Bates-F/D; IrrDis		SSP	Report	12	10	84
Shaw and Vondra (1995)	Effect for B; Males; Low SES; Bates-F/D; IrrDis		SSP	Report	12	10	59
	Effect for B; Females; Low SES; Bates-F/D; IrrDis		SSP	Report	12	10	41
Singer et al. (1985)	Mixed risk		SSP	Report	15	15	73
Smith et al. (2006)	Males		M-AQS	Obs	24	24	78
	Females		M-AQS	Obs	24	24	76
Spangler and Zimmermann (2014)	IrrDis; FearDis		SSP	Obs	12	144	90
Stams et al. (2002)	Effect for B; At-risk child		SSP	Report	12	20	145
	Effect for D; At-risk child		SSP	Report	12	20	143
Stevenson-Hinde and Marshall (1999)	Males; FearDis; TempInAtt	Y	MSSP	Obs	54	54	52
	Females; FearDis; TempInAtt	Y	MSSP	Obs	54	54	58
Stevenson-Hinde and Shouldice (1990)	Males; FearDis; TempInAtt		MSSP	Obs	30	30	41
	Females; FearDis; TempInAtt		MSSP	Obs	30	30	41
	Males	Y	MSSP	Obs	30	30	35
	Females	Y	MSSP	Obs	30	30	32
Stevenson-Hinde et al. (2011)	Males; Mixed risk; FearDis TempInAtt	Y	MSSP	Obs	51	51	42
	Females; Mixed risk; FearDis; TempInAtt	Y	MSSP	Obs	51	51	36
Sull (1995)			M-AQS	Report	56	56	89
Susman-Stillman et al. (1996)	Low SES; IrrDis; PosEmo	Y	SSP	Obs; Report	12	6	211
Switzer (2006)			M-AQS	Report	61	61	90
Szewczyk-Sokolowski et al. (2005)			O-AQS	Report	54	54	98
Tarabulsy et al. (2008)	Mixed risk		O-AQS	Report	15	6	127

Table 1
Continued

Source	Sample description[a]	Belsky-Rovine split	Att measure[b]	Temp measure[c]	Age of att (months)[d]	Age of temp (months)	*N*
Teti et al. (1991)	Effect for BvA; IrrDis		SSP	Obs	18	18	43
	Effect for BvC; IrrDis		SSP	Obs	18	18	37
	Effect for AvC; IrrDis		SSP	Obs	18	18	18
Usui and Miyake (1984)	Effect for BvC; T&C-Diff; FearDis		SSP	Report	12	8	47
Van Bakel and Riksen-Walraven (2004)	FearDis; IrrDis; PosEmo		MSSP	Report	15	15	127
Van Dam and Van IJzendoorn (1998)	Bates-F/D; FearDis; IrrDis; PosEmo	Y	SSP	Report	18	18	39
Van der Mark et al. (2002)	Females; FearDis		SSP	Obs	16	16	125
Vaughn et al. (1992)							
Hron-Stewart Sample 1	Effect for B; T&C-Diff		O-AQS	Report	24	24	49
Hron-Stewart Sample 2	Effect for B; T&C-Diff		O-AQS	Report	33	33	40
Trudel sample	Effect for B		M-AQS	Report	18	24	74
Waters and Kotsaftis sample	Effect for B; Males		M-AQS	Report	42	39	179
Volling et al. (2002)	M–C att; IrrDis; PosEmo		SSP	Obs	13	13	61
	F–C att		SSP	Obs	13	13	62
Wachs and Desai (1993)			M-AQS	Report	25	25	56
Wachs et al. (2011)	Low SES; IrrDis		O-AQS	Report	12	12	172
Weber et al. (1986)		Y	SSP	Report	13	13	36
Wheeler (2004)			M-AQS	Report	22	9	47
Wieczorek-Deering et al. (1991)	Effect for BvA only; Bates-F/D; FearDis; IrrDis; PosEmo		SSP	Report	18	18	95
	Effect for BvC only; Bates-F/D; FearDis; IrrDis; PosEmo		SSP	Report	18	18	85
Wille (1988)	Low SES; Mixed risk; IrrDis; PosEmo		SSP	Report	13	7	54
Wong et al. (2009)	M–C att; Bates-F/D; IrrDis		SSP	Report	13	4	62
	F–C att; Bates-F/D; IrrDis		SSP	Report	12	4	62
Yan-hua et al. (2012)	T&C-Diff; FearDis		SSP	Report	15	15	151
Ziegenhain et al. (1996)	FearDis		MSSP	Obs	21	20	64

[a]M–C att = mother–child attachment; F–C att = father–child attachment; T&C-Diff = Thomas and Chess (1977) difficulty; B&P-Emo = Buss and Plomin (1975, 1984) emotionality; Bates-F/D = Bates (1980) fussy/difficult; Roth-NegAff = Rothbart (1989) negative affectivity; FearDis = fearful distress; IrrDis = irritable distress; PosEmo = positive emotionality; TempInAtt = temperament coded during an attachment assessment. [b]AQS = Waters and Deane (1985) Attachment Q-Set (O indicates completed by observer, M indicates completed by mother); MSSP = Modified SSP by reducing number of separations and/or lengthening duration of separation; SSP = Ainsworth et al. (1978) strange situation procedure; Other = SSP and MSSP combined. [c]Report = Mother-reported questionnaire; Obs = Observation. [d]0 indicates that temperament assessment was administered within the first month after birth of infant. [e]Value reflects sample size before winsorizing; winsorized $N = 900$.

assess interrater reliability, 30% of studies were randomly selected and rated by two coders. The agreement between the coders across the moderator variables was 97%.

Meta-Analytic Procedures

Consistent with our previous meta-analyses (Fearon et al., 2010; Groh et al., 2012, 2014), we conducted four separate meta-analyses on negative temperament, one for the relation between attachment security and temperament, one for the relation between avoidance and temperament, one for the relation between resistance and temperament, and one for the relation between disorganization and temperament. For these meta-analyses, all temperament dimensions were combined to form one overall composite reflecting negative (vs. positive) temperament (scores on positive dimensions were reversed before being combined with negative dimensions). A set of moderator analyses were conducted to determine whether variables listed above

increased or attenuated the association between attachment and temperament.

In these meta-analyses, we compared temperament of the children in each attachment classification with all other classifications combined (e.g., insecure avoidant vs. not avoidant), parallel to our previous meta-analyses (Fearon et al., 2010; Groh et al., 2012, 2014). As a follow-up, we also compared the secure classification with each insecure classification (e.g., secure vs. insecure avoidant) as the most "pure" reference category and each insecure classification with each of the other insecure classifications (e.g., insecure avoidant vs. insecure resistant) in a separate set of analyses on a smaller set of studies with pertinent data. To examine the link between emotional reactivity expressed within the context of the SSP and temperament, a meta-analysis on the relation between attachment subclassifications categorized according to the Belsky and Rovine (1987) split (A1–B2 vs. B3–C2) and temperament was conducted.

Following up this main set of meta-analyses, we also examined whether the association between attachment and temperament varied according to temperament theoretical tradition and temperament dimension. These meta-analyses focused on (partially) overlapping groups of participants. For example, some studies reported data from multiple temperament dimensions (e.g., Seifer et al., 1996). Thus, 85% CI were reported to allow for exploratory comparisons (see below). Concerning the analyses on temperament theoretical tradition, we divided the overall negative temperament composite into studies that differed in theoretical approach to the operationalization of temperament. Studies that employed questionnaire assessments of temperament were characterized as pertaining to one of four main theoretical orientations and separate meta-analyses for the dimensions of negative temperament from each of these theoretical traditions (Thomas & Chess's *difficulty*, Buss & Plomin's [negative] *emotionality*, Bates's *fussiness/difficulty*, and Rothbart's *negative affectivity*) were conducted in relation to attachment security, avoidance, resistance, and disorganization.

Concerning temperament dimensions, temperamental fearful distress (e.g., behavioral inhibition, distress to novelty, approach [reverse scored], shyness), irritable distress (e.g., general fussiness, anger, distress to limitations), and positive emotionality (e.g., general positive affect, sociability) were examined in relation to attachment security, avoidance, resistance, and disorganization. These three dimensions were specifically examined in the current report because of relevant theoretical arguments in the literature concerning their potential relation to attachment (e.g., Goldsmith et al., 1986; Kagan, 1982; Lewis & Feiring, 1989) and because sufficient numbers of studies were available to conduct these meta-analyses. To facilitate comparisons across temperament dimensions, the direction of all positively valenced temperament dimensions (e.g., positive emotionality) were reversed for analyses. Thus, higher scores on all temperament dimensions reflect greater levels of negative temperament.

The meta-analyses were performed using the Comprehensive Meta-Analysis (CMA) program (Borenstein, Rothstein, & Cohen, 2005; version 2). For each study, an effect size (d) was calculated as the standardized difference between the two pertinent groups (e.g., secure vs. insecure). In studies using continuous attachment scores (e.g., studies reporting on the AQS), associations were re-expressed as Cohen's d (see Mullen, 1989, and Mullen & Rosenthal, 1985, Chapter 6, for the formulae for transformation of various statistics into Cohen's d). Effect sizes indicating a negative relation between negative temperament and attachment security and avoidance (e.g., lower levels of negative temperament in the secure group compared to the reference group) were given a positive sign. Effect sizes indicating a positive relation between negative temperament and attachment disorganization and resistance (e.g., greater levels of negative temperament in the resistant group compared to the reference group) were also given a positive sign. Thus, a positive combined effect for the set of studies comparing resistant children with nonresistant children on negative temperament would mean that across studies the level of negative temperament in resistant children was higher, on average, than among other children.

Using CMA, combined effect sizes were computed. Significance tests and moderator analyses were performed using random effects models, as this approach is considered to be most widely applicable and conservative (Borenstein et al., 2005). Random effects models allow for the possibility that there are random differences between studies that are associated with variations in procedures, measures, and settings that go beyond subject-level sampling error and thus point to different study populations (Lipsey & Wilson, 2001). To test the homogeneity of the overall and specific sets of effect sizes, we computed Q statistics (Borenstein et al., 2005). In addition, we computed 95% CI around the point estimate of each set of effect sizes. Q statistics and p values were also computed to

assess differences between combined effect sizes for specific subsets of studies grouped by moderators. Again, the more conservative random effects model tests were used. Contrasts were only tested when at least two of the subsets consisted of at least four studies.

When the children in two sets of studies (partially) overlapped (e.g., some studies reported on multiple types of temperament assessments, and we wanted to compare the combined effects for these sets), it was impossible to directly compare effect sizes across these sets. We computed 85% CI for the point estimates of the combined effect sizes in the two sets; nonoverlapping 85% CIs indicate a significant difference between combined effect sizes. This approach of comparing 85% CIs serves as a conservative significance test (Goldstein & Healy, 1995; Van IJzendoorn, Juffer, & Klein Poelhuis, 2005).

For each study, Fisher's Z scores were computed as well-distributed equivalents for the effect size d, and the Z scores were standardized to test for outliers. For the main analyses, no outliers (standardized Z values smaller than -3.29 or larger than 3.29; Tabachnik & Fidell, 2001) were found for study effect sizes.

Results

Mother–Child Attachment and Overall Negative Temperament

Security

The first and most important question concerned the association between mother–child attachment security and negative temperament, regardless of its various forms and theoretical perspectives. As seen in Table 2, in the total set of 131 studies including $N = 13{,}018$ children (after winsorizing the outlying sample size in Rispoli et al., 2013; see Method), we found a significant combined effect size of $d = .21$ in a heterogeneous set of outcomes. Because a previous meta-analysis provided evidence that the AQS completed by the mother is not a valid assessment of attachment security (Van IJzendoorn et al., 2004), the studies using the mother-reported AQS were excluded. In the remaining set we found a lower but still significant combined effect size of $d = .14$, again in a heterogeneous set of outcomes, showing that studies employing the mother-reported AQS significantly and artificially inflated the association between attachment and temperament. Therefore, mother-reported AQS studies were excluded from subsequent moderator analyses. Only type of attachment assessment (SSP vs. MSSP vs. observer AQS) was found to significantly impact the association between attachment and temperament. Specifically, in the 69 studies using the SSP, the combined effect size for attachment security and negative temperament decreased to $d = .08$ (see Table 2), which was significantly lower than that of the combined set of observer AQS studies ($Q[1] = 6.80$, $p = .004$). No other sample or design-related moderators were significant.

Avoidance

In 51 studies involving $N = 5{,}950$ children and their mothers, the insecure-avoidant attachment classification was differentiated from the other classifications, and in these studies the combined effect size was not significant, $d = .10$ (see Table 3). The set of studies was heterogeneous, and we found two moderators explaining some of this heterogeneity. The temporal relation between attachment and temperament assessments was a significant moderator, with concurrent assessments showing a significant association of $d = .22$, whereas associations with temperament measurements taken before or after the attachment assessments were not significant. In samples with only boys, the association was rather strong, $d = .57$, whereas in samples with only girls ($d = .08$) or in mixed samples ($d = .05$) no association was found. Upon inspection of samples comprising only boys, it was found that three of the five studies included assessments of temperament within an attachment assessment, which might have inflated the association between attachment and temperament for the subsample of studies comprising boys.

Resistance

The largest combined effect size for the association between attachment and negative temperament was found for mother–child resistant attachment, with a significant $d = .30$ across 55 studies including 6,268 children (see Table 3). The temporal design of the study was a significant moderator, and concurrent assessments of negative temperament and attachment resistance yielded the highest effect sizes ($d = .47$). Furthermore, using behavior observed in the context of the attachment assessment (e.g., within the SSP) as an index of temperament inflated the association from a combined association of $d = .23$ in studies assessing temperament independently of attachment to a combined association of $d = .77$ in studies assessing temperament within the context of the attachment assessment.

Table 2
Secure Attachment and Negative Temperament

	k	*N*	*d*	95% CI	Homogeneity *Q*	Contrast *Q*[a]
Total set	131	13,018	.21**	0.15, 0.27	272.68**	
Total set (w/o M-AQS)	109	11,440	.14**	0.08, 0.19	175.98**	
Ethnicity						0.28
Caucasian	95	8,415	.14**	0.08, 0.20	133.34**	
Other	14	3,025	.10	−0.03, 0.23	42.60**	
Country						0.09
North America	73	8,750	.14**	−0.08, 0.20	129.55**	
Europe	29	1,833	.13*	−0.02, 0.25	34.16	
Other	7	857	.11	−0.08, 0.30	11.85	
Sex						2.10
Boys	7	860	−.01	−0.22, 0.20	7.26	
Girls	7	882	.16	−0.05, 0.36	6.67	
Mixed	95	9,698	.15**	0.09, 0.20	154.05**	
Risk status						0.75
Not at risk	85	9,021	.14**	0.08, 0.20	135.77**	
At-risk child	8	496	.17	−0.06, 0.39	20.57**	
At-risk mother	5	390	.03	−0.23, 0.29	3.58	
Mixed	11	1,533	.13	−0.04, 0.30	13.32	
SES						2.13
Middle/high	92	8,897	.15**	0.10, 0.21	145.25**	
Low	17	2,543	.05	−0.07, 0.18	23.97	
Attachment measure[b]						8.39*
SSP	69	7,043	.08**	0.02, 0.15	90.87*	
Modified SSP	23	1,820	.18**	0.07, 0.29	22.10	
AQS (observer)	16	2,557	.27**	0.15, 0.40	32.76**	
Temporal design						1.50
Att before temp	8	671	.02	−0.18, 0.21	10.78	
Concurrent	62	5,960	.14**	0.07, 0.22	86.23*	
Att after temp	39	4,809	.15**	0.06, 0.23	69.03**	
Measurement of temp						
Temp during att assess	11	463	.19	−0.02, 0.41	8.66	
Temp independent of att	98	10,977	.13**	0.08, 0.19	167.08**	

	k	*N*	*d*	85% CI	Homogeneity *Q*
Temp theoretical tradition					
Thomas/Chess difficulty	13	831	.06	−0.05, 0.17	17.03
Buss/Plomin emotionality	4	302	.06	−0.12, 0.24	1.25
Bates fussy/Difficult	12	1,111	.17*	0.07, 0.27	10.97
Rothbart neg affectivity	1	124	−.04	−0.33, 0.25	na
Temp dimension					
Fearful distress	52	4,977	.10*	0.04, 0.16	84.99**
Irritable distress	50	5,789	.13**	0.07, 0.18	77.57**
Positive emotionality	27	3,119	.06	−0.02, 0.13	29.31

[a]Subgroups with $k < 4$ excluded from contrast. [b]Excluding one study with mixed strange situation procedure (SSP) and modified SSP. SES = socioeconomic status. *$p < .05$. **$p < .01$.

Disorganized Attachment

In 23 studies involving $N = 3{,}784$ children and their mothers, the disorganized attachment classification was differentiated from the other classifications, and in these studies the combined effect size was trivial and not significant, $d = .11$ (see Table 3). The set of studies was homogeneous and there were no significant moderators.

Table 3
Avoidant, Resistant, and Disorganized Attachment and Negative Temperament

	k	*N*	*d*	95% CI	Homogeneity *Q*	Contrast *Q*[a]
Avoidant attachment	51	5,950	.10	−0.02, 0.19	117.78**	
Ethnicity						1.97
Caucasian	44	4,492	.13*	0.01, 0.24	93.17**	
Other	7	1,458	−.08	−0.34, 0.19	20.13**	
Country						0.20
North America	34	4,644	.09	−0.04, 0.21	78.96**	
Europe	14	930	.15	−0.08, 0.38	35.26**	
Other	3	376	.00	−0.41, 0.41	2.21**	
Sex						6.31*
Boys	5	731	.57**	0.18, 0.96	22.67**	
Girls	6	841	.08	−0.25, 0.41	5.18	
Mixed	40	4,378	.05	−0.06, 0.17	85.47**	
Risk status						0.95
Not at risk	40	4,447	.10	−0.02, 0.23	84.59**	
At-risk child	4	202	−.11	−0.57, 0.35	17.14**	
At-risk mother	1	131	.01	−0.65, 0.68	na	
Mixed	6	1,170	.15	−0.16, 0.47	14.83*	
SES						0.30
Middle/high	42	4,260	.11	−0.01, 0.23	91.88**	
Low	9	1,690	.04	−0.20, 0.27	24.62**	
Temporal design						5.19*
Att before temp	2	213	.08	−0.48, 0.63	16.04**	
Concurrent	27	2,001	.22**	0.07, 0.36	47.37**	
Att after temp	22	3,736	−.02	−0.16, 0.13	43.59	
Attachment measure						0.83
SSP	36	4,600	.07	−0.06, 0.19	70.03**	
Modified SSP	15	1,350	.18	−0.03, 0.38	47.62**	
Measurement of temp						2.89
Temp during att assess	9	369	.29*	0.04, 0.55	22.07**	
Temp independent of att	42	5,581	.06	−0.03, 0.15	81.27**	

	k	*N*	*d*	85% CI	Homogeneity *Q*	Contrast *Q*[a]
Temp theoretical tradition						
Thomas/Chess difficulty	5	329	.04	−0.12, 0.20	5.80	
Buss/Plomin emotionality	2	192	−.27	−0.49, 0.06	0.02	
Bates fussy/Difficult	4	428	.09	−0.05, 0.23	1.03	
Rothbart neg affectivity	1	124	.28	0.02, 0.54	n.a.	
Temperament dimension						
Fearful distress	29	2,796	.20**	0.10, 0.30	65.90**	
Irritable distress	28	4,045	.01	−0.09, 0.10	70.96**	
Positive emotionality	18	1,841	.04	−0.08, 0.16	72.22**	

	k	*N*	*d*	95% CI	Homogeneity *Q*	Contrast *Q*[a]
Resistant attachment	55	6,268	.30**	0.21, 0.40	138.24**	
Ethnicity						0.54
Caucasian	48	4,810	.34**	0.22, 0.46	128.72**	
Other	7	1,458	.21	−0.10, 0.52	8.47	
Country						1.90
North America	37	4,862	.26**	0.13, 0.39	93.48**	
Europe	15	1,030	.45**	0.22, 0.68	35.11**	
Other	3	376	.67*	0.08, 1.25	5.53	

Table 3
Continued

	k	*N*	*d*	95% CI	Homogeneity *Q*	Contrast *Q*[a]
Sex						1.70
Boys	5	731	.57**	0.17, 0.98	16.00**	
Girls	6	841	.24	−0.14, 0.62	12.57*	
Mixed	44	4,696	.31**	0.18, 0.43	107.37**	
Risk status						2.29
Not at risk	43	4,725	.29**	0.16, 0.42	101.05**	
At-risk child	4	202	.44	−0.04, 0.92	3.85	
At-risk mother	1	131	−.14	−0.85, 0.57	na	
Mixed	7	1,210	.54**	0.23, 0.86	26.15**	
SES						3.72
Middle/high	45	4,441	.38**	0.25, 0.50	122.20**	
Low	10	1,827	.10	−0.15, 0.35	13.40	
Temporal design						6.51*
Att before temp	2	213	−.07	−0.63, 0.50	0.28	
Concurrent	31	2,319	.47**	0.31, 0.62	62.74**	
Att after temp	22	3,736	.18*	0.02, 0.34	59.65**	
Attachment measure						2.67
SSP	40	4,918	.27**	0.13, 0.40	82.56**	
Modified SSP	15	1,350	.48**	0.26, 0.71	55.37**	
Measurement of temp						12.42**
Temp during att assess	9	369	.77**	0.48, 1.05	10.69	
Temp independent of att	46	5,899	.23**	0.13, 0.32	128.76	

	k	*N*	*d*	85% CI	Homogeneity *Q*
Temp theoretical tradition					
Thomas/Chess difficulty	7	506	.17	−0.06, 0.40	8.43
Buss/Plomin emotionality	2	192	.00	−0.40, 0.40	3.63
Bates fussy/difficult	6	576	.29	0.06, 0.52	21.44**
Rothbart neg affectivity	1	124	.13	−0.40, 0.65	na
Temperament dimension					
Fearful distress	29	2,796	.39**	0.29, 0.50	90.59**
Irritable distress	29	4,145	.20**	0.10, 0.30	80.15**
Positive emotionality	18	1,841	.09	−0.03, 0.22	59.54**

	k	*N*	*d*	95% CI	Homogeneity *Q*	Contrast *Q*[a]
Disorganized attachment	23	3,784	.11	−0.03, 0.25	26.54	
Ethnicity						0.08
Caucasian	19	2,509	.08	−0.04, 0.19	23.61	
Other	4	1,275	.11	−0.08, 0.29	2.93	
Country						0.00
North America	11	2,641	.08	−0.05, 0.20	15.28	
Europe	9	767	.08	−0.05, 0.20	9.14	
Other	3	376	.19	−0.17, 0.55	1.32	
Sex						
Boys	3	637	−.09	−0.34, 0.16	1.91	
Girls	3	622	.14	−0.10, 0.38	5.25	
Mixed	17	2,525	.10	−0.01, 0.21	16.68	
Risk status						
Not at risk	17	2,471	.10	−0.03, 0.23	20.33	
At-risk child	3	232	.14	−0.19, 0.46	5.24	
At-risk mother	1	131	.07	−0.36, 0.50	na	
Mixed	2	950	.04	−0.21, 0.30	na	

Table 3
Continued

	k	*N*	*d*	95% CI	Homogeneity *Q*	Contrast *Q*[a]
SES						0.08
Middle/high	18	2,547	.08	−0.04, 0.19	20.28	
Low	5	1,237	.11	−0.07, 0.28	6.26	
Temporal design						0.00
Att before temp	2	233	.17	−0.14, 0.47	1.07	
Concurrent	12	1,103	.08	−0.10, 0.25	11.67	
Att after temp	9	2,448	.07	−0.05, 0.20	12.95	
Attachment measure						0.01
SSP	14	2,889	.09	−0.02, 0.20	17.08	
Modified SSP	9	895	.08	−0.12, 0.27	9.44	
Measurement of temp						
Temp during att assess	3	112	.04	−0.37, 0.44	2.84	
Temp independent Of att	20	3,672	.09*	0.01, 0.17	24.09	

	k	*N*	*d*	85% CI	Homogeneity *Q*
Temp theoretical tradition					
Thomas/Chess difficulty	1	70	.15	−0.20, 0.51	n.a.
Buss/Plomin emotionality	3	376	.15	−0.00, 0.30	1.20
Temperament dimension					
Fearful distress	17	2,774	.02	−0.03, 0.08	14.46
Irritable distress	12	2,640	.01	−0.04, 0.07	11.19
Positive emotionality	5	1,346	.05	−0.03, 0.13	1.76

[a]Subgroups with $k < 4$ excluded from contrast. SSP = strange situation procedure; SES = socioeconomic status. *$p < .05$. **$p < .01$.

Comparing Attachment Classifications

We also compared each insecure classification with security and with each of the other insecure classifications and found no significant combined effect sizes for the comparison of secure versus avoidant, $d = .00$ ($k = 56$), secure versus disorganized, $d = .17$ ($k = 17$), avoidant versus disorganized, $d = .20$ ($k = 17$), or resistant versus disorganized $d = .02$ ($k = 17$) children. However, the contrasts between resistant and secure attachment, and resistant versus avoidant attachment were significant, $d = .26$ ($k = 57$) and $d = .26$ ($k = 53$), respectively, suggesting that resistant attachment showed stronger associations with temperament than secure or avoidant temperament. Finally, children classified as A1–B2 versus B3–C2 in the SSP (Belsky & Rovine, 1987) did not differ significantly in terms of negative temperament, $d = .16$ ($k = 20$, $N = 1{,}386$).

Attachment and Specific Dimensions and Assessments of Temperament

We next examined whether the theoretical perspective that informed the operationalization of negative temperament moderated the association between attachment and temperament. The 85% CIs for the associations between each negative temperament dimension from the four main theoretical traditions (Thomas & Chess's difficulty, Buss & Plomin's emotionality, Bates's fussy/difficult, and Rothbart's negative affectivity) and attachment security overlapped (see Table 2). Similarly, the 85% CIs for the associations between the negative temperament dimensions and resistance, avoidance, and disorganization (see Table 3) overlapped. These findings indicate that the meta-analytic association between attachment and negative temperament does not differ depending on temperament theoretical orientation.

We also examined whether temperament dimension moderated the association between attachment and temperament. The 85% CIs for the associations between attachment security and temperamental fearful distress, irritable distress, and positive emotionality overlapped (see Table 2). Similarly, the 85% CIs for the meta-analytic associations between each of these dimensions and avoidance and disorganization (see Table 3) overlapped. In contrast, resistance was found to be more strongly associated with greater levels of fearful distress than with

lower levels of positive emotionality (see Table 3). Together, these findings indicate that, except in the case of resistance, the meta-analytic association between attachment and temperament does not vary according to these temperament dimensions.

Finally, regarding type of temperament assessment, significant differences were not found in the strength of the association between temperament and any of the attachment comparisons according to how temperament was assessed.

Father–Child Attachment and Overall Negative Temperament

Only a small set of studies on father–child attachment and temperament were available. Accordingly, we were only able to conduct meta-analyses on negative temperament in relation to father–child attachment security, avoidance, and resistance. Negative temperament was not related to any of these patterns of attachment (security: $d = .15$, $k = 7$, $N = 647$; avoidance: $d = .08$, $k = 4$, $N = 346$; resistance: $d = .27$; $k = 4$, $N = 346$). However, the magnitudes of these associations are comparable to those found for mother–child attachment.

Temperament, Social Competence, Externalizing Behavior, and Internalizing Symptoms

Finally, we compared the combined effect sizes for the association between attachment and temperament (excluding studies employing the mother-reported AQS and those in which temperament was assessed within an attachment assessment) with those from our prior meta-analyses on the developmental significance of early attachment for children's subsequent socioemotional adaptation. Specifically, the effect sizes from the meta-analyses on attachment and social competence (Groh et al., 2014), externalizing behavior (Fearon et al., 2010), and internalizing symptoms (Groh et al., 2012) were extracted from these prior reports and compared to the meta-analytic effect size of the association between attachment and temperament. To facilitate a comparison of the effect sizes, the 85% CIs for the point estimates of the combined effect sizes were used (see Method). Regarding the effect for security, the 85% CIs for social competence and externalizing problems did not overlap with the CIs for internalizing symptoms or temperament (social competence: $k = 80$, $d = .39$, 85% CI [0.34, 0.45]; externalizing: $k = 69$, $d = .31$, 85% CI [0.25, 0.37]; internalizing: $k = 42$, $d = .15$, 85% CI [.08, .22]; temperament: $k = 98$, $d = .13$, 85% CI [.09, .17]). Attachment security was thus significantly more strongly related to social competence and externalizing problems than to temperament and internalizing problems. For resistant attachment, the 85% CIs for social competence and temperament did not overlap with the CI for internalizing symptoms (the latter being weaker), but did overlap with the CI for externalizing problems (social competence: $k = 12$, $d = .29$, 85% CI [0.14, 0.43]; externalizing: $k = 35$, $d = .11$, 85% CI [−0.01, 0.21]; internalizing: $k = 21$, $d = .03$, 85% CI [−0.07, 0.13]; temperament: $k = 46$, $d = .23$, 85% CI [0.15, 0.30]). For disorganized attachment, the 85% CIs for temperament and internalizing problems did not overlap with externalizing problems (social competence: $k = 12$, $d = .25$, 85% CI [0.14, 0.36]; externalizing: $k = 34$, $d = .34$, 85% CI [0.22, 0.46]; internalizing: $k = 18$, $d = .08$, 85% CI [−0.03, 0.18]; temperament: $k = 20$, $d = .09$, 85% CI [−0.03, 0.15]), indicating that disorganization was significantly more strongly associated with externalizing problems than with temperament and internalizing problems. Avoidant attachment was not significantly more strongly related to social competence, externalizing problems, or internalizing problems than to temperament (see Figure 1).

Discussion

Enduring questions concerning the extent to which temperamental variation and attachment quality are associated with each other have motivated numerous empirical investigations and narrative reviews in the nearly 4 decades since the development of tools for assessing the quality of parent–child attachment relationships. The importance of this question for developmental science is reflected in the sheer number of investigations reporting on the association between attachment and temperament. In that context, the current meta-analysis represents the largest quantitative review on attachment to date. By quantitatively synthesizing this large literature, this meta-analysis provides evidence that the combined association between temperament and attachment security is weak in magnitude, that temperament is modestly associated with resistant attachment, and that the combined associations between temperament and both avoidant and disorganized attachment are weak and not significant. In addition, by comparing the meta-analytic association identified here between attachment security and temperament with associations from our prior meta-analyses on attachment and social competence (Groh et al., 2014),

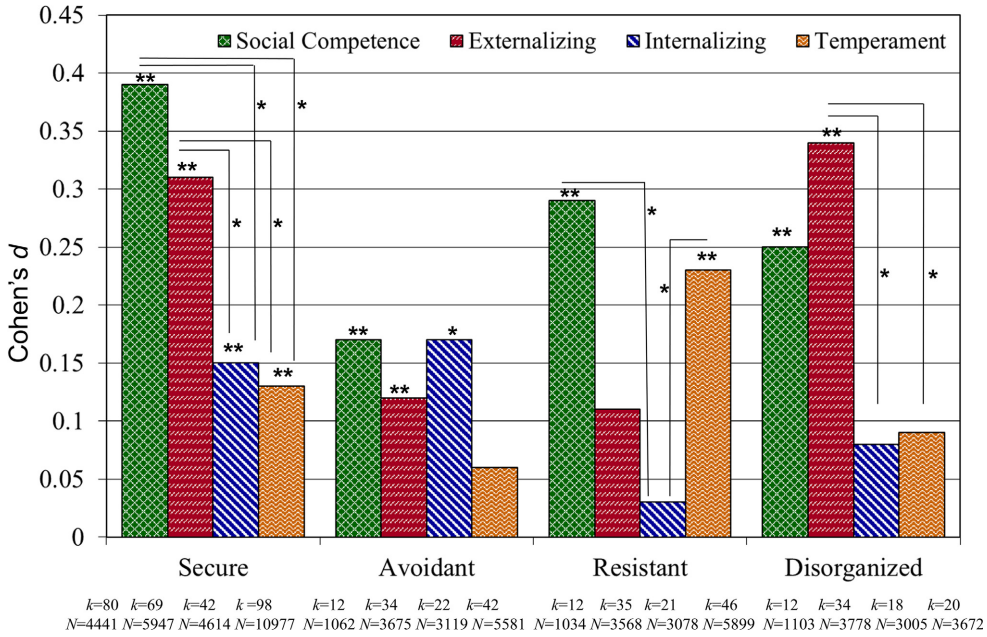

Figure 1. Combined effect sizes for the four attachment categories for social competence with peers, externalizing symptoms, internalizing symptoms, and temperament. [Color figure can be viewed at wileyonlinelibrary.com].
Note. Secure = secure versus insecure; Avoidant = insecure avoidant versus not avoidant; Resistant = insecure resistant versus not resistant; Disorganized = disorganized versus not disorganized. Effect sizes are presented in the direction of hypotheses. Thus, security was associated meta-analytically with higher levels of social competence and lower levels of externalizing and internalizing symptomatology, whereas insecure subtypes were associated meta-analytically with lower levels of social competence and higher levels of externalizing and internalizing symptomatology. Security and avoidance were associated meta-analytically with lower levels of negative temperament, whereas resistance and disorganization were associated meta-analytically with higher levels of negative temperament. Asterisks over bars indicate significant combined effect sizes. Asterisks along lines indicate significant differences between the combined effect sizes. *$p < .05$. **$p < .01$.

externalizing problems (Fearon et al., 2010), and internalizing symptoms (Groh et al., 2012), the current meta-analysis provides evidence that the association between attachment security and temperament is comparable in magnitude to the weak association between attachment security and internalizing symptomatology and that such associations are significantly weaker than those between attachment security and children's social competence and externalizing behaviors. Taken together, the cumulative evidence to date suggests that attachment and temperament are only weakly associated developmental constructs.

The attachment–temperament debate has its origins in the opposing arguments made by temperament and attachment scholars that either temperamental variation is inconsequential to determining security status (Sroufe, 1985) or temperamental variation accounts for individual differences in attachment security (e.g., Kagan, 1982). Accordingly, the first and most important question addressed in the current meta-analysis concerned the extent to which attachment insecurity and negative temperament are associated. Drawing on data from 109 samples comprising over 11,000 children, the average association between mother–child attachment insecurity (vs. security) and infant negative temperament was $d = .14$. According to conventional criteria established by Cohen (1992), an effect of $d = .20$ is considered small in magnitude. Thus, although the combined association between attachment insecurity and negative temperament reached statistical significance, the magnitude of this effect falls below the conventional criteria of being considered small in magnitude. Moreover, this combined effect decreased to $d = .08$ in the set of 69 studies using the SSP, providing no support for the claim that the SSP is in essence a measure of infant temperament (Kagan, 1982). Similarly, in a smaller set of studies comprising seven independent samples ($N = 647$) on the association between father–child attachment insecurity and infant negative temperament, the combined association was nonsignificant ($d = .15$). Thus, these meta-analytic findings provide little empirical support for the idea that temperament and attachment are essentially

overlapping constructs. Rather, they are aligned with conclusions from some narrative reviews of the literature (Mangelsdorf & Frosch, 1999; Vaughn & Bost, 1999; Vaughn & Shin, 2011; Vaughn et al., 2008) that temperament and attachment security are different and weakly related constructs.

We also examined the empirical support for potential rapprochements to the traditional attachment–temperament debate that have claimed that attachment and temperament might be associated in an oblique manner (Van IJzendoorn & Bakermans-Kranenburg, 2012). For example, it has been contended that temperament plays a role in helping determine the pattern of insecure attachment that an infant develops with the caregiver. Findings from the current meta-analysis provide mixed support for this idea. Specifically, avoidant attachment was not significantly associated with lower levels of negative temperament (d = .10). However, similar to findings from Goldsmith and Alansky's (1987) meta-analysis on temperamental proneness to distress and resistance, in this meta-analysis insecure-resistant attachment was significantly associated with negative temperament (d = .30). This finding indicates that children classified as resistant exhibited elevated levels of negative temperament when compared to other children and, in particular, when compared to secure and insecure-avoidant children.

Although modest in magnitude, the strongest association between temperament and attachment was found for the resistant attachment classification. It is important to note that such evidence does not necessarily indicate that negative temperamental characteristics cause resistant attachments. Indeed, evidence that infants develop different attachment relationships with different caregivers (e.g., secure attachment to mother and insecure-resistant attachment to father) provides little support for a causal role of temperament in determining attachment classifications (Goossens & Van IJzendoorn, 1990; see also Sroufe, 1985). That said, the association between resistance and temperament is noteworthy, especially when considering that to date twin studies have not had adequate power to examine genetic contributions to infant resistance. Thus, given current evidence, some genetic influence on resistant attachment cannot be ruled out, which in turn may be explicable in terms of temperamental negativity. Testing such a hypothesis would require large twin samples given the modest associations involved and the relatively low prevalence of resistant attachment. In addition, there might be methodological reasons to expect some relation between temperament and resistant attachment. For example, reports of temperament include affective items pertaining to parent–child interactions and standardized observational assessments of temperament (e.g., Laboratory Temperament Assessment Battery–Preschool Version [LAB-TAB]; Goldsmith, Reilly, Lemery, Longley, & Prescott, 1999) are often conducted with the parent present, which might confound the assessment of temperament with attachment. It is also important to note that the hallmark of resistance is hyperactivation of the attachment system. Accordingly, when confronted with attachment-relevant challenges, resistant infants exhibit heightened distress in addition to strong levels of proximity seeking (combined with either anger or inconsolability) and little independent exploration (Ainsworth et al., 1978; Cassidy & Berlin, 1994). Thus, the modest association identified here between temperament and resistant attachment might in part be due to overlap between aspects of the behavioral definitions of temperament and attachment.

The current meta-analysis did not provide support for another potential rapprochement to the traditional attachment–temperament debate offered by Belsky and Rovine (1987) that infant temperament is reflected in emotional reactivity distinguished by the grouping of A1–B2 versus B3–C2 attachment subclassifications. Despite some similarity between the heightened levels of distress exhibited by securely attached children receiving the B3 and B4 subclassifications and resistant children (C1–C2), this similarity is typically restricted to the beginning of the reunion episodes of the SSP during which B3 and B4 children do indeed display heightened levels of distress. Importantly, however, in contrast to resistant children, B3 and B4 children's separation distress is relieved upon the caregiver's return, and these children typically resume exploring the environment with or without their caregiver by the end of the reunion episode (Ainsworth et al., 1978; Van IJzendoorn, Goossens, Kroonenberg, & Tavecchio, 1985). Taken together, the absence of a significant meta-analytic association between the Belsky and Rovine (1987) split and negative temperament might be taken as indirect evidence for the difference between highly distressed secure children (B3–B4) and resistant children, ultimately providing further evidence that the SSP is not an appropriate context in which to assess infant temperament.

Following up findings from a prior meta-analysis published over 15 years ago (Van IJzendoorn et al., 1999), we also examined the meta-analytic association between infant disorganization and temperament. In the current meta-analysis, the data set was almost

twice as large, yet similar to findings from the prior meta-analysis in which the combined association between disorganization and negative temperament was found to be almost precisely zero, the combined effect size in the current, updated report was also found to be nonsignificant, $d = .11$. In another meta-analysis on parenting precursors of disorganized attachment, Madigan et al. (2006) found that infant disorganization was rather strongly associated with frightened, frightening, or anomalous parental behaviors, amounting to a combined effect size of $r = .34$ ($d = .70$). Taken together, evidence from the current meta-analysis, in combination with findings from Madigan et al. (2006) meta-analysis, suggests that disorganized attachment is more strongly rooted in parental interactive behavior than in a temperamental basis of infants' general negativity.

Importantly, some methodological factors moderated the meta-analytic association between attachment and temperament. Specifically, converging with findings from a prior meta-analysis on the validity of the AQS (Van IJzendoorn et al., 2004), the magnitude of the association between attachment and temperament was inflated in studies employing the mother-reported AQS. Because parents are not trained observers of infant behavior, they might be at a disadvantage in terms of their ability to differentiate negative temperamental characteristics from dyadically grounded insecure attachment behaviors. Similarly, associations between attachment and temperament were inflated when temperament was assessed within the context of the attachment assessment (e.g., fear of stranger, distress at separation). These findings indicate that although using a parental assessment of attachment or assessing temperament and attachment within the same procedure might be an appealing strategy to reduce assessment costs and participant burden, there is sufficient evidence to advise against such practices.

As this is the fourth in a series of meta-analyses on early attachment, it is well-positioned to evaluate the association between attachment and temperament within the context of evidence for the broader developmental significance of early attachment. Specifically, in addition to being presumed to be independent of temperament, early attachment is thought to have the strongest implications for children's interpersonal relationships and important, yet weaker, implications for children's behavioral and emotional problems (Belsky & Cassidy, 1995). Thus, the association between attachment and temperament would be expected to be not only weak in magnitude but also *weaker* in magnitude than associations between attachment and children's social competence and to a lesser extent attachment and externalizing and internalizing symptomatology. Providing some support for the expected relative associations with attachment across developmental domains, findings indicated that the association between early security and temperament was weaker in magnitude than the associations between early security and children's social competence and externalizing behaviors yet comparable in magnitude to the association between security and internalizing symptoms. Such evidence indicates that early attachment security has the strongest associations—at least with regard to "main effect" associations—with children's subsequent social interactions with peers and the weakest associations with children's internalizing symptoms and negative temperamental reactivity. Similarly, in contrast to meta-analytic evidence that early avoidant and disorganized attachment significantly heighten children's risk for psychopathology and undermine their peer competence, neither of these attachment classifications were significantly associated with negative temperament. However, the association between resistant attachment and negative temperament was comparable in magnitude to the modest association between resistant attachment and social competence and both of these associations were significantly stronger than the association between resistant attachment and internalizing symptomatology. These findings provide evidence of a nontrivial association between early resistant attachment and temperament, although the nature of the association, as already discussed, is open to a range of interpretations.

Limitations and Future Directions

Although meta-analysis is a powerful analytic technique for quantitatively summarizing large literatures, it has been criticized for obscuring important variation across studies. Indeed, a potential limitation of the current meta-analysis might be that all aspects of temperament that have been examined in relation to attachment were combined to create a single dimension reflective of negative temperament, thereby obscuring potential nuance in patterns of associations between temperament and attachment according to specific facets of infant temperament. To address this issue, we examined whether the meta-analytic association between temperament and attachment differed according to how temperament was operationalized. Interestingly, no significant differences in the strength of

the associations between temperament and attachment quality were found according to whether negative temperament was operationalized with respect to the four main theoretical traditions of temperament. Moreover, for the most part, these more "pure" operationalizations of temperament were not significantly associated with attachment quality. A similar pattern of findings was obtained when examining the meta-analytic associations of attachment classifications with the more specific temperament dimensions of fearfulness, irritability, and positive emotionality. Taken together, despite the potential drawbacks of summarizing across various aspects of temperament, findings from analyses using the negative temperament composite largely converge with those from analyses in which more homogenous dimensions of temperament were used. That said, it is important to note that several other dimensions of temperament have been examined in relation to attachment, but the limited number of relevant studies reporting on the same dimension of temperament did not permit meta-analytic examination of these other temperament dimensions.

Another potential limitation of meta-analysis is that publication bias might lead to an imprecise estimation of the true effect size in the population. Although this is a valid concern that warrants attention when conducting meta-analyses, publication bias does not seem to be a serious concern in the current data set for several reasons. First, the temperament–attachment literature is characterized by contrasting theoretical perspectives and thus contrasting expectations. There was and is, to our knowledge, no consensus about what to expect for the associations between attachment and temperament: some researchers would predict finding a significant association, others would not. Thus, publication bias favoring significant results seems less of an issue for this particular literature. Second, in many studies the test for the association between temperament and attachment was a secondary analysis for a project designed to test other hypotheses and was reported to describe the sample involved or to justify covariates in primary analyses. It simply was not the central topic of many articles, which arguably lowers the chance that researcher and publication biases play a role. Third, the combined effect size we found for attachment security and negative temperament was small, which means that the empirical effect sizes must be distributed to the positive as well as the negative direction of this estimate, with not much room for publication bias or correction thereof (Sutton, Duval, Tweedie, Abrams, & Jones, 2000).

In conclusion, the current meta-analysis provides evidence for a significant yet weak association between attachment security and temperament, suggesting that attachment and temperament are relatively independent developmental constructs. However, this study also yielded evidence of a somewhat larger association between one subtype of insecurity—resistance—and temperament. Both these lines of evidence suggest, albeit in different ways, that an important goal for future research is to develop novel approaches for integrating research on attachment and temperament that, as a result of the attachment–temperament debate, has historically been conducted in separate, parallel literatures. Toward that end, the differential susceptibility framework (Belsky, 1997; Ellis, Boyce, Belsky, Bakermans-Kranenburg, & Van IJzendoorn, 2011) provides a theoretical model for how to integrate these two important developmental constructs (Van IJzendoorn & Bakermans-Kranenburg, 2012). Specifically, infant temperamental characteristics (e.g., distress proneness) have been conceptualized as susceptibility factors that serve to heighten children's sensitivity to environmental factors, such as attachment, for better and for worse. Recent research has provided some support for this idea (Gilissen, Bakermans-Kranenburg, Van IJzendoorn, & Van der Veer, 2008; McElwain, Holland, Engle, & Wong, 2012; Stupica, Sherman, & Cassidy, 2011; cf. Lickenbrock et al., 2013; see Vaughn & Bost, 2016), but further research is necessary to determine whether the differential susceptibility framework might serve as a rigorous theoretical framework for bridging attachment and temperament perspectives on child development.

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References for studies in the meta-analysis may be found in the Data S1.

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Supporting Information

Additional supporting information may be found in the online version of this article at the publisher's website:

Data S1. References for Studies in Meta-Analysis