The Significance of Early Temperamental Reactivity for Children's Social Competence with Peers: A Meta-Analytic Review and Comparison with the Role of Early Attachment

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The dataset and scripts are available at:
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Abstract

Early temperamental reactivity and attachment security are key predictors of children's social competence with peers. Leveraging meta-analytic evaluation of the significance of early attachment for social competence already available (Groh et al., 2014), this quantitative review examined the significance of early temperamental reactivity for social competence with peers and compared the strength of this association with that for attachment. Based on 140 independent samples (*u*=382; *N*=49,891), the meta-analytic association between early difficult temperament and (lower) social competence was significant (*r*=0.13, *z*=0.13; 95% *CI* 0.11, 0.16), but decreased as time between assessments increased. Findings were similar for negative and positive emotionality. Greater negative emotionality was associated with lower social competence (*r*=0.14, *z*=0.14; 95% *CI* 0.11, 0.17, *k*=93, *u*=172), and greater positive emotionality was associated with better social competence (*r*=0.18, *z*=0.18; 95% *CI* 0.12, 0.24, *k*=43, *u*=54). Meta-analytic associations were reduced when overlapping informants and overlapping items in temperament and social competence assessments were excluded (difficult temperament: *r*=0.10, *z*=0.10; 95% *CI* 0.06; 0.13; negative emotionality: *r*=0.10, *z*=0.10; 95% *CI* 0.05, 0.15; positive emotionality: *r*=0.10, *z*=0.10; 95% *CI* 0.06,0.14). Meta-analytic associations between these broadband temperament dimensions and social competence were smaller than the meta-analytic association between attachment security and social competence. Discussion focuses on the developmental significance of early temperament for social competence and ways to reconcile literatures on early temperament and attachment in future research on the developmental antecedents of children's social competence.

Public Significance Statement: This meta-analysis indicates that children's early temperamental reactivity is weakly associated with social competence, the association wanes over time, and the association is smaller than the association between early attachment security and social competence.

Keywords: temperament; social competence; peers; meta-analysis; attachment

The Significance of Early Temperamental Reactivity for Children's Social Competence with Peers: A Meta-Analytic Review and Comparison with the Role of Early Attachment

Children's social interactions with peers are a salient developmental context, and positive functioning within the peer group has broad developmental significance (Rubin et al., 2009). Children spend a large and increasing portion of time with peers across development (Ladd & Golter, 1988; Larson & Richards, 1991). Moreover, unlike children's other relationships, peer relationships are characterized by their horizontal nature (i.e., similarity in age and status) and expectations of mutual exchange (i.e., reciprocity) between relationship partners (Hartup, 2009; Sullivan, 1953). Successfully navigating peer relationships is a key developmental task (Rose-Krasnor & Denham, 2009; Rubin et al., 2006; Waters & Sroufe, 1983), and children who demonstrate social competence with peers exhibit better adjustment, including lower internalizing and externalizing symptoms (Bornstein et al., 2010; Prinstein et al., 2009), better academic performance (Ladd, 1990; Wentzel, 2009), and better adjustment in adulthood (Bagwell et al., 1998; Parker & Asher, 1987). Given the important role of peers in children's development, it is critical to understand early factors that contribute to the development of children's social competence with peers.

Two dominant theoretical frameworks for understanding early contributors to children's socioemotional development are attachment theory and temperament theories (Goldsmith & Harman, 1994). Attachment theory emphasizes how early attachment-relevant experiences with caregivers shape development (Bowlby, 1969/1982). According to attachment theory, children form internal working models of the self, others, and relationships based on their early attachment-relevant experiences that inform future relationships, including relationships with peers (Bretherton & Munholland, 2008; Bowlby, 1973). Temperament theories, by contrast,

focus on the role of early individual differences in child characteristics that arise from genetic, biological, and environmental influences (Mervielde & De Pauw, 2012; Rothbart, 2012; Shiner et al., 2012; Zentner & Bates, 2008). According to temperament theories, early temperament contributes to children's social competence with peers because children's dispositional emotional reactivity shapes children's social behavior (Coplan & Bullock, 2009; Eisenberg et al., 2009).

Sizeable literatures on the developmental significance of early attachment and temperament for children's social competence have accumulated (Berlin et al., 2008; Booth-LaForce & Groh, 2018; Coplan & Bullock, 2012; Goldsmith & Harman, 1994; Eisenberg et al., 2009; Sanson et al., 2004). Given the sheer size and complexity of these literatures, meta-analysis has been a useful tool for quantitatively summarizing scholarship in this area to provide a more precise estimate of the associations and to explain variation in associations between studies through moderator analyses. To date, we have meta-analyzed over four decades of research on the predictive significance of early attachment security for children's social competence (Groh et al., 2014). This meta-analysis comprised studies in which attachment was assessed in early childhood (1-6 years) using well-validated observational assessments (Strange Situation procedure, Attachment Q-Sort, Modified Strange Situation procedure) and assessments of positive functioning in the peer environment (social skills, sociometrics, observed positive peer behavior). In line with attachment theory, in 80 samples comprising over 4,000 children, early secure (v. insecure) attachment was moderately associated with children's social competence (r = 0.19). Moreover, in line with the expected enduring developmental significance of early attachment, the magnitude of this association was not moderated by the time between attachment and social competence assessments, indicating that the association did not decrease over longer periods of time. Although several methodological (e.g., type of attachment

assessment, type of social competence assessment) and sample (e.g., socioeconomic status, risk status, child sex) characteristics were examined, none significantly moderated the association between early attachment security and children's social competence (Groh et al., 2014).

With regards to early temperament, a range of temperament constructs have been examined in relation to children's social competence with peers, perhaps due, in part, to variation across temperament theories in the conceptualization of temperament. Although all temperament theories include aspects of children's emotional reactivity (e.g., expression of negative and positive emotion), some theorists have incorporated aspects of children's self-regulation (e.g., effortful control) under the broad umbrella of temperament constructs. A recent meta-analysis has provided evidence that children's self-regulation assessed in the early life course (prior to school entry) is associated with social competence (r = 0.22; Robson et al., 2020). However, there exists no quantitative review of the literature on early temperamental *reactivity* and children's social competence with peers. This represents a significant gap, given the centrality of temperamental reactivity to theoretical frameworks for the developmental origins of social competence (Eisenberg et al., 2009; Hay et al., 2004; Rubin et al., 2006). Moreover, whereas cogent arguments have been made for the conceptual distinction between the quality of children's attachment relationships with parents and individual differences in children's temperamental reactivity (Sroufe, 1985; but see van IJzendoorn & Bakermans-Kranenburg, 2012), early attachment quality might be expected to be related to children's self-regulation given the expected regulatory functions of parent-child attachment relationships (Bowlby, 1973; Cassidy, 1994; Sroufe, 1996). Indeed, meta-analytic evidence indicates that early attachment security is moderately associated with children's self-regulation (r = 0.19; Pallini et al., 2018), but only weakly associated with children's temperamental reactivity (r = 0.07; Groh et al., 2017).

Thus, early attachment and temperamental reactivity are conceptually and empirically (largely) distinct constructs thought to serve as important predictors of children's subsequent social competence. However, without a comparable meta-analysis on early temperamental reactivity and social competence, the relative significance of early attachment security and temperamental reactivity for social competence remains unknown. Thus, the current study uses meta-analysis to provide a comprehensive quantitative review of the substantial literature examining the significance of temperamental reactivity assessed in the early life course for children's social competence with peers.

Early Temperamental Reactivity and Children's Social Competence with Peers

Several theoretical models include temperament as an individual difference factor that has direct implications for children's adjustment, including social competence, externalizing symptomatology, and internalizing symptomatology (e.g., Eisenberg et al., 2009; Hay et al., 2004; Rubin et al., 2006). Although these aspects of children's adjustment demonstrate some overlap, here we focus on children's social competence, and a central component of social competence is developing positive social relationships (Howes, 2009). Temperamental reactivity has implications for children's relationships with adults (e.g., student-teacher relationships; Buhs et al., 2018) and siblings (e.g., Brody et al., 1994). However, temperamental reactivity has been hypothesized to be particularly influential for relationships with peers. Peer relationships represent a unique developmental context in comparison to relationships with adults or family members due to their voluntary and egalitarian nature (Hartup, 2009; Sullivan, 1953) and often involve emotionally-evocative challenges (Coplan & Bullock, 2012). Accordingly, many theories linking temperamental reactivity to social competence center on children's social competence with peers, which encompasses various skills, behaviors, and characteristics. In

early childhood, social competence with peers includes skills such as social problem solving (e.g., effectively managing conflict with peers) and social perspective-taking (e.g., accurately interpreting a peer's emotions; Rose-Krasnor & Denham, 2009). In terms of behaviors, socially competent children engage in prosocial behaviors (e.g., sharing with peers) and cooperative play with other peers (Hay et al., 2004; Rose-Krasnor & Denham, 2009). Further, it is characteristic of socially competent children to have dyadic friendships and to be well-liked in the peer group (Hay et al., 2004; Howes, 2009; Rose-Krasnor & Denham, 2009).

Models of children's social competence that consider temperament hypothesize implications across the various components of social competence with peers. Rubin and colleagues (2006) proposed that children's dispositional emotional reactivity affects children's social behaviors with peers and their overall functioning in the peer group. Similarly, Hay and colleagues (2004) emphasize the role of negative emotionality in children's ability to effectively approach peers and engage in prosocial behaviors, which has important implications for acceptance in the peer group. Eisenberg and colleagues (2009) suggest that individual differences in children's tendencies to experience and express positive and negative emotions will affect their status with peers, the quality of their behaviors with peers and friends, and the quality of their close friendships. Despite variation across theories, they have in common the prediction that temperament has broad implications for various components of social competence with peers (e.g., peer status, prosocial behaviors, friendships), and that temperamental *reactivity* should be important for social competence with peers.

Researchers have proposed at least three mechanisms by which temperamental reactivity affects children's social competence. First, in line with evocative *r*GE processes, children's temperamental tendencies to express certain emotions could be especially influential in how

peers respond to them (Knafo & Jaffee, 2013; Zentner & Shiner, 2012). For example, peers are more likely to want to interact with a child who has high levels of positive emotionality, giving the child greater opportunity to develop socially competent peer behaviors (Eisenberg et al., 2009). Second, children's temperament might influence whether a child approaches or avoids peers akin to active *r*GE processes in which children select environments that suit their characteristics (Knafo & Jaffee, 2013; Zentner & Shiner, 2012). For instance, inhibited children may be less likely to engage with peers and might then miss out on socialization experiences that are key for developing social competence (Coplan & Bullock, 2012; Rubin et al., 2009; Sanson et al., 2004). Third, through environmental construal, temperament may influence how children perceive their environment (Zentner & Shiner, 2012). For example, the peer context is likely to evoke strong emotions given that it involves socially demanding tasks such as sharing and navigating conflict (Coplan & Bullock, 2012). Children who have high levels of specific forms of negative emotionality might be more prone to detecting peer conflict and responding with anger, leading to peer rejection (Coplan & Bullock, 2012; Eisenberg et al., 2009).

Broadband Temperament Composites and Specific Temperament Constructs

Although research on temperament dates back to the early 20th century (see Rothbart, 2012), modern day research on the developmental significance of temperament can be traced back to the New York Longitudinal Study (NYLS; Thomas et al., 1963). The NYLS was crucial for describing individual differences in infants' behavioral reactions and organizing the identified behaviors into core dimensions of temperament (Rothbart, 2012; Shiner & DeYoung, 2013). In addition, within the context of the study, specific tools were designed for assessing temperament in infancy, greatly facilitating the empirical investigation of the developmental significance of early temperament (Mervielde & De Pauw, 2012). Indeed, since the NYLS, the

number of studies examining temperament has increased exponentially (Zentner & Shiner, 2012). Moreover, the landscape of temperament research has evolved over time. As interest in the empirical investigation of temperament has expanded, so did the approaches to studying temperament. Since the NYLS, new temperament constructs have been identified and different approaches to creating broadband temperament composites have been developed.

As such, one of the complexities in summarizing the corpus of studies examining the link between temperamental reactivity and social competence with peers is the variation in the temperament composite or specific temperament construct examined across studies (De Pauw et al., 2009; Shiner & DeYoung, 2013; Sterry et al., 2010). Historically, overall temperamental *difficulty* has been examined in relation to child adjustment, and this practice is still common in modern day research (e.g., Belsky & Pluess, 2009). Thomas and Chess (1977) first characterized infants as having a difficult temperament if they had higher levels of negative characteristics (e.g., negative [v. positive] mood, intense reactions to stimuli) and lower levels of positive characteristics (e.g., regular sleeping, eating, and elimination; adapt well to environmental changes; Bates et al., 1979). The emotional tendencies of children with more difficult temperaments are expected to put them at risk for poor adjustment outcomes, including challenges in the peer group, because such characteristics may be perceived poorly by peers, may lead children to be less likely to approach peers, and may undermine children's ability to effectively interact with peers (Bates et al., 1979; Thomas & Chess, 1972).

In the decades since the NYLS, conceptualizations of temperament have evolved. One approach to examining temperament involves distinguishing between negative emotionality and positive emotionality as separate dimensions rather than representing temperament along a bipolar continuum of negative versus positive emotionality. Moreover, children's regulatory

capacities (e.g., attentional focusing, inhibitory control, perceptual sensitivity) have been incorporated into some conceptual approaches to temperament (e.g., Rothbart's approach; Rothbart & Derryberry, 1981). In line with these revisions, factor analytic research indicates that temperament is multidimensional, including two separate factors of *negative temperamental emotionality* and *positive temperamental emotionality.* Further, when aspects of children's regulatory functioning are included in temperament assessments, these characteristics load onto a third factor reflecting *self-regulation* (Mervielde & De Pauw, 2012; Zentner & Shiner, 2012). As noted above, a recent meta-analysis demonstrated that early self-regulation is associated with social competence (Robson et al., 2020). However, there exists no meta-analytic review examining the predictive significance of emotional reactivity components of early temperament, representing a significant gap in the literature. Thus, here we focus on reactivity components of temperament, including negative emotionality and positive emotionality.

Negative emotionality includes temperamental characteristics such as fear, anger/irritable distress, and sadness (Buss & Plomin, 1984; Mervielde & De Pauw, 2012; Rothbart & Bates, 2006). Negative emotionality is proposed to undermine children's social competence with peers because children tend to avoid peers who express high levels of negative emotions (Eisenberg et al., 2009; Furr & Funder, 1998). Further, because the peer context is especially likely to evoke strong emotions (e.g., anger during conflict), higher levels of negative emotionality may interfere with children's ability to respond to peers in socially competent ways (Coplan & Bullock, 2012). In contrast, positive emotionality encompasses both expressions of positive emotions (e.g., positive affect, sociability, and smiling or laughing) as well as children's tendencies to approach rewarding and/or social stimuli (e.g., approach/positive anticipation, high intensity pleasure).

Positive emotionality is expected to promote children's social competence by predisposing them to engage more with peers and be more desirable social partners to peers (Putnam, 2012).

Moving away from broadband dimensions, temperament scholars have increasingly noted the utility of studying specific temperament constructs because considering broadband dimensions could obscure unique associations among temperament and adjustment (Zentner & Shiner, 2012). Further, some temperament approaches draw from the functionalist perspective of emotions which stipulates that specific emotions arise from distinct purposes or goals (Campos et al., 1989; 1994; Goldsmith et al., 1987). As such, there can be important conceptual distinctions between certain temperament constructs, such as anger and fear, that are not well-captured by broadband temperament dimensions. In line with this thinking, some studies have reported variable associations among temperament and social competence depending on the specific temperament construct considered (e.g., Carson et al., 1987; Coplan & Rubin, 1998; Evans et al., 2012). For instance, some studies have reported non-significant associations between negative emotionality and socially competent behaviors with peers, but significant associations for other temperament constructs (i.e., shyness, sociability, Coplan & Rubin, 1998; sensory sensitivity, Evan et al., 2012). Although examining specific temperament constructs could be important if some constructs are more strongly associated with social competence than others, in the absence of *a priori* hypotheses, this practice could undermine replicability and result in spurious associations.

To provide a comprehensive review that reflects the literature, we considered several dimensions of temperament. First, in line with historical approaches to studying temperament that are still represented in current research, we examined overall temperamental difficulty in relation to social competence with peers. Next, given empirical support for the multidimensional

nature of temperament, we examined the broadband dimensions of negative emotionality and positive emotionality in relation to social competence. Last, to evaluate whether certain temperament constructs are more strongly associated with social competence than others, we examined associations between specific temperament constructs and social competence.

Developmental Time Course of Associations

From a developmental perspective, child age is essential to consider in evaluating the magnitude of associations between children's early temperamental reactivity and social competence with peers over time. Considering the age of temperament assessment provides insight into the role of the development of temperament in the extent to which early temperament is associated with children's social competence. Temperament scholars differ in their views of how temperament develops in infancy. According to Buss and Plomin (1984), temperament is highly heritable and stable from early in development. However, others have suggested that temperament stabilizes and becomes increasingly integrated over time (e.g., Goldsmith et al., 1987; Rothbart et al., 2000). If temperament is early emerging and stable over time, the link between early temperamental reactivity and children's later social competence would be expected to be the same regardless of when temperament is assessed. However, if children's temperament emerges and consolidates throughout infancy, temperamental reactivity and later social competence might be expected to be more strongly associated when temperament is assessed later (v. earlier) in early childhood. Thus, we examined the role of age of temperament assessment in moderating the meta-analytic association between early temperament and children's social competence in studies employing longitudinal designs.

Second, considering the time between temperament and social competence assessments provides insight into the nature of longitudinal associations between early temperamental

reactivity and children's social competence over the course of child development. Some studies have provided evidence that temperamental reactivity assessed in early childhood is longitudinally predictive of children's subsequent social adjustment (e.g., Eisenberg et al., 2003; Fox & Henderson, 1999; Laible et al., 2017; Maszk et al., 1999; Newman et al., 1997). Such evidence suggests that early temperament has long-term predictive significance for the development of children's social competence with peers. However, because social competence was typically only assessed at one time point in these studies, it remains unknown whether the effect of early temperamental reactivity on children's social competence is maintained beyond that time point (i.e., enduring) or wanes over time (i.e., transient; Roisman & Fraley, 2013). Meta-analysis is useful in evaluating the nature of longitudinal associations because within the literature on early temperamental reactivity and social competence, studies vary in terms of the time between temperament and social competence assessments. Such variation can be used to evaluate whether the magnitude of the association between early temperamental reactivity and social competence remains stable versus decreases (reflective of an enduring v. transient association) as the length of time between assessments increases. Thus, we examined the moderating role of time between temperament and social competence assessments in longitudinal studies.

The Role of Methodological Differences and Sample Characteristics

The literature on early temperament and social competence with peers is diverse in terms of the range of methods employed and samples examined. Such variation is important to capture, as it might impact the strength of associations between early temperamental reactivity and children's social competence with peers. First, numerous temperament measures have been developed. The most commonly used were derived from the traditions of Thomas and Chess

(e.g., Behavioral Styles Questionnaires; BSQ; McDevitt & Carey, 1978), Buss and Plomin (e.g., Emotionality, Activity, Sociability Temperament Survey; EAS; Buss & Plomin, 1984), Rothbart (e.g., Child Behavior Questionnaire; CBQ; Rothbart et al., 2001) and Goldsmith (e.g., Toddler Behavior Assessment Questionnaire; TBAQ; Goldsmith, 1996; Laboratory Temperament Assessment Battery; Lab-TAB; Goldsmith & Rothbart, 1996). There are significant differences among temperament measures in their conceptual orientations (e.g., Buss and Plomin emphasizes heritability; Goldsmith focuses on emotional expression), length (e.g., 195 items for the CBQ; 20 items for the EAS), and depth (e.g., the BSQ assesses behaviors across specific contexts; the EAS assess overall characteristics regardless of context). Given the differences among temperament measures, we tested whether temperament measure moderated the association between temperamental reactivity and social competence with peers.

Another important consideration is whether temperament is assessed via report or observation. The merits of questionnaire versus observational assessments of temperament have been debated among temperament scholars (Gartstein et al., 2012). Some scholars have strongly encouraged the use of observational assessments because of the various biases inherent in questionnaire measures (e.g., informants have different interpretations of children's behaviors; informant characteristics influence the quality/accuracy of reports), low concordance between different informants of the same child, and low concordance between reports and behavioral observations (Kagan, 2012; Kagan & Fox, 2006). Moreover, observations are argued to provide a more accurate and objective assessment of a child's behavior that helps ensure researchers are assessing the behavior of interest (Kagan & Fox, 2006). Alternatively, others note that observations might not capture a child's full behavioral repertoire across contexts, and further argue that caregiver reports are based on an in-depth familiarity with the child's behaviors across

their various environmental contexts during their normal lives rather than an artificial lab environment (Rothbart & Bates, 2006; Rothbart & Mauro, 1990; Rothbart, 2012).

Studies also vary in their use of parents, teachers, or observers as temperament informants. Researchers have proposed that informants' views of temperament are affected by the relevance of the trait to the context and the availability of the trait to be observed (Funder, 1995; Telgasi et al., 2015). Parents have been argued to have the most in-depth knowledge and availability to observe their children's temperamental reactivity across contexts (Rothbart & Bates, 2006; Teglasi et al., 2015) although they may also have biases regarding their children's behaviors (e.g., due to the relationship with the child and/or social-desirability bias; Seifer et al., 2004). In their evaluations of temperament, parents may focus on temperamental reactivity as it relates to the parent-child bond (Teglasi et la., 2015). Teachers, in contrast, only have availability to observe children's temperamental reactivity in one context (i.e., the classroom), although they observe a wider range of children across a variety of challenging situations. Thus, unlike parents whose observations are more likely to be based on a smaller number of children, teachers' evaluations are based on a larger sample of children, contributing to a broader understanding of the range of children's behavior (De Los Reyes et al., 2009; Saudino et al., 2005). In their evaluations of temperament, teachers might be most focused on temperamental reactivity as it relates to school adjustment (Teglasi et al., 2015). Last, trained observers typically observe children's temperamental reactivity in a single setting (e.g., lab environment), but have extensive training in identifying relevant behaviors. Given the unique perspectives of the different temperament informants, we tested differences in the association between temperamental reactivity and social competence among studies using parent, teacher, and observer informants of temperament.

Social competence assessments are also varied, and include reports of social skills, sociometric assessments of peer status, and observations of behaviors in the peer group (Rubin et al., 2009). Reports of social skills include assessments of children's prosocial behaviors (e.g., sharing or helping peers; Strengths and Difficulties Questionnaire; Goodman, 2001), play behaviors (e.g., cooperative play; Penn Interactive Peer Play Scale; Fantuzzo et al., 1995), and positive social interactions with peers (e.g., effectively resolving conflicts; Social Competence and Behavior Evaluation Scale; LaFreniere & Dumas, 1996). Sociometric assessments typically involve peer nomination procedures through which each child receives a score reflecting their overall likeability, popularity, and/or number of friendships (Cillessen, 2009). Observations of social competence include observations of positive play behaviors (e.g., initiating play; Farver & Branstetter, 1994; Howes, 1980), positive interaction with peers (e.g., cooperation; The Individualized Classroom Assessment Scoring System; Downer et al., 2010; Vitiello et al., 2012), and prosocial behaviors towards peers (e.g., responding to peer distress with concern; Denham, 1994). Although temperament is expected to have broad significance for children's social competence (e.g., Eisenberg et al., 2009), differences between measures of social competence might contribute to differences in the extent to which early temperament reactivity is associated with children's social competence and thus were examined here.

Studies have used parents, teachers, peers, children (i.e., self-report), and observers as informants for social competence assessments. As with temperament, each informant offers a unique perspective. Although parents view their children's social behaviors across many contexts, they are less privy to peer interactions in the school context in comparison to teachers and peers. Indeed, greater convergence has been found between teacher and peer reports of social competence compared to parent reports (Renk & Phares, 2004). Further, within the school

context, compared to teachers, peers have more privileged access and direct knowledge of children's functioning in the peer group (e.g., Newcomb et al., 1993). Regarding children's self-reports, some researchers have argued that children have the most direct and internal knowledge of their own experiences whereas others have noted children may lack the ability to accurately report on their own social competence (e.g., Fabes et al., 2009). Last, trained observers can provide skilled assessments of social competence with clear standards across individuals but are limited by the various challenges of observational methodologies (e.g., limited time to view behaviors; critical peer behaviors may be infrequent and not occur around adults; Fabes et al., 2009). Given the varied perspectives different informants provide, we examined the moderating role of social competence informant.

Further considering the role of methodological factors, some temperament scholars have raised concerns that certain methods employed in research on temperament might produce inflated estimates of the predictive significance of temperament. Specifically, some studies employ the same informant for child temperament and social competence (e.g., Mendez et al., 2002; Van Hecke et al., 2007). Although as noted above, specific informants offer unique perspectives on children's temperamental reactivity and social competence, employing the same informant for both assessments has the potential to inflate associations due to shared-method variance and single-informant bias (Eisenberg et al., 2000). Moreover, depending on the temperament construct (e.g., positive affect, sociability, fear), specific items used to assess children's temperament also reflect socially competent behavior with peers (e.g., "[My child] is comfortable asking other children to play"; Rothbart et al., 2001), which might be expected to inflate associations between temperament and social competence (Eisenburg et al., 2000; Sanson et al., 2004). Therefore, we examined the moderating role of informant and item overlap.

Regarding sample characteristics, several temperament scholars have emphasized the importance of considering a child's characteristics and background in examining the links between temperament and adjustment. Indeed, in line with the concept of goodness of fit (e.g., Thomas & Chess, 1977), the extent to which children's temperament characteristics predict children's subsequent socioemotional adjustment has been argued by some temperament scholars to depend on the sociocultural context (Sanson et al., 2004). Links between temperament and social competence have also been proposed to depend on child characteristics (e.g., sex; Coplan & Bullock, 2012; Else-Quest et al., 2006). Thus, to capture sample diversity, samples were characterized according to child sex (male v. female), socioeconomic status (high/middle v. low), and risk status (at risk [e.g., clinical sample] v. not-at-risk); and the role of these sample characteristics in moderating meta-analytic associations between early temperament variation and children's social competence was examined.

The Present Study

We used meta-analysis to evaluate the predictive significance of temperamental reactivity assessed in the early life course for the development of children's social competence with peers. Given the centrality of temperament in theoretical models of the early antecedents of children's social competence and in line with our prior meta-analysis on early attachment and social competence (Groh et al., 2014), we included studies that assessed temperamental reactivity in early childhood (i.e., birth to 6 years). To provide a comprehensive quantitative synthesis of the literature, separate meta-analyses were conducted for each broadband dimension of temperament: (1) difficult temperament (i.e., negative v. positive temperamental reactivity characteristics), (2) negative emotionality, and (3) positive emotionality. Difficult temperament and negative emotionality were expected to be negatively associated with social competence and

positive emotionality was expected to be positively associated with social competence. Further, to examine whether specific temperament constructs were more (v. less) strongly related to children's social competence with peers, we conducted a separate meta-analysis comparing the effects for each temperament construct (e.g., anger, fear, positive affect).

Next, we examined a range of factors that might be expected to moderate the association between early temperamental reactivity and social competence. To examine the role of developmental factors, we considered the age at which temperament was assessed and the time between temperament and social competence assessments. We also examined the moderating role of the following methodological factors: (1) temperament measure (Thomas and Chess v. Buss and Plomin v. Rothbart v. Goldsmith), (2) temperament measure type (report v. observation), (3) temperament informant (parent v. teacher v. observer), (4) type of social competence measure (reported social skills v. sociometric ratings v. observation), and (5) social competence informant (parent v. teacher v. peer v. self v. observer). We also examined the moderating role of several sample characteristics: (1) child sex (male v. female), (2) socioeconomic status (SES; high/middle v. low), (3) risk status (at-risk mother and/or child v. not at-risk mother or child v. mixed risk [combination of at-risk mother and/or child and not at-ask mother or child]). We also examined the role of informant overlap (i.e., same informant for temperament and social competence v. different informants) and item overlap (i.e., whether or not items used to assess temperament also reflect children's socially competent behavior with peers). Further, to evaluate potential publication bias, the role of publication status (peer-reviewed journal v. not peer-reviewed journal [dissertation, chapter]) was examined as well.

Finally, to more broadly evaluate theories regarding the early antecedents of children's socially competent behavior with peers (Berlin et al., 2008; Booth-LaForce & Groh, 2018;

Coplan & Bullock, 2012; Goldsmith & Harman, 1994; Eisenberg et al., 2009; Sanson et al., 2004), we compared the meta-analytic associations between early temperamental reactivity and social competence reported here with the meta-analytic association between early secure (v. insecure) attachment and social competence reported in our prior meta-analysis (Groh et al., 2014). Comparisons were conducted for each broadband dimension of temperament reactivity (i.e, difficult temperament, negative emotionality, positive emotionality). To create more comparable corpora of studies, we also conducted these comparisons according to type of assessment for temperament (i.e., observations of attachment v. observations of temperament, reports of temperament) and social competence (i.e., parent/teacher report v. sociometric rating v. observation).

Method

Relevant published articles, chapters, and dissertations were identified via systematic search using the electronic databases PsycInfo and Web of Science with the keywords temperament, behavior* inhib*, shy*, irritab*, frustrat*, difficult*, anger prone*, behavior* style, easy, emotionality, sociabl*, Neonatal Behavioral Assessment Scale, Infant Behavior Questionnaire, Infant Characteristics Questionnaire, fuss*, adaptab*, withdraw, mood, self regulation, Infant Temperament Questionnaire, fear, manageab*, regularity, dull, and rhythmicity (asterisks indicate the search contained the word or word fragment). To narrow the search, each temperament keyword was cross-searched with the following social competence keywords: social competenc*, peer competenc*, interpersonal function*, popular*, social reject*, peer reject*, social accept*, peer accept*, friend*, sociometric, social aggress*, prosocial, antisocial, interpersonal interaction, and empathy.

The search returned 35,120 papers in Web of Science and 30,953 papers in PsycInfo (see Figure 1). The abstracts of the articles were reviewed and a large number of articles that were clearly irrelevant (e.g., studies not involving children, non-empirical articles) were eliminated, resulting in 1,465 articles. The corpus was further narrowed by reviewing the articles to eliminate those that did not assess temperament and social competence, resulting in 359 articles. The 359 articles were reviewed according to the criteria below and 124 articles were identified as relevant for the meta-analysis. The reference lists of these articles were reviewed to identify other papers of relevance, resulting in the identification of 3 additional papers. Reference lists of key chapters (e.g., Goldsmith et al., 2001), narrative reviews (e.g., Calkins, 1994), and meta-analyses (e.g., Robson et al., 2020) were also reviewed, and no additional papers were identified beyond those already identified via our search. In total, 127 papers were included in the meta-analysis.

Inclusion and Exclusion Criteria

Studies were included in the meta-analysis if they reported on the relation between temperament and social competence with peers. The specific focus of this meta-analysis was on temperamental reactivity. Accordingly, temperament constructs included in the meta-analysis were: (a) activity (i.e., arm/leg movement; locomotor activity), (b) adaptability (i.e., responsiveness to new or altered situations; ease with which responses are modified in desired directions), (c) anger/irritable distress (e.g., anger/frustration; general fussiness; distress to restraint or limitations), (d) approach/positive anticipation (i.e., rapid approach, excitement, and positive anticipation of pleasurable events), (e) fear (i.e., distress, withdrawal, inhibition when confronted with novel people and/or environments), (f) high intensity pleasure (i.e., amount of pleasure or enjoyment related to high stimulus intensity, rate, complexity, novelty, and

incongruity), (g) intensity (i.e., energy level of response), (h) mood (i.e., amount of pleasant, joyful and friendly behavior v. unpleasant, crying and unfriendly behavior), (i) negative emotionality (i.e., blend of fear and anger/irritable distress), (j) positive affect (i.e., general expression of positive emotion), (k) rhythmicity (i.e., predictability of any function [e.g., in relation to the sleep-wake cycle, hunger, feeding pattern, elimination schedule]), (l) sadness (i.e., general low mood; lowered mood and activity specifically related to personal suffering, physical state, object loss, or inability to perform a desired action), (m) sensory sensitivity/threshold (i.e., sensitivity to external stimulation; intensity level of stimulation necessary to evoke a response) (n) smiling/laughter (i.e., smiling/laughter in caretaking or play situations), (o) sociability (i.e., preference to be with others), and (p) soothability (rate of recovery from peak distress; ability to recover from distress with parent soothing; see: Rothbart & Mauro, 1990; Rothbart & Bates, 2006; Zentner & Shiner, 2012).

Self-regulatory aspects of temperament (e.g., attention span, distractibility, effortful control, impulsivity, inhibitory control, low intensity pleasure) were excluded from the current meta-analyses because (1) a prior meta-analysis has examined the relation between early self-regulation and children's social competence (Robson et al., 2020), and (2) a key goal of this meta-analysis was to evaluate theories regarding the significance of early temperament emotional reactivity and early attachment security as two (largely) distinct antecedents of children's social competence with peers. Papers were excluded if they employed measures of emotion that were not purely temperament measures (e.g., Emotion Regulation Checklist, Shields & Cicchetti, 1997; California Child Q-Sort, Block & Block, 1980). Papers were also excluded when the assessment of emotional reactivity occurred during parent-child or peer interactions (Cassidy et al., 1992; Isley et al., 1999; LaFreniere & Dumas, 1992). Given the

specific focus of this meta-analysis on the significance of early temperament for children's social competence with peers, studies were included if child temperament was assessed between 0-6 years of age. This age range is consistent with our prior meta-analysis on early attachment and social competence with peers (Groh et al., 2014), thereby facilitating comparison.

Social competence was defined as social skills (e.g., interpersonal awareness, ability to form friendships, cooperation), the quality of interpersonal interactions (e.g., peer group entry, sharing with peers, play behavior), and social status (e.g., popularity, likability, number of friends). The specific focus of the current meta-analysis was on social competence with peers outside of the family context. For this reason, papers were excluded if they reported on: (a) sibling relationships, (b) interactions with adults, (d) self-development constructs (e.g., self-esteem), (f) behaviors that reflect externalizing (e.g., aggression) or internalizing (e.g., social withdraw) symptoms, and (g) social cognition (e.g., social information processing).

Temperament was assessed using questionnaires completed by parents (e.g., Penela et al., 2015), teachers/caregivers (e.g., Sher-Censor et al., 2016), and observations coded by trained observers (e.g., Dollar & Stifter, 2012). Social competence was assessed using questionnaires completed by parents (e.g., Jokela, 2010) and teachers/caregivers (e.g., Coplan, & Rubin, 1998), sociometric ratings completed by peers and/or teachers (e.g., Eisenberg et al., 1993), and observations in groups and/or dyads coded by trained observers (e.g., Kochanska & Radke-Yarrow, 1992).

Given the focus of this report on the significance of early temperament reactivity for social competence, when papers had multiple assessments for temperament and/or social competence over time, the earliest assessment of temperament was selected and the earliest social competence assessment occurring concurrently with or following the temperament

assessment was used (e.g., Bohlin & Hagekull, 2009; Letcher et al., 2009). Similarly, when papers reported on the same temperament construct from (partly) overlapping samples (e.g., Penela et al., 2015, Walker et al., 2013), the paper with the earliest temperament assessment was included (e.g., Walker et al., 2013). In some cases, assessments of specific temperament constructs from the same sample occurred at different time points (e.g., fear and positive affect assessed at an earlier time point [Degnan et al., 2011] than anger/irritable distress [Walker et al., 2013]). To be as inclusive as possible, the earliest assessment of each temperament construct was selected.

Some studies reported results separately for different subsamples. For example, some studies reported results separately for males and females (e.g., Eisenberg et al., 1993), cohorts of participants (e.g., Endendijk et al., 2015), and different ethnic/racial groups (e.g., Streit et al., 2017). In these cases, subsamples were treated as independent samples in analyses.

In total, 127 studies were identified that yielded 382 effect sizes nested in 140 independent samples with 49,891 children that were included in the meta-analysis on difficult temperament. Of these, 172 effect sizes nested in 93 independent samples with 36,407 children were included in the meta-analysis for negative emotionality and 54 effect sizes nested in 43 independent samples with 26,981 children were included in the meta-analysis for positive emotionality. The total number of children included in each meta-analysis was computed using the sample sizes from each independent sample (when independent samples reported multiple effects with varying sample sizes, the larger sample size was used for determining totals). For the temperament constructs meta-analyses, the 382 effect sizes nested in 140 independent samples were included (see Appendix).

Coding System

A coding system was developed for describing the characteristics of the study design and sample. The type of temperament construct assessed was coded as: (1) activity, (2) adaptability, (3) anger/irritable distress (4) approach/positive anticipation of pleasurable events, (5) fear, (6) high intensity pleasure, (7) intensity, (8) mood, (9) negative emotionality, (10) positive affect, (11) rhythmicity, (12) sadness, (13) sensory sensitivity/threshold, (14) smiling/laughter, (15) sociability, or (16) soothability. If multiple temperament constructs were combined in the paper, temperament construct was coded as "blend." Type of blend was coded to indicate whether the blend reflected commonly used composites of temperament constructs derived via factor analysis (e.g., "negative emotionality" and "surgency" derived from the Infant Behavior Questionnaire).

Temperament constructs were coded according to whether they pertained to the broadband dimensions of *negative emotionality* or *positive emotionality*. To determine which temperament constructs should be included in each broadband dimension, two experts in the area of temperament (Rebecca Shiner and Marcel Zentner) were consulted. These experts and co-authors not involved in the literature search or coding process (Bakermans-Kranenburg, Fearon, Roisman, Van IJzendoorn, and Vaughn) completed a blind vote in which they indicated which temperament constructs should be grouped together into the broadband dimensions. The following constructs were indicated as pertaining to negative emotionality by at least 6 out of 7 raters: anger/irritable distress, fear, sadness, and negative emotionality (including combinations of fear and anger/irritable distress; negative emotionality factor derived from the Infant Behavior Questionnaire, Early Childhood Behavior Questionnaire, or Children's Behavior Questionnaire). The following constructs were indicated as pertaining to positive emotionality by at least 6 out of 7 raters: approach/positive anticipation, high intensity pleasure, positive affect, sociability,

smiling/laughter, and surgency (i.e., factor derived from the Infant Behavior Questionnaire, Early Childhood Behavior Questionnaire, or Children's Behavior Questionnaire). The following constructs were viewed as pertaining to both negative and positive temperamental emotionality, and thus were not include in these broadband composites: activity, adaptability, intensity, mood, rhythmicity, sensory sensitivity/threshold, and soothability.

Several potential moderators were coded. Age at temperament and social competence assessment were coded and time between temperament and social competence assessments was calculated by subtracting the age at which temperament was assessed from the age at which social competence was assessed. Temperament measure was coded as: (1) Thomas and Chess, (2) Buss and Plomin, (3) Rothbart, (4) Goldsmith, or (5) other. Type of temperament assessment was coded as report, observation, or mixed. Temperament informant was coded as: (1) parent (mother, father, parent, or combined mother/father), (2) teacher, (3) observer, or (4) combined informants (e.g., parent/teacher). Type of social competence assessment was coded as: (1) rated social skills, (2) sociometric rating, (3) observed social competence in dyads/groups, or (4) mixed. Social competence informant was coded as: (1) parent, (2) teacher, (3) peer, (4) self-report, (5) observer, or (6) combined informants. Several potential moderators related to the sample were coded: child sex (male, female), socioeconomic status (middle/high, low), and risk status (not at-risk child or parent, at-risk child or parent, mixed risk [combined sample of not at-risk child or parent and at-risk child or parent]). Publication status was coded as peer-reviewed source if the study was published in a peer-reviewed journal or not peer-reviewed source if the study was an unpublished dissertation or part of a book chapter.

Given that effect sizes can be affected by shared method variance (e.g., overlapping informants; Eisenberg et al., 2000) or conceptual overlap in items used to assess temperament

and social competence (Sanson et al., 2004), we also coded whether there were overlapping informants for temperament and social competence (different informants, same informant) and whether the assessments of temperament and social competence included overlapping items (overlap [e.g., "When a familiar child came to your home, how often did your child engage in an activity with the child?"], no overlap). In some cases, we were unable to obtain the measure of temperament used in the study (e.g., He et al., 2017), and thus, unable to determine whether items used to assess temperament overlapped with social competence. In such cases (k = 21), overlap was coded as "unable to determine."

For fourteen studies, authors were contacted for critical methodological or statistical information and seven authors were able to provide the relevant information. As in previous meta-analyses (e.g., Fearon et al., 2010; Groh et al., 2012), 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 so we could examine associations between temperamental reactivity and social competence in various subsamples (i.e., within sex and low- and high-SES groups). To assess interrater reliability, 30 (24%) randomly selected studies were coded by two coders. The agreement between the two coders across the moderator variables was excellent (continuous moderators: *ICC*s > 0.99; categorical moderators: κs > 0.82).

Meta-Analytic Procedures

As noted above, it was common in the literature for multiple effect sizes to be nested within samples. Thus, multilevel meta-analyses were performed using the *metafor* package (Viechtbauer, 2010) in RStudio v1.4.1103 (RStudio Team, 2020) and following the procedures and R codes provided by Harrer and colleagues (2019). A random-effects approach was applied because the included effect sizes were considered a random sample from a larger population of

studies (e.g., Assink et al., 2018; Raudenbusch, 2009; Van den Noortgate & Onghena, 2003). Using this approach, multiple effect sizes from the same study are retained in analyses. Dependency of effect sizes was modeled using a 3-level meta-analytic model such that variance between studies was modeled at level 3, variance between effect sizes from the same study was modeled at level 2, and sample variance was modeled at level 1 (see Assink et al., 2018; Harrer et al., 2019). In the current meta-analysis, several studies reported on multiple effect sizes from a single sample, including reporting on multiple: (a) temperament constructs (e.g., fear and anger; Blair & Peters, 2003), (b) temperament informants (e.g., parent and teacher; Taylor et al., 2014), (c) social competence informants (e.g., teacher and peers; Gulay, 2012), (d) types of temperament measure (e.g., report and observation; Porter, 2009), and/or (e) types of social competence measure (e.g., reported social skills and sociometrics; Pettit, 1999). In such cases, multiple effect sizes were nested within sample. For example, if a sample included effect sizes for the association between mother-reported temperament and social competence and teacher-reported temperament and social competence, each effect size was retained (modeled at level 2) and nested within the sample (modeled at level 3).

Model coefficients were estimated using a restricted maximum likelihood method and an *F*-test was used as an omnibus-test of all model predictors. The significance of level-2 and level-3 variance was determined by conducting model comparisons in which the deviance of the full model was compared to the deviance of a model without one of the two variance parameters. Model comparisons were conducted using one-sided log-likelihood-ratio-tests. After a final variance structure was established, moderators were tested as covariates (Assink et al., 2018; Harrer et al., 2019).

For each study, associations were reported as Pearson's *r* (i.e., the bivariate correlation between temperament and social competence). In accordance with our hypotheses, effect sizes indicating a negative association between negative temperamental emotionality and social competence or a positive association between positive temperamental emotionality and social competence were given a positive sign. Effect sizes indicating a positive association between negative emotionality and social competence or a negative association between positive emotionality and social competence were given a negative sign. Thus, a positive combined effect for the set of studies examining the association between difficult temperament and social competence, negative emotionality and social competence, or positive emotionality and social competence would indicate that across studies, difficult temperament was associated with lower social competence.

Consistent with temperament theories and the operationalization of specific temperament constructs (Rothbart & Mauro, 1990; Rothbart & Bates, 2006; Zentner & Shiner, 2012), the following temperament constructs were expected to be negatively associated with social competence: activity, anger/irritable distress, fear, intensity, mood (negative v. positive), negative emotionality, sadness, and sensory sensitivity/threshold. For example, higher scores on fear were expected to be associated with lower scores on social competence. For a negative association between fear and social competence, the effect size was assigned a positive sign because the effect was in the expected direction. The following temperament constructs were expected to be positively associated with social competence: adaptability, approach/positive anticipation, high intensity pleasure, positive affect, rhythmicity, smiling/laughter, sociability, and soothability. For example, higher scores on positive affect were expected to be associated with higher scores on social competence and were assigned a positive sign.

To prepare the dataset for analyses, Fisher's *Z* scores were computed for each effect size as well-distributed equivalents for the effect size *r* and the *Z* scores were standardized to test for outliers. There were 9 studies reporting outlying effect sizes (standardized Z-values outside of +/- 3.29; Tabachnik & Fidell, 2001). Outlying values were winsorized, maintaining the rank order of effect sizes in the set. After conducting analyses, combined effect sizes were then converted to *r* to facilitate interpretation. Unique identifier variables were provided for each effect size and for each study level variable for level 3 clustering. For moderator analyses, a dummy-coded column was created for each subgroup. As an example, "child sex" had three columns: one in which "Male" was coded (0=no, 1=yes), one in which "Female" was coded (0=no, 1=yes), and one in which "Mixed Sex" was coded (0=no, 1=yes). Continuous predictors (e.g., age of temperament assessment) were standardized (Harrer et al., 2019).

Four separate multilevel meta-analyses were conducted. The first meta-analysis evaluated the association between difficult temperament and children's social competence with peers, and thus, all effect sizes were included. Moderator analyses were first performed to determine whether the magnitude of the association between difficult temperament and social competence differed according to whether constructs were assessed by the same informant. The role of item overlap was also examined. Based on the results of these analyses, results are reported for both the total set of effect sizes and a subset of effect sizes that did not have overlapping informants or overlapping items. Next, moderator analyses were conducted to examine whether the variables described above increased or attenuated the association between difficult temperament and social competence. Note, moderator analyses were only conducted when at least two of the subsets had four or more independent samples (Bakermans-Kranenburg et al., 2003). The following moderators were considered: temperament measure, type of temperament measure, temperament

informant, type of social competence measure, social competence informant, child sex, socioeconomic status, risk status, and publication status. Meta-regressions were also conducted to determine whether age of temperament assessment and time in between temperament and social competence assessments moderated the association between difficult temperament and social competence. Given the developmental focus of these analyses, they were conducted using the subset of longitudinal studies. Moreover, given that later assessments of temperament are more likely to occur in concurrent study designs, focusing on the subset of longitudinal studies helps reduce dependency between age of temperament and time between temperament and social competence assessments.

The second meta-analysis examined the association between negative temperamental emotionality and children's peer competence. For this meta-analysis, temperament constructs reflecting negative emotionality (i.e., anger/irritable distress, fear, negative emotionality, sadness) were selected, and the same moderator analyses were conducted that were conducted for difficult temperament. The third meta-analysis examined the significance of positive temperamental emotionality for children's peer competence. For this meta-analysis, temperament constructs reflecting positive emotionality (i.e., approach/positive anticipation, high intensity pleasure, positive affect, sociability, smiling/laughter, surgency) were selected, and the same moderator analyses were conducted that were conducted for difficult temperament.

Fourth, we examined links between specific temperament constructs and social competence and evaluated whether the association between temperament and social competence varied depending on the temperament construct assessed. All effect sizes were included in the temperament constructs analyses and each temperament construct was tested as a moderator.

Last, to compare the significance of early temperamental reactivity for social competence to that of early attachment security, we computed 85% *CI*s for the point estimates of the combined effect sizes in the sets. Non-overlapping 85% *CI*s indicate a significant difference between combined effect sizes. This approach of comparing 85% *CI*s is a conservative significance test (Goldstein & Healy, 1995; Van IJzendoorn et al., 2005).

Results

Summary of Sample Demographics

For the entire corpus of studies, the median sample size was 121 children and ranged from 28 to 7,695. Children were 44 months on average at the time of the temperament assessment, with a range of 0.28 to 78.90 months (median: 48). Eighty-four percent of the samples were mixed sex (k = 117) and twelve samples were all female (9%) and thirteen were all male (9%). In terms of race and ethnicity, 81 samples were reported to be predominately White/European American (58%). Seven samples were primarily Asian or Asian American (5%), four were primarily Black or African American (3%), one was primarily Hispanic or Latino (<1%), and eleven samples reported mixed racial compositions (8%). The remaining 36 studies did not provide information regarding race/ethnicity (26%). The majority of samples were described as having high, middle, or mixed socioeconomic statuses. Twenty-two samples were identified as being of low socioeconomic status (16%). Regarding risk status, there were 4 samples that were identified as being at-risk (3%) and 4 samples that were mixed-risk (3%). Among the samples identified as being at-risk, risk status was described as: at risk for behavioral problems, children with dyslexia, and parents with history of depression. The majority of samples were collected in the United States (64%). Additional samples were from Canada (7%), China (5%), the Netherlands (4%), the United Kingdom (4%), Australia, (3%), Italy (2%),

Turkey (2%), Sweden (1%), and South Korea (1%). Less than 1% were from Croatia, Finland, New Zealand, Norway, Romania, Singapore, and Spain. Studies were primarily published in peer-reviewed sources (82%; i.e., articles published in academic journals) and 18% were not from peer-reviewed sources (i.e., dissertations or chapters). See Table 1 for a summary of study descriptors and moderators.

Early Difficult Temperament and Children's Social Competence with Peers

Of primary interest was whether early difficult temperament increased risk for lower social competence with peers. In a combined set of 140 independent samples with 382 total effect sizes and 49,891 children, there was a significant association between temperament and social competence with peers, $r = 0.13$ ($z = 0.13$, 95% *CI* 0.11, 0.16; see Table 2). Children who were rated or observed to have higher levels of difficult temperament exhibited lower levels of social competence with peers. A significant amount of variance could be attributed to within-study effects (40.64%) and between-study effects (48.33%). Model comparisons indicated that removal of within-study effects (level 2) significantly worsened model fit ($\chi^2[1] = 568.27$, $p < .001$), as did removal of between-study effects (level 3; $\chi^2[1] = 46.36$, $p < .001$), indicating significant variability in effect sizes within the same study (level 2) and between studies (level 3) and signaling the multi-level approach was appropriate. Further, the *Q*-statistic was significant ($Q[381] = 2560.43$, $p < .001$), indicating that there was heterogeneity in the effect sizes. Thus, we examined the role of several potential moderators that might account for variability in effect sizes.

We first examined the role of informant and item overlap in increasing the association between early difficult temperament and children's social competence with peers. As seen in Table 2, informant overlap ($F[1, 380] = 37.10$, $p < .001$) significantly moderated the meta-

analytic association. Specifically, the combined association was significantly larger when difficult temperament and social competence were assessed via the same informant (r = 0.23; z = 0.23; 95% *CI* 0.16, 0.29) than when they were assessed via different informants (r = 0.09; z = 0.09, 95% *CI* 0.01, 0.17). In addition, the combined association was larger when difficult temperament and social competence assessments had overlapping items (r = 0.18; z = 0.18; 95% *CI* 0.11, 0.25) compared to all other effect sizes, $F(1, 380) = 7.64$, $p < .01$. When difficult temperament and social competence assessments did not have overlapping items, the combined association was smaller (r = 0.11; z = 0.11; 95% *CI* 0.04, 0.18) compared to all other effect sizes, $F(1, 380) = 10.10$, $p = .002$. Effect sizes for which item overlap could not be determined did not differ from all other effect sizes, r = 0.16; z = 0.16; 95% *CI* 0.07, 0.25; $F(1, 380) = 0.80$, $p = .37$. Results therefore provide evidence consistent with the idea that informant and item overlap contribute to larger effect sizes.

Based on these results, a subset of effect sizes was created in which effect sizes that had overlapping informants for temperament and social competence and/or overlapping items on temperament and social competence measures were removed. Effects for which item overlap could not be determined were included in the non-overlapping subset because the moderator analysis indicated that they did not differ from all other effect sizes. An overall effect was tested for the non-overlapping subset. In a set of 75 independent samples with 161 effect sizes and 13,879 children, the association between difficult temperament and social competence was significant, r = 0.10 (z = 0.10; 95% *CI* 0.06, 0.13; see Table 2). In line with these results, all subsequent moderator analyses were conducted using the total set of effect sizes and the non-overlapping subset.

The first moderator analyses conducted were a series of meta-regressions to examine the effect of age of temperament assessment and time between temperament and social competence assessments on the meta-analytic association between difficult temperament and children's social competence. These analyses were conducted using the sub-set of longitudinal effect sizes (total set: k = 45; u = 116; non-overlapping set: k = 26; u = 59) to help disentangle age of temperament assessment from time between temperament and social competence assessments. Findings indicated that the moderating effect of age of temperament assessment was significant in the total set of longitudinal effect sizes (slope = 0.04, 95% *CI* 0.01, 0.07; p = .01), indicating that the later temperament was assessed, the stronger the combined association between difficult temperament and social competence. This result, however, was no longer statistically significant in the smaller non-overlapping set of longitudinal effect sizes (slope = 0.04, 95% *CI* -0.01, 0.08; p = .09), although the effect size was numerically the same and therefore not substantively different. In both the total set of longitudinal studies and the set of longitudinal effect sizes without overlapping informants and items, time between assessments was a significant moderator of the meta-analytic association between difficult temperament and social competence (total set: slope = -0.03, 95% *CI* -0.06; 0.00, p = .05; non-overlapping set: slope = -0.04, 95% *CI* -0.07, -0.00; p = .04), indicating that the meta-analytic association between difficult temperament and social competence decreased as the time between temperament and social competence assessments increased. In light of such evidence and the moderate correlation between age and time between assessments (rs = -0.42; -0.36), we conducted meta-analytic regressions in which both age of temperament assessment and time between assessments were entered simultaneously into the model. However, the combined effects for both variables were non-significant in the total set and non-overlapping subset of longitudinal effect sizes (ps = .06-.86).

We next considered whether methodological differences moderated the association between difficult temperament and social competence. Focusing first on type of temperament measure, findings revealed that in both the total set and non-overlapping subset, the Thomas and Chess, Rothbart, and Goldsmith measures did not produce significantly different combined effect sizes when compared to all other measures. Similarly, in the total set of effect sizes, the combined effect size for Buss and Plomin measures did not significantly differ from that for all other measures. However, when accounting for informant and item overlap in the non-overlapping subset of studies, Buss and Plomin measures produced smaller combined effect sizes (r = 0.01; z = 0.01; 95% CI -0.10, 0.12) compared to all other measures (F[1, 159]= 7.14, p = .01; see Table 2).

Turning next to type of temperament measure, the pattern and significance of findings differed between the total set and non-overlapping set of effect sizes. As seen in Table 2, in the total set, the combined effect size was smaller for observations of temperament (r = 0.06; z = 0.06; 95% *CI* -0.02, 0.15) compared to reports (r = 0.14; z = 0.14; 95% *CI* 0.02, 0.26), F(1, 375) = 5.60, p = .02. However, in the non-overlapping subset, the combined effect size for observations and reports of temperament did not significantly differ (F[1, 157] = 1.07, p = .30), indicating that reports and observations of difficult temperament produce comparable meta-analytic associations with social competence when accounting for informant and item overlap.

Next, we examined the moderating role of temperament informant. In the total set of effect sizes, the combined effect for teacher reports of temperament was larger (r = 0.35; z = 0.37; 95% *CI* 0.28, 0.45) compared to parent (r = 0.11; z = 0.11; 95% *CI* 0.02, 0.20; F[1, 317] = 63.17, p < .001) and observer (r = 0.05; z = 0.05; 95% *CI* -0.04, 0.14; F[1, 77] = 58.64, p < .001) reports of temperament. Results were similar for the non-overlapping subset: the combined effect

for teacher informants was larger (r = 0.29; z = 0.30; 95% *CI* 0.18, 0.41) compared to parent (r = 0.07; z = 0.07; 95% *CI* -0.04, 0.17; F[1, 120] = 30.76, $p < .001$) and observer (r = 0.06; z = 0.06; 95% *CI* -0.05, 0.17; F[1, 45] = 23.49, $p < .001$) informants for temperament. Although parent reports produced a larger combined effect compared to observer informants in the total set of effect sizes, this difference might be attributed to informant or item overlap, as parent and observer informants did not differ in the subset of non-overlapping effect sizes, F(1, 139) = 0.04, p = .84 (see Table 2).

Turning to the moderating role of methodological factors specific to the measurement of social competence, the magnitude of the meta-analytic association between difficult temperament and social competence did not vary according to type of social competence measure (reported social skills, sociometric rating, observation, mixed, see Table 2). Focusing on social competence informant, although parent reports produced a larger combined effect (r = 0.18; z = 0.18; 95% *CI* 0.10, 0.26) compared to all other informants in the total set (F[1, 380] = 5.42, p = .02), this difference was no longer significant in the non-overlapping subset of effect sizes (F[1, 159] = 3.29, p = .07, see Table 2), indicating that the larger effect for parent informants for social competence in the total set may be attributable to overlap in informant or items.

The meta-analytic association between difficult temperament and social competence was not significantly moderated by sample characteristics (child sex, SES, risk status; Fs = 0.00-2.64; ps = .11-.97, see Table 2) in the total set or in the non-overlapping subset of effect sizes. Publication status also did not moderate the meta-analytic association between difficult temperament and social competence in the total set (F[1,380] = 0.08, p = .78) or in the non-overlapping set (F[1,159] = 0.14, p = .71).

Early Negative Emotionality and Children's Social Competence with Peers

The next set of meta-analyses evaluated whether negative emotionality placed children at risk for lower levels of social competence. In a combined set of 93 independent samples with 172 effect sizes and 36,407 children, the overall combined effect was significant (r = 0.14; z = 0.14; 95% *CI* 0.11, 0.16; see Table 3). Children who had higher levels of negative emotionality had lower levels of social competence. A significant amount of variance was attributed to within-study effects (32.18%) and between-study effects (53.51%). Model comparisons indicated that model fit was significantly worsened by removal of level 2 (χ^2[1] = 128.62, p <.001) and level 3 effects (χ^2[1] = 18.59, p <.001). The Q-statistic also was significant (Q[171] = 1132.44, p < .001) and potential moderators were tested that might account for variability in effect sizes.

We first considered the role of informant overlap and item overlap (see Table 3). Informant overlap (F[1, 170] = 13.57, p < .001) significantly moderated the meta-analytic association. The meta-analytic association was significantly larger when negative emotionality and social competence were assessed by the same informant (r = 0.21; z = 0.21; 95% *CI* 0.12, 0.30) compared to when they were assessed by different informants (r = 0.10; z = 0.10; 95% *CI* -0.01, 0.21). Further, when negative emotionality and social competence had item overlap, the combined association was larger compared to all other effect sizes, r = 0.20; (z = 0.20; 95% *CI* 0.11, 0.29, F(1, 170) = 10.93, p = .001. When negative emotionality and social competence did not have item overlap, the combined association was smaller compared to all other effect sizes, r = 0.11 (z = 0.11; 95% *CI* 0.02, 0.21), F(1, 170) = 4.86, p = .02. When item overlap could not be determined, the combined association did not differ from all other effect sizes, r = 0.10 (z = 0.10; 95% *CI* -0.02, 0.21), F(1, 170) = 1.34, p = .25.

Based on these results, subsequent moderator analyses were again conducted using both the total set of effect sizes and a subset in which overlap was removed (effect sizes were retained if item overlap could not be determined). An overall effect was first computed for the non-overlapping subset. In a set of 42 independent samples with 69 effect sizes and 9,305 children, the meta-analytic association between negative emotionality and social competence was significant, r = 0.10, (z = 0.10; 95% *CI* 0.05, 0.15). All subsequent moderator analyses were again conducted using both the total set of effect sizes and the non-overlapping subset.

Meta-regressions were conducted to examine whether age of temperament assessment and time between assessments moderated the association between negative emotionality and social competence in the total (k = 29; u = 65) and non-overlapping (k = 15, u = 29) sets of longitudinal studies. In the total set of longitudinal effect sizes, the combined effect between negative emotionality and social competence was significantly larger the later temperament was assessed (slope = 0.05; 95% *CI* 0.01, 0.09; p = .01). The effect of age of temperament assessment was not significant, however, in the non-overlapping set of longitudinal effect sizes (slope = 0.04; 95% *CI* -0.02, 0.09, p = .17). Time between temperament and social competence assessment was not a significant moderator in the total set of longitudinal effect sizes (slope = -0.02, 95% *CI* -0.05, 0.01; p = .18) nor in the non-overlapping set of longitudinal effect sizes (slope = -0.03, 95% *CI* -0.07, 0.01, p = .17).

Next, moderator analyses were conducted to examine the role of methodological differences (see Table 3). Focusing first on methodological differences in how temperament was assessed, temperament measure (Thomas and Chess, Buss and Plomin, Rothbart, Goldsmith) was not a significant moderator in the total set or the non-overlapping set of effect sizes, Fs = 0.01-2.98, ps = .09-.95. Regarding type of temperament measure, the combined effect did not differ

according to whether temperament was assessed via report or observations in the total set (F[1, 165] = 3.13, p = .08) or in the non-overlapping set (F[1, 65] = 0.77, p = .39).

Next, we examined the role of temperament informant. In the total set, results indicated that the combined effect for teacher informants was larger (r = 0.46; z = 0.43; 95% *CI* 0.33, 0.59) compared to parent informants (r = 0.12; z = 0.12; 95% *CI* 0.00, 0.24; F[1, 133] = 43.17, p < .001) and observer informants (r = 0.06; z = 0.06; 95% *CI* -0.05, 0.17, F[1, 22] = 48.58, p < .001). In the non-overlapping subset, there were too few studies with teacher informants (k = 3) to conduct comparisons. Parent informants did not differ from observers in either the total set of effect nor in the subset of non-overlapping effect sizes, Fs = 0.00-2.86, ps = .09-.96.

Regarding the methodological differences in the measurement of social competence, type of social competence measure was not a significant moderator in the total set or in the non-overlapping set, Fs = 0.02-3.10, ps = .08-.89 (see Table 3). For social competence informant, parent informants produced a larger combined effect size in the total set (r =0.19; z =0.19; 95% *CI* 0.08, 0.29) compared to all other informants (F[1, 170] = 4.18, p = .04), but this effect was not significant in the non-overlapping subset of effect sizes (see Table 3).

The meta-analytic association between negative emotionality and social competence was not moderated by sample characteristics (child sex, SES; Fs = 0.00-3.87, ps = .13-.99; see Table 3) in the total set or in the non-overlap subset of effect sizes. There were too few risk samples (ks <4) to test risk status as a moderator. Publication status was also not a significant moderator in either the total set nor in the non-overlapping set of studies, Fs = 0.01-0.08, p's = .78-.92.

Early Positive Emotionality and Children's Social Competence with Peers

A third set of meta-analyses was conducted to examine whether positive emotionality was associated with social competence in a combined set of 43 independent samples with 54

effect sizes and 26,981 children. The meta-analytic association between early positive emotionality and children's social competence with peers was significant (r = 0.18; z = 0.18; 95% *CI* 0.12, 0.24; see Table 4), indicating that children with higher levels of positive emotionality exhibited higher levels of social competence. In this model, 26.80% of variance was attributable to within-study effects and 67.44% of variance was attributable to between-study effects. Model comparisons did not indicate significant change in model fit when levels 2 and 3 were removed, ps = .08-.15. Past work suggests that model comparisons might not reach significance when the number of independent samples and/or effect sizes is small and that it is still appropriate to apply a multilevel approach when less than 75% of the variance can be accounted for by level 1 (Assink & Wibbelink, 2016). Following this recommendation, a multilevel approach was retained for the positive emotionality analyses. The Q statistic also was significant, indicating heterogeneity in the effect sizes, $Q(53) = 397.19$, $p < .001$.

Moderator analyses were first conducted to examine the role of informant overlap and item overlap. There was a significant effect for informant overlap such that the meta-analytic association between positive emotionality and social competence was larger for effect sizes with the same informant (r = 0.31; r = 0.32; 95% *CI* 0.15, 0.48) compared to effect sizes with different informants (r = 0.09; z = 0.09; 95% *CI* -0.09, 0.26), $F(1, 52) = 22.93$, $p < .001$. The F tests for item overlap were not significant (Fs = 0.14-1.61, ps = .21-.71). In light of such evidence, all findings for positive emotionality are reported for the total set of effect sizes and the subset without overlapping informants. In a combined set of 29 independent samples, 36 effect sizes, and 3,306 children, the overall combined effect for the non-overlapping subset was r = 0.10 (z = 0.10; 95% *CI* 0.06, 0.15).

Next, a series of meta-regressions were conducted to examine the effects of age of temperament assessment and time between temperament and social competence assessments in the total set of longitudinal effect sizes (k = 8, u = 9) and the non-overlapping subset of longitudinal effect sizes (k = 4, u = 5). Age of temperament assessment was a significant moderator in the total set (slope = -0.05, 95% *CI* -0.09, -0.00, p = .04). In contrast to findings from the meta-analyses on difficult temperament and negative emotionality, these findings indicated the combined association between positive emotionality and social competence was stronger the earlier positive emotionality was assessed. However, age of temperament assessment was no longer a significant moderator in the non-overlapping subset (slope = -0.17, 95% *CI* -0.39, 0.05, p = .09). Time between temperament and social competence assessments was not a significant moderator in the total set or non-overlapping subset of effect sizes (total set: slope = 0.03, 95% *CI* -0.03, 0.09, p = .27; non-overlapping subset: slope = 0.05, 95% *CI* -0.31, 0.41, p = .68).

Next, moderator analyses were conducted to examine the role of methodological differences. Temperament measure and type of temperament measure did not significantly moderate the meta-analytic association between positive emotionality and children's social competence in either the total set or the non-overlapping subset of effect sizes, Fs = 0.00-3.70, ps = .06-.98. For temperament informant, teacher informants produced larger combined effect sizes (r = 0.52; z = 0.58; 95% *CI* 0.42, 0.74) compared to parent informants (r = 0.13; z = 0.13; 95% *CI* -0.09, 0.35, F[1, 41] = 53.71, p < .001) and observers (r = 0.08; z = 0.08; 95% *CI* -0.15, 0.32, F[1, 13] = 90.06, p < .001) in the total set of effect sizes. There were too few effect sizes leveraging teacher reports (k = 3; u = 3) to conduct moderator analyses for temperament informant in the non-overlapping subset of effect sizes. Similar to findings from the difficult

temperament and negative emotionality meta-analyses, the meta-analytic association did not vary according to whether parent informants or observations were used to assess temperament in either the total set or in the non-overlapping subset (*F*s = 0.00-0.71; *p*s = .41-.96).

Regarding methodological differences in the assessment of social competence, there were no significant moderator effects for type of social competence assessment in the total set or in the non-overlapping set of effect sizes, *F*s = 0.20-1.17, *p*s = .11-.29. For social competence informant, the combined effect between positive emotionality and social competence was smaller for peer informants for social competence (*r* = 0.01; *z* = 0.01; 95% *CI* -0.19, 0.21) compared to other social competence informants in the total set of effect sizes, $F(1, 52) = 7.38$, $p = .01$. However, this difference was no longer significant in the non-overlapping set of effect sizes, $F(1, 34) = 0.39$, $p = .54$.

Next, the moderating role of sample characteristics was examined. Socioeconomic status was a significant moderator in the total set such that the combined effect between positive emotionality and social competence was smaller in middle/high SES samples (*r* = 0.14; *z* = 0.14; 95% *CI* = -0.15, 0.43) compared to low SES samples (*r* = 0.47; *z* = 0.51; 95% *CI* 0.31, 0.71, $F[1, 52] = 24.67$, $p < .001$). There were too few low SES samples (*k* = 1) in the non-overlapping subset of effect sizes to conduct moderator analyses. In the total set and non-overlapping subset, child sex was not a significant moderator, *F*s = 1.15-2.41, *p*s = .17-.40. The moderating effect of risk status could not be examined in the total set or non-overlapping subset of effect sizes due to too few at-risk samples (*k* = 1 and 2, respectively). Publication status was not a significant moderator in the total set or in the non-overlapping set, *F*s = 0.16-3.73, *p*s = .06-.69.

Early Temperament Constructs and Children's Social Competence with Peers

A fourth set of meta-analyses was conducted to examine the association between specific temperament constructs and social competence (see Table 5). To obtain separate effect sizes for each temperament construct and an *F* value to determine whether the effect size for individual temperament constructs significantly differed from the other temperament constructs, each temperament construct was added as a moderator to the difficult temperament meta-analysis. Based on results from the difficult temperament meta-analysis indicating that informant and item overlap significantly increased the meta-analytic association, the temperament construct analyses were conducted for the total set and the non-overlapping subset of effect sizes.

In the total set, *F* tests were significant for activity, adaptability, approach/positive anticipation, fear, and soothability (*F*s = 4.34-9.10, *p*s = .01-.04), indicating that the combined effect of activity was significantly smaller compared to all other temperament constructs and the combined effects of approach/positive anticipation, fear, and soothability were larger compared to all other temperament constructs. However, in the overlapping subset, the effects for activity, fear, and soothability on children's social competence were no longer significantly different from the combined effect of other temperament constructs. Too few effect sizes were available in the non-overlapping subset to conduct contrasts for adaptability and approach/positive anticipation; however, the combined effects for these temperament constructs were smaller in the non-overlapping subset (*r*'s = 0.04-0.11) than in the total set (*r*'s = 0.24-0.27).

Early Temperament Reactivity, Early Attachment, and Social Competence

We compared the effect size for the association between attachment security and social competence to the effect size for the association of early temperamental reactivity and social competence. In a previous meta-analysis, children with secure attachments were found to have

higher levels of social competence than children with insecure attachments (Groh et al., 2014). Specifically, in 80 independent samples with 4,441 children, the meta-analytic association between secure (v. insecure) attachment and social competence was $r = 0.19$ (85% *CI* 0.17, 0.22). To compare this meta-analytic association with those reported here for the broadband temperament dimensions, we computed the 85% confidence intervals for the combined associations between each broadband dimension (difficult temperament, negative emotionality, positive emotionality) and children's social competence with peers given that studies included reported on (partially) overlapping samples of children. Non-overlapping 85% *CI*s indicate a significant difference between combined effect sizes (Goldstein & Healy, 1995; Van IJzendoorn et al., 2005). In light of evidence reported above, comparisons focused on the set of studies reporting on temperament and social competence without overlapping reporters/items. This allowed for a more direct comparison to attachment, given that early attachment and social competence assessments are typically completed by independent raters. As seen in Figure 2, the confidence intervals for associations between each of the broadband temperament dimensions and social competence did not overlap with the confidence interval for secure (v. insecure) attachment and social competence (difficult temperament: $r = 0.10$, 85% *CI* 0.07, 0.12; negative emotionality: $r = 0.10$, 85% *CI* 0.06, 0.14; positive emotionality: $r = 0.10$, 85% *CI* 0.06, 0.14; attachment security: $r = 0.19$, 85% *CI* 0.17, 0.22). As such, results indicated that the meta-analytic association between early attachment security and children's social competence was stronger than the meta-analytic associations between broadband dimensions of temperament emotionality and children's social competence.

Notably, the corpora of studies included in these meta-analyses varied in terms of how constructs were assessed. Whereas attachment was assessed via observation, temperament was

assessed either by report or observation. Similarly, studies varied in terms of how social competence was assessed (reported social skills, sociometric ratings, observation). Thus, to provide more comparable contrasts, we further compared the meta-analytic associations between early attachment security and social competence and broadband dimensions of early temperament emotionality and social competence according to assessment type (see Table 6, Figure 3). Focusing first on difficult temperament, findings indicated that the 85% *CI* for the meta-analytic association between early attachment security (assessed via observation) and social competence (r = 0.19, 85% *CI* 0.17, 0.22) did not overlap with the 85% *CI*s for the meta-analytic association between difficult temperament and social competence when temperament was assessed via observation (r = 0.06, 85% *CI* -0.02, 0.14). In contrast, the 85% *CI*s did overlap when difficult temperament was assessed via report (r = 0.10, 85% *CI* 0.00, 0.20). However, the effect size for studies leveraging reports was identical to that from the total corpus of non-overlapping studies, and thus, the somewhat smaller corpus of studies employing reports of temperament (k = 58) might have contributed to the wider, overlapping confidence interval. Regarding type of social competence assessment, the 85% *CI*s overlapped when social competence was assessed via reported social skills (attachment security: r = 0.18, 85% *CI* 0.14, 0.22; difficult temperament: r = 0.10, 85% *CI* 0.02, 0.17), sociometric ratings (attachment security: r = 0.19, 85% *CI* 0.14, 0.24; difficult temperament: r = 0.09, 85% *CI* 0.02, 0.17), and observations (attachment security: r = 0.15, 85% *CI* 0.11, 0.19; difficult temperament: r = 0.09, 85% *CI* 0.02, 0.17). Turning to the smaller corpora of studies reporting on negative emotionality (k's = 4-29) and positive emotionality (k's = 4-23), regardless of how temperament and social competence were assessed, the 85% *CI*s for the meta-analytic associations overlapped. However, it is noteworthy that regardless of type of social competence assessment, the combined

association between early attachment security and social competence was significant, whereas none of the combined associations for negative and positive emotionality when disaggregated by type of temperament and social competence assessment were significant (see Table 6, Figure 3).

Discussion

This review provides the first meta-analytic estimates of the significance of individual differences in temperamental reactivity assessed in the early life course for children's social competence with peers and compares them with the meta-analytic association between early attachment security and social competence. Findings revealed that difficult temperament poses modest risk to children's social competence with peers. Further, when teasing apart children's negative and positive temperament characteristics, the findings were much the same, such that negative temperamental emotionality was associated with lower levels of social competence and positive temperamental emotionality was associated with higher levels of social competence. Nonetheless, findings from this meta-analytic review demonstrate that the magnitude of associations between early temperament, regardless of how it is defined, and social competence are small in magnitude when evaluated against field-specific and general criteria (Cohen, 1992; Funder & Ozer, 2019) and when compared to the meta-analytic association between early attachment security and children's social competence. Below, we elaborate on these findings and discuss findings from moderator analyses examining the developmental patterning of associations, as well as the role of methodological and sample characteristics in amplifying or attenuating the meta-analytic associations.

Across studies on the predictive significance of early temperament there is variability in the specific aspect of temperament examined in relation to children's social competence. To capture this variability, and in line with updates in the representation of the latent structure of temperament from factor analytic evidence, we conducted separate meta-analyses on difficult

temperament, negative emotionality, and positive emotionality. Regardless of the broadband dimension employed, the meta-analytic associations between temperamental characteristics reflecting emotional reactivity and social competence were significant (*r*s = 0.13-0.18). However, findings revealed that studies employing the same (v. different) informants and studies employing overlapping (v. non-overlapping) items (except in the meta-analysis on positive emotionality) produced significantly larger associations between temperament and social competence. When these studies were excluded, the meta-analytic associations were reduced (*r*s = 0.10), yet remained comparable across broadband dimensions.

One potential interpretation of this finding is that certain informants have better insight into children's temperamental reactivity and social competence. For example, if parents have the most in-depth knowledge of their children, we might expect larger meta-analytic associations when parents are the informants for both temperament and social competence. However, findings reported here regarding the moderating role of informant type do not support this interpretation because, as described below, different informants for temperament (teacher) and social competence (parent) produced larger combined effect sizes. Alternatively, evidence that informant and item overlap increased the magnitude of effect sizes is in line with arguments from some temperament scholars that such practices can produce effect sizes inflated by shared method variance (Eisenburg et al., 2000; Sanson et al., 2004). As such, these findings inform best practices for conducting research on temperament and social competence, suggesting that such practices should be avoided in future work by using multiple informants for both temperament and social competence assessments. Findings also inform future research by indicating that studies on early temperamental reactivity and social competence generally featured moderate samples that are underpowered to detect the meta-analytic associations free of

overlap reported here (median N = 121, median power for one-tailed tests = 29%), increasing the risk of false positives and negatives. Such evidence signals the need for larger, well-powered samples in this literature (note: N = 617 is required to detect r = .10 [one-tailed] with 80% power).

Moreover, despite compelling arguments regarding the potential for broadband temperament dimensions to obscure the effects of specific temperament constructs (Zentner & Shiner, 2012), findings from this meta-analysis provided little evidence that specific temperament constructs are more strongly associated with social competence than others. Specifically, although the magnitude of meta-analytic associations with social competence differed for some specific temperament constructs (i.e., activity, adaptability, approach/positive anticipation, fear, and soothability) compared to others in the total set of studies, the magnitude of such associations was reduced and no longer significant in the subset of studies in which overlapping reporters and overlapping items used to assess temperament and social competence were removed. Thus, differences among specific temperament constructs likely emerged due to differences in how the constructs were assessed, specifically, whether the construct had overlapping reporters or overlapping items with social competence.

In terms of characterizing the magnitude of the meta-analytic associations reported here, the associations between the early broadband temperament dimensions and children's social competence fall at Cohen's (1992) criteria of 0.10 for a small or weak effect size and at the criteria for evaluating effect sizes specific to psychological sciences for a small effect size (r = 0.10; Funder & Ozer, 2019) once overlapping informants and items are removed. Nonetheless, such standards for characterizing effect sizes are not without criticism (e.g., Ferguson, 2009; Lipsey & Wilson, 1993; McCartney & Rosenthal, 2000). Another useful approach is to compare

the magnitude of associations to meta-analytic estimates derived from other constructs relevant to the outcome of interest (Bakker et al., 2019; Ferguson, 2009; McCartney & Rosenthal, 2000). Given the proposed developmental significance of early temperament and attachment for children's social competence (Berlin et al., 2008; Booth-LaForce & Groh, 2018; Coplan & Bullock, 2012; Goldsmith & Harman, 1994; Eisenberg et al., 2009; Sanson et al., 2004), our prior meta-analysis on early attachment and children's social competence with peers offers a useful point of reference. Indeed, in designing and conducting the current meta-analysis, we endeavored to make the same methodological and analytic decisions as employed in our prior meta-analysis on early attachment and social competence to facilitate comparison. Findings indicated that the magnitude of the associations between temperamental reactivity, regardless of broadband dimension, and social competence (rs = 0.10) were significantly smaller than the meta-analytic association between early attachment security and children's social competence (r = 0.19; Groh et al., 2014). Such evidence indicates that both early attachment security and, to a lesser extent, early broadband dimensions of temperament emotionality are associated with the development of children's social competence with peers.

However, it is important to note that consistent with the nature of measures of attachment in the early life course, our meta-analysis comprised assessments of individual differences in the quality of attachment based on direct observations by trained raters. In contrast, the vast majority of studies on early temperament and social competence employ parent or teacher reports (>80%). Further, differences may exist between the literatures on attachment and temperament in terms of the type of social competence outcomes examined. Thus, we compared the meta-analytic effects for early attachment and temperament emotionality according to type of temperament and social competence assessment. When observations of temperament were used, the meta-analytic

association for early attachment security (r = 0.19) was stronger than the meta-analytic association for difficult temperament (r = 0.06). However, the meta-analytic associations were comparable for early attachment security and difficult temperament when temperament was assessed via reports and regardless of how social competence was assessed. These findings suggest that differences between the meta-analytic associations for early attachment security and difficult temperament may depend on how temperament is assessed. For negative and positive emotionality, although the meta-analytic associations for these broadband temperament dimensions with social competence were not significant when disaggregated by type of temperament and social competence assessment, the meta-analytic associations for early attachment security and temperament did not differ. However, the smaller number of studies on negative emotionality (ks = 4-29) and positive emotionality (ks = 4-23) contribute to wider, easily overlapping confidence intervals for these comparisons.

Another useful comparison is that of the meta-analytic association between self-regulation and children's social competence, given that some temperament approaches have included children's self-regulation under the umbrella of temperament constructs. A recent meta-analysis examined the association between self-regulation assessed in childhood (M age = 5.0 ± 2.3 years) and social competence (Robson et al., 2020). Facilitating comparison to the current meta-analysis, Robson and colleagues (2020) reported that in a subset of studies in which self-regulation was assessed in early childhood (i.e., prior to school entry), the meta-analytic association between early self-regulation and social competence was r = 0.22. Thus, the meta-analytic association between early self-regulation and children's social competence was larger than that for broadband dimensions of early temperamental reactivity (rs = 0.10) and comparable to that for early attachment security (r = 0.19). However, there are several key differences

between the Robson and colleagues' (2020) meta-analysis and the current meta-analysis that are important to note. First, the meta-analytic estimates reported here for temperamental reactivity are based on a large corpus of studies (*k*s = 29-75) increasing precision in the estimate of effect sizes, whereas the meta-analytic estimates for the link between early self-regulation and social competence was based on a small set of studies (*k* = 5; Robson et al., 2020). Moreover, Robson and colleagues (2020) included studies employing the same informant for self-regulation and social competence (Aro et al., 2007) and studies in which items used to assess self-regulation and social competence overlapped (Lengua et al., 2015), which as discussed, can increase associations. Further, Robson and colleagues (2020) included studies that reported on social competence composites that included negative behaviors in the peer context that overlap with externalizing and internalizing symptomatology (Hubert et al., 2017).

The magnitude of the meta-analytic associations reported here between broadband dimensions of temperamental reactivity and social competence with peers seem to diverge somewhat from characterizations of the significance of temperament for social competence presented in narrative reviews of the literature. For example, after reviewing the literature, Coplan and Bullock (2012) concluded that, "It seems clear that from early childhood to adolescence temperament makes a unique, substantive, and integral contribution to the quality and quantity of children's social interactions, friendships, and experiences within the broader peer group" (p. 454). Further, in a review by Eisenberg and colleagues (2009), they state that, "…negative emotionality and global measures of difficult temperament tend to be negatively related to a variety of measures of peer competence. Positive emotionality is generally positively related to peer status and competence…" (p. 484). Similarly, Sanson and colleagues (2004) suggest that "There are clear linkages between temperament and…socially competent

functioning…" (p. 159) and that "A large body of research shows that temperament directly affects peer relationships, the most common finding being that temperamental inhibition predicts withdrawal from peers…" (p. 150). In line with these reviews, the meta-analytic associations between the broadband temperament dimensions and social competence were significant, robust and meaningful. However, evidence from this quantitative synthesis also provides a tempered characterization of the magnitude of these associations. Indeed, in light of these prior narrative reviews, the predictive significance of early difficult temperament, negative emotionality, and positive emotionality for children's peer competence is not as strong as one would have expected. In light of such differences, it is worth noting that potential differences in scope between the narrative reviews and this meta-analysis might have contributed to the divergent conclusions drawn. For example, although these prior narrative reviews were primarily focused on temperament assessed in the early life course in relation to children's social competence with peers, the reviews might have included studies in which temperament was assessed beyond the age range examined here (0-6 years). Further, although it is common for researchers to examine social competence, internalizing symptoms, and externalizing symptoms as different indices of adjustment, there is overlap in the behaviors that define these indices (e.g., Bornstein et al., 2010). As such, although the focus of the current meta-analysis was on positive social competence with peers, it is likely that narrative reviews include studies that employ assessments of children's negative behaviors with peers that overlap with externalizing and/or internalizing behaviors (e.g., aggression, social withdrawal). In addition, such reviews might not have been sensitive in excluding studies employing overlapping informants for temperament and social competence, or they may have been more selective in focusing on temperament constructs from specific conceptual approaches to temperament. Moreover, differences may have emerged due to

limitations of narrative reviews (e.g., reviewer bias, selective reviewing) more generally, that meta-analyses are less prone to due to the use of a structured, standardized methodology of quantitatively summarizing literatures (Cooper & Rosenthal, 1980).

In light of evidence from this meta-analysis, considering why the meta-analytic association between temperamental reactivity and social competence with peers was weak is important. One possibly is that the extent to which temperamental reactivity affects children's social competence with peers is dependent on the environmental context. As previously discussed, temperament scholars have noted that temperamental reactivity might influence behaviors with peers through environmental elicitation (i.e., evocative *r*GE processes; Knafo & Jaffee, 2013; Zentner & Shiner, 2012). That is, a child's temperamental reactivity influences how their peers respond to them (e.g., a temperamentally difficulty child evokes negative peer reactions). In considering a peer's response, however, it is important to note that how a peer responds to a child might also depend on the temperamental reactivity of the peer. Indeed, recent research provides evidence for an interaction effect between children's temperamental reactivity and their peers' temperamental reactivity in predicting their adjustment (Johns et al., 2019).

Moreover, in light of evidence from this meta-analysis, considering other ways in which temperament contributes to children's social competence, beyond direct effects, might prove useful. For example, some temperament scholars have proposed that temperament might serve as a moderating factor that impacts the degree to which other early experiences contribute to social competence (Rothbart & Bates, 2006). Indeed, according to differential susceptibility theory (Belsky, 1997; Ellis et al., 2011), temperamental characteristics (e.g., difficult temperament) are thought to serve as susceptibility factors that heighten children's sensitivity to positive and negative environmental inputs for better and for worse. In line with this theory, meta-analytic

evidence indicates that the association between positive parenting and more positive adjustment and negative parenting and negative adjustment is stronger for children with more (v. less) difficult temperaments and for children with higher (v. lower) levels of negative emotionality (Slagt et al., 2016).

The Significance of Early Temperamental Reactivity for Social Competence Across Development

To examine whether links between early temperamental emotional reactivity and social competence change over the course of development, we examined the role of age of temperament assessment and time between temperament and social competence assessments in moderating the meta-analytic associations between broadband temperament dimensions (difficulty, negative emotionality, positive emotionality) and social competence in longitudinal studies. Focusing first on age of temperament assessment, for both difficult temperament and negative emotionality, age at which temperament was assessed emerged as a significant moderator of the meta-analytic association in the total set of longitudinal studies. Of note, the moderating effect of age of temperament assessment dropped to non-significant in the subset of studies without overlapping informants and items. However, the estimates of the slope (slope = 0.04-0.05) were comparable in both the total set and non-overlapping set of studies. Thus, the smaller set of studies in the non-overlapping subset (difficult temperament: total - k = 45, u = 116, non-overlapping - k = 26, u = 59; negative emotionality: total – k = 29, u = 65, non-overlapping – k = 15, u = 19) might have reduced statistical power. These findings indicate that later assessments of temperament produce larger associations between difficult temperament and children's social competence. Some conceptual approaches to temperament allow for developmental change in temperament over the course of infancy due to maturation (e.g.,

Goldsmith et al., 1987; Rothbart et al., 2000) and narrative and quantitative reviews suggest temperament becomes increasingly stable over the course of early childhood (Roberts & DelVecchio, 2000; Lemery et al., 1999; Rothbart et al., 2000). Thus, relatively earlier assessments of temperament might have weaker predictive significance for children's social competence because systems involved in children's emotional reactivity are still developing.

To evaluate the enduring versus transient nature of associations between early temperament and the development of social competence, we examined the moderating role of the time between temperament and social competence assessments. Among studies reporting on difficult temperament, when there was a longer (v. shorter) duration between temperament and social competence assessments, the meta-analytic association was weaker in the total set of longitudinal studies (age range: 4 – 145 months). Moreover, this effect was robust to the removal of studies reporting on overlapping informants and items. Such evidence is consistent with a transient model of development (Roisman & Fraley, 2013), in which the predictive significance of early difficult temperament for children's subsequent social competence wanes over the course of development approaching zero. Although the direction and magnitude of the effect of time between assessments on the meta-analytic association between negative emotionality and social competence was comparable to that of difficult temperament, the effect was not significant. As with age of temperament assessment, this might be due to the relatively small number of longitudinal studies in the negative emotionality corpus.

In light of these findings, it is important to note that studies with later temperament assessments are more likely to have shorter time intervals between temperament and social competence assessments. Thus, we focused on the subset of longitudinal studies in analyses to disentangle these effects. However, even in the longitudinal set of studies on difficult

temperament, age of temperament assessment and time between assessments are still moderately associated (r = -0.36). To further examine the unique effect of age and time between assessments on the meta-analytic association between difficult temperament and children's social competence, we conducted a meta-regression in which both variables were entered simultaneously. However, neither age nor time between assessments emerged as significant moderators. In light of such evidence, future research should employ longitudinal designs comprising multiple waves of temperament and social competence assessments that would facilitate distinguishing between the effects of age and time between assessments, as well as allow for more sophisticated statistical modeling to evaluate the transient versus enduring nature of associations (Roisman & Fraley, 2013).

In the small corpus of studies on positive emotionality and children's social competence, time between assessments did not moderate the association between positive emotionality and social competence in the total set or non-overlapping subset of longitudinal effect sizes. Age of temperament assessment was found to moderate the association between positive emotionality and social competence, such that the earlier temperament was assessed the stronger the association between positive emotionality and social competence. However, this effect was no longer significant in the non-overlapping subset of longitudinal effect sizes. Caution is warranted in interpreting these findings, as there were few longitudinal studies in the total set (k = 8, u = 9) and the interval between assessments was somewhat shorter for positive emotionality (12-102 months) than for difficult temperament (4-145 months) and negative emotionality (5-145 months).

The Role of Methodological Differences

Across the literature on temperament and social competence, studies vary in their use of different temperament measures, which stem from different conceptual approaches to temperament. Thus, in the current meta-analysis, we tested whether the significance of difficult temperament, negative emotionality, and positive emotionality for social competence differed according to the measure used to assess temperament. The magnitude of the meta-analytic association between difficult temperament and children's social competence did not differ according to temperament measure in the total set of studies. However, the effect size for Buss and Plomin's (1975; 1984) measures decreased from $r = 0.11$ in the total set of studies to $r = 0.01$ in the non-overlapping subset of studies, and in the non-overlapping subset, the combined association for Buss and Plomin's measures was smaller (essentially nil) compared to measures from other approaches. These findings might be explained by the fact that Buss and Plomin's Emotionality, Activity, and Sociability (Buss & Plomin, 1984) measure has overlapping items with social competence (i.e., "Makes friends easily"). Furthermore, Buss and Plomin's measures are the narrowest in scope, including only dimensions of emotionality, activity, and sociability. Their measures also do not differentiate between different forms of negative and positive affect, and include only 20 items that are general (e.g., "Child cries easily"), with relatively few items (5) per dimension.

Turning next to the type of temperament measure, we examined whether the use of reports compared to observations moderated meta-analytic associations between broadband dimensions of temperamental reactivity and children's social competence with peers. For difficult temperament, again findings differed in the total set compared to the non-overlapping subset of studies. Specifically, observations produced a smaller meta-analytic association ($r =$

0.06) compared to reports (r = 0.14) in the total set of effect sizes. However, when effect sizes with overlapping informants and items were removed, there were no differences between temperament reports (r = 0.10) and observations (r = 0.06). Such evidence suggests that the difference in magnitude of the meta-analytic effect between reports and observations in the total set of studies might be attributed to the use of overlapping informants or items for temperament reports. Moreover, for negative and positive emotionality, the meta-analytic associations with social competence did not differ according to whether temperament was assessed via report or observations. These findings are striking in light of the longstanding debate in the temperament literature regarding how to best assess temperament (Gartstein et al., 2012; Rothbart, 2012). Specifically, temperament scholars have debated the tradeoffs in leveraging questionnaires versus observations of temperament, noting that reports might be prone to reporter bias (Kagan, 2009; 2011) and that observational assessments might not capture the full range of children's temperament across contexts (Gartstein et al., 2012; Putnam et al., 2008). Moreover, questionnaires and observations of temperament tend to be only weakly to modestly correlated (e.g., Kiel & Hummel, 2017; Olino et al., 2013; Seifer et al., 1994). Our results indicate that once overlapping informants and items were removed, reports and observations of temperamental characteristics produce comparable estimates of the developmental significance of early temperamental reactivity for children's social competence with peers.

Regarding different temperament informants, we examined differences in the meta-analytic association between temperamental reactivity and social competence among studies using parent, teacher, and observer informants. Findings indicated that for difficult temperament, negative emotionality, and positive emotionality, the meta-analytic association between temperamental reactivity and social competence was larger for studies using teacher informants

compared to parent or observer informants in the total sets and non-overlapping set of effect sizes (note: there were too few studies in the non-overlapping subset to conduct comparisons for positive emotionality). Although parent informants produced larger meta-analytic associations for difficult temperament and negative emotionality with social competence than observer informants in the total set, this difference was not robust to the removal of sources of reporter and item overlap. Regarding the difference in effect sizes across broadband dimensions of temperament for teacher compared to parent and observer informants, researchers have proposed that temperament informants will attend to information that is both available and relevant to them (Teglasi et al., 2015). Thus, such evidence might suggest that teachers are especially in-tune to aspects of temperamental reactivity in children that are relevant to social competence with peers. Compared to parents, teachers may have greater access to children's temperamental reactivity in the same context in which many peer group interactions occur (e.g., the classroom; recess) and compared to observers, teachers view children's temperamental reactivity over longer periods of time. Further, teacher informants observe children in groups of similar age peers, perhaps giving them greater ability to characterize a child's temperamental reactivity relative to other children. That said, some important caveats should be noted in interpreting the medium to large effect sizes for teacher informants of temperament (*r*s = 0.29-0.52). First, the number of studies using teacher informants were relatively small (*k*s = 10-17 for difficult temperament, 3-8 for negative emotionality, 3-6 for positive emotionality). Second, out of the 9 studies showing outlying effects, 7 used teacher informants for temperament (Izard et al., 2008; Mendez et al., 2002; Nozadi et al., 2018; Sendil, 2010). Although the outlying effects were winsorized based on the full sample in analyses, they may have been influential in affecting the

size of the combined association in the smaller subset of studies using teacher informants for temperament.

Turning to methodological differences in the assessment of social competence, differences in the magnitude of the meta-analytic association between temperamental reactivity and children's social competence with peers did not emerge according to type of social competence measure (reported social skills, sociometric ratings, observations) in either the total set or non-overlapping set of studies for any of the broadband temperament dimensions. Such findings support theoretical models, which propose that temperamental reactivity should have broad implications for the different components of social competences (Eisenberg et al., 2009; Hay et al., 2004; Rubin et al., 2006). In the total set of studies, the meta-analytic associations with social competence for difficult temperament and negative emotionality were found to be larger when parent informants of social competence were used. However, this difference was no longer significant when effect sizes with informant and item overlap were removed. The magnitude of the combined association between positive emotionality and social competence was smaller when peer informants of social competence were used compared to all other informants in the total set of studies; however, this difference was no longer significant in the non-overlapping set of effect sizes. Given the divergence of findings across broadband temperament dimensions and the overlapping versus non-overlapping sets of studies, any differences between social competence informants should be interpreted with caution.

The Role of Sample Characteristics and Publication Status

We examined the moderating role of several sample characteristics across studies on the meta-analytic association between broadband temperament dimensions (difficulty, negative emotionality, positive emotionality) and social competence with peers. Findings indicated that

the meta-analytic association between early temperament (regardless of broadband dimension) and social competence did not significantly differ for girls and boys. Such evidence is striking when considering evidence from prior meta-analytic work examining sex differences in temperament constructs (Else-Quest et al., 2006). Specifically, findings from this prior meta-analysis revealed some weak to moderate (*r*s = 0.05-0.26) differences in mean levels of specific temperament constructs comprising the broadband dimensions of negative and positive emotionality examined here. Evidence from this meta-analysis builds on these prior findings suggesting that despite evidence for some mean-level differences between boys and girls in specific temperament constructs, the predictive significance of early broadband dimensions of difficult temperament, negative emotionality, and positive emotionality for children's social competence is comparable for boys and girls.

The meta-analytic association between early temperamental reactivity and social competence with peers did not differ for studies reporting on samples characterized by low versus middle/high SES for the corpus of studies on difficult temperament or negative emotionality. For the corpus of studies on positive emotionality, the meta-analytic association was stronger for studies reporting on samples characterized by low SES (r = 0.47) compared to studies reporting on samples characterized by high SES (r = 0.14) in the total set of effect sizes. There were too few studies in the low SES group (k = 1; u = 1) to conduct moderator analyses in the non-overlapping subset for the positive emotionality meta-analysis. Although our results provide some evidence that positive emotionality may be a stronger predictor of social competence with peers in low SES samples, it is important to note that this effect is affected by four out of five effect sizes in which studies have overlap in informants and should be interpreted with caution. Thus, taken together, these findings provide little evidence for a diathesis stress

model in which the predictive significance of early temperament characteristics is theorized to be strongest in economically deprived populations (Lengua & Wachs, 2012).

We examined whether publication status (published in a peer reviewed journal v. not published in a peer-reviewed journal) moderated the meta-analytic association between temperamental reactivity and social competence. Publication status did not emerge as a significant moderator in the meta-analyses for difficult temperament, negative emotionality, or positive emotionality. Such evidence suggests that the meta-analytic association between temperamental reactivity and social competence was not affected by publication bias.

Limitations

The findings of the current meta-analysis should be interpreted in light of its limitations. First, when surveying the sample characteristics of this literature, the homogeneity of sample characteristics is striking, with over 80% of studies comprising middle/high SES samples and fewer than 15% of samples comprising children from racial/ethnic minority backgrounds. Further, over 60% of the studies were conducted in the United States. The lack of diversity in the samples is consistent with a recent report indicating that fewer than 12% of studies published in top developmental journals from 2010-2020 focused on race (Roberts et al., 2020). Accordingly, there have been recent calls for a greater focus on diverse samples in developmental science in order to determine whether findings are generalizable or are specific to a sociocultural context (Roisman, 2021). Given the sample homogeneity in the current meta-analysis, it is unknown whether the findings generalize beyond White, middle-to-upper class North American samples and additional research with more diverse samples (in terms of race/ethnicity, socioeconomic status, risk status, geography) are sorely needed.

The lack of diverse samples in this literature is also evident in the moderator analyses examining the role of risk status. Findings indicated that the meta-analytic association between early difficult temperament and children's social competence with peers did not significantly differ by risk status in the total set of studies. However, out of 140 independent samples, only 4 were at-risk. Moreover, the relative lack of at-risk samples in this literature precluded the evaluation of risk status for the corpus of studies on difficult temperament in the non-overlapping subset and for the corpora of studies on negative and positive emotionality.

We would be remiss if we did not note some limitations of the search procedures conducted for this meta-analysis. Search procedures precluded articles that were not published in English, which can represent a mono-language bias and may have contributed to the lack of diversity in the sample characteristics (Johnson, 2021). Further, our search process did not include requesting unpublished data from researchers. That said, publication status did not moderate the meta-analytic associations, and there are several reasons why publication bias might not be a particularly serious concern in the temperament literature. Specifically, in this literature, it is a common practice to report associations for various temperament constructs (e.g., Bohlin & Hagekull, 2009; Jianduan et al., 2009; Russell et al., 2003). Thus, the temperament literature may better represent non-significant as well as significant findings in the peer-reviewed, published literature. In addition, it is common for studies to examine temperament as a covariate in the analyses of studies that have hypotheses unrelated to temperament as a central focus. Such practices lower the likelihood that publication bias will affect the reported effect sizes. Moreover, the combined effect sizes for broadband dimensions of temperamental reactivity and social competence were 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 et al., 2000).

The Significance of Early Temperament and Early Attachment for Social Competence with Peers: Toward a Reconciliation

A key goal of this meta-analysis was to evaluate evidence in relation to predictions about the developmental antecedents of social competence with peers using two dominant theories in the field: attachment theory and temperament theories. Research on attachment and temperament is typically conducted in parallel, which can create a sense that either attachment *or* temperament is relevant for children's developmental outcomes. However, findings from this meta-analysis, along with those from our prior meta-analysis (Groh et al., 2014), provide evidence that early attachment and early temperamental reactivity, regardless of broadband dimension, contribute to children's social competence with peers. Findings also indicated that early attachment security may play a more salient and enduring role than early temperamental reactivity in children's positive peer behavior. However, such evidence regarding the relative contribution of early attachment security and temperamental reactivity to children's social competence is not without caveats. For example, more specific comparisons revealed that differences in the magnitude of the meta-analytic associations between attachment security and difficult temperament may emerge for some assessments of temperament (i.e., observations), but not others (i.e., reports). Further, it is possible that differences between the theories guiding research on temperament and attachment contributed to subtle differences in research design or focus that might further explain the differences in the meta-analytic associations with social competence for early temperamental reactivity and attachment security. For example, as informed by the expected significance of attachment security for interpersonal functioning within close relationships, a

substantial number of studies on early attachment and social competence assessed children's social competence with friends (k = 23), allowing for a comparison of the meta-analytic effect according to friendship status (Groh et al., 2014). In contrast, few studies examined links between early temperament and children's behaviors with friends (k = 3; Dunn & Cutting, 2001; Tarullo et al., 2011; Tung et al., 2018), precluding moderator analyses in this meta-analysis.

Given prior meta-analytic evidence that early attachment security and temperamental reactivity are only weakly associated (r = 0.07; Groh et al., 2017), findings presented here together with meta-analytic evidence for the role of early attachment in children's social competence (Groh et al., 2014) suggest that early temperamental reactivity and attachment security may play a complementary role in the development of children's social competence. Thus, an important next step is to reconcile the parallel literatures on the developmental significance of early attachment and temperament. In the current meta-analysis, only 9 studies (6%) included both temperament and attachment assessments. Future research on children's social competence that incorporates measures of both temperament and attachment might facilitate reconciliation of the literatures on early attachment and temperament. Although such an approach presents challenges given the time and resources required for including some measures, particularly those typically employed in evaluating the quality of early attachment (e.g., Strange Situation procedure; Ainsworth et al., 1978), such efforts might be achieved through increased collaboration among temperament and attachment scholars.

Further, this integrative approach might serve to move research beyond a focus on the independent contribution of attachment and temperament to a focus on how attachment and temperament might work together to shape the development of children's social competence, an approach that might increase the explanatory power of early attachment and temperament for

children's social competence. The differential susceptibility framework is one possibility for integrating attachment theory and temperament theories (Belsky, 1997; Van IJzendoorn & Bakermans-Kranenburg, 2012; Vaughn et al., 2008). As noted above, according to the differential susceptibility framework, temperament characteristics (difficulty, negative emotionality) are thought to heighten children's sensitivity to positive and negative environmental inputs for better and for worse. Thus, it might be expected that early temperament plays an important role in moderating the predictive significance of attachment security for children's social competence. Specifically, the predictive significance of early secure versus insecure attachment for higher versus lower levels of social competence might be stronger for children whose temperament heightens their sensitivity to the environment. Although some evidence has emerged to support this perspective (McElwain et al., 2012; Gilissen et al., 2008; for reviews see Van IJzendoorn & Bakermans-Kranenburg, 2012; Vaughn & Bost, 2016), further research is necessary to determine whether the differential susceptibility framework will prove useful in reconciling the attachment and temperament literatures into a unified framework for understanding the antecedents of children's social competence with peers.

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Table 1
Summary Statistics of Included Studies and Moderators

Variable	Total
Studies (Effect sizes; Children)	140 (382; 49,891)
Publication Status[a, b]	
Peer Reviewed	115 (82%)
Not Peer Reviewed	25 (18%)
Country[a]	
United States	90 (64%)
Canada	10 (7%)
China	6 (4%)
Netherlands	6 (4%)
United Kingdom	5 (4%)
Australia	4 (3%)
Turkey	3 (2%)
Italy	3 (2%)
Other Countries (≤ 1% each)	13 (9%)
Race/Ethnicity [a]	
White or European American	81 (58%)
Asian or Asian American	7 (5%)
Black or African American	4 (3%)
Hispanic or Latino	1 (<1%)
Mixed Racial/Ethnic Composition	11 (8%)
Not Reported	36 (26%)
Child Sex[b]	
Male	38 (10%)
Female	35 (9%)
Mixed Sex	309 (81%)
Socioeconomic Status (SES)[b]	
Medium/High SES	341 (89%)
Low SES	41 (11%)
Risk Status[b]	
At Risk	6 (2%)
Mixed Risk	9 (2%)
Not at Risk	367 (96%)
Study Design	
Longitudinal	116 (30%)
Cross-Sectional	266 (70%)

Table 1
Continued

Variable	Total
Temperament Measure[b, c]	
Thomas & Chess	88 (23%)
Buss & Plomin	55 (14%)
Rothbart	123 (32%)
Goldsmith	51 (13%)
Other	65 (17%)
Type Temperament Measure[b, c]	
Report	334 (87%)
Observation	43 (11%)
Mixed	5 (1%)
Temperament Informant[b, c]	
Parent	284 (74%)
Teacher	36 (9%)
Observer	44 (12%)
Combined	18 (5%)
Type Social Competence Measure[b, c]	
Report	245 (64%)
Sociometric	68 (18%)
Observation	68 (18%)
Mixed	1 (<1%)
Social Competence Informant[b, c]	
Parent	74 (19%)
Teacher	159 (42%)
Peer	46 (12%)
Self	16 (4%)
Observer	70 (18%)
Combined	17 (4%)
Informant Overlap[b, c]	
Same Informant	110 (29%)
Different Informant	272 (71%)
Item Overlap[b, c]	
Overlapping	78 (20%)
No Overlap	225 (59%)
Undetermined	79 (21%)
No Overlap Subset[b]	161 (42%)

Table 1
Continued

Variable	*M* (*SD*)	*Range*	*Mdn*
Sample Size[a]	356.36 (1047.21)	28-7,695	124
Publication Year[a]	--	1985-2019	2011
Child Sex (*M* % male per study)	51% (21%)	0-100%	50%
Age at Temperament Assessment (months)[c]	43.65 (18.99)	0.28-78.90	48.99
Age at Social Competence Assessment (months)[c]	57.12 (23.35)	12.00-180.00	54.63
Longitudinal Lag Range[c, d]	41.94 (35.35)	0.85-145.00	34.99

Notes. [a]Numbers are reported using *k* (studies). [b]Numbers represent the number of effect sizes. [c]Used as a moderator in analyses. [d]Lag reported for longitudinal studies only.

Table 2
Difficult Temperament and Social Competence

	Total Set						No Overlap Subset					
	[a]*k*	# ES	*z*	95% CI	*r*	[b]*F* value	[a]*k*	# ES	*z*	95% CI	*r*	[b]*F* value
Overall Effect	140	382	0.13	0.11, 0.16	0.13	--	75	161	0.10	0.06, 0.13	0.10	
Informant overlap												
Different informants	106	272	0.09	0.01, 0.17	0.09	37.10***	--	--	--	--	--	--
Same informant	47	110	0.23	0.16, 0.29	0.23		--	--	--	--	--	--
Item Overlap[a]												
No overlap	100	225	0.11	0.04, 0.18	0.11	10.10**	--	--	--	--	--	--
Overlapping	52	78	0.18	0.11, 0.25	0.18	7.64**	--	--	--	--	--	--
Undetermined	21	79	0.16	0.07, 0.25	0.16	0.80	--	--	--	--	--	--
Child Sex												
Male	13	38	0.14	0.04, 0.25	0.14	[c]2.64	11	26	0.17	0.05, 0.29	0.17	[c]2.12
Female	12	35	0.06	-0.05, 0.17	0.06		10	22	0.08	-0.05, 0.21	0.08	
Mixed	117	309	0.14	0.02, 0.26	0.14		56	113	0.08	-0.05, 0.22	0.08	
SES												
Middle/High	119	341	0.13	0.01, 0.26	0.13	1.35	61	138	0.10	-0.07, 0.26	0.10	0.00
Low	22	41	0.17	0.08, 0.26	0.17		14	23	0.09	-0.03, 0.21	0.09	
Risk Status												
At Risk	4	6	0.08	-0.10, 0.25	0.08	[d]0.62	2	3	0.15	-0.08, 0.38	0.15	--
Not At Risk	132	367	0.14	-0.07, 0.35	0.14		73	158	0.09	-0.30, 0.48	0.09	
Mixed Risk	4	9	0.06	-0.12, 0.23	0.06		--	--	--	--	--	
Publication Status												
Peer Reviewed	115	306	0.14	0.02, 0.25	0.14	0.08	60	122	0.10	-0.04, 0.24	0.10	0.14
Not Peer Reviewed	27	76	0.13	0.04, 0.21	0.13		16	39	0.08	-0.03, 0.19	0.08	

Table 2
Continued

	Total Set						No Overlap Subset					
	[a]*k*	# ES	*z*	95% CI	*r*	[b]*F* value	*k*[a]	# ES	*z*	95% CI	*r*	[b]*F* value
Temp. Measure												
Thomas & Chess	25	88	0.17	0.08, 0.26	0.17	2.07	4	12	0.06	-0.11, 0.23	0.06	0.23
Buss & Plomin	20	55	0.11	0.02, 0.20	0.11	0.71	11	19	0.01	-0.10, 0.12	0.01	7.14**
Rothbart	52	123	0.11	0.04, 0.19	0.11	1.78	29	58	0.13	0.03, 0.24	0.13	3.50^{+}
Goldsmith	23	51	0.10	0.01, 0.18	0.10	1.90	17	40	0.06	-0.05, 0.17	0.06	1.74
Type Temp. Measure												
Report	121	334	0.14	0.02, 0.26	0.14	3.52^{+}	58	127	0.10	-0.04, 0.24	0.10	0.29
Observation	21	43	0.06	-0.02, 0.15	0.06	6.25**	16	32	0.06	-0.05, 0.17	0.06	1.29
Mixed	4	5	0.22	0.05, 0.24	0.22	1.50	2	2	0.25	0.02, 0.47	0.25	--
Temp. Informant												
Parent	100	284	0.11	0.02, 0.20	0.11	12.06***	46	108	0.07	-0.04, 0.17	0.07	6.97**
Teacher	17	36	0.37	0.28, 0.45	0.35	63.76***	10	14	0.30	0.18, 0.41	0.29	25.36***
Observer	21	44	0.05	-0.04, 0.14	0.05	8.54**	17	33	0.06	-0.05, 0.17	0.06	1.66
Combined	8	18	0.24	0.12, 0.36	0.24	4.87**	4	6	0.25	0.07, 0.42	0.25	4.72**
						[e]63.17***						[e]30.76***
						[f]3.93*						[f]0.04
						[g]58.64***						[g]23.49***
Type SC Measure												
Report	104	245	0.14	0.06, 0.23	0.14	1.95	47	90	0.10	-0.01, 0.20	0.10	0.00
Sociometric	33	68	0.10	0.02, 0.18	0.10	2.68	25	44	0.09	-0.00, 0.19	0.09	0.00
Observation	29	68	0.13	0.05, 0.21	0.13	0.02	15	27	0.09	-0.01, 0.20	0.09	0.00
Mixed	1	1	0.20	-0.16, 0.56	0.20	--	--	--	--	--	--	--

Table 2
Continued

	Total Set						No Overlap Subset					
	[a]*k*	# ES	*z*	95% CI	*r*	[b]*F* value	*k*[a]	# ES	*z*	95% CI	*r*	[b]*F* value
SC Informant												
Parent	32	74	0.18	0.10, 0.26	0.18	5.42*	8	10	0.17	0.04, 0.30	0.17	3.29^{+}
Teacher	68	159	0.11	0.04, 0.19	0.11	2.65	39	85	0.08	-0.02, 0.17	0.08	2.26
Peer	23	46	0.10	0.01, 0.19	0.10	1.66	19	29	0.13	0.02, 0.24	0.13	1.14
Self	8	16	0.06	-0.08, 0.20	0.06	1.69	3	9	-0.00	-0.20, 0.19	-0.00	--
Observer	29	70	0.14	0.06, 0.22	0.14	0.00	15	28	0.10	-0.01, 0.20	0.10	0.02
Combined	6	17	0.27	0.14, 0.41	0.26	6.94**	--	--	--	--		--

Notes. # ES = number of effect sizes; Temp. = Temperament; SC = Social competence; [a]*k* refers to the number of studies in each analysis; [b]*F* values compare each subset to all other effects, unless otherwise specified; comparisons were only conducted when $k \geq 4$; [c]Boys v. Girls; [d]Risk v. No Risk; [e]Parent v. Teacher Report; [f]Parent v. Observer; [g]Teacher Report v. Observer; ***$p < .001$; **$p < .01$; *$p < .05$; $^{+}p < .10$

Table 3
Negative Emotionality and Social Competence

	Total Set						No Overlap Subset					
	[a]*k*	# ES	*z*	95% CI	*r*	[b]*F* value	[a]*k*	# ES	*z*	95% CI	*r*	[b]*F* value
Overall Effect	93	172	0.14	0.11, 0.17	0.14		42	69	0.10	0.05, 0.15	0.10	
Informant overlap												
Different informants	66	118	0.10	-0.01, 0.21	0.10	13.57***	--	--	--	--	--	--
Same informant	32	54	0.21	0.12, 0.30	0.21		--	--	--	--	--	--
Item Overlap[a]												
No overlap	37	48	0.11	0.02, 0.21	0.11	4.86*	--	--	--	--	--	--
Overlapping	57	97	0.20	0.11, 0.29	0.20	10.93**	--	--	--	--	--	--
Undetermined	15	27	0.10	-0.02, 0.21	0.10	1.34	--	--	--	--	--	--
Child Sex												
Male	7	13	0.08	-0.07, 0.22	0.08	[c]0.53	4	6	0.13	-0.10, 0.36	0.13	--
Female	5	9	0.03	-0.14, 0.19	0.03		3	3	0.14	-0.13, 0.41	0.14	
Mixed	81	150	0.15	-0.02, 0.32	0.15		35	60	0.09	-0.18, 0.36	0.09	
SES												
Middle/High	82	156	0.13	-0.07, 0.33	0.13	1.13	36	60	0.10	-0.18, 0.37	0.10	0.05
Low	11	16	0.18	0.05, 0.32	0.18		6	9	0.11	-0.09, 0.31	0.11	
Risk												
At Risk	2	2	0.03	-0.28, 0.22	-0.03	--	1	1	0.17	-0.21, 0.56	0.17	--
Not At Risk	89	169	0.14	-0.16, 0.44	0.14		41	68	0.10	-0.57, 0.76	0.10	
Mixed Risk	2	5	0.17	-0.07, 0.41	0.17		--	--	--	--	--	
Publication Status												
Peer Reviewed	78	151	0.14	-0.03, 0.30	0.14	0.01	35	59	0.10	-0.17, 0.36	0.10	0.08
Not Peer Reviewed	16	21	0.13	0.01, 0.25	0.13		7	10	0.12	-0.08, 0.31	0.12	

Table 3
Continued

	Total Set						No Overlap Subset					
	[a]*k*	# ES	*z*	95% CI	*r*	[b]*F* value	*k*[a]	# ES	*z*	95% CI	*r*	[b]*F* value
Temp. Measure												
Thomas & Chess	15	25	0.13	0.01, 0.25	0.13	0.01	--	--	--	--	--	--
Buss & Plomin	19	32	0.13	0.02, 0.25	0.13	0.00	10	12	0.03	-0.14, 0.20	0.03	2.73
Rothbart	26	46	0.14	0.04, 0.24	0.14	0.06	9	15	0.18	0.01, 0.34	0.18	2.98^{+}
Goldsmith	18	35	0.10	-0.01, 0.21	0.10	1.36	13	26	0.05	-0.10, 0.21	0.05	1.68
Type Temp. Measure												
Report	77	137	0.14	0.01, 0.28	0.14	1.36	29	47	0.11	-0.08, 0.29	0.11	0.19
Observation	16	30	0.07	-0.04, 0.18	0.07	3.88^{+}	12	20	0.06	-0.10, 0.22	0.06	1.03
Mixed	4	5	0.23	0.06, 0.40	0.23	1.77	2	2	0.24	-0.04, 0.51	0.24	--
Temp. Informant												
Parent	68	125	0.12	0.00, 0.24	0.12	3.69^{+}	26	43	0.07	-0.10, 0.23	0.07	2.74
Teacher	8	10	0.46	0.33, 0.59	0.43	43.72***	3	4	0.47	0.28, 0.68	0.44	--
Observer	15	29	0.06	-0.05, 0.17	0.06	5.68*	12	20	0.06	-0.10, 0.22	0.06	1.03
Combined	5	7	0.22	0.06, 0.39	0.22	1.99	2	2	0.24	-0.04, 0.51	0.24	--
						[e]43.17***						--
						[f]2.86^{+}						[f]0.00
						[g]48.58***						--
Type SC Measure												
Report	70	115	0.15	0.03, 0.26	0.14	1.08	29	43	0.12	-0.07, 0.30	0.12	0.98
Sociometric	15	26	0.10	-0.01, 0.22	0.10	0.96	10	16	0.11	-0.07, 0.28	0.11	0.02
Observation	15	31	0.12	0.01, 0.24	0.12	0.14	4	10	-0.03	-0.24, 0.18	-0.03	3.10^{+}
Mixed	--	--	--	--	--	--	--	--	--	--	--	--

Table 3
Continued

	Total Set						No Overlap Subset					
	[a]*k*	# ES	*z*	95% CI	*r*	[b]*F* value	*k*[a]	# ES	*z*	95% CI	*r*	[b]*F* value
SC Informant												
Parent	25	40	0.19	0.08, 0.29	0.19	4.18*	8	10	0.18	-0.02, 0.38	0.18	1.53
Teacher	45	74	0.12	0.02, 0.21	0.12	1.60	24	41	0.10	-0.07, 0.27	0.10	0.01
Peer	11	17	0.10	-0.03, 0.23	0.10	0.58	8	10	0.12	-0.06, 0.31	0.12	0.17
Self	4	4	0.06	-0.16, 0.28	0.06	0.74	2	2	0.05	-0.27, 0.36	0.05	--
Observer	15	31	0.12	0.01, 0.24	0.12	0.14	4	10	-0.03	-0.24, 0.18	-0.03	3.10^{+}
Combined	3	6	0.25	0.07, 0.42	0.25	--	--	--	--	--	--	--

Notes. # ES = number of effect sizes; Temp. = Temperament; SC = Social competence; [a]*k* refers to the number of studies in each analysis; [b]*F* values compare each subset to all other effects, unless otherwise specified; comparisons were only conducted when $k \geq 4$; [c]Boys v. Girls; [d]Risk v. No Risk; [e]Parent v. Teacher Report; [f]Parent v. Observer; [g]Teacher Report v. Observer; ***p< .001; **p < .01; *p < .05; ^{+}p <.10

Table 4
Positive Emotionality and Social Competence

	Total Set						No Overlap Subset					
	[a]*k*	# ES	*z*	95% CI	*r*	[b]*F* value	[a]*k*	# ES	*z*	95% CI	*r*	[b]*F* value
Overall Effect	43	54	0.18	0.12, 0.24	0.18		29	36	0.10	0.06, 0.15	0.10	
Informant overlap												
Different informants	29	36	0.09	-0.09, 0.26	0.09	22.93***	--	--	--	--	--	--
Same informant	16	18	0.32	0.15, 0.48	0.31		--	--	--	--	--	--
Item Overlap[a]												
No overlap	21	24	0.21	0.01, 0.40	0.21	0.76	--	--	--	--	--	--
Overlapping	14	16	0.13	-0.07, 0.32	0.13	1.61	--	--	--	--	--	--
Undetermined	9	14	0.20	-0.01, 0.41	0.20	0.14	--	--	--	--	--	--
Child Sex												
Male	4	4	0.19	-0.07, 0.45	0.19	[c]2.41	4	4	0.17	-0.04, 0.37	0.17	[c]1.15
Female	4	4	0.04	-0.22, 0.30	0.04		4	4	0.02	-0.18, 0.22	0.02	
Mixed	36	46	0.19	-0.12, 0.50	0.19		22	28	0.10	-0.14, 0.33	0.09	
SES												
Middle/High	38	49	0.14	-0.15, 0.43	0.14	24.67***	28	35	0.10	-0.58, 0.77	0.07	--
Low	5	5	0.51	0.31, 0.71	0.47		1	1	0.14	-0.26, 0.54	0.14	
Risk												
At Risk	2	2	0.04	-0.29, 0.37	0.04	--	1	1	0.09	-0.24, 0.42	0.09	--
Not At Risk	41	52	0.19	-0.35, 0.72	0.19		28	35	0.10	-0.45, 0.65	0.10	
Mixed Risk	--	--	--	--	--		--	--	--	--	--	
Publication Status												
Peer Reviewed	32	40	0.17	0.25, 0.44	0.17	0.16	19	24	0.06	-0.14, 0.27	0.06	3.73[+]
Not Peer Reviewed	11	14	0.20	-0.01, 0.41	0.20		10	12	0.17	-0.00, 0.35	0.17	

Table 4
Continued

	Total Set						No Overlap Subset					
	[a]*k*	# ES	*z*	95% CI	*r*	[b]*F* value	*k*[a]	# ES	*z*	95% CI	*r*	[b]*F* value
Temp. Measure												
Thomas & Chess	8	13	0.24	0.02, 0.45	0.24	0.99	5	8	0.20	0.01, 0.40	0.20	3.70^{+}
Buss & Plomin	8	8	0.14	-0.08, 0.36	0.14	0.41	4	4	0.10	-0.11, 0.31	0.10	0.00
Rothbart	12	16	0.14	-0.06, 0.35	0.14	0.54	9	11	0.10	-0.09, 0.29	0.10	0.00
Goldsmith	7	8	0.11	-0.12, 0.35	0.11	0.84	6	7	0.08	-0.13, 0.28	0.08	0.14
Type Temp. Measure												
Report	37	47	0.19	-0.16, 0.55	0.19	1.74	23	29	0.10	-0.17, 0.37	0.10	0.14
Observation	6	7	0.07	-0.17, 0.32	0.07	--	6	7	0.08	-0.13, 0.29	0.08	--
Mixed	--	--	--	--	--	--	--	--	--	--	--	--
Temp. Informant												
Parent	29	36	0.13	-0.09, 0.35	0.13	7.51**	18	24	0.08	-0.13, 0.30	0.08	0.64
Teacher	6	7	0.58	0.42, 0.74	0.52	58.21***	3	3	0.42	0.17, 0.66	0.40	--
Observer	7	8	0.08	-0.15, 0.32	0.08	1.72	7	8	0.08	-0.11, 0.28	0.08	0.06
Combined	1	3	0.12	-0.28, 0.53	0.12	--	1	1	-0.13	-0.43, 0.17	-0.13	--
						[e]53.71***						
						[f]0.71						[f]0.00
						[g]90.06***						
Type SC Measure												
Report	32	38	0.19	-0.07, 0.44	0.19	0.20	17	22	0.08	-0.13, 0.28	0.08	0.86
Sociometric	8	10	0.10	-0.10, 0.30	0.10	1.85	8	9	0.12	-0.07, 0.31	0.12	0.21
Observation	5	6	0.26	0.03, 0.50	0.25	1.17	4	5	0.16	-0.07, 0.39	0.16	0.75
Mixed	--	--	--	--	--	--	--	--	--	--	--	--

Table 4
Continued

	Total Set						No Overlap Subset					
	[a]*k*	# ES	*z*	95% CI	*r*	[b]*F* value	*k*[a]	# ES	*z*	95% CI	*r*	[b]*F* value
SC Informant												
Parent	10	11	0.17	-0.03, 0.38	0.17	0.01	1	1	0.09	-0.24, 0.42	0.09	--
Teacher	22	27	0.19	-0.00, 0.38	0.19	0.13	17	22	0.08	-0.12, 0.29	0.08	0.55
Peer	6	6	0.01	-0.19, 0.21	0.01	7.38**	6	6	0.13	-0.07, 0.34	0.13	0.39
Self	1	2	0.01	-0.44, 0.45	0.01	--	1	2	0.01	-0.35, 0.36	0.01	--
Observer	5	6	0.26	0.03, 0.50	0.25	1.17	4	5	0.16	-0.07, 0.39	0.16	0.75
Combined	2	2	0.27	0.06, 0.49	0.26	--	--	--	--	--	--	--

Notes. # ES = number of effect sizes; No Overlap = set of studies without informant overlap. Temp. = Temperament; SC = Social competence; [a]*k* refers to the number of studies in each analysis; [b]*F* values compare each subset to all other effects, unless otherwise specified; comparisons were only conducted when $k \geq 4$; [c]Boys v. Girls; [d]Risk v. No Risk; [e]Parent v. Teacher Report; [f]Parent v. Observer; [g]Teacher Report v. Observer; ***p< .001; **p < .01; *p < .05; [+]p <.10

Table 5
Temperament Constructs and Social Competence

	Total Set						No Overlap Subset					
	[a]*k*	# ES	*z*	95% CI	*r*	[b]*F* value	[a]*k*	# ES	*z*	95% CI	*r*	[b]*F* value
Activity	33	42	0.07	0.00, 0.15	0.07	7.56**	15	20	0.05	-0.05, 0.12	0.05	2.27
Adaptability	8	8	0.24	0.12, 0.37	0.24	4.34*	2	2	0.04	-0.21, 0.29	0.04	--
Anger/Irritable Distress	47	61	0.14	0.07, 0.20	0.14	0.05	30	38	0.12	0.04, 0.20	0.12	1.81
Approach/Positive Anticipation	10	11	0.28	0.16, 0.39	0.27	9.10**	3	3	0.11	-0.10, 0.32	0.11	--
Fear	69	95	0.16	0.10, 0.23	0.16	4.48*	16	18	0.07	-0.04, 0.17	0.07	0.88
High Intensity Pleasure	1	1	0.20	-0.13, 0.53	0.20	--	1	1	0.20	-0.08, 0.49	0.20	--
Intensity	10	13	0.11	-0.00, 0.23	0.11	0.21	3	3	0.19	-0.05, 0.43	0.19	--
Mood	7	7	0.18	0.05, 0.31	0.18	0.59	1	1	0.15	-0.20, 0.50	0.15	--
Negative Emotionality	2	2	0.19	-0.03, 0.41	0.19	--	1	1	0.22	-0.01, 0.45	0.22	--
Positive Affect	21	22	0.18	0.09, 0.27	0.18	2.50	9	10	0.08	-0.05, 0.20	0.08	0.18
Rhythmicity	11	15	0.11	0.00, 0.21	0.11	0.40	1	3	0.04	-0.20, 0.29	0.04	--
Sadness	6	9	0.02	-0.12, 0.16	0.01	3.71^{+}	6	9	0.01	-0.13, 0.15	0.01	2.63
Sensory Sensitivity/Threshold	9	12	0.08	-0.03, 0.18	0.08	2.05	5	8	0.11	-0.02, 0.24	0.11	0.10
Smiling/Laughter	3	3	0.24	0.03, 0.45	0.24	--	--	--	--	--	--	--
Sociability	8	8	0.17	0.05, 0.29	0.17	0.52	--	--	--	--	--	--
Soothability	15	15	0.23	0.13, 0.33	0.23	7.13**	4	4	0.14	-0.06, 0.33	0.14	0.30
Other Blend	49	93	0.11	0.04, 0.19	0.11	1.43	27	48	0.12	0.01, 0.22	0.12	1.20

Notes. # ES = number of effect sizes; [a]*k* refers to the number of studies in each analysis; [b]*F* values compare each subset to all other effects; comparisons were only conducted when $k \geq 4$. ***$p < .001$; **$p < .01$; *$p < .05$; $^{+}p < .10$

Table 6
Comparisons between effect sizes for temperament and attachment by type of assessment

	Secure v. Insecure Attachment			Difficult Temperament			Negative Emotionality			Positive Emotionality		
	r	*85% CI*	*k*	*r*	*85% CI*	*k*	*r*	*85% CI*	*k*	*r*	*85% CI*	*k*
Attachment/Temperament												
Report	--	--	--	0.10[a,b]	0.00, 0.20	58	0.11[a,b]	-0.03, 0.24	29	0.10[a,b]	-0.09, 0.30	23
Observation	0.19[a]	0.17, 0.22	80	0.06[b]	-0.02, 0.14	12	0.06[a,b]	-0.06, 0.18	12	0.08[a,b]	-0.13, 0.22	7
Social Competence												
Reported Social Skills	0.18[a]	0.14, 0.22	47	0.10[a]	0.02, 0.17	47	0.12[a]	-0.02, 0.25	29	0.08 [a]	-0.07, 0.23	17
Sociometric Rating	0.19[a]	0.14, 0.24	22	0.09[a]	0.02, 0.17	25	0.11[a]	-0.02, 0.23	10	0.12[a]	-0.02, 0.26	8
Observation	0.15[a]	0.11, 0.19	43	0.09[a]	0.02, 0.17	15	-0.03[b]	-0.18, 0.12	4	0.16 [a]	-0.002, 0.33	4

Note. ***$p < .001$. **$p < .01$. *$p < .05$. Effect sizes that share a superscript have overlapping confidence intervals and do not significantly differ from one another. Effect sizes were compared within Attachment/Temperament reports and observations and separately for each type of social competence assessment.

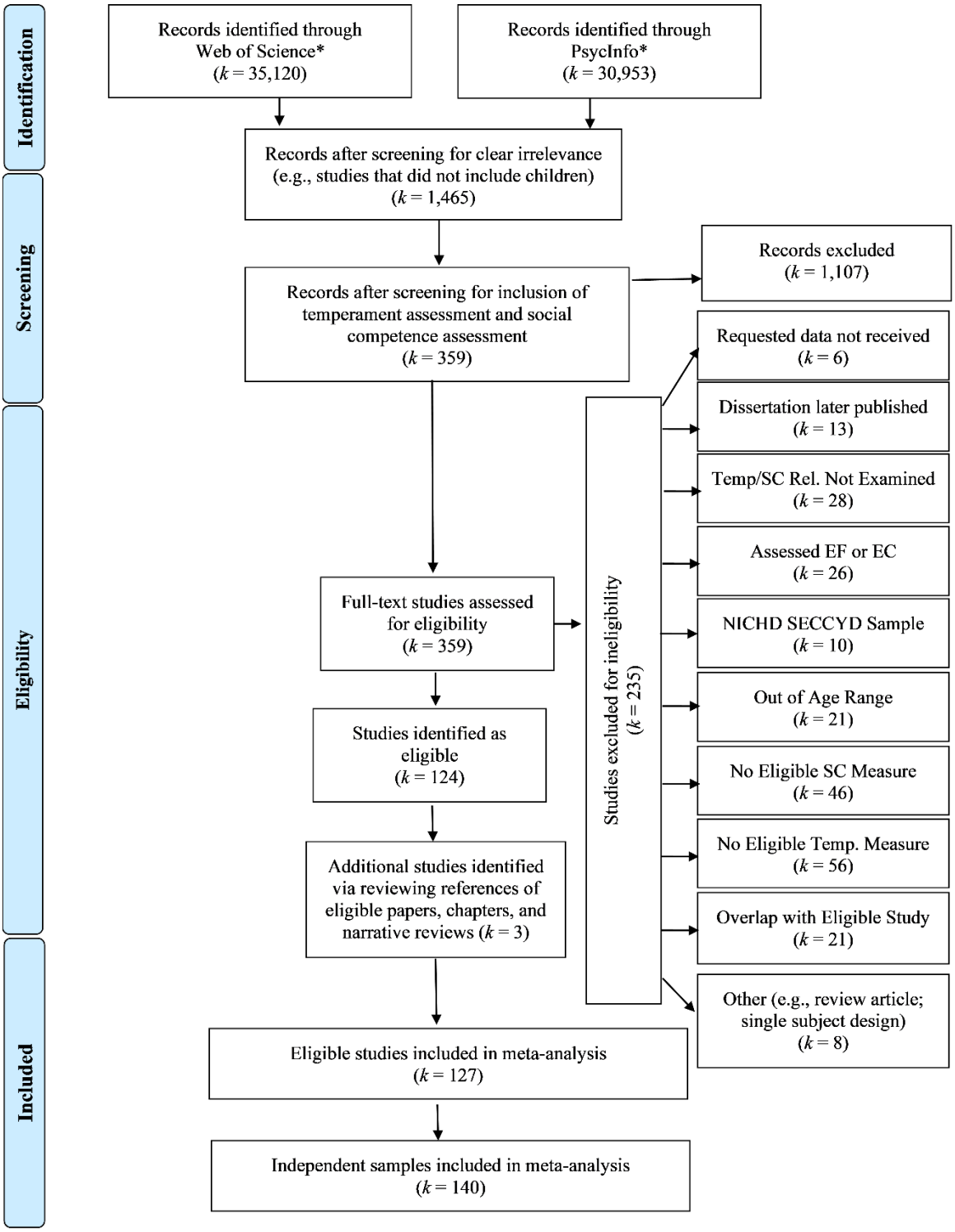

Figure 1. Flow chart of study identification. A list of excluded studies is available in the online supplementary materials (https://osf.io/9xkms/?view_only=f9935e8ed138492f83df885d0dd98096).

*Searches were conducted between September 13, 2016 and November 10, 2019.

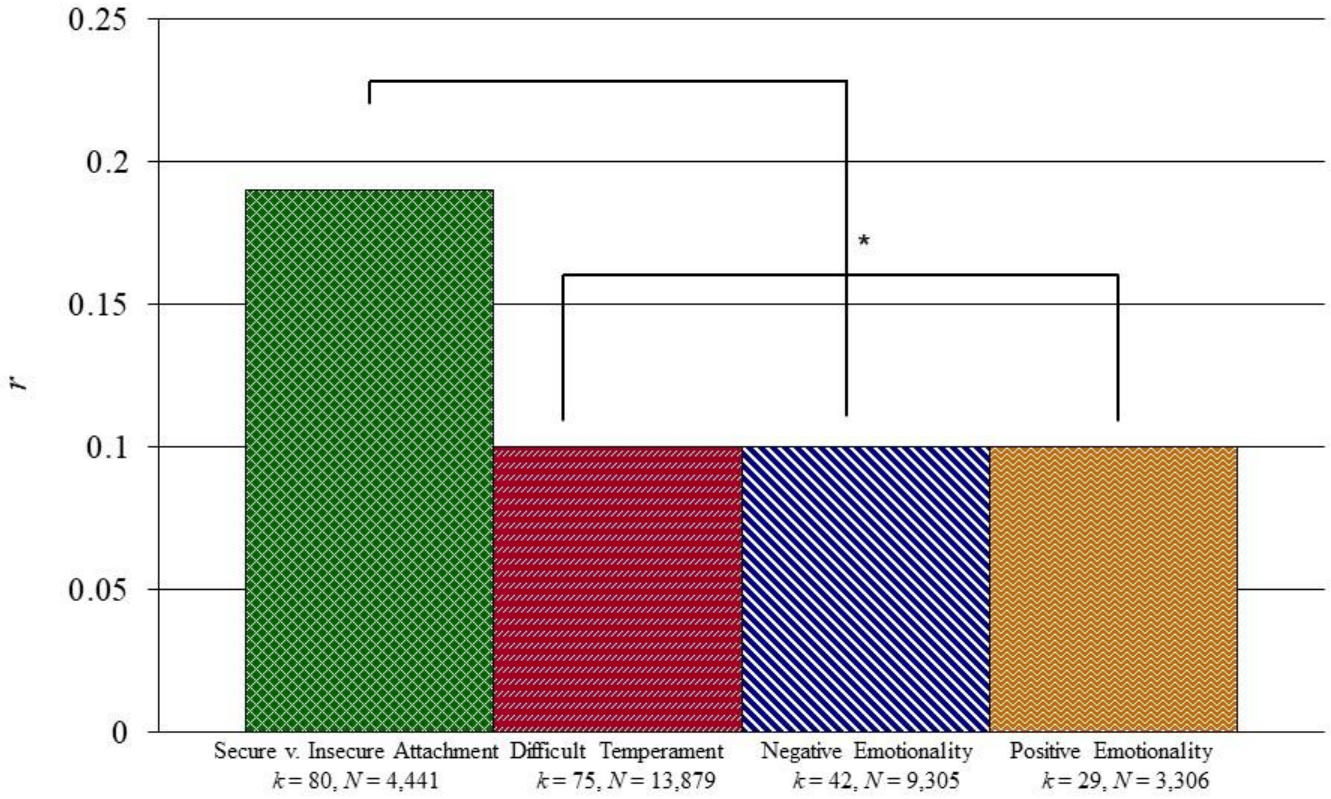

Figure 2. Comparison of effect sizes of secure v. insecure attachment, difficult temperament, negative emotionality, and positive emotionality on social competence. Brackets between bars indicate significant differences between effect sizes. *p <.05.

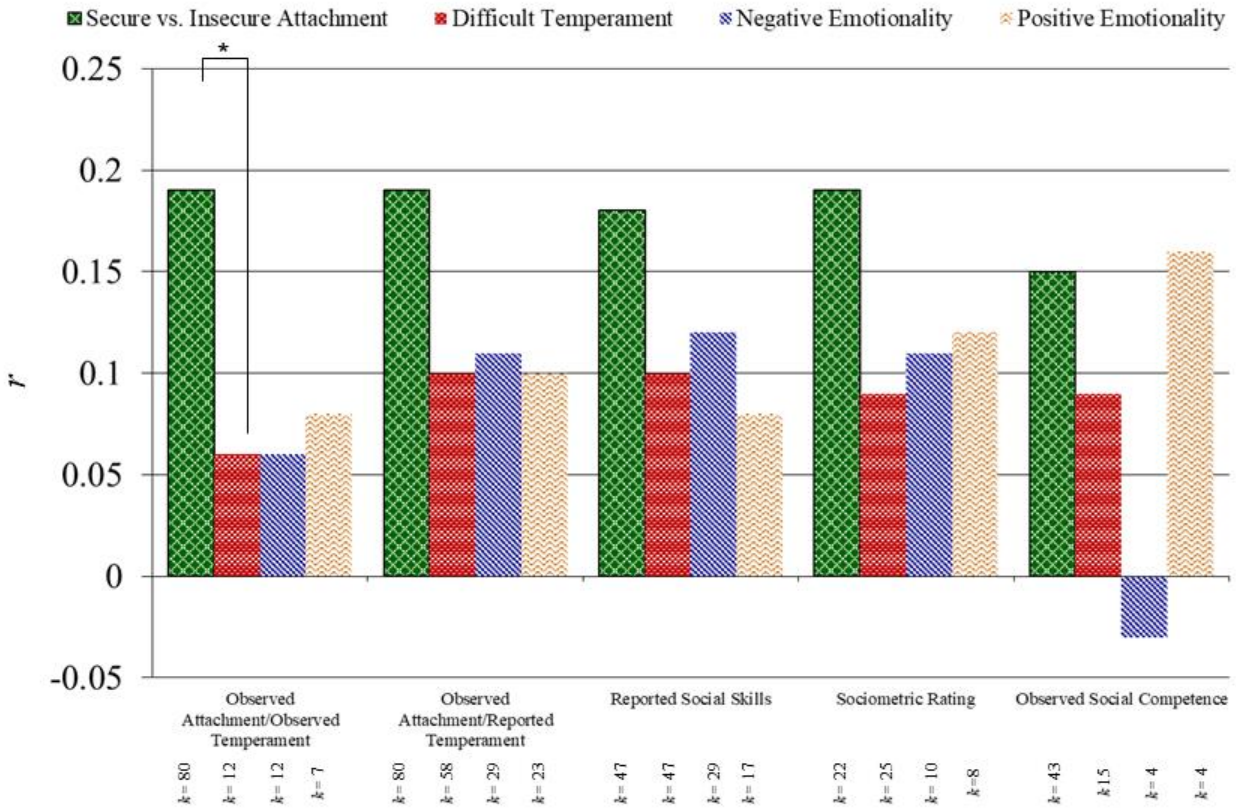

Figure 3. Comparison of effect sizes among secure v. insecure attachment, difficult temperament, negative emotionality, and positive emotionality on social competence by type of assessment. Brackets between bars indicate significant differences between effect sizes. *p <.05.

Appendix

Table of studies with sample descriptions, moderators, and effect sizes.

Table A1
Table of studies with sample descriptions, moderators, and effect sizes

Source[a]	Sample	Age Temp. Assessment (Months)	Time Between Assessments[b]	Temp. Measure	Type Temp. Measure	Temp. Informant	Type SC Measure	SC Informant	Temp. Construct	Effect[c]	n[d]
Acar et al., 2015		45.67	11.76	Rothbart	Rep	Parent	Obs	Observer	Fear	0.19 0.23 0.12	40
Adessky, 1997[1]	Male	73.98		Buss & Plomin	Rep	Parent	Socio	Peer	Sociability Fear Anger Activity	0.00[g] 0.00[g] 0.00 0.00	106
Adessky, 1997[2]	Female	73.98		Buss & Plomin	Rep	Parent	Socio	Peer	Sociability Fear Anger Activity	0.00[g] 0.00[g] 0.00 0.00	83
Arace et al., 2019[1]	Female	25.89		Other	Rep	Parent	Rep	Teacher	Fear Anger Pos. Affect Activity	0.00 0.00 0.00 0.00	293
Arace et al., 2019[2]	Male	25.89		Other	Rep	Parent	Rep	Teacher	Fear Anger Pos. Affect Activity	0.00 0.15 0.14 0.00	232
Armentrout, 1995		54		Thomas & Chess	Rep	Parent	Rep	Self	Fear Blend	0.06 0.35	46

Table A1
Continued

Source[a]	Sample	Age Temp. Assessment (Months)	Time Between Assessments[b]	Temp. Measure	Type Temp. Measure	Temp. Informant	Type SC Measure	SC Informant	Temp. Construct	Effect[c]	n[d]
Auerbach-Major, 1997[1]	Male	44.5		Rothbart	Rep	Parent	Obs	Observer	Blend	0.37 0.00 0.31 0.07	53
							Socio	Peer		0.17 0.27	
Auerbach-Major, 1997[2]	Female	44.5		Rothbart	Rep	Parent	Obs	Observer	Blend	0.00 0.20 0.02 0.13	43
							Socio	Peer		-0.10 -0.26	
Balkaya et al., 2018		54.12		Rothbart	Rep	Parent	Rep	Teacher	Fear	0.16[g]	152
Barnett et al., 2010		42.03		Goldsmith	Obs	Observer	Rep	Parent	Anger	0.16	127
Basset et al., 2017; Fettig, 2016	Basset	48.35		Rothbart	Rep	Parent	Obs	Observer	Blend	0.02[g]	228
	Fettig	48.1					Rep	Teacher		-0.05	243
Berdan et al., 2008	Mixed Risk	54	12	Rothbart	Rep	Parent	Rep	Self	Blend	0.07[g]	200
							Socio	Peer		-0.21[g]	
Berzenski, 2014	Low SES	49.05		Goldsmith	Obs	Observer	Rep	Teacher	Blend	-0.08	167

Table A1
Continued

Source[a]	Sample	Age Temp. Assessment (Months)	Time Between Assessments[b]	Temp. Measure	Type Temp. Measure	Temp. Informant	Type SC Measure	SC Informant	Temp. Construct	Effect[c]	n[d]
Blair & Peters, 2003	Low SES	58		Rothbart	Rep	Parent	Rep	Teacher	Fear Anger	-0.18 0.10	42
Blair et al., 2004		44.39		Rothbart	Rep	Parent	Rep	Teacher	Blend	0.02 0.09	153
Bohlin & Hagekull, 2009		12.5	89.5	Thomas & Chess	Rep	Parent	Rep	Combined	Anger	0.00[f]	96
		34	68	Buss & Plomin					Sociability Fear Neg. Emo. Activity	0.32[f,g] 0.41[f,g] 0.30[f] -0.28[f]	
Bosquet & Egeland, 2006	Low SES	0.28	65.72	Other	Obs	Observer	Rep	Teacher	Blend	0.10	155
Bowen et al., 1995[1]	Male	60[e]		Other	Rep	Parent	Socio	Peer	Fear	0.11	220
Bowen et al., 1995[2]	Female	60[e]		Other	Rep	Parent	Socio	Peer	Fear	0.21	159
BrajsaZganec & Hanzec, 2014		61.62		Buss & Plomin	Rep	Parent	Rep	Parent	Fear Anger Activity	0.29[f,g] 0.11[f] -0.07[f]	258
Briggs-Gowan & Carter, 1998		22.9		Buss & Plomin	Rep	Parent	Rep	Parent	Sociability Soothability Anger Activity	0.14[f] 0.24[f] 0.06[f] 0.02[f]	214

Table A1
Continued

Source[a]	Sample	Age Temp. Assessment (Months)	Time Between Assessments[b]	Temp. Measure	Type Temp. Measure	Temp. Informant	Type SC Measure	SC Informant	Temp. Construct	Effect[c]	n[d]
Broeren et al., 2013		73.08		Other	Rep	Parent	Rep	Parent	Fear	0.29[f,g]	224
Brophy-Herb et al., 2019	Low SES	48.98		Rothbart	Rep	Parent	Rep	Teacher	Blend	0.21	611
Buss et al., 2013		24.05	46.51	Goldsmith	Obs	Observer	Rep	Teacher	Fear	-0.01	55
Calkins et al., 1999		24		Goldsmith	Obs	Observer	Obs	Observer	Anger	0.42[f] 0.00[f]	51
Carson et al., 1987		25		Thomas & Chess	Rep	Parent	Rep	Teacher	Adaptability Intensity Fear Mood Activity Rhythmicity Sensory Sens.	0.08 0.05 0.13 0.06 0.03 -0.01 0.06	202
Carter et al., 1999		23.8		Buss & Plomin	Rep	Parent	Rep	Parent	Sociability Soothability Anger	0.18[f,g] 0.29[f] 0.13[f]	1235
Carter et al., 2003		12.2		Rothbart	Rep	Parent	Rep	Parent	Soothability Fear Smiling/Laugh. Anger Activity	0.27[f] 0.16[f] 0.35[f] 0.17[f] -0.02[f]	91
Chang et al., 2012	Male; Low SES	18	54	Other	Rep	Parent	Rep	Teacher	Anger	-0.03 0.02 0.03	202

Table A1
Continued

Source[a]	Sample	Age Temp. Assessment (Months)	Time Between Assessments[b]	Temp. Measure	Type Temp. Measure	Temp. Informant	Type SC Measure	SC Informant	Temp. Construct	Effect[c]	n[d]
Chen et al., 2014		24		Other	Obs	Observer	Rep	Parent	Fear	0.11	263
Cheung & Elliot, 2017		67.07		Rothbart	Rep	Parent	Socio	Peer	Fear	0.19[g] -0.06[g] -0.14[g]	132
Coplan & Rubin, 1998		51.56		Buss & Plomin	Rep	Parent	Rep	Teacher	Sociability Fear Neg. Emo. Activity	0.18[g] 0.28[g] 0.10 -0.08	296 296 295 294
Coplan et al., 2004		48.59		Buss & Plomin	Rep	Parent	Rep Obs Rep Obs	Teacher Observer Teacher Observer	Fear Anger	0.15[g] 0.23[g] 0.15 0.02	119
Corapci, 2008	Low SES	60.5		Other	Rep	Teacher	Rep Obs	Teacher Observer	Fear	0.12[g] 0.29[g]	113
Criss et al., 2002		60[e]	6	Other	Rep	Parent	Socio	Peer	Anger	0.12 0.17	455
De La Osa et al., 2014	At Risk	35.64		Rothbart	Rep	Parent	Rep	Parent	Blend	-0.01[g] -0.19[g]	612
Degnan et al., 2011; Walker et al., 2013	Degnan	9	51	Goldsmith	Obs	Observer	Obs	Observer	Blend	0.00[f]	206
	Walker	24			Rep	Parent			Fear	0.27[g]	570

Table A1
Continued

Source[a]	Sample	Age Temp. Assessment (Months)	Time Between Assessments[b]	Temp. Measure	Type Temp. Measure	Temp. Informant	Type SC Measure	SC Informant	Temp. Construct	Effect[c]	n[d]
DiBiase & Miller, 2015	Low SES	53.825		Rothbart	Rep	Parent	Rep	Teacher	Fear	-0.09[g]	94
Diener & Kim, 2004[1]	Male	36	5	Rothbart	Rep	Parent	Rep	Teacher	Fear Anger Activity	0.10[g] 0.54 0.30	63
Diener & Kim, 2004[2]	Female	36	5	Rothbart	Rep	Parent	Rep	Teacher	Fear Activity Anger	-0.02[g] 0.23[g] 0.19	47
DiLalla, 1998		60		Thomas & Chess	Rep	Parent	Obs	Observer	Blend	0.37	62
DiLalla et al., 2015		60		Thomas & Chess	Rep	Parent	Obs	Observer	Fear	0.20	177
Dollar & Stifter, 2012		55	21	Other	Rep	Observer	Obs Rep	Observer Parent	Blend	0.09[f] -0.04	81
Dollar et al., 2017		42	18	Goldsmith	Obs	Observer	Socio	Teacher	Fear Anger Pos. Affect Activity	0.10 0.31 0.13 -0.09	121
Dunn & Cutting, 1999		49.92		Buss & Plomin	Rep	Parent	Obs	Observer	Fear Anger	-0.02[g] -0.19	128

Table A1
Continued

Source[a]	Sample	Age Temp. Assessment (Months)	Time Between Assessments[b]	Temp. Measure	Type Temp. Measure	Temp. Informant	Type SC Measure	SC Informant	Temp. Construct	Effect[c]	n[d]
	Taylor	30	54	Rothbart	Comb Rep	Teacher Parent	Rep	Combined	Anger Fear	0.11[f] 0.12[f]	213
Eggum, 2010; Taylor et al., 2014; VanSchyndel et al., 2017	Eggum	41.745	31.29	Rothbart	Rep	Parent	Socio	Teacher	Sadness	-0.02	143
				Goldsmith	Obs	Observer	Socio	Teacher	Sadness	-0.04 0.02	
	VanSchyndel; Male	48	24	Goldsmith	Obs	Observer	Socio	Teacher	Pos. Affect	-0.26 0.09	123
	VanSchyndel; Female									-0.01	92
Eggum-Wilkens et al., 2014		60[d]	12	Rothbart	Rep	Parent	Rep	Teacher	Fear	0.09[g]	248
Eisenberg et al., 1993	Male	62.1	4	Rothbart Other	Rep	Combined Parent/Teach.	Rep	Combined	Blend Intensity	0.41[f] 0.65[f,h]	48
				Rothbart Other			Socio	Peer	Blend Intensity	0.46 0.33	
Eisenberg et al., 1993	Female	61.4	4	Rothbart Other	Rep	Combined Parent/Teach.	Rep	Combined	Blend Intensity	-0.13[f] 0.48[f]	45
				Rothbart Other			Socio	Peer	Blend Intensity	0.01 0.17	
Endendijk et al., 2014[1]	Cohort 1	27.97		Rothbart	Rep	Parent	Obs	Observer	Blend	0.30[g] 0.14	126

Table A1
Continued

Source[a]	Sample	Age Temp. Assessment (Months)	Time Between Assessments[b]	Temp. Measure	Type Temp. Measure	Temp. Informant	Type SC Measure	SC Informant	Temp. Construct	Effect[c]	n[d]
Endendijk et al., 2014[2]	Cohort 2	40.21		Rothbart	Rep	Parent	Obs	Observer	Blend	0.09[g] 0.11	65
Endendijk et al., 2014[3]	Cohort 3	55.14		Rothbart	Rep	Parent	Obs	Observer	Blend	0.37[g] 0.26	59
Evans et al., 2012		63		Buss & Plomin	Rep	Parent	Rep	Teacher	Anger Activity Sensory Sens.	0.10 0.01 0.00 -0.04 0.20 0.07	260
				Other							
Fabes et al., 2002		50.49		Other	Rep	Teacher	Socio	Peer	Anger	0.40	94
Fabes et al., 2001		59.2		Buss & Plomin	Rep	Teacher	Rep	Teacher	Anger	0.05[f]	57
Farver & Branstetter, 1994		49.4		Thomas & Chess	Rep	Parent	Rep Socio Obs	Teacher Observer	Blend	-0.10 0.22 0.34 -0.08	52
Feng et al., 2014		74.4		Rothbart	Rep	Teacher	Socio	Teacher	Fear	0.30[g]	54
Fogle, 2004	Low SES	53		Thomas & Chess	Rep	Parent	Rep	Combined	Fear Adaptability Intensity Activity	0.13[f,g] 0.26[f] 0.23[f] 0.37[f]	61

Table A1
Continued

Source[a]	Sample	Age Temp. Assessment (Months)	Time Between Assessments[b]	Temp. Measure	Type Temp. Measure	Temp. Informant	Type SC Measure	SC Informant	Temp. Construct	Effect[c]	n[d]
Frenkel et al., 2015		35	145	Goldsmith	Comb	Combined	Rep	Self	Fear	0.02	117
Genova-Lantham, 2014		57.38		Rothbart	Rep	Parent	Rep	Teacher	Smiling/Laugh. Sensory Sens.	0.12[g] -0.06	91
Gleason et al., 2005[1]	Male	54		Rothbart	Rep	Teacher	Socio	Peer	Soothability Activity	0.00 0.00	34
Gleason et al., 2005[2]	Female	54		Rothbart	Rep	Teacher	Socio	Peer	Soothability Activity	0.41 0.00	41
Grady & Hastings, 2018		42.24		Rothbart	Rep	Parent	Rep Obs	Teacher Observer	Fear	0.07[g] -0.21[g] 0.17[g] 0.06[g]	99
Graham & Coplan, 2012		56.88		Other	Rep	Parent	Rep	Self Teacher	Fear	0.10[g] 0.20[g]	79
Gulay, 2012		66		Thomas & Chess	Rep	Parent	Rep Socio Rep Socio Rep Socio	Teacher Peer Teacher Peer Teacher Peer	Intensity Fear Rhythmicity	0.20 0.27 0.29 0.21 0.24 0.26	140
He et al., 2017		36	24	Other	Comb	Combined	Rep	Teacher Parent	Fear	0.17[f,g] 0.22[f,g]	153

Table A1
Continued

Source[a]	Sample	Age Temp. Assessment (Months)	Time Between Assessments[b]	Temp. Measure	Type Temp. Measure	Temp. Informant	Type SC Measure	SC Informant	Temp. Construct	Effect[c]	n[d]
Hertsberg & Zebrowski, 2016	Mixed Risk	57.72		Rothbart	Rep	Parent	Socio	Self	Blend	-0.20[g] 0.06[g]	28
Hinde et al., 1993		49		Thomas & Chess	Rep	Parent	Obs	Observer	Intensity Fear Mood Activity	0.00 0.00 0.00 0.21	58
Hisley, 1990		68.55		Other	Rep	Parent	Rep	Self	Adaptability Fear Mood Activity Rhythmicity	-0.06 0.08 0.07 -0.03 -0.08 -0.08 0.12	53 51 53 53 53 52 52
Huelsman et al., 2014		53.07		Thomas & Chess	Rep	Parent	Rep	Teacher	Adaptability Intensity Fear Mood Activity Rhythmicity Sensory Sens.	0.21 -0.02 0.12 0.13 0.22 0.07 0.16	44
Izard et al., 2008[1]	Study 1; Low SES	46.68		Other	Rep	Teacher	Rep	Teacher	Blend Pos. Affect	0.29[f] 0.65[f,h]	179
Izard et al., 2008[2]	Study 2; Low SES	50.64		Other	Rep	Teacher	Rep	Teacher	Blend Pos. Affect	0.21[f] 0.65[f,h]	191

Table A1
Continued

Source[a]	Sample	Age Temp. Assessment (Months)	Time Between Assessments[b]	Temp. Measure	Type Temp. Measure	Temp. Informant	Type SC Measure	SC Informant	Temp. Construct	Effect[c]	n[d]
Jianduan et al., 2009		24.1		Thomas & Chess	Rep	Parent	Rep	Parent	Adaptability Intensity Fear Mood Activity Rhythmicity Sensory Sens.	0.29[f] 0.02[f] 0.20[f] 0.29[f] 0.16[f] 0.26[f] 0.19[f]	5323
Jokela, 2010		9	27	Thomas & Chess	Rep	Parent	Rep	Parent	Fear Mood Rhythmicity	0.06[f] 0.14[f] 0.04[f]	7695
Klein et al., 2018		37		Goldsmith	Obs	Observer	Rep	Teacher	Fear Anger	-0.18 0.12	124
Kochanska & Radke-Yarrow, 1992	Mixed Risk	30	3	Other	Obs	Observer	Obs	Observer	Fear	0.18[f] 0.07[f] -0.12[f] -0.01[f]	100
Kolak et al., 2013; Volling & Feagans, 1995	Kolak	24		Goldsmith	Rep	Parent	Rep	Parent	Fear Anger	0.33[f] 0.47[f]	110
	Volling	17.7	12	Rothbart	Rep	Parent	Obs	Observer	Pos. Affect Fear Anger Activity	0.20[g] 0.02 -0.02 0.07	36

Table A1
Continued

Source[a]	Sample	Age Temp. Assessment (Months)	Time Between Assessments[b]	Temp. Measure	Type Temp. Measure	Temp. Informant	Type SC Measure	SC Informant	Temp. Construct	Effect[c]	n[d]
Laible et al., 2017; Korucu et al., 2017	Laible	49.01	34.99	Thomas & Chess	Rep	Parent	Rep	Parent	Fear	0.38[f] 0.34[f] 0.26[f] 0.21[f]	158
									Anger	0.16[f] 0.24[f] 0.25[f] 0.14[f]	180
	Korucu; Low SES	53.69		Rothbart	Rep	Parent	Obs Rep	Observer	Sensory Sens.	-0.06 -0.06	212
Kushner et al., 2016	At Risk	49.8		Goldsmith	Obs	Observer	Rep	Parent	Blend	0.17	149
Lam et al., 2018		62.28		Rothbart	Obs	Parent	Rep	Teacher	Blend	0.11	258
Letcher et al., 2009[1]	Male	6	78	Thomas & Chess	Rep	Parent	Rep	Teacher	Fear Anger	-0.03 0.00	622 620
Letcher et al., 2009[2]	Female	6	78	Thomas & Chess	Rep	Parent	Rep	Teacher	Fear Anger	-0.08 -0.07	573 566
Lee, 2009	Low SES	57		Buss & Plomin	Rep	Parent	Rep	Parent	Anger	0.25[f]	214
Louie et al., 2015[1]	Asian American	45.79		Goldsmith	Obs	Observer	Rep	Teacher	Sadness Anger Pos. Affect	0.19 0.23 -0.10	43
Louie et al., 2015[2]	European American	45.79		Goldsmith	Obs	Observer	Rep	Teacher	Sadness Anger Pos. Affect	-0.03 -0.03 0.12	36

Table A1
Continued

Source[a]	Sample	Age Temp. Assessment (Months)	Time Between Assessments[b]	Temp. Measure	Type Temp. Measure	Temp. Informant	Type SC Measure	SC Informant	Temp. Construct	Effect[c]	n[d]
Louie et al., 2015[3]	Korean	45.79		Goldsmith	Obs	Observer	Rep	Teacher	Sadness Anger Pos. Affect	0.01 0.23 0.15	42
Magdalena, 2015		73.2		Rothbart	Rep	Parent	Rep	Teacher	Blend	0.00[g] 0.00[g]	45
Maszk et al., 1999		58		Other	Rep	Teacher	Socio	Peer	Intensity	0.16	70
Mathiesen & Prior, 2006		18	84	Buss & Plomin	Rep	Parent	Rep	Parent	Sociability Fear Anger Activity	0.13[g] 0.19[g] 0.20[f] -0.03[f]	401
Mathieson & Banerjee, 2010		30.7		Rothbart	Rep	Parent	Rep	Teacher	Blend	0.00[g] -0.06[g]	104
McElwain et al., 2014		32.67	6.14	Goldsmith	Rep	Parent	Obs	Observer	Fear Fear Fear Anger Anger Anger	0.13 0.11 0.13 0.01 0.03 -0.15	114 112 108 114 112 108
Mendez et al., 2002	Low SES	56.1		Other	Rep	Teacher	Rep	Teacher	Fear Adaptability Activity	0.65[f,g,h] 0.65[f,h] 0.41[f]	141
Modders , 1999	Low SES	54	22.8	Buss & Plomin	Rep	Parent	Rep	Teacher	Anger	0.22[g]	56

Table A1
Continued

Source[a]	Sample	Age Temp. Assessment (Months)	Time Between Assessments[b]	Temp. Measure	Type Temp. Measure	Temp. Informant	Type SC Measure	SC Informant	Temp. Construct	Effect[c]	n[d]
Moran et al., 2013		36.75		Rothbart	Rep	Parent	Rep	Parent	Fear Anger	0.20[f] 0.18[f]	306
				Goldsmith	Obs	Observer			Fear Anger	0.04 0.05	
Nelson et al., 1999		61	47	Goldsmith	Rep	Parent	Rep	Teacher	Activity Adaptability Intensity	0.16 0.18 0.40	75
NICHD$_1$	Female	6	48	Thomas & Chess	Rep	Parent	Rep Socio	Teacher	Blend	0.02 -0.09	436 364
			18				Obs	Observer		0.06	309
NICHD$_2$	Female; Low SES	6	48	Thomas & Chess	Rep	Parent	Rep Socio	Teacher	Blend	0.07 -0.02	45 29
			18				Obs	Observer		0.09	20
NICHD$_3$	Male	6	48	Thomas & Chess	Rep	Parent	Rep Socio	Teacher	Blend	0.04 0.05	452 338
			18				Obs	Observer		0.10	315
NICHD$_4$	Male; Low SES	6	48	Thomas & Chess	Rep	Parent	Rep Socio	Teacher	Blend	0.22 0.09	47 31
			18				Obs	Observer		0.38	17
Nozadi et al., 2018		51		Rothbart	Rep	Teacher	Rep	Teacher	Sadness Anger	0.45 0.65[h]	77
Oades-Sese et al., 2011	Low SES	56.04		Other	Rep	Teacher	Rep	Teacher	Fear Anger Activity	0.65[g] 0.45 0.42	207
Ortiz & Barnes, 2018		7.5	43.5	Other	Rep	Parent	Rep	Parent	Blend	0.09[f]	411

Table A1
Continued

Source[a]	Sample	Age Temp. Assessment (Months)	Time Between Assessments[b]	Temp. Measure	Type Temp. Measure	Temp. Informant	Type SC Measure	SC Informant	Temp. Construct	Effect[c]	n[d]
Parker, 2017		67.92		Rothbart	Rep	Parent Teacher Parent Teacher	Rep	Parent Teacher Teacher Parent	Blend	0.38[f] 0.59[f] 0.10 0.27	291
Peterson et al., 2018		9.68	17.195	Rothbart	Rep	Parent	Rep	Parent	Blend	0.03[f] 0.14[f]	6853
Pettit, 1999	Low SES	53.44		Buss & Plomin	Rep	Teacher	Rep Socio	Teacher Peer	Activity	0.13[f] 0.03	68
Porter, 2009		47.8		Other Rothbart	Obs Rep	Observer Parent	Obs	Observer	Fear Approach	0.01[f] 0.00[g] 0.00	54
Rissanen, 2011		57.84		Thomas & Chess	Rep	Teacher	Rep	Teacher	Fear	0.60[f]	94
Russell et al., 2003		56.905		Buss & Plomin	Rep	Parent	Rep	Teacher	Sociability Fear Anger Activity	0.14[g] 0.18[g] -0.06 0.02	369
Rydell et al., 2003		60	12	Other	Rep	Parent	Rep	Teacher	Fear Anger Pos. Affect	-0.08 0.22 -0.19	124
Sears, 1999		36	24	Rothbart	Rep	Parent	Socio	Peer	Blend	0.20	75

Table A1
Continued

Source[a]	Sample	Age Temp. Assessment (Months)	Time Between Assessments[b]	Temp. Measure	Type Temp. Measure	Temp. Informant	Type SC Measure	SC Informant	Temp. Construct	Effect[c]	n[d]
Sendil, 2010		64		Thomas & Chess	Rep	Teacher	Socio	Peer	Approach Rhythmicity Blend	0.65[g] 0.08 0.44	42
							Rep	Teacher	Approach Rhythmicity Blend	0.66[f,h] -0.09[f] 0.42[f]	
Sette et al., 2016		53.29		Rothbart	Rep	Parent	Rep	Teacher	Fear	0.08[g]	163
Sirois et al., 2019		25.4	53	Goldsmith	Rep	Parent	Rep	Parent	Anger	0.31[f]	86
Slagt et al., 2019		56.4		Rothbart	Rep	Parent	Rep	Teacher	Blend	-0.02 0.06	144
Smith-Donald et al., 2007	Low SES	60.5		Other	Rep	Observer	Rep	Teacher	Pos. Affect	0.14	63
Spegman & Houck, 2005	Low SES	12		Thomas & Chess	Rep	Parent	Rep	Parent	Blend	0.23[f]	126
Stams et al., 2002	At Risk	20	64	Other	Rep	Parent	Comb	Combined	Blend	0.20[f]	146
Streit et al., 2017[1]	Low SES; African American	15.11	111.97	Buss & Plomin	Rep	Parent	Rep	Teacher	Anger	0.08	254
Streit et al., 2017[2]	Low SES; European American	15	111.96	Buss & Plomin	Rep	Parent	Rep	Teacher	Anger	0.00	307

Table A1
Continued

Source[a]	Sample	Age Temp. Assessment (Months)	Time Between Assessments[b]	Temp. Measure	Type Temp. Measure	Temp. Informant	Type SC Measure	SC Informant	Temp. Construct	Effect[c]	n[d]
Strickland, 2013		60		Rothbart	Comb	Teacher	Rep	Parent	Blend	0.40	580
Sull, 1995		56		Thomas & Chess	Rep	Parent	Obs	Observer	Adaptability Intensity Fear Mood Activity Rhythmicity Sensory Sens.	0.46 -0.06 0.32 0.18 -0.21 0.04 0.10	89
Szewczyk-Sokolowski et al., 2005		54		Other	Rep	Parent	Socio	Peer	Fear Anger	0.10 0.28	98
Tarullo et al., 2011		45.6		Rothbart	Rep	Teacher	Socio Obs Socio	Teacher Observer Peer	Blend	0.19[f,g] 0.31[g] -0.13[g]	166 167 166
				Goldsmith	Obs	Observer	Socio Obs Socio	Teacher Observer Peer	Fear	0.00 0.10[f] -0.13	114
Taylor, 1985		64		Thomas & Chess	Rep	Parent	Rep	Self	Blend	0.00	57
Tolep, 2016	At Risk	49.8		Goldsmith	Obs	Observer	Rep	Parent	Blend Pos. Affect	0.17 0.09	156
Tout, 1998[1]	Male	39		Rothbart	Rep	Teacher	Socio	Peer	Blend	0.15[g] 0.48	65

Table A1
Continued

Source[a]	Sample	Age Temp. Assessment (Months)	Time Between Assessments[b]	Temp. Measure	Type Temp. Measure	Temp. Informant	Type SC Measure	SC Informant	Temp. Construct	Effect[c]	n[d]
Tout, 1998[2]	Female	39		Rothbart	Rep	Teacher	Socio	Peer	Blend	0.10[g] 0.14	54
Tung et al., 2019		36	12	Goldsmith	Rep	Parent	Rep	Self	Blend	-0.03	141
Van Hecke et al., 2007		15	15	Rothbart	Rep	Parent	Rep	Parent	Fear Soothability	-0.05[f,g] 0.04[f]	52
Vanier, 2006[1]	Sample 1	76.5		Buss & Plomin Rothbart	Rep	Parent	Rep	Parent	Fear Blend	0.21[f,g] -0.08[f]	197
Vanier, 2006[2]	Sample 2	78.9		Rothbart	Rep	Parent	Rep	Parent	Fear	0.05[f]	205
Vaughan, 2005		24	6	Goldsmith	Rep	Parent	Rep	Parent	Fear	0.04[f]	64
Verron & Teglasi, 2018		57.38		Rothbart	Rep	Parent	Rep	Teacher	Fear Smiling/Laugh. Soothability Approach Fear Sadness HI Pleasure Anger Anger Activity Sensory Sens.	0.26[g] 0.08[g] 0.04 0.12 0.04 -0.17 0.10 -0.01 -0.08 -0.06 -0.10	86 87 88 88 68 72 85 88 88 90 83

Table A1
Continued

Source[a]	Sample	Age Temp. Assessment (Months)	Time Between Assessments[b]	Temp. Measure	Type Temp. Measure	Temp. Informant	Type SC Measure	SC Informant	Temp. Construct	Effect[c]	n[d]
Walls, 1997		51.1		Rothbart	Rep	Parent	Rep	Teacher	Blend	0.10[g]	33
Wang & Saudino, 2015		35.88		Goldsmith	Rep	Parent	Rep	Parent	Pos. Affect	0.29[f]	582
Williams et al., 2016		8.7	67.26	Other	Rep	Parent	Rep	Teacher	Anger	0.01	2880
Wu et al., 2019		48		Buss & Plomin	Rep	Parent	Rep	Parent	Fear Soothability Anger	0.39[f,g] 0.26[f] 0.16[f]	4467
Zarra-Nezhad et al., 2018	Mixed Risk	36	12	Rothbart	Obs	Parent	Rep	Parent	Fear	0.38[f]	185
Zhang et al., 2017		33.3		Thomas & Chess	Rep	Parent	Rep	Combined	Blend	0.54[f]	118
Zhang, 2015		73.08		Rothbart	Rep	Teacher	Socio	Teacher	Fear	0.42[f,g]	162

Notes. [a]Sources that provided multiple independent samples are marked with numerical superscripts. [b]Time between temperament and social competence assessments is reported in months for longitudinal studies only. [c]Effect sizes are reported as Fisher's Zs. [d]Separate sample sizes are reported for effects when there was variation across a sample; in all other cases, one sample size is reported per sample. [e]Grade, not age was reported in manuscript and was therefore imputed (60 months for Kindergarten; 66 months for Kindergarten/First Grade). [f]Overlapping informants for temperament and social competence assessments. [g]Overlapping items for temperament and social competence assessments. [h]Winsorized effect size. Temp. = Temperament. SC = Social Competence. Rep = Report; Obs = Observation; Socio = Sociometric assessment. HI Pleas. = High Intensity Pleasure. Neg. Emo. = Negative Emotionality. Pos. Affect = Positive Affect. Sensory Sens. = Sensory Sensitivity. Smile/Laugh. = Smiling/Laughter.