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# Nature and Nurturing: Parenting in the Context of Child Temperament

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**Abstract** Accounting for both bidirectional and interactive effects between parenting and child temperament can fine-tune theoretical models of the role of parenting and temperament in children's development of adjustment problems. Evidence for bidirectional and interactive effects between parenting and children's characteristics of frustration, fear, self-regulation, and impulsivity was reviewed, and an overall model of children's individual differences in response to parenting is proposed. In general, children high in frustration, impulsivity and low in effortful control are more vulnerable to the adverse effects of negative parenting, while in turn, many negative parenting behaviors predict increases in these characteristics. Frustration, fearfulness, and effortful control also appear to elicit parenting behaviors that can predict increases in these characteristics. Irritability renders children more susceptible to negative parenting behaviors. Fearfulness operates in a very complex manner, sometimes increasing children's responses to parenting behaviors and sometimes mitigating them and apparently operating differently across gender. Important directions for future research include the use of study designs and analytic approaches that account for the direction of effects and for developmental changes in parenting and temperament over time.

**Keywords** Parenting · Temperament · Transaction · Interaction

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Extensive empirical evidence leaves little doubt of the importance of parenting in children's social, emotional, and behavioral development. Aspects of parental control, including discipline, monitoring, and autonomy granting, as well as affective components of parent behaviors, including warmth, acceptance, and responsiveness, consistently emerge as predictors of children's adjustment (e.g., Frick 1994; Loeber and Stouthamer-Loeber 1986; Maccoby 2000; McLeod et al. 2007). However, our models of caregiver influences on development may be enhanced by considering the role of individual characteristics, particularly temperament, in shaping and conditioning the effects of parenting. This perspective fits with the growing understanding that development occurs through reciprocal transactions between children's characteristics and environmental factors (Hinshaw 2008).

One potential mechanism of parenting effects on child adjustment is how parents shape children's temperamental emotional and self-regulatory characteristics, which in turn are key predictors of children's adjustment (e.g., Davidov and Grusec 2006). Simultaneously, researchers recognize that parents' behaviors are responsive to temperament, with children eliciting distinct parenting behaviors (e.g., Collins et al. 2000; Lengua 2006). In fact, many studies show additive effects of child temperament and parenting in predicting child adjustment problems. That is, both temperament and parenting contribute uniquely and simultaneously to children's behavioral and emotional adjustment. These findings suggest a complex interplay between child temperament and parent behaviors. Considering this complexity is likely to refine our models of the development of behavioral, social, and emotional adjustment problems in children.

A parallel body of research has examined the degree to which children's temperament may condition the effects of

parenting on adjustment, suggesting that children's responsiveness or sensitivity to parenting may vary depending on individual differences in emotionality and self-regulation (Belsky 2005; Wachs 1991). However, transactional and interactional models of parenting and temperament generally have been considered separately. This is surprising given that a bioecological framework suggests that both transactions and interactions between individuals and the environment are needed to adequately describe developmental processes (Wachs 1991; Wachs and Kohnstamm 2001). Further, the identification of transactional or interactional processes does not negate the possibility that other relation may exist (Rutter and Pickles 1991). Instead, consideration of bidirectional and interactive effects nicely highlights both mediational and conditional processes.

In this review, we examine both bidirectional and interaction effects side-by-side to provide an overarching perspective on parenting in the context of children's individual differences in temperament. Interestingly, researchers have come to assume the presence of both interactive and bidirectional effects despite a lack of comprehensive examination. In addition, this review examines empirical evidence of both the transactional and interactive relations between parenting and child temperament to highlight potentially specific developmental pathways to internalizing and externalizing problems and other indicators of children's social–emotional adjustment. To accomplish this, we review the bidirectional and interactive effects of specific temperament dimensions, as opposed to broad, higher-order dimensions, in conjunction with a range of parenting behaviors to identify specific patterns of effects. Consideration of the relations between specific temperament and parenting dimensions could elucidate when and how temperament may mediate and/or moderate the effect of parenting and for which outcomes.

In this review, we first provide a brief overview of parenting, child temperament, and conceptual models for transactional and interactive relations between them. We also comment on design and methodological issues in this area of research. We then review the evidence of bidirectional and interactive effects between temperament and parenting for children's negative affect, including frustration and fearfulness, as well as self-regulation, and impulsivity, as these temperament characteristics have been identified as relevant to children's social and emotional adjustment and the emergence of psychopathology. For each temperament characteristic, we examine parenting behaviors that engender the characteristic, are elicited by it, and are predictive of adjustment problems. Examining multiple parenting and temperament dimensions might highlight combinations of the two that predict the development of specific adjustment problems. Studies that examined bidirectional or directional relations between temperament and parenting are summarized in Appendix Table 1, and studies that examined interactions between temperament and parenting are summarized in Appendix Table 2. Each table presents information on the study design (i.e., developmental stage, sample size) and results. Studies were selected using a comprehensive search of research databases including PsychInfo. Search terms targeted studies measuring the aspects of parenting (e.g., warmth, control) and the dimensions of temperament described below.

## Parenting

Parenting is an important predictor of children's social and emotional adjustment (Maccoby 2000). Historically, parenting behaviors have been viewed as falling along two dimensions: parental control behaviors and parental behaviors that convey affect toward the child (e.g., Frick 1994; Loeber and Stouthamer-Loeber 1986; Maccoby 2000; McLeod et al. 2007). However, recent research reflects increasing attention to parental responses to children's emotions, including emotion responsiveness and emotion coaching (e.g., Gottman 1997).

Several parental control behaviors are considered relevant to children's adjustment, including behavioral control strategies such as discipline and monitoring and psychological control strategies including autonomy granting, overcontrol, intrusive, and oversolicitous parenting. These distinctions reflect the target of the parenting behavior (Barber 1996). Behavioral control focuses on parents' efforts to restrict and manage children's behaviors by monitoring children's activities, conveying rules or standards for appropriate or desirable behaviors, employing reinforcement for appropriate or desirable behaviors and consequences for inappropriate behaviors, as well as engaging in these behaviors with a degree of consistency. These rearing patterns predict children's emotional and behavioral problems when parents' control behaviors are inconsistent (e.g., Barber 1996; Chamberlain and Patterson 1995; Hill et al. 2003), harsh or coercive (e.g., Nix et al. 1999), or when parents use physical punishment as a means of control (e.g., Deater-Deckard et al. 1996; Stormshak et al. 2000).

Parental psychological control has been defined as parental control attempts that intrude into a child's psychological and emotional development by stifling his/her independent thinking and self-expression (Barber 1996; Barber and Harmon 2002; Stone et al. 2002). Such control behaviors may be particularly apparent or detrimental in situations in which children are able or expected to function with some degree of autonomy (Rubin et al. 2001), suggesting the role of parental control may shift

across development. This type of control has been operationalized in various ways, including low autonomy granting, intrusiveness, negative control, and overcontrol (e.g., Barber et al. 2002; McLeod et al. 2007; Rubin et al. 2001, 2002; Silk et al. 2003). Psychological control negatively impacts child development (Barber 1996) and is thought to be a specific risk factor for internalizing problems (Barber et al. 2005; Eccles et al. 1997; Siqueland et al. 1996; Stark et al. 1990; Whaley et al. 1999), although some studies have demonstrated an association with children's externalizing problems (Morris et al. 2002b). Further, these studies have highlighted the detrimental role of psychological control across development.

The affective quality of the parent–child relationship has been typically described along the dimensions of warmth and acceptance versus negative affect and rejection. The warmth dimension reflects parents' positive affect, appreciation, affection, and involvement with their children. Researchers suggest that warm and supportive family environments foster well-being in children. Conversely, family environments laden with feelings of negativity, rejection, and diminished warmth foster maladjustment and the development of internalizing and externalizing problems (Downey and Coyne 1990; Herman and McHale 1993; Siqueland et al. 1996). For example, parental acceptance is related to lower levels of emotional and behavioral problems (e.g., Papp et al. 2005), and parental warmth is related to empathy and prosocial behaviors (Bornstein 1989; Davidov and Grusec 2006), particularly in younger children. Parental negative affect, or rejection, predicts higher levels of internalizing and externalizing problems (e.g., Burge and Hammen 1991; Lengua et al. 2000; McLeod et al. 2007; Mezulis et al. 2006; Muris et al. 2001; Stormshak et al. 2000).

Increasingly, attention is focused on parenting behaviors that are in response to children's emotions; acknowledging, supporting, and guiding children's emotional responses. These have included emotion coaching, emotional scaffolding, responsiveness, empathic awareness, synchrony, and sensitivity. Responsiveness refers to the presence and fit of the maternal response to child cues, thus encompassing parental synchrony and sensitivity. In addition, it variously refers to maternal responses to children's specific emotional expressions (Davidov and Grusec 2006) or general needs (Bornstein et al. 2008). Research has demonstrated that maternal responsiveness to young children's negative emotions, such as anger, may reduce children's expressions of anger and increase positive affect (Denham 1993). More generally, responsive parenting predicts children's prosocial adjustment (Bornstein et al. 2008; Davidov and Grusec 2006) and lower conduct problems (Lahey et al. 2008).

It is noteworthy that there is little consistency across studies in the labeling and operationalization of many parenting behaviors. For example, responsiveness is a term applied to a range of behaviors, including parental responses to negative affect, sensitivity to child cues, or scaffolding. Additionally, many variables combine several parenting behaviors including those that cross dimensions (e.g., measures of overprotection may combine parental control and warmth; Rubin et al. 2001) making it difficult to distinguish the unique effects of specific parenting behaviors. This lack of standard conceptualization and operationalization of parenting behaviors makes comparison of findings across studies complicated. In this review, we grouped parenting dimensions along the control, warmth, and responsiveness dimensions whenever possible.

## Temperament

Temperament is defined as the physiological basis for individual differences in reactivity and self-regulation, including motivation, affect, activity, and attention characteristics (Rothbart and Bates 2006). Reactivity refers to responsiveness to change in the external and internal environments and includes physiological and emotional reactions and is detectable early in life (within the first year). Commonly included in the studies of temperament are indicators of frustration or anger, fear (inhibition, withdrawal), approach, pleasure, and positive affect. Self-regulation refers to orienting and executive control of attention and behavior that operates to modulate reactivity, facilitating or inhibiting the physiological, affective, or behavioral response. Self-regulation is commonly assessed with measures of attention focusing, attention shifting, and inhibitory control, which compose the construct effortful control (Rothbart et al. 2001). As self-regulation reflects more executive-based processes, these components of attention and inhibitory control often follow a protracted development, beginning at the end of the first year of life.

Underlying these dimensions of reactivity and self-regulation are individual differences in motivational systems reflecting sensitivity to reward and punishment (Rothbart and Bates 2006). Activation of the behavioral inhibition system (BIS), which is responsive to cues of punishment or threat, produces fear and anxiety, serving to inhibit approach behaviors in response to negative consequences and cues of aversive consequences. Neurally, the BIS has been linked to the amygdala as well as serotonin, norepinephrine, and GABA circuits (Lara and Akiskal 2006) including the septo-hippocampal pathway (Gray and McNaughton 2003). Activation of the behavioral activation system (BAS), which is responsive to cues of reward, motivates approach or behavioral activation toward an incentive or active avoidance of punishment (Gray 1991),

is associated with pleasure and positive anticipation, and produces frustration when reward attainment is blocked. Neuroanatomically, the BAS has been linked to structures such as the nucleus accumbens and pathways regulated by dopamine and glutamate activity (Lara and Akiskal 2006). The balance between children's reward and punishment orientations influences children's perceptions of a situation (e.g., threatening or enticing), their affective reactions to the situation (e.g., fear, frustration, excitement, or boredom), and their behavioral responses (e.g., avoidance, withdrawal, or approach).

Temperament is genetically based, with heritability estimates for broad dimensions of temperament being approximately .5 to .8. Temperament is also relatively stable, with estimates ranging from .3 to .8 depending on the dimension of temperament and developmental period. Nonetheless, there is considerable evidence for experience and context playing a role in shaping the expression of temperament (Rothbart and Bates 2006). As such, temperament might be viewed as an individual's likely or typical response range that makes the individual differentially responsive to his or her immediate experiences and differentially selective of experiences. However, temperament is also shaped by experience, and certain characteristics may be selectively shaped, as the context may be more or less accepting or accommodating of the child's characteristic responses. Thus, temperament represents characteristics present early in life that shape and are shaped within the context of social and environmental interactions (e.g., Shiner and Caspi 2003) and that result in differential responsiveness to socialization experiences (e.g., Wachs 1991).

Temperament is an important contributor to children's social and emotional development and adjustment problems. Negative emotionality and low effortful control predict internalizing and externalizing problems (e.g., Eisenberg et al. 2001; Frick and Morris 2004; Rothbart and Bates 2006), and effortful control predicts social competence and self-esteem (Dennis et al. 2007; Lengua 2003; Spinrad et al. 2006). More specifically, fearfulness or inhibition is believed to be a risk factor for the development of anxiety problems (Kagan 1999; Rapee 2002) and perhaps internalizing more generally (e.g., Colder and O'Connor 2004; Eisenberg et al. 2001; Lengua 2003; Putnam and Stifter 2005), whereas irritability appears to be related to both internalizing and externalizing problems and lower social competence (e.g., Eisenberg et al. 2001; Frick and Morris 2004; Lengua 2003, 2006; Rothbart et al. 1994). Impulsivity is a risk factor for social and externalizing problems (e.g., Colder and O'Connor 2004; Eisenberg et al. 2001; Eisenberg et al. 2005a, b; Frick and Morris 2004; Lengua 2003). It is notable that effortful control is related to lower emotional and behavioral problems and higher social competence, empathy, and self-esteem (e.g., Kochanska 1995; Lengua 2006; Lengua et al. 2007; Murray and Kochanska 2002; Olson et al. 2005; Spinrad et al. 2006; Valiente et al. 2004), suggesting that it is important in multiple aspects of children's emotional, behavioral, and social development.

A number of potential mechanisms might account for the relation between temperament and adjustment. Temperament is believed to have direct effects on the development and expression of symptoms and indirect effects through selection or structuring of the environment, eliciting patterns of social interactions, and through biasing cognitive processing. Temperament also interacts with social and environmental experiences, exacerbating or buffering their effects (Rothbart and Bates 2006). The interplay between parenting and temperament in each of these mechanisms might be particularly relevant in understanding the relation between temperament and child adjustment.

## Bidirectional or Transactional Model of Parenting and Temperament

In a transactional model, parenting and child temperament are expected to mutually shape each other over time. Child development does not occur along immutable trajectories, but rather through reciprocal, bidirectional, or transactional relations in which children influence and are influenced by the context within which they develop, including parenting (Hinshaw 2008; Wachs and Kohnstamm 2001). Specifically, the concept of transactional relations is borne out of an ecological perspective on development, which conceptualizes maturation as the outcome of reciprocal relations between children's characteristics and environmental influences (Cicchetti and Lynch 1993). Further, transactional or bidirectional models can elucidate mechanisms and mediating pathways whereby parents' and children's characteristics predict adjustment.

In the transactional relation between parenting and temperament, parents' efforts might be aimed at reducing child negative affect and dysregulated behaviors, although those very child behaviors might elicit more negative parenting that actually engenders greater emotional and behavioral dysregulation. Parents' efforts might also aim to encourage positive characteristics such as effortful control, which in turn might elicit more acceptance and appropriate control strategies that further encourage adaptive emotional and behavioral responses.

Child behavior may have an evocative influence on parenting. For example, children's behavior problems predict more negative parenting behaviors (e.g., Caspi and Moffit 1995; Dumas and Wekerle 1995; Ge et al. 1996;

Patterson 1982; Patterson et al. 1992; Pettit et al. 2001; Plomin et al. 1977), while those parenting behaviors are shown to engender greater behavior problems in children (e.g., Chamberlain and Patterson 1995; Deater-Deckard et al. 1996; Hill et al. 2003; Nix et al. 1999; Stormshak et al. 2000). Indeed, parenting and child behavior problems are reciprocally related (e.g., Hipwell et al. 2008, Burke et al. 2008). A similar pattern is seen for temperament and parenting behaviors, as reviewed below.

Alternative explanations for the correspondence between parenting and temperament include shared genetic bases and modeling. Both of these represent alternative explanations for shared qualities along similar dimensions. For example, both parents and children might share a physiological basis for anxiousness or inhibition, based on shared genes, and inhibited or anxious behaviors might arise in the child through parental modeling of similar behaviors (e.g., Dubi et al. 2008). Thus, in this case, genetic and modeling bases for the child's behavior operate in a similar direction, increasing children's inhibition or anxiety. However, emerging research from twin and sibling studies highlights the importance of parenting behaviors in shaping children's behavior and adjustment through non-shared environmental processes, beyond shared genetic risk (e.g., see Pike et al. 1996; Caspi et al. 2004). Further, there is evidence of evocative effects or shaping of behaviors that cut across temperament characteristics or domains. Parental behaviors such as inconsistent discipline also predict increases in children's anxiousness (e.g., Lengua and Kovacs 2005), although inconsistent discipline is not thought to be related to parental anxiety or a phenotypic indicator of parents' genetic basis for anxiety. Neither a shared genetic-based characteristic nor modeling is likely to account for this association. Further, there is evidence of greater genetic influence on the affective qualities of parenting compared to parental control (e.g., Braungart 1994; Elkins et al. 1997). Thus, we might be more convinced of child evocative effects and parent socialization when there is evidence that children's or parents' behaviors predict changes in the other's behaviors that cut across characteristics or constructs, particularly when examining parental control. In addition, studies that show changes in temperament or parenting predicted by the other, above initial correlations between them and above the stability of each, suggest that the behavioral expression of genetic effects are relevant mechanisms of changes. Importantly, prediction of behavioral changes over time cannot be fully accounted by a shared genetic basis.

## Interaction Models of Parenting and Temperament

Another proposed effect of temperament in the development of children's behavioral and emotional adjustment is its role as a moderator of socialization experiences (Rothbart and Bates 2006). Specifically, the effects of parenting might depend on children's temperament, and interactions between parenting and child temperament might account for complexity in developmental processes. Thus, parenting behaviors are not expected to uniformly influence development, but rather the degree, and perhaps direction of effect, will vary based on children's characteristics. Several theories have been developed to explain how and why temperament may interact with parenting. Early models considered the goodness-of-fit between an individual and the environment (Chess and Thomas 1991; Lerner and Lerner 1994). This conceptualization stems from the Thomas and Chess tradition and holds that adjustment develops from the match between individuals' characteristics and parents' behaviors. More recently, models propose children's differential responsiveness to parenting behaviors. The broadest of these models, organisimic specificity, was put forth by Wachs and purports that individuals variously respond to environmental factors based on their individual differences (Wachs 1987, 1991; Wachs and Gandour 1983). Evidence supporting this hypothesis demonstrated that infants varied in their sensitivity to the environment by their classification as "easy" or "difficult" (Wachs and Gandour 1983). Several more recent and specific extensions of this hypothesis include the biological sensitivity to context model, which purports that individuals vary in the degree to which the environment affects their development, suggesting that some individuals are highly permeable or susceptible to environmental conditions, while others are largely unaffected by environmental circumstance (Boyce and Ellis 2005; Ellis and Boyce 2008).

Focusing specifically on parental influence, Belsky and others have offered a more specific model of differential responsiveness, namely the differential susceptibility hypothesis (Belsky 1997, 2005; Belsky et al. 2007; Belsky and Pluess 2009). Differential susceptibility proposes that children's individual characteristics, particularly reactivity, may increase their responsiveness to parenting, both positive and negative. Thus, highly reactive children flourish in response to positive parenting and flounder in response to negative parenting. The former point is particularly important in distinguishing the differential susceptibility hypothesis from a diathesis-stress model (Belsky 2005; Belsky et al. 2007). Without evidence of benefit in a positive environment, the differential susceptibility is not supported, as it specifically requires that children benefit in the presence of optimal parenting. Rather evidence that vulnerable individuals are most affected by negative or risky environments would support a diathesis-stress model, with temperamental

vulnerabilities and negative parenting each conferring risk for problems.

These theories (organismic specificity, biological sensitivity to context, differential susceptibility) hold that temperament will moderate the relation between parenting and adjustment. Further, these models suggest that temperament has both synergistic and buffering effects (Wachs 1991). Notably, the initial conceptualization and testing of these theories has focused on the reactivity components of temperament until recently (see Belsky and Pluess 2009). Thus, it is unclear whether these predictions extend to include the regulatory aspects of temperament. Extension of these models to include temperament characteristics such as effortful control and impulsivity would suggest that children low in effortful control and/or high in impulsivity would be more susceptible to parents' rearing behaviors.

The above theoretical models posit that temperament serves as a risk or protective factor and alters the effect of parenting on development. That is, the effect of the environment varies across levels of individual reactivity. However, it is important to consider an alternative hypothesis, environmental specificity, in which developmental outcomes vary as a function of different environmental variables, including specific parenting behaviors (Wachs 1987, 1991). It is equally plausible that parenting serves to buffer the relation between a temperamental vulnerability and adjustment. Thus, some researchers have followed a risk-buffering model in which the individual characteristic or parenting behavior is classified as a risk factor (e.g., high fear or intrusive parenting), while the other variable serves to buffer or amplify the relation between the risk factor and adjustment (Veenstra et al. 2006). Regardless of the putative moderator selected, models indicating specificity generally suggest that temperament and parenting are not universal vulnerabilities for maladjustment, but rather conditional and specific relations should be assessed to achieve a more complete understanding of development.

## Design and Methodological Issues

Aspects of study design can facilitate conclusions drawn from the pattern of relations between parenting and temperament (Shadish et al. 2003). Studies based on longitudinal data allow clarification of the direction of effects between parenting and temperament and the examination of change over time. This is particularly important in transactional models, in which the goal is to clarify the degree to which parenting shapes temperament and vice versa, beyond the effects of shared genetics and the stability of characteristics. Further, some analytic approaches allow stronger conclusions about direction of effects. In particular, stronger conclusions about one variable shaping another can be drawn when subsequent levels of parenting or temperament are predicted after controlling for prior levels of each. Thus, longitudinal studies combined with analytic approaches that clarify the direction of effects are more conclusive in their support for the relations between parenting and temperament. Although correlation coefficients may be informative as indicators of effect size estimates, partial relations, or standardized regression coefficients from analyses that control for other relevant variables, particularly prior levels of the predicted variable are more informative. They provide a more conservative estimate of the effect size, as well. Thus, in reporting effect sizes of bidirectional relations between parenting and temperament, both $r$ (correlation coefficient) and $\beta$ (standardized regression coefficient or partial $r$) are reported in Appendix Table 1 when available.

Intervention studies offer particular methodological rigor. Intervention and prevention trials use random assignment to test the assumed underlying etiological processes (Cicchetti and Hinshaw 2002). A small number of studies test parenting intervention programs in relation to child characteristics (Brody et al. 2005; Sheeber and Johnson 1994; van den Boom 1989) and provide rigorous evidence for underlying assumptions about the relations between parenting and temperament.

Regarding tests of interaction effects, it is important to note that interaction effects in psychology tend to be small in magnitude for several reasons (Champoux and Peters 1987; Chaplin 1991, 1997). First, the predicted form of the interaction is often ordinal rather than crossover. In the studies reviewed here, most often the strength but not the direction of the relation between parenting and adjustment was modified by temperament. Second, the reliability of the product term is less than or equal to the less reliable of the two first-order predictors. That is, the effect of measurement error is amplified when considering interaction terms as compared with first-order predictors (Aiken and West 1991). Consequently, the magnitude of the observed effect size of the interaction can be expected to be an underestimate of the true effect size, leading to inflated support for direct effects and an underestimation of interaction effects (Aiken and West 1991). In addition, the estimation of interaction effects in regression uses the full range of the variables being investigated, whereas in other approaches, cases are often selected from the extremes of the distributions of continuous variables, increasing the observed effect size (McClelland and Judd 1993). Thus, although effect sizes for interaction effects can be inferred from incremental changes in $R^2$ values (as reported in Appendix Table 2), it is important to note that small increases in additional

variance explained do not necessarily translate into small or weak interaction effects (Champoux and Peters 1987). This information should be considered in conjunction with the observed patterns of relations and simple slope values that characterize the nature of the interaction effects. Therefore, when they were available in the published report of the study, simple slopes or correlations across levels of temperament are reported in Appendix Table 2.

Several challenges arise in attempting to characterize the magnitude and pattern of interaction effects in published studies. First, many studies do not report the $R^2$ or incremental change in $R^2$ associated with a significant interaction. In addition, sometimes even when it is reported, the $R^2$ is the proportion of variance accounted for by a set of variables or a set of interaction terms and not a single interaction term. As a result, the effect size for a particular interaction effect is often unavailable. Second, most studies do not probe the pattern of a significant interaction effect if the $R^2$ for a set of tests is non-significant. In addition, studies do not always report the simple slope values even when a significant interaction was probed. Note that when studies reported F or t statistics, these were converted to an $r$ when sufficient information was available (Wolf 1986).

Another methodological consideration is the measurement method used. Both parenting and temperament can be assessed using a variety of methods. However, in research with children, questionnaire and observational measurements are the most commonly used method of assessment for both. Physiological indicators of temperament are also sometimes used. As measures of temperament, both observational and parent-report questionnaire measures are viewed as valid indicators each providing unique perspective on children's temperament (Rothbart and Bates 2006). Similarly, there are benefits and costs to using either questionnaire or observational measure of parenting. Observational measures are not subject to the reporters' bias about parental behaviors; however, they also may fail to capture low base-rate behaviors or underestimate negative parenting behaviors which parents might be less likely to demonstrate when being observed (Morris et al. 2002b). It is interesting to note that there is often little correspondence across these methods of assessment. When studies used multiple methods of assessment, measures were sometimes combined and sometimes retained as separate indicators. Notably, shared method variance might inflate observed associations between parenting and temperament, while alternatively patterns of findings might differ across methods of assessment. The measurement approach used in each study is reported in Appendix Tables 1 and 2 and was considered in evaluating the pattern of associations between parenting and temperament.

## Child Developmental Stages and Gender

The meaning and impact of different child characteristics and parenting behaviors might be dependent on children's developmental stage and gender, which should be considered when reviewing the interaction and transactional relations between temperament and parenting. It is possible that different child characteristics and parenting behaviors have distinct meaning or impact at different developmental stages. Wachs (1991) posits that interaction effects are more likely to be observed early in development, during infancy or early childhood, suggesting that research with younger children may be more likely to find support for differential relations. However, one could also expect that conditional relations may be more likely later in childhood as temperament becomes more stable and perhaps more independent from parenting. In the review that follows, we will point out when findings differ across developmental stages.

It is also possible that the bidirectional and interaction effects of temperament and parenting might operate differently for boys and girls (Sanson and Rothbart 1995). There is evidence of small mean differences across gender on fear and frustration (Else-Quest et al. 2006**,** Kohnstamm 1989) with girls being more fearful and boys being higher in frustration and anger. Also, girls are higher in effortful control than boys (Else-Quest, et al. 2006; Silverman 2003). However, mean differences do not indicate that temperament effects are moderated by gender. In their review of gender-by-temperament interactions, Rothbart and Bates (2006) concluded that there was not a consistent pattern in how gender moderated relations between temperament and adjustment. The evidence regarding gender differences in parenting effects can be characterized in a similar way. Although there is evidence of differences in parenting practices across girls and boys (e.g., Russell et al. 2003), the findings are inconsistent and do not emerge in meta-analyses (Lytton and Romney 1991). However, Sanson and Rothbart (1995) suggest that researchers might need to account for child temperament when examining gender differences in the relation between parenting and child outcomes. Evidence of gender differences will be highlighted when available.

## The Transactional and Interactive Relations Between Temperament and Parenting

In the next sections, we review the transactional and interactive effects between temperament and parenting, including temperament dimensions that reflect negative affect (specifically frustration and fear), self-regulation or effortful control, and impulsivity, as each of these dimensions have

demonstrated a role in the emergence of adjustment problems and psychopathology. Studies examining the transactions or interactions of positive emotionality, activity level, or sociability were not included as these dimensions are not consistently related to adjustment problems and have been infrequently studied together with parenting.

The focus of the review will center on (1) the degree to which empirical evidence supports transactional and/or interactive effects of temperament and parenting and (2) the degree to which the patterns of relations help to clarify pathways to adjustment problems across childhood. The review is organized to allow for comparison across studies on similar parenting dimensions. Thus, findings related to parental control behaviors, the affective components of parenting, and parental responsiveness and sensitivity will be reported together. Careful attention was devoted to children's developmental stages, allowing for the identification of similarities or differences as children age. Some studies have examined whether the observed patterns vary by gender or sex. When gender differences were examined, any differences will be highlighted. Further, temperament dimensions are often referred to under a variety of terms in the literature (e.g., negative emotionality, negative affectivity, fear, and inhibition). The studies in this review were categorized based on the original authors' conceptualization (i.e., operational definition and measurement) of the temperament dimension used in each study.

## General Negative Affect or Difficult Temperament

Although the goal of this manuscript is to review specific dimensions of temperament in relation to parenting, a significant proportion of studies investigated broad dimensions of negative affect or difficult temperament. Thus, we begin by reviewing those findings before examining specific dimensions that compose these broader constructs.

### *Bidirectional Relations with Parenting*

Cross-sectional studies suggest that children's difficult temperament or negative emotionality is associated with parenting that is higher in control (Braungart-Rieker et al. 1997; Coplan et al. 2009; Kyrios and Prior 1990; Lee and Bates 1985; Porter et al. 2005), distress, negativity, or rejection (Eisenberg et al. 1999; Lerner and Galambos 1985) and lower in responsiveness (Davidov and Grusec 2006). Further, these findings extend across childhood.

However, longitudinal studies begin to help clarify the degree to which parenting shapes children's negative emotionality and vice versa. Children high in negative affect can easily become over-aroused, may be difficult to sooth, and as they get older, may direct angry and oppositional behaviors toward parents, which in turn increase parental attempts to control the children's affect and behavior in more negative and adverse ways. The results from several studies suggest that infants higher in negative emotionality evoke parenting that is more power assertive and controlling (Clark et al. 2000; Pettit and Bates 1984). However, one study failed to show that difficult temperament predicted increases in maternal intrusiveness across the first year of life (Feldman et al. 1997).

Children's difficult temperament or negative emotionality also appears to shape the affective qualities of parenting, predicting less maternal affection (Booth-LaForce and Oxford 2008; Pettit and Bates 1984) and higher maternal rejection or negativity (Bridgett et al. 2009). Mixed findings have been obtained when difficult temperament is considered a predictor of responsive or sensitive parenting, with some studies showing an evocative role for temperament (Feldman et al. 1997; Mills-Koonce et al. 2007) but others not (Clark et al. 2000). However, only one study has rigorously tested bidirectional relations between children's negative emotionality and supportive parenting. Scaramella et al. (2008) found that toddlers' negative emotionality predicts lower parental support, but not vice versa, in a sample of 47 toddlers. Thus, it appears that negative emotionality or difficult temperament may shape parenting, particularly in young children.

Longitudinal studies further suggest that parenting behaviors have the parallel effect of exacerbating children's negative affect and difficulty. Considering parental control, harsh parenting predicted changes in toddlers' negative emotionality (Scaramella et al. 2008). Further, this direction of effect was unique, as toddlers' temperamental emotionality did not shape harsh parenting (Scaramella et al. 2008). However, preliminary studies in older children suggest that perceptions of higher maternal control and parental discipline predict increases in difficult temperament across time (Bezirganian and Cohen 1992). Conversely, children's low emotionality (as measured by callous-unemotional traits) appears to be relatively unresponsive to parenting, as increases in parental effective control did not shape the behavior of children low in reactivity (Hawes and Dadds 2005). Still, additional studies are needed to evaluate the degree to which parental control behaviors shape children's difficult temperament or negative emotionality. Disengaged and insensitive parenting predicted sustained or increased levels of infants' negative affect in some studies (e.g., Belsky et al. 1991), but not others (e.g., Malatesta and Haviland 1982). Although the magnitudes of these effects tend to be modest to moderate in size, the pattern of bidirectional relations suggests a negative and escalating cycle of mutual influence between parents and children similar to the coercive cycle of parent–child interactions involving

children's behavior problems (Patterson 1982; Patterson et al. 1992; Scaramella and Leve 2004).

*Interactions with Parenting*

Evidence for interactions between parenting and negative affect or difficult temperament suggests that children higher in negative affect or difficult temperament demonstrate an increased risk for adjustment problems in the presence of poor parenting. However, this may depend on the parenting dimensions considered. Conversely, children low in emotionality and prosocial behavior (i.e., high in callous-unemotionality) may be unresponsive to parenting behaviors, demonstrating increased adjustment problems regardless of parental rearing practices (Wootton et al. 1997).

Research examining the interaction of negative emotionality or difficulty with parental control behaviors has generally failed to support models of differential responding (Lengua et al. 2000). However, significant interactions emerged when parental use of physical punishment (Lahey et al. 2008; Paterson and Sanson 1999) or parental overprotection, intrusiveness, or overcontrol is considered (Gilliom and Shaw 2004; Hastings et al. 2008; Maziade et al. 1985, 1990). These studies generally demonstrate that children higher in negative emotionality (or difficult temperament) exhibit more adjustment problems in the face of parenting that is high in psychological control, consistent with a diathesis-stress model.

Evidence suggests that children high in negative emotionality are more sensitive to parenting behaviors when the affective qualities of parenting are considered. In infants, Belsky et al. (1998) found that negative parenting predicted the emergence of externalizing problems and inhibition at age 3 for children who were high in negative emotionality. Another study found that parental support and positivity in infants decreased risk for injury into toddlerhood for infants high in negative reactivity (Schwebel et al. 2004). Moreover, the pattern of findings was consistent with the differential susceptibility hypothesis, as children high in negative emotionality were found to exhibit more difficulty in the context of a negative maternal environment, but benefited from parenting that was more positive and supportive. In pre-adolescents, there is evidence that children high in negative emotionality may be more sensitive to perceptions of maternal rejection (Lengua et al. 2000). However, other studies have not supported interactions of parental warmth, support, or rejection with negative emotionality (Hastings et al. 2008; Paterson and Sanson 1999; Vitaro et al. 2006). Thus, the findings for the interaction of negative emotionality or difficulty with the affective qualities of parenting are inconsistent.

Interactions of parental responsiveness with negative emotionality or difficulty emerge consistently. Several longitudinal studies suggest that infants high in negative emotionality or difficult temperament benefit from parenting that is sensitive (Leerkes et al. 2009) and synchronous (Feldman et al. 1999). In addition, young children who were high in negative emotionality as infants benefited the most from a comprehensive intervention aimed at improving parenting and child-care, among other things (Blair 2002). Similarly, maternal sensitivity exerted greater impact on attachment security of infants high in negative reactivity (Van Ijzendoorn and Bakermans-Kranenburg 2006). Parallel patterns of interactions emerged when examining indicators of school readiness in first-grade children. Children's difficult temperament at 6 months of age interacted with mothers' emotional support such that children with difficult temperaments whose mothers exhibited low levels of maternal emotional support demonstrated the lowest level of school readiness, whereas at high levels of emotional support, children with difficult temperaments demonstrated the highest levels of school readiness (Stright et al. 2008). These results are consistent with the differential susceptibility hypothesis as children high in negative affect were more responsive to positive and negative parenting behaviors. Only one study failed to support the interaction between maternal responsiveness and infant difficult temperament in predicting later conduct problems (Lahey et al. 2008).

*Summary of Negative Affect or Difficult Temperament*

Most studies examining bidirectional or interactive relations of negative emotionality or difficult temperament with parenting studied young children, with few studies conducted beyond infancy and toddlerhood (e.g., Lengua and Kovacs 2005; Lengua et al. 2000; Stice and Gonzales 1998). Although correlational support is relatively consistent, much of the evidence presented is preliminary in nature as all but one study (Scaramella et al. 2008) lacked rigorous tests of bidirectional relations. Nevertheless, difficult temperament and negative emotionality seem to draw for parenting that is less affectionate, supportive, and responsive, but not necessarily harsh. Further, parenting that is high in control, particularly psychological control, appears to engender children's negative reactivity, a finding that preliminarily holds across childhood. This suggests that increases in negative emotionality might be one mechanism for the relation between parenting and child adjustment problems. In contrast, children's low emotionality or reactivity appears to be relatively unchanged in response to parenting behaviors. However, additional research is needed to clarify these processes.

When interactive relations were examined, children's temperamental negative emotionality or difficult temperament is at increased risk for adjustment problems in the presence of parenting that is less responsiveness, sensitivity, or higher in psychological control. Support for the differential susceptibility hypothesis emerged when parental responsiveness or sensitivity was considered (e.g., Stright et al. 2008). However, for parental control behaviors, the results imply a diathesis-stress model in which children high in negative emotionality or difficulty are more likely to demonstrate adjustment problems in the presence of parental psychological control. An exception is for children identified as high in callous-unemotionality, as these children appear to be at increased risk for conduct problems regardless of parents' behaviors.

Notably, few studies have examined bidirectional relations or interactions of difficult temperament or negative emotionality outside of infancy. This may stem from the increased ability to assess specific temperament reactivity dimensions, such as fear and frustration, as children mature. This is particularly important given that the components of negative emotionality, fear, and frustration are posited to stem from different, mutually exclusive neurological systems and may operate differently in relation to adjustment outcomes. For example, fearfulness may make children easier to discipline and predicts more compliance in toddlers (e.g., Kochanska et al. 2001; van der Mark et al. 2002), whereas frustration predicts more behavioral and emotional problems (Lengua and Kovacs 2005; Lengua 2006; Rothbart and Bates 2006). Also, in middle childhood, dispositional internalizing emotions, which included fear and anxiety, were related differently to parent reactions than dispositional externalizing emotions, which included anger and irritability. Dispositional externalizing emotions were related to parental punitive and minimizing reactions, whereas internalizing emotions were not (Eisenberg et al. 1999). Thus, specific aspects of reactivity and regulation may operate differently and therefore should be considered separately, as we have below.

## Frustration or Irritability

### *Bidirectional Relations with Parenting*

Child frustration, irritability, and anger are correlated with parental negative behaviors, such as anger, rejection, hostility, and intrusiveness (Arcus 2001; Calkins et al. 2004; Cole et al. 2003; Crockenberg and Smith 1982; Kochanska et al. 2004; Martini et al. 2004; van den Boom and Hoeksma 1994; Zhou et al. 2004), and they appear to engender each other over time, with bidirectional effects being moderate in magnitude. Negative parenting behaviors including inconsistency, rejection, hostility, and harshness all contribute to negative interactions between parents and children, increasing children's anger and frustration (Eisenberg et al. 1999; Lengua 2006; Lengua and Kovacs 2005), while children who are irritable appear to contribute to conflictual relationships with their parents, engendering more negative parenting behaviors.

For parental control, parents' inconsistent discipline predicted increases in irritability for pre-adolescent youth (Lengua 2006; Lengua and Kovacs 2005), and in turn, children's irritability or frustration predicted parental negative control and discipline strategies (Calkins 2002; Lengua 2006). The findings suggest that consistent discipline is important for decreasing children's irritability and that this in turn may predict fewer externalizing problems (Lengua 2006). However, there are some counterintuitive findings, as corporal punishment predicted decreases in teacher-reported anger and aggressive behavior in preschoolers (Kimonis et al. 2006). This may reflect differences in measurement or developmental periods, and lack of adequate tests for bidirectional processes, highlighting the need for further investigation.

The transactions between the affective qualities of parenting and irritability have been examined less often than parental control behaviors, with no longitudinal studies examining these transactions in younger children. Findings from one study suggest that parental rejection and child irritability engender one another over time and in turn present a pathway for the development of internalizing problems in pre-adolescents (Lengua 2006). However, evidence that warmth was related to toddlers' irritability (Kochanska et al. 2004) was not replicated in a pre-adolescent sample using transactional designs (Lengua and Kovacs 2005).

Studies examining longitudinal relations of frustration to parental responsiveness found that mothers of irritable infants demonstrated less effective stimulation and physical contact, less involvement and responsiveness to positive signals, and more soothing behaviors compared with mothers of non-irritable infants (van den Boom and Hoeksma 1994). When bidirectional relations were tested, maternal responsiveness predicted decreases in irritability, whereas irritability predicted decreases in responsiveness (van den Boom 1989), and an intervention that increased maternal responsiveness resulted in decreases in infant irritability (van den Boom 1989).

### *Interactions with Parenting*

Child irritability also interacts with parenting behaviors such that negative parenting behaviors are more strongly related to adjustment problems for children who are higher in irritability compared with children who are lower in

irritability. However, there is mixed support for interactions between parenting and irritability or frustration, with several null findings (e.g., Calkins 2002; Crockenberg and McClusky 1986; Kiff et al. 2007; Morrell and Murray 2003; Oldehinkel et al. 2006; Xu et al. 2009). Children high in irritability are particularly affected by parenting that is overprotective or high in psychological control. High frustration coupled with parental overcontrol seems to predict more aggressive behavior and externalizing symptoms (Calkins 2002; Degnan et al. 2008a; Morris et al. 2002b) with some exceptions (Veenstra et al. 2006; Xu et al. 2009). Moreover, this has been replicated from toddlerhood through pre-adolescence. Negative forms of parental control, such as psychological control, inconsistency, or physical discipline, might be particularly upsetting for children high in frustration, who might experience more distress and anger in response to such parental control efforts and may not internalize the rules or expectations that parents are enforcing. Generally, sensitivity to parental overcontrol for children high in frustration seems to be specific to externalizing problems (Kiff et al. 2007; Sentse et al. 2009), although a few studies have suggested that perceptions of overcontrol may predict concurrent depression or internalizing symptoms (Oldehinkel et al. 2006; Morris et al. 2002a, b).

Children who are highly frustrated or irritable might need predictable, clear, and reasonable boundaries to manage their emotions and behavior and seem to benefit from consistent discipline (Lengua 2008). In addition, researchers have demonstrated that parenting behaviors targeted at helping children manage their emotions during a frustrating laboratory task related to the development of children's aggressive behaviors. Thus, at the age of 6 months, children's irritable distress and mothers' efforts to encourage their children's attention toward the distress interacted to predict children's level of aggressive behavior problems at the age of 2.5 years (Crockenberg et al. 2008). High levels of infant distress when coupled with parenting behaviors that encouraged the child to attend to a frustrating event predicted more behavior problems 2 years later. Conversely, low infant distress predicted less behavior problems regardless of the level of maternal behavior. Similarly, young children high in frustration may benefit from parental guidance and structuring to help modulate their approach orientation and anger proneness (Calkins 2002), although this may not be as beneficial for older children (Kiff et al. 2007).

For warm and supportive parenting, the experience or perception of low emotional warmth has been linked to fewer prosocial behaviors (Kochanska et al. 2005) and concurrent depressive symptoms in pre-adolescents high in irritability (Oldehinkel et al. 2006), but not increases in internalizing symptoms across time (Kiff et al. 2007; Sentse et al. 2009). Further, multiple studies failed to support the interaction between frustration and perceptions of emotional warmth in predicting externalizing problems in middle childhood through adolescence (e.g., Carlo et al. 1998; Sentse et al. 2009; Veenstra et al. 2006). Rather, research has demonstrated that for children high in irritability or frustration, maternal hostility and rejection were associated with greater externalizing (Lengua 2008; Morris et al. 2002a; Sentse et al. 2009; Veenstra et al. 2006), but not internalizing problems (Kiff et al. 2007; Lengua 2008; Morris et al. 2002a; Oldehinkel et al. 2006; Sentse et al. 2009). Notably, all of the significant findings included children's reports of parental hostility or rejection, suggesting that perceptions of parental hostility or rejection may be important in this pattern. These associations suggest that the effects of parental hostility and rejection might be pronounced in children who are easily aroused to anger. Often, the association between a negative parenting behavior and child adjustment for irritable children is two or three times the magnitude of the association for children lower in irritability. For children high in irritability, a negative parent–child relationship might produce resentment and distress that can impede the internalization of rules, disrupt social interactions, or result in acting out.

### *Summary of Frustration*

The pattern of bidirectional associations between frustration and parenting is rather consistent. Frustration and irritability elicit and are increased by negative parenting behaviors such as rejection, inconsistency, and harsh parenting, and children higher in irritability are more prone to internalizing and externalizing problems in the presence of negative parenting behaviors. Moreover, this pattern suggests a mechanism in the development of adjustment problems as maternal rejection has been shown to predict changes in irritability and, in turn, pre-adolescents' internalizing and externalizing problems (Lengua 2006).

However, support for the interaction between children's irritability or frustration and parenting behaviors is mixed. Many studies examined these interactions in younger (e.g., infant or toddler) or older (e.g., pre-adolescent) children with no studies examining how parenting may interact with children's frustration in preschool or early childhood. The results suggest that children vary in their sensitivity to some parental control behaviors, particularly for younger children and when parental overcontrol or psychological control is examined. However, in older samples, the findings are less consistent with most studies failing to support multiplicative effects (Kiff et al. 2007; Sentse et al. 2009; Veenstra et al. 2006; Xu et al. 2009). With regard to the

affective quality of parental rearing behaviors, perceptions of parental rejection appear to place children high in irritability at increased risk for externalizing problems. Although findings indicate that child frustration or irritability results in differential responding to parenting behaviors, there was little support for differential susceptibility in which children high in irritability "flourish" in response to positive parenting. Rather, parenting and children's irritability often served as unique risk factors for adjustment problems (Kiff et al. 2007; Xu et al. 2009). Most results were consistent with a diathesis-stress model in which children high in frustration were at greater risk for developing problems. Yet a few findings were in line with the differential susceptibility hypothesis (Degnan et al. 2008b), although this was difficult to evaluate when studies provided inadequate information to evaluate adherence to Belsky's criteria (Morris et al. 2002a, b).

## Fear and Inhibition

### *Bidirectional Relations with Parenting*

An interesting and complicated picture of the relation between parenting and fear emerges from studies examining their transactional relations. A number of studies have examined bidirectional relations between child fear and parental control, and most of those studies have assessed psychological control, such as overcontrol, autonomy granting, or intrusiveness. Parental overcontrol is related to children's fearful inhibition (Chen et al. 1998; Coplan et al. 2009; Kochanska et al. 2004). However, when examined longitudinally, the direction of findings is inconsistent. In a sample of toddlers, parental reports of intrusiveness predicted decreases in inhibition (Park et al. 1997). However, in other studies, protective or overly solicitous parenting predicted increases in toddlers' fearful inhibition (Rubin et al. 2002; Rubin et al. 1997). In turn, fearfulness seems to elicit more protective, solicitous, and accommodating responses and less encouragement of autonomy from parents (Belsky et al. 2000; Martini et al. 2004; Rubin et al. 1999). Notably, all of these studies utilized samples of young children, limiting our understanding beyond toddlerhood. Few studies have examined parental behavioral control, but in tests of bidirectional relations, consistent and direct limit setting predicted decreases in fear during infancy (Arcus 2001) and middle childhood (Lengua and Kovacs 2005) but increases in fear in the transition to early adolescence (Lengua 2006).

Interestingly, in some studies, positive affective qualities of parenting, such warmth and acceptance, maintained or engendered fearfulness in younger children (Arcus 2001; Kochanska et al. 2004), while in others they were unrelated to changes in fear (Park et al. 1997). However, a longitudinal test of bidirectional relations between fear and parental acceptance in middle childhood failed to show a role of parenting in shaping fearfulness (Lengua and Kovacs 2005). Instead, parental rejection predicted increases in pre-adolescent fearfulness and, in turn, internalizing problems (Lengua 2006). In addition, it appears that fearfulness in children elicits greater acceptance and comforting and less rejection from parents (Lengua and Kovacs 2005; Lengua 2006; Nachmias et al. 1996).

Few studies have considered bidirectional relations between parental responsiveness or sensitivity and fear, and fewer have used longitudinal designs (Park et al. 1997). Further, the findings are contradictory with some indicating no relation between responsiveness and fear (Kochanska et al. 2004; Park et al. 1997) and others demonstrating positive cross-sectional relations between fear and responsiveness (Kiel and Buss 2006). These inconsistent results likely stem from differences in the operationalization of maternal responsiveness and sensitivity.

It might be important to consider the child's age when examining relations between fear and parenting, as it appears that inconsistent limit setting, solicitousness, sensitivity, and protective behaviors during infancy and early childhood might maintain or increase fear (Arcus 2001; Park et al. 1997; Rubin et al. 1997), whereas rejection and consistent limit setting predicted increases in fear in pre-adolescents (Lengua 2006). The different needs and abilities of children at these various developmental stages might account for these differences. Younger children require their parents' facilitation of emotion regulation and adaptive responses in social and novel situations. However, older children are more autonomous and might require a sense of their parents' acceptance and support of their independence. It is also important to note that these effects tend to be modest in size. This suggests that although fear and parenting shape each other to some extent, these bidirectional effects are not pronounced and may be less salient than the effects for other temperament characteristics such as irritability and impulsivity.

### *Interactions with Parenting*

Mirroring the bidirectional relations between parenting and fear, the patterns of interaction effects between parenting and fear are inconsistent, with fear variously exacerbating or mitigating the effects of negative parenting behaviors. It appears that differences in patterns of interaction effects depend on children's level of fear (fearful or fearless) and the aspect of parenting (control or affective). Notably, fear is unique in that both high and low levels are vulnerabilities

for the development of problems, with fearfulness consistently linked to anxiety (Schwartz et al. 1999) and low fear being a risk factor for externalizing symptoms (Kochanska et al. 2007). It also appears that gender moderates the interactions between parenting and fear, with different patterns of associations emerging for boys and girls.

The interaction between parental control behaviors and fear has been extensively examined, and the effectiveness of parents' efforts to control children's behaviors appears to depend on children's level of fear. However, the findings are inconsistent, including non-significant interactions between fearfulness and parental control (e.g., Kiff et al. 2007; Leve et al. 2005; Morris et al. 2002b; Oldehinkel et al. 2006; Sentse et al. 2009), particularly when internalizing outcomes are considered. It is also important to distinguish between indicators of behavioral control, such as consistent or appropriate discipline, and psychological control or intrusiveness.

Fearful children appear to be responsive to gentle or moderate behavioral control (Nachmias et al. 1996) and even to inconsistent discipline (Lengua 2008). Fearful children might be more sensitive to cues of negative consequences so that discipline applied, even inconsistently serves to effectively reduce problem behaviors. Gentle discipline predicted compliance for fearful children (Kochanska 1995, 1997), while fearful temperament exacerbated the negative effects of power assertive or harsh parenting (Fowles and Kochanska 2000; Kochanska et al. 2007; Leve et al. 2005). Fearful children might experience over-arousal in response to harsh or physical punishment and may not optimally internalize the rules that parents are enforcing, which in turn may predict the emergence of behavior problems. This may be particularly true for boys (Colder et al. 1997; Lengua 2008), as their fearful responses may be more pronounced and/or less socially acceptable. However, there are some exceptions (e.g., Cornell and Frick 2007; Gilliom and Shaw 2004; Leve et al. 2005; Kimonis et al. 2006) as authoritarian parenting predicted more prosocial behavior for fearful girls (Hastings et al. 2005).

Conversely, low-fear children do not seem to be adversely impacted by parenting that is harsh or power assertive (Cornell and Frick 2007; Kochanska et al. 2007), although not in all cases (Leve et al. 2005). For children low in fear, gentle discipline is thought to be ineffective for eliciting compliance, as it does not result in an "optimal" level of arousal. Instead, fearless children appear to be sensitive to parents' use of inconsistent discipline practices. Inconsistent discipline appears to increase adjustment problems, particularly for fearless boys (Lengua 2008).

Studies of psychological control also result in inconsistent patterns of findings. For example, inhibited toddlers were observed as socially wary two years later, only if their mothers were observed to be intrusive or controlling (Rubin et al. 2002). However, some studies suggest that parental overprotection can be related to positive adjustment, including more prosocial behavior for fearful girls (Hastings et al. 2005). Another exception is a study that found that negative maternal control predicted reduced growth in children's internalizing symptoms from 2 to 6 years in fearful, highly reactive children (Gilliom and Shaw 2004). In school-age children, perceptions of parental overprotection were related to concurrent externalizing problems (Morris et al. 2002b) and later depressive symptoms for boys (Colder et al. 1997). Moreover, fearful boys reported notably fewer depressive symptoms in the presence of low parental control, consistent with Belsky's differential susceptibility model (Colder et al. 1997). However, in older children, there is less evidence for variations in sensitivity to parental overcontrol or low autonomy granting based on fearfulness. In particular, studies of pre-adolescent youth did not support the interaction between fear and various measures of parental overcontrol (Kiff et al. 2007; Oldehinkel et al. 2006; Sentse et al. 2009). There is some evidence that variations in sensitivity may be present in adolescents as van Brakel and colleagues demonstrated that maternal control interacted with adolescents' fearfulness to predict anxiety symptoms only when attachment style was also taken into account (van Brakel et al. 2006). For children high in inhibition who were also securely attached, maternal control was related to lower levels of anxiety. Thus, it appears that younger, fearful children may be sensitive to experiences of parental overcontrol and that there may be sex differences in whether parenting relates to negative or positive outcomes in fearful children. However, additional research is needed.

Together, these very complex findings suggest that negative maternal control serves to sustain or exacerbate problems in most boys; however, for those high in fear, it seems to have a counterintuitive association, relating to lower internalizing and externalizing problems. It is possible that what appears to be overly controlling behaviors from mothers might be their attempts to contain or modulate children's emotional dysregulation. Their experience with their children high in emotional reactivity might have taught them that quick, firm efforts at control are required to divert escalation of emotional reactions. Several recent studies support this supposition (Hastings et al. 2005; Gilliom and Shaw 2004; Kiff et al. 2007). For example, maternal negative affect in parent–child interactions interacted with children's fear in predicting initial levels and changes in anxiety and depression symptoms as children transitioned to adolescence (Kiff et al. 2007). For children high in fear, greater maternal negativity was associated with a decrease in depression across the study.

These diverse patterns of results suggest that the interaction effects of fear and parents' harsh or critical forms of control are complex and perhaps depend on other factors such as child age, gender, or the presence of other child or family characteristics. Greater consistency in measures of parenting, fearfulness, and replication of findings at different developmental periods is needed to clarify these complex patterns of associations.

For relational or affective aspects of parenting, it appears that fearful children are more susceptible to the adverse effects of negative parenting but do not necessarily benefit more from positive relationship qualities. For example, social reticence in 4-year-olds was predicted by an interaction between toddlers' inhibition and derision, with inhibition predicting later reticence only if mothers exhibited derisive comments (Rubin et al. 2002). In pre-adolescence, maternal rejection was more strongly related to adjustment problems in girls who were high in fear compared with girls low in fear or in boys (Oldehinkel et al. 2006). Further, these findings have been replicated in longitudinal investigations in which fearful children report more internalizing symptoms in relation to rejection (Kiff et al. 2007; Sentse et al. 2009). Similarly, fear and shyness in 18-month-old boys, but not girls, predicted greater shyness at 30 months when mothers were insensitive (Eggum et al. 2009). The effects of parental rejection or insensitivity might be pronounced in children who are highly reactive and who might experience greater distress as a result of such parental behaviors. Therefore, children higher in fear might be more adversely affected by negative relationships with their parents than children lower in fear. Fearful children might internalize parental rejection and criticism more readily, as those children might perceive that their relationship with their parents is threatened (e.g., Gruner et al. 1999), resulting in increases in adjustment problems. However, this proposed association was not consistently supported (Kiff et al. 2007; Lengua 2008). Interestingly, fearful children, at least in pre-adolescence, do not seem to be particularly sensitive to parental warmth (Kiff et al. 2007; Oldehinkel et al. 2006; Sentse et al. 2009). Conversely, fearless children show benefit from parenting that is warm, responsive, and positive (Fowles and Kochanska 2000; Hastings et al. 2005; Kochanksa 1995, 1997; Kochanska et al. 2007; Lahey et al. 2008; Leve et al. 2005).

### *Summary of Fear*

Both bidirectional and interaction effects of parenting and fear are observed. However, the pattern of associations for fearfulness is complex, and fear might operate differently given different aspects of parenting, for boys and girls, at different developmental periods and at different levels of fear (fearful versus fearless). For the most part, fearfulness appears to render children highly sensitive to parenting efforts, both positive and negative, which must be carefully balanced in response. As a result, parents must balance warmth and responsiveness with consistency and appropriate limit setting that is not overprotective or controlling to reduce child fearfulness and the likelihood of problems emerging. There is some evidence that maternal negativity may maintain or increase child fearfulness and, in turn, the emergence of internalizing problems. However, additional research is needed to understand how these bidirectional relations translate into pathways to the development of adjustment problems.

Child fearfulness also moderates the relation of parenting with adjustment outcomes. Although a relatively large number of studies have examined the interaction between temperamental fear and parenting to predict children's adjustment, most studies tend to focus on parental control behaviors rather than the affective quality of parenting. With regard to specific parenting dimensions, support was consistently found for variations in children's responsiveness to parental discipline practices. Interestingly, children high in fear tend to be adversely impacted by parental control behaviors, particularly intrusive and harsh parenting (Colder et al. 1997; Kochanska et al. 2007; Lengua 2008; Rubin et al. 2002). Conversely, with few exceptions (e.g., Nachimas et al. 1996), children low in fear seem to benefit from warm and supportive parenting environments (Kochanska 1995, 1997; Kochanska et al. 2007). These patterns are consistent with Kochanska's proposal that children low in fear benefit from warm and supportive parenting environments, while children high in fear may be overly aroused by harsh parenting practices. Further, this pattern has been found in toddlers to pre-adolescents.

However, some unexpected associations emerged, namely maternal negativity or negative control was not consistently associated with poorer adjustment (e.g., Gilliom and Shaw 2004; Kiff et al. 2007). Instead, fearful children sometimes demonstrated better adjustment in the face of parental negativity and did not benefit from more positive parenting. While these findings may be contrary to expectations, increasing evidence suggests that traditionally negative parenting behaviors should not be considered universally negative. Rather, they may reflect parents' efforts to contain children's fearful distress, thereby externally managing children's anxious arousal.

Gender differences, particularly in interaction effects, emerged across studies suggesting that boys may be more sensitive to parenting behaviors across levels of fear (Colder et al. 1997; Eggum et al. 2009; Gilliom and Shaw 2004; Hastings et al. 2005; Lengua 2008). However, some of these studies included only boys (Colder

et al. 1997; Gilliom and Shaw 2004) making it difficult to discern whether different patterns would have emerged for girls.

Support for Belsky's differential susceptibility hypothesis emerged, predominantly in studies examining maternal responsiveness or sensitivity interacting with low fear (Karrass and Braungart-Rieker 2003; Kochanska 1997; Lahey et al. 2008). There was some support for Belsky's model in fearful children (Colder et al. 1997; Eggum et al. 2009; Hastings et al. 2005). However, most studies failed to support Belsky's condition that children high in fear would substantially benefit from better parenting (e.g., Gilliom and Shaw 2004; Kiff et al. 2007; Oldehinkel et al. 2006; Sentse et al. 2009). Instead, a diathesis-stress model in which fearful or low-fear children were adversely affected by negative parenting behaviors fit many of the findings (e.g., Kochanska et al. 2007; Lengua 2008; Morris et al. 2002b; Oldehinkel et al. 2006).

This complexity of the relations between fear to parenting and adjustment is perhaps the most surprising and intriguing finding of this review and highlights the need for greater efforts to understand the role of children's fear and inhibition in the development of adjustment problems beyond simply examining its direct relation to anxiety. It also suggests that parenting advice and interventions might need to be tailored to address parents with fearful children in particular.

## Self-regulation or Effortful Control

### *Bidirectional Relations with Parenting*

In infants and young children, parenting consistently predicts the development of self-regulation and effortful control and effect sizes tend to be moderate. The use of rewards (Kyrios and Prior 1990) and control strategies that include clear, consistent limits and non-punitive discipline relate to higher effortful control (e.g., Karreman et al. 2008a; Lengua et al. 2007; Olson et al. 1990), whereas power assertion, coercion, rejection, and punitive discipline correlate with lower effortful control (Colman et al. 2006; Karreman et al. 2008a; Kochanska et al. 2008; Kochanska and Knaack 2003; Morrell and Murray 2003). In addition, maternal warmth, sensitivity, and scaffolding predict increases in effortful control in early childhood (Braungart-Rieker et al. 2001; Clark et al. 2008; Colman et al. 2006; Eiden et al. 2004; Feldman et al. 1999; Halverson and Deal 2001; Karreman et al. 2008b; Kochanska et al. 2000; Lengua et al. 2007; Olson et al. 1990).

However, evidence for the role of parenting in the development of effortful control or self-regulation in older children is less consistent. In an intervention study, Brody et al. (2002, 2005) demonstrated that intervention-related changes in maternal competence-promoting parenting predicted increases in youth self-control. However, the measure of self-control in this study may include the aspects of impulsivity, as the measure assessed thinking ahead about consequences, planning ahead, and keeping promises, which may have more to do with impulse control than with attention regulation and cognitive inhibition. As discussed below, impulsivity is more consistently related to parenting behaviors than effortful control. In a longitudinal study examining parenting and effortful control in children transitioning from middle childhood to adolescence, parental warmth and positive expressivity predicted increases in children's effortful control earlier, but not later in middle childhood (Eisenberg et al. 2005a, b), a finding consistent with evidence that parenting did not predict changes in effortful control in pre-adolescents (Lengua and Kovacs 2005; Lengua 2006). Notably, these studies tested transactional models in which parenting was a predictor of changes in effortful control and vice versa, presenting several rigorous tests of bidirectional relations between parenting and effortful control in middle childhood. Thus, parenting may be an important force in shaping children's self-regulation and effortful control in early childhood but may have less of a role during pre-adolescence and adolescence. It is critical to understand the role of parenting in the development of self-regulation as this might point to a key mechanism of the effect of parenting on children's adjustment. Parenting may promote or hinder the development of self-regulation, which has been shown to be an important basis for children's adjustment problems and psychopathology (Olson et al. 2005; Posner and Rothbart 2000).

Few studies have examined the extent to which self-regulation or effortful control might elicit parenting behaviors. In infants, effortful control predicted lower hostile and coercive parenting (Morrell and Murray 2003). This finding was replicated in toddlers (Bridgett et al. 2009). When bidirectional relations were tested during middle childhood, effortful control predicted decreases in rejection in one study (Lengua 2006), but not in other similar studies (Eisenberg et al. 2005a, b; Lengua and Kovacs 2005). Similar tests have not been conducted in preschool or adolescent samples. Although effortful control is highly correlated with impulsivity, it is possible that impulsivity, and not low effortful control, elicits negative parenting responses, as described below.

### *Interaction with Parenting*

The effects of parenting also may depend on children's self-regulation or effortful control as children's self-

regulation might mitigate the degree of external regulation and control they require. Self-regulation or effortful control appears to be particularly relevant in moderating the relation between parental control behaviors and externalizing problems, with the relation of negative control to problems sometimes being two or three times stronger in children lower in effortful control. In young children, two studies examined the interaction between parental overcontrol and children's physiological regulation as measured by vagal withdrawal during laboratory tasks (Degnan et al. 2008b; Hastings et al. 2008). In both studies, for children high in physiological regulation, observations of low parental control predicted less aggressive behavior problems (Degnan et al. 2008b) and less social wariness and inhibition (Hastings et al. 2008). Conversely, when parents were high in control or protection, these children reported more adjustment problems suggesting that the addition of external regulation was not a benefit. These findings point to a goodness-of-fit model in which the match between children's level of internal regulation and parents' degree of external regulation is important.

Older children low in self-regulation seem to benefit from parenting that is higher in control, guidance and lower in autonomy granting, which predicted lower externalizing (Van Leeuwen et al. 2004; Xu et al. 2009) and decreases in internalizing (Kiff et al. 2007) with some exceptions (Morris et al. 2002a; Veenstra et al. 2006). Also, inconsistent discipline and physical punishment predicted externalizing in low effortful control pre-adolescents but not in high effortful control youth (Lengua 2008). In addition, maternal hostility was related to externalizing problems for school-age children low in effortful control (Morris et al. 2002a).

It is interesting to note that tests for an interaction between effortful control and indicators of positive parent–child relationship, such as warmth, have generally been non-significant (Kiff et al. 2007; Lengua 2008; Van Leeuwen et al. 2004; Veenstra et al. 2006). However, some evidence suggests that children vary in their sensitivity to supportive parenting based on their self-control. Specifically, children lower in self-regulation seem to benefit from parenting (particularly paternal parenting) that is high in support or positivity (Hastings et al. 2008; Van Leeuwen et al. 2004). The interaction between effortful control and the affective quality of parenting emerges most consistently when examining parental negativity, with few exceptions (e.g., Lengua 2008; Veenstra et al. 2006). Children low in effortful control demonstrated more externalizing problems when they reported high maternal hostility (Morris et al. 2002a) and maintained higher anxiety when mothers were observed to be high in negative affect (Kiff et al. 2007).

### *Summary of Self-regulation or Effortful Control*

Parental responsiveness, consistency, and warmth in early childhood consistently predicted developmental increases in effortful control, but the findings were less consistent later in childhood, and may reflect the role of parenting in the development of impulsivity more than effortful control itself (e.g., Brody et al. 2002, 2005). There might be a sensitive period in the infant and preschool years in which parenting has its greatest effect on effortful control. By early adolescence, parental behaviors do not appear to relate to changes in effortful control or self-regulation. Instead, children's temperamental self-regulation may instead serve to moderate children's response to variations in parenting later in childhood. The effects of child effortful control on parental behaviors have not been adequately studied and should be examined further.

Evidence supports the interaction between children's self-regulation and parental control behaviors, particularly in predicting externalizing problems (Degnan et al. 2008b; Lengua 2008; Xu et al. 2009; Van Leeuwen et al. 2004), whereas fewer studies supported the prediction of internalizing problems (Hastings et al. 2008; Kiff et al. 2007). Overall, children low in self-regulation appear to benefit from parental control including less autonomy granting, more guidance, and consistency. There was little consistent support for interactions between self-regulation and the affective components of parenting, potentially as a result of variability in the measures of self-regulation used, including physiological regulation. Thus, measurement differences may account for divergent findings. Lastly, no studies examined the interaction of self-regulation with responsiveness.

Some support for the differential susceptibility hypothesis was yielded (e.g., Kiff et al. 2007). However, the predominant pattern of findings was such that children low in self-regulation sometimes benefited from increased parental control and structuring but most often seem to demonstrate more problems regardless of parenting. Conversely, children higher in effortful control demonstrated fewer adjustment problems, even when parental behaviors were less than ideal. These findings are inconsistent with the differential susceptibility hypothesis as more "negative" parenting behaviors including high control and/or lower autonomy granting were related to better adjustment for children lower in self-regulation and unrelated to problems for children higher in self-regulation. In sum,

children low in self-regulation are more likely to demonstrate adjustment problems, particularly externalizing, across all levels of parenting.

## Impulsivity

Impulsivity is moderately to highly correlated with effortful control (e.g., Eisenberg et al. 2007; Rothbart et al. 2001). However, impulsivity is considered an indicator of approach motivation or surgency rather than a component of self-regulation (Rothbart et al. 2001). Impulsivity and effortful control are believed to stem from different neurological bases, with effortful control reflecting executive activity in the pre-frontal cortex and impulsivity stemming from BAS activation reflecting activity in the basolateral amygdala and ventral tegmental areas. Impulsivity may be best conceptualized as a multifaceted construct including motivational (insensitivity to punishment/non-reward or sensitivity to reward) and cognitive regulatory components (inhibitory control; e.g., Evenden 1999; Mezzacappa et al. 1998; Whiteside and Lynam 2001). Given this, we review studies examining impulsivity separately from effortful control.

### *Bidirectional Relations with Parenting*

Although relatively few studies have examined the relation of parenting with the development of impulsivity in particular, as opposed to broader construct of self-regulation, those have consistently shown that parenting behaviors are moderately related to increases or decreases in impulsivity, with only rare exceptions (Calkins et al. 1998). In cross-sectional studies, power-based control efforts were related to greater impulsivity in toddlers (Silverman and Ragusa 1990) and preschool-age children (Mauro and Harris 2000), while parental autonomy granting was associated with better delay performance (Silverman and Ragusa 1990). Further, it is possible that parenting predicts impulsivity only in children with a genetic predisposition for this trait. Specifically, polymorphic variations in the 7-repeat allele of the dopamine receptor D4 gene (7-repeat DRD4 polymorphism) have been associated with ADHD and attention-related outcomes. For children with the 7-repeat allele of the dopamine receptor D4 gene, low-quality parenting was correlated with higher levels of sensation seeking, a variable closely associated with impulsivity. Conversely, parenting was unrelated to children's sensation seeking in children classified as 7-repeat absent (Sheese et al. 2007). It is possible that parenting predicts impulsivity only in children with a genetic predisposition for this trait. However, these cross-sectional studies limit our understanding of transactional effects.

Few studies have examined this relation longitudinally, limiting our understanding of whether parenting predicts changes in impulsivity, or vice versa. In one longitudinal study, power-based control, including strictness and intrusiveness, predicted lower delay or greater impulsivity in young children (Houck and Lecuyer-Maus 2004). In another longitudinal study, children whose mothers used relatively non-restrictive clear, consistent, and non-punitive discipline when children were 2 years old demonstrated better behavioral control and delay of gratification when they were 6 and 8 years old (Olson et al. 1990, 2002).

Little research addresses whether impulsivity predicts parenting. One study examined whether parenting behaviors were contingent on children's impulsivity during a delay of gratification task and showed that parents' distracting or non-distracting responses were contingent on children's ability to delay, and vice versa (Putnam et al. 2002). However, these findings are based on a cross-sectional design, limiting the elucidation of bidirectional processes. We were unable to find additional studies that examined whether impulsivity elicited particular parenting behaviors, apart from studies examining a broader construct of self-regulation or combined impulsivity and irritability to create a measure of dysregulation (e.g., Rubin et al. 1998). In fact, impulsivity and irritability tend to be correlated, and both are believed to stem from the BAS or reward motivation system. This is an important area for future investigation, as impulsivity is a key risk factor in the development of psychopathology (Nigg 2006), and the elicitation of negative parenting behaviors may be one mechanism of that effect. We posit that impulsivity in children may elicit more inappropriate control behaviors, particularly harsh and physical discipline, from parents as children require more external regulation of their behaviors and often in circumstances in which they are approaching situations that are dangerous or prohibited. However, we posit that impulsivity will not elicit more rejection or hostility from parents, except through its correlation with irritability.

### *Interactions with Parenting*

Overall, much support emerges for the interaction between parental control behaviors and children's temperamental impulsivity, although there was little overlap across studies in the specific parenting dimensions examined. Children high in impulsivity benefit from parenting that is high in control (Rubin et al. 1998; Stice and Gonzales 1998; Xu et al. 2009) and consistency (Lengua et al. 2000), but that is not harsh (Leve et al. 2005; Rubin et al. 2003; Xu et al. 2009). Moreover, these findings have been replicated from toddlerhood through adolescence.

One study found that parental inconsistent discipline was more strongly related to depression and conduct problems for children higher in impulsivity (Lengua et al. 2000). Similar findings emerged in other studies. In particular, parental negative control was related to higher aggressive behavior and externalizing problems for toddler boys low in behavioral control (Rubin et al. 1998) and for school-age children high in resistant temperament (Bates et al. 1998). Similarly, parental indulgence predicted school-age children's proactive aggression only when children were above the mean on sensation seeking (Xu et al. 2009). In adolescence, perceptions of parental control were related to antisocial behavior for adolescents low in behavioral control (Stice and Gonzales 1998).

The increased sensitivity of children high in impulsivity to parental discipline practices that are harsh has been well supported with one exception (King and Chassin 2004). In particular, a longitudinal investigation into changes in children's externalizing problems demonstrated that maternal harsh discipline interacted with girls' impulsivity to predict the level of externalizing problems at age 17 (Leve et al. 2005). For girls higher in impulsivity, lower maternal harshness was associated with fewer problems. Conversely, harsh parenting and impulsivity demonstrated additive but not interactive effects in predicting the level of boys' externalizing problems. Harsh parenting was also shown to interact with children's sensation seeking in predicting proactive aggression, such that for children high in sensation seeking, harsher parenting was related to more aggressive behavior (Xu et al. 2009). The interaction of maternal parenting with children's impulsivity was also examined in relation to internalizing problems and was not significant (Leve et al. 2005), which is similar to the pattern of findings described for effortful control.

Several studies examined variations in responsiveness to warm, supportive, and sensitive parenting. For school-age children at genetic risk for impulsivity (presence of the 7-repeat DRD4 polymorphism), which is associated with decreased dopamine receptor efficiency, high maternal sensitivity predicted fewer externalizing problems, a pattern consistent with the differential susceptibility hypothesis (Bakermans-Kranenburg and van Ijzendoorn 2006). Further, toddlers high in exuberance appear to benefit from parental discipline practices characterized by positive and warm emotional tones, predicting increases in effortful control across 2 years (Cipriano and Stifter 2010). However, when considered in adolescence, there is mixed support for a substantial benefit of a supportive parent–child relationship for children high in impulsivity. One study demonstrated that for high-school seniors high in behavioral undercontrol, perceptions of high parental support were related to concurrent reports of less antisocial behavior problems (Stice and Gonzales 1998). However, another study following adolescents into early adulthood found that supportive parenting predicted less substance use at age 20, particularly for youth low in impulsivity (King and Chassin 2004). It is important to note that these studies utilized samples at different risk for problems including a community sample (Stice and Gonzales 1998) and a high-risk sample (King and Chassin 2004), which may account for these differences.

### *Summary of Impulsivity*

An important direction for future temperament research will be to clarify the relations among impulsivity, effortful control and irritability, as these dimensions are correlated with each other, but potentially differentially related to other variables such as parenting and adjustment outcomes. Compared to effortful control, impulsivity is more consistently predicted by parenting, with clear, consistent, nonpunitive parenting, leading to improvements in children's impulsivity. Conversely, impulsivity appears to increase in the presence of harsh and inappropriate controlling behaviors by parents. We hypothesize that child impulsivity elicits more inappropriate control behaviors from parents, as impulsive children may be harder to manage in situations that are dangerous or prohibited. However, the effect of child impulsivity on parental behaviors has not been examined to date.

Impulsivity also appears to render children more vulnerable to the effects of inappropriate or harsh parental control, increasing risk for the development of externalizing problems. Findings across studies are fairly consistent and demonstrate that children high in impulsivity benefit from parenting that is more consistent (Lengua et al. 2000), higher in behavioral control (Bates et al. 1998; Stice and Gonzales 1998; Xu et al. 2009), and more sensitive (Bakermans-Kranenburg and van Ijzendoorn 2006; Rubin et al. 2002) but that is not harsh or negative (Leve et al. 2005; Rubin et al. 1998; Xu et al. 2009). In addition, these findings seem to be consistent across children's developmental stages from toddlerhood through adolescence. With regard to models of differential susceptibility, although children high in impulsivity tend to benefit from more supportive, consistent, and/or structured parenting, few of the findings were consistent with the differential susceptibility hypothesis (Bakermans-Kranenburg and van Ijzendoorn 2006). Instead, most results were consistent with a diathesis-stress model. Children high in impulsivity were at greater risk for adjustment problems across levels of parenting behavior. However, in the presence of beneficial parenting (e.g., higher support, more consistency), children high in impulsivity were buffered against the development of problems.

## Summary and Conclusions

Researchers are increasingly attentive to children's individual differences in relation to parenting. While parenting is thought to shape children's emotional and self-regulatory behaviors, those same child behaviors appear to elicit different parenting and to result in differential child responses to parents' behaviors. In addition, researchers have become increasingly interested in how, why, and when children vary in their sensitivity to different parenting behaviors and environmental characteristics. Generally, there was support for both bidirectional and interactive relations between parenting and temperament. Bidirectional relations between parenting and child temperament suggest that parents shape children's emotional and self-regulation characteristics while also responding differently to children based on those characteristics. However, the ability to draw specific mechanistic conclusions is significantly limited by the lack of rigorous studies testing for bidirectional relations. Thus, additional research is needed to gain a better understanding of transactional processes between temperament and parenting across childhood. In addition, a wide variety of studies support the interaction between parenting and temperament in predicting children's adjustment pointing to variations in children's sensitivity to parental control and responsiveness behaviors based on their level of negative emotionality or self-regulation. Less support was garnered for interactions with affective qualities of parenting.

### Support for Theoretical Models

In this review, we evaluated support for both transactional and interactive relations between parenting and temperament. With regard to transactional models, researchers and clinicians have advocated bioecological and transactional frameworks for how parents and children jointly and mutually shape one another during development (e.g., Bell 1968). Further, it is widely accepted that developmental pathways occur through reciprocal transactions between individuals and their environments (Hinshaw 2008). However, surprisingly few studies adequately test transactional models. This review highlights evidence that supports a reciprocal model of development when children's temperament and parenting are examined. However, it is difficult to ascertain to what degree parenting shapes children's characteristics and vice versa, largely due to there being very few studies that examined bidirectional effects using longitudinal designs and quantitative methods that might clarify these directional effects (for guidance on these models see Bollen and Curran 2004; Cook and Campbell 1979; Gottman 1995; Shadish et al. 2003). Thus, additional research is needed to fully understand to what degree temperament and parenting shape one another. Future research would benefit from longitudinal designs that include three (or more) time points, assess parenting and temperament across developmental periods, and include indicators of adjustment outcomes. Such studies would present rigorous tests of bidirectional processes and begin to elucidate the degree to which parenting and temperament shape one another.

Interactive relations between temperament and parenting have been tested somewhat more rigorously and speak to various models of children's differential responsiveness to parenting behaviors. As noted throughout the review, some interaction findings are in line with specific models of differential susceptibility, particularly when parental responsiveness or sensitivity is considered (e.g., Belsky et al. 1998; Lahey et al. 2008; Stright et al. 2008). However, most of the findings do not adhere to the differential susceptibility criteria that children with temperamental vulnerabilities flourish in the presence of positive parenting as well as flounder in the face of negative parenting. Instead, temperamental vulnerabilities such as high negative emotionality or low self-regulation seem to place children at increased risk for developing adjustment problems, but this may be mitigated by positive and good-fitting parenting behaviors. This suggests that the bulk of interaction findings are consistent with a diathesis-stress model for person-by-environment interactions. In addition, some findings were consistent with goodness-of-fit frameworks (e.g., Degnan et al. 2008b; Kiff et al. 2007), but these were few and limited to interactions with effortful control or self-regulation. In addition, some findings are counterintuitive to current theoretical models (e.g., Gilliom and Shaw 2004; Hastings et al. 2005; Kiff et al. 2007; Stice and Gonzales 1998) and require replication as well as reconsideration of existing theories.

### Predictors of Adjustment Outcomes

Bidirectional and interactive relations may clarify specific pathways to children's adjustment problems. Consideration of bidirectional relations between children's emotionality and parents' rearing behaviors allows for a more complex examination of the mechanisms contributing to the development of psychopathology in children. Moreover, by examining how individuals shape and are shaped by their environment, we can examine factors that contribute to and maintain characteristics and precursors for adjustment problems, clarifying the etiology of psychological disorders and highlighting targets for intervention. However, most studies reviewed here were not designed to answer this question. This is either because studies were cross-sectional in design, precluding clarification of direction of effects, or because researchers were solely interested in

reciprocal relations between parenting and temperamental characteristics, thereby choosing not to extend the findings to include adjustment. When examined, research suggests that parenting, particularly negativity, may be important in shaping children's emotionality and, in turn, adjustment problems (Lengua 2006). Yet additional research is needed.

With regard to interactive effects, there was wide support for the interaction of parenting behaviors with children's emotional and regulatory characteristics predicting the development or maintenance of externalizing problems. However, this may be an artifact of the published literature, as more studies examined externalizing than internalizing symptoms or positive adjustment. Overall, children's frustration, low effortful control or self-regulation, and high impulsivity increase children's risk for externalizing behavior problems, particularly in the face of negative parenting or inappropriate control (e.g., Degnan et al. 2008b; Lengua et al. 2000). In addition, fearfulness consistently presents a risk for the development of internalizing symptoms, particularly in the face of negative or overly controlling parenting (e.g., Colder et al. 1997; Oldehinkel et al. 2006). Positive indicators of adjustment were considered less frequently but interactions of negative emotionality (Stright et al. 2008) and fear (Cornell and Frick 2007) with parenting seem to be important in predicting prosocial or positive adjustment indicators.

## Conclusions

The findings of this review suggest that the relations between parenting and temperament and their effects on children's adjustment are complex. The evidence indicates that temperament and parenting may shape each other, as well as condition each other's effects. However, no study has determined whether transactional or interaction effects on adjustment are more pronounced or robust. In fact, that may be an irrelevant question. It may be best to conceptualize the relations between temperament and parenting from a developmental framework that accounts for the differential effects of either parenting or temperament in the presence of the other at a given time point and their mutual influence on each other over time. Interactions capture children's differential sensitivity to parenting behaviors (at a point in time) as a predictor of the development of adjustment problems, while transactional relations might represent the process of how temperament characteristics or parenting behaviors emerge. Thus, it is likely that these processes occur simultaneously. This is depicted in the theoretical model presented in Fig. 1. The initial panel (1a), representing a single time point, highlights that children's adjustment in relation to parenting at a given time might be dependent on children's temperament. The converse may also be true, that is, that the effects of temperament on adjustment at a given time might be dependent upon parenting. Additionally, over time (1b), children's temperament might elicit different parental behaviors, just as parental behaviors may shape children's characteristics, and these bidirectional effects further account for children's adjustment.

## Methodological Considerations and Future Directions

To conceptualize the effects of parenting and temperament from a developmental framework, greater attention to clarifying the direction of effects is needed. The use of cross-sectional designs provides preliminary but limited information about how the association between parenting and temperament emerges. In addition, many studies examined the effects of one variable on the other, particularly parenting on children's emotionality and self-regulation, without considering their bidirectional effects. Intervention studies and studies that include multiple assessments examining mutual prediction of change over time are needed. These studies should include multiple assessments across developmental stages in order to clarify how transactional processes predict adjustment across childhood.

With regard to interactive effects, the question of whether parenting or temperament moderates the effects of the other might be resolved with studies that incorporate growth modeling and other longitudinal methods. Studies of interaction effects can be improved by clarifying the hypothesized mechanism of effect when testing the putative moderator (parenting or temperament) and then testing whether changes in one predict changes in adjustment at different initial levels of the other. Thus, research demonstrating whether parenting × temperament interactions predict growth or changes in adjustment problems is needed.

Greater clarity on the relation of temperament to parenting could be achieved if there were greater consistency across studies in the parenting variables examined. This point cannot be emphasized enough. Although parenting behaviors could be loosely grouped into dimensions (e.g., control, warmth, responsiveness), studies varied greatly in their labeling, measurement, and specification of parenting behaviors. In addition, studies examining a range of specific parenting behaviors that cover both the affective and control dimensions of parenting can facilitate the identification of patterns of relations between parenting and temperament. For example, related but different parenting behaviors are found in the various studies (e.g., harsh,

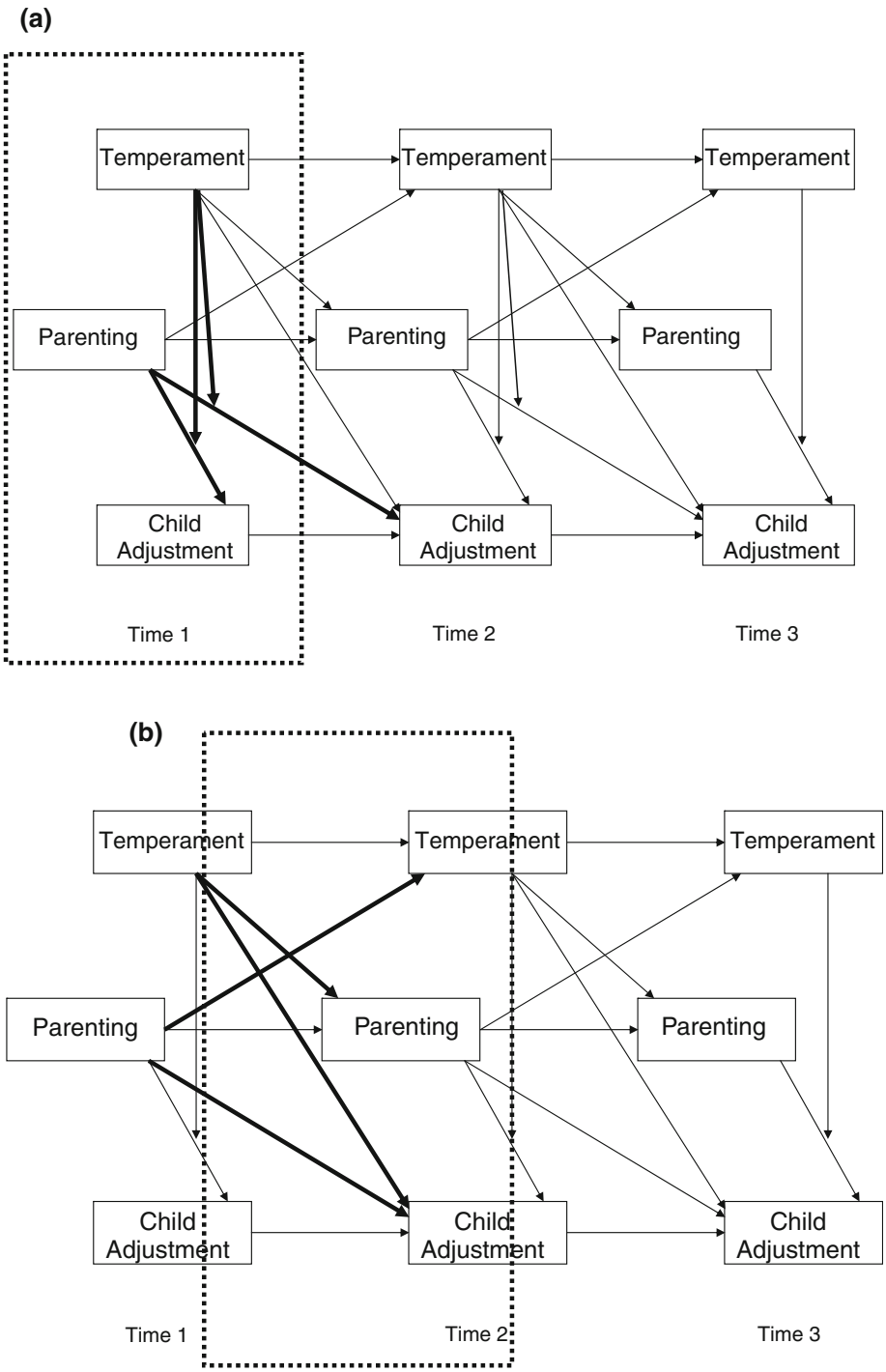


**Fig. 1** Example statistical models for testing interactive and transactional relations between temperament and parenting, with (**a**) interaction effects at a single time point and (**b**) bidirectional effects across time

hostile, physical discipline, and behavioral control). However, it is unclear what the relations of these parenting behaviors to each other might be. Such detailed operationalization of parenting within studies would advance our understanding of the relation of parenting to temperament, as well as the role of parenting in the emergence of social, emotional, and behavioral problems in children. In fact, few studies have examined multiple parenting and temperament dimensions simultaneously.

Inconsistencies in findings across studies might indicate that additional variables are moderating the associations. In particular, multiple temperament characteristics might interact with each other, as they are also interacting or transacting with parenting. For example, the transaction

between fearfulness and parenting might depend on children's effortful control. It is also possible that multiple parenting behaviors interact as they moderate the effects of temperament. For example, emotional or behavioral problems might be less likely in fearful children whose parents are both responsive and use appropriate discipline, whereas they may be maintained or increased if parents are responsive but lax in discipline. Thus, greater clarity in the relation between parenting and temperament might require the examination of 3-way interactions in some cases. Other potential moderators of the parenting × temperament associations include the gender and developmental stage of the child; however, the pattern of findings thus far does not point to any consistent group differences.

Additionally, measurement issues might account for some inconsistencies in findings, although measurement approach did not appear to play a marked role in the pattern of findings observed in this review. There are no gold standards for measuring parenting or temperament, and studies variously use laboratory tasks, behavioral observations, questionnaires, with a few studies employing physiological measures. This might be particularly demonstrated by the inconsistent findings for fear, where it is possible that different operationalizations of fear or inhibition account for inconsistencies. In addition, valid objective or maternal observations of fearfulness might be challenging to obtain, as fearful behaviors are not always ostensible, particularly in older children, whereas self-report of fear might be difficult to obtain from younger children. Inclusion of multiple indicators of fear, including observed, reported, and physiological measures, might clarify some associations with parenting, and such multimethod assessments can be applied more broadly to other temperament and parenting dimensions as well.

## Implications

This review highlights the importance of considering children's individual differences in temperament when examining parenting effects on children's development and adjustment for a number of reasons. First, doing so allows us to fine tune the predictive models of the development of adjustment problems: which children are likely to develop particular problems in the context of what parenting behaviors? For example, for children low in effortful control, externalizing problems are very likely to emerge when their parents are inconsistent and harsh in their discipline, which is not the case for children high in effortful control. Second, the examination of parenting and temperament together helps elucidate one potential mechanism of parenting effects on children's adjustment, that is, through shaping children's emotionality and self-regulation. Third, it increases our understanding of differential parenting effects. Why do some parenting behaviors seem to be more detrimental or beneficial for some children compared to other children? Parents often make the observation that "what works for one child doesn't work for the other." Delving further into the interaction and transactional relations between parenting and temperament can improve the advice practitioners give to parents, allowing the tailoring of advice to address individual children's characteristics. Fourth, as researchers and practitioners are increasingly focusing on parents' role in attending to and supporting children's emotional development (e.g., Gottman et al. 1997), attention to individual differences in emotionality and self-regulation will become increasingly relevant, as the level and course of children's developing emotions is partly dependent on their temperament characteristics. Finally, parenting interventions need to account for temperament, because the children who are particularly vulnerable to the adverse effects of negative parenting behaviors are precisely the children who elicit those behaviors from parents. Parents with children high in negative emotionality or low in self-regulation might benefit from training in mindfulness of their own reactions to their children, strategies for managing their own emotional and behavioral reactions, and strategies tailored to managing children's particularly difficult emotions and behaviors.

## Appendix

See Tables 1 and 2.

**Table 1** Studies examining bidirectional or directional relations between parenting and temperament

| Authors (Year) | Study design | Temperament and parenting relation (* indicates significant association) | *r* | *β* or partial *r* |
|---|---|---|---|---|
| *Infant/toddler studies* | | | | |
| Arcus (2001) | $N = 94$ | Infant crying (O)–maternal attention to distress (O)* | .33 | |
| | 4–14 Months | Inhibition (O) ← maternal attention to distress (O)* | n.a. | |
| | Longitudinal | Inhibition (O) ← maternal limit setting (O)* | n.a. | |
| Bates et al. (1982) | $N = 168$ | Difficult (M,O)–maternal social contact (O)* | .19 | |
| | 6 Months | Difficult (M,O)–maternal teaching (O) | −.01 | |
| | Cross-sectional | Difficult (M,O)–maternal satisfaction (O) | −.12 | |
| | | Difficult (M,O)–maternal non-restrictiveness (O) | .01 | |
| Belsky et al. (1991) | $N = 148$ | Negative emotionality (M,O) ← paternal involvement (O)* | n.a. | |
| | 3–9 Months | Negative emotionality (M,O) ← maternal sensitivity (O)* | | |
| | Longitudinal | Negative emotionality (M,O) ← mat. unresponsiveness (O)* | | |
| Booth-LaForce and Oxford (2008) | $N = 1092$ | Dysregulated temperament (M) → secure attachment (O)* | | −.08 |
| | 6–54 Months | Dysregulated temperament (M) → insensitive parenting (O) | | n.s. |
| | Longitudinal | | | |
| Braungart-Rieker et al. (1997) | $N = 57$ | Negative reactivity (M)–maternal guidance (O)* | −.28 | |
| | 30 Months | Negative reactivity (M)–maternal control (O)* | .36 | |
| | Cross-sectional | | | |
| Braungart-Rieker et al. (2001) | $N = 94$ | Self-regulation (O)–maternal sensitivity (O)* | .30 | |
| | 4–13 Months | | | |
| | Longitudinal | | | |
| Bridgett et al. (2009) | $N = 156$ | Negative emotionality–intercept (M) → negative parenting (M) | | n.s. |
| | 4–18 Months | Negative emotionality–slope (M) → negative parenting (M)* | | .22 |
| | Longitudinal | Regulatory capacity–intercept (M) → negative parenting (M)* | | −.23 |
| | | Regulatory capacity–slope (M) → negative parenting (M)* | | −.61 |
| Calkins (2002) | $N = 73$ | Frustration distress (O) → maternal negative control (O) | −.10 | −.25 |
| | 18–24 Months | Frustration distress (O) → positive guidance (O) | −.05 | n.a. |
| | Longitudinal | | | |
| Calkins et al. (2004) | $N = 162$ | Frustration distress (M,O) → Maternal sensitivity (O) | | −.24 |
| | 6 Months | Frustration distress (M,O) → maternal intrusiveness (O)* | | .31 |
| | Cross-sectional | Frustration distress (M,O) → physical stimulation (O)* | | −.46 |
| Calkins and Johnson (1998a, b) | $N = 73$ | Frustration distress (O) → negative control (O) | −.27 | n.s. |
| | 18 Months | Frustration distress (O) → positive guidance (O) | n.s. | n.s. |
| | Cross-sectional | Frustration distress (O) → pre-emptive Interference (O)* | .43 | .43 |
| Calkins et al. (1998) | $N = 65$ | Frustration distress (O)–positive guidance (O) | n.a. | |
| | 24 Months | Frustration distress (O)–negative control (O) | | |
| | Cross-sectional | Impulsivity (O)–positive guidance (O) | | |
| | | Impulsivity (O)–negative control (O) | | |
| Chen et al. (1998) | $N = 118$ Chinese | Inhibition (O)–maternal acceptance (M)* | .17/−.22 | |
| | $N = 82$ Canadian | Inhibition (O)–maternal rejection (M) | −.18/.10 | |
| | 24.5 Months | Inhibition (O)–encouragement of achievement (M)* | .18/−.21 | |
| | Cross-sectional | Inhibition (O)–punishment (M)* | .15/.21 | |
| | Chinese/Canadian | Inhibition (O)–encouragement of independence (M)* | .18/.12 | |
| | | Inhibition (O)–protection (M)* | .03/.22 | |
| Clark et al. (2000) | $N = 108$ | Negative emotionality (O) → power assertion (O)* | .23 | .22 |
| | 8–15 Months | Negative emotionality (O) → responsiveness (O) | −.08 | −.01 |

**Table 1** continued

| Authors (Year) | Study design | Temperament and parenting relation (* indicates significant association) | *r* | $\beta$ or partial *r* |
|---|---|---|---|---|
| | Longitudinal | | | |
| Crockenberg and Smith (1982) | *N* = 56 | Irritability (O) ← maternal attitudes about responsiveness (O)* | | −.28 |
| | 0–3 Months | Irritability (O) → maternal responsiveness to crying (O)* | | .33 |
| | Longitudinal | | | |
| Eiden et al. (2004) | *N* = 226 | Effortful control (O) ← Maternal warmth (O)* | .40/.29 | .29/.07 |
| | 12–36 Months | Effortful control (O) ← Paternal warmth (O)* | .19/.25 | .08/.21 |
| | Longitudinal boys/ girls | | | |
| Feldman et al. (1997) | *N* = 48 | Fussy-difficult (M) → Maternal sensitivity (O)* | −.42 | −.28 |
| | 3–9 Months | Fussy-difficult (M) → Intrusiveness (O) | −.02 | −.15 |
| | Longitudinal | | | |
| Feldman et al. (1999) | *N* = 36 | Self-control (O)–mother warm control (O)* | .35 | .22 |
| | 3–9 Months | Self-control (O) ← mother–infant affect synchrony (O)* | .56 | .51 |
| | Longitudinal | | | |
| Houck and Lecuyer-Maus (2004) | *N* = 78 | Delay ← maternal indirect limit setting (O)* | n.a. | |
| | 12–60 Months | Delay ← maternal teaching limit setting (O)* | | |
| | Longitudinal | Delay ← maternal power-based limit setting (O)* | | |
| Kiel and Buss (2006) | *N* = 72 | Fearfulness (O) ← mother approach personality (M)* | | .15 |
| | 24 Months | Fearfulness (O) ← mother inhibited personality (M) | | n.s. |
| | Cross-sectional | | | |
| Kochanska et al. (2008) | *N* = 102 | Self-regulation (O) ← Mother mutually responsive orientation (O)* | .51 | .16 |
| | 7–52 Months | Self-regulation (O) ← Father mutually responsive orientation (O)* | .28 | .10 |
| | Longitudinal | Self-regulation (O) ← mother power assertion (O)* | −.45 | −.20 |
| | | Self-regulation (O) ← father power assertion (O)* | −.52 | −.29 |
| Kochanska et al. (2004) | Study 1: | Anger (O) → maternal shared positive ambience (O)* | | −.32 |
| | *N* = 102 | Anger (O) → maternal responsiveness (O) | | −.08 |
| | 7 Months | Anger (O) → maternal consistent tracking (O) | | −.15 |
| | Cross-sectional | Fear (O) → maternal shared positive ambience (O)* | | .32 |
| | Study 2: | Fear (O) → maternal responsiveness (O) | | .14 |
| | *N* = 112 | Fear (O) → maternal consistent tracking (O) | | .12 |
| | 9–45 Months | Attention (O) → maternal shared positive ambiance (O) | | −.08 |
| | Longitudinal | Attention (O) → maternal responsiveness (O) | | .02 |
| | | Attention (O) → maternal consistent tracking (O) | | .16 |
| Kochanska and Knaack (2003) | *N* = 106 | Effortful control (M,O) ← maternal power assertion (O)* | −.54 | −.37 |
| | 14–45 Months | | | |
| | Longitudinal | | | |
| Kochanska et al. (2000) | *N* = 106 | Effortful control (M, O) ← maternal responsiveness (O)* | .29 | .22 |
| | 9–33 Months | | | |
| | Longitudinal | | | |
| Lee and Bates (1985) | *N* = 111 | Difficult (M)–maternal prohibition (O) | .14 | |
| | 6–24 Months | Difficult (M)–maternal scolding (O) | .03 | |
| | Longitudinal | Difficult (M)–maternal physical punishment (O) | .01 | |
| | | Difficult (M)–maternal remove or restrain (O)* | .23 | |
| | | Difficult (M)–maternal given into demand (O)* | .16 | |

**Table 1** continued

| Authors (Year) | Study design | Temperament and parenting relation (* indicates significant association) | *r* | *β* or partial *r* |
|---|---|---|---|---|
| Maccoby et al. (1984) | *N* = 57 | Difficult (M) → maternal teaching effort (O)* | −.52/.33 | −.57/−.12 |
| | 12–18 Months | Difficult (M) ← maternal teaching effort (O)* | | −.44/−.06 |
| | Longitudinal boys/girls | Difficult (M)–physical manipulation (O) | −.07/−.22 | n.s. |
| Malatesta and Haviland (1982) | *N* = 52 | Negative emotionality (M,O) ← maternal contingent responding (O) | n.s. | |
| | 3–12 Months | Negative emotionality (M,O) ← maternal anxiety (O) | n.s. | |
| | Longitudinal | | | |
| Mills-Koonce et al. (2007) | *N* = 148 | Negative affect (O) → maternal sensitivity (O)* | | .17 |
| | 6–12 Months | | | |
| | Longitudinal | | | |
| Morrell and Murray (2003) | *N* = 59 | Self-regulation (O) → maternal hostile parenting (O)* | | .35/.42 |
| | 9 Months–8 years | Self-regulation (O) → maternal coercive parenting (O)* | | .25/−.63 |
| | Longitudinal | | | |
| | Boys/girls | | | |
| Nachmias et al. (1996) | *N* = 77 | Inhibition (O)–encouragement to approach (O)* | .27 | |
| | 18 Months | Inhibition (O)–demands to approach (O) | n.s. | |
| | Longitudinal | Inhibition (O)–comfort (O)* | .44 | |
| Olson et al. (2002) | *N* = 89 | Impulsivity (O) ← maternal object stimulation (O)* | .28 | |
| | 5 Months–8 years | Impulsivity (O) ← maternal non-punitive (O)* | .26 | |
| | Longitudinal | Impulsivity (O) ← maternal verbal stimulation (O) | .22 | |
| | | Impulsivity (O) ← maternal affection (O) | .04 | |
| Park et al. (1997) | *N* = 125 | Inhibition (O) ← paternal intrusiveness (O)* | | −.27 |
| | 12–36 Months | Inhibition (O) ← maternal intrusiveness (O)* | | −.26 |
| | Longitudinal | Inhibition (O) ← paternal sensitivity (O) | | .09 |
| | | Inhibition (O) ← maternal sensitivity (O) | | .01 |
| | | Inhibition (O) ← paternal positive affect (O) | | .07 |
| | | Inhibition (O) ← maternal positive affect (O) | | −.04 |
| | | Inhibition (O) ← paternal negative affect (O)* | | −.20 |
| | | Inhibition (O) ← maternal negative affect (O) | | −.18 |
| | | Inhibition (O) ← paternal detachment (O) | | −.03 |
| | | Inhibition (O) ← maternal detachment (O) | | .08 |
| Pettit and Bates (1984) | *N* = 128 | Difficult (M,O)–maternal affection and caregiving (O)* | −.28 | |
| | 6–13 months | Difficult (M,O)–maternal teaching (O) | n.s. | |
| | Longitudinal | Difficult (M,O)–maternal management (O)* | .49 | |
| Putnam et al. (2002) | *N* = 58 | Inability to delay (O)–maternal distraction (O)* | −.27 | |
| | 30 months | Inability to delay (O)–maternal reasoning (O)* | .30 | |
| | Cross-sectional | Inability to delay (O)–maternal bargaining (O) | .17 | |
| | | Inability to delay (O)–maternal indirect commands (O)* | .31 | |
| | | Inability to delay (O)–maternal direct commands (O)* | .27 | |
| Rubin et al. (1997) | *N* = 108 | Inhibition (O) ← fear × maternal oversolicitousness (O)* | | .08 |
| | 24–27 Months | | | |
| | Longitudinal | | | |

**Table 1** continued

| Authors (Year) | Study design | Temperament and parenting relation (* indicates significant association) | *r* | *β* or partial *r* |
|---|---|---|---|---|
| Scaramella et al. (2008) | *N* = 47 | Distress reactivity (O) ← Harsh parenting (O)* | .53 | .45 |
| | 12–24 Months | Distress reactivity (O) ← supportive parenting (O) | −.15 | −.00 |
| | Longitudinal | Distress reactivity (O) → Harsh parenting (O) | .06 | .01 |
| | | Distress reactivity (O) → Supportive parenting (O)* | −.41 | −.33 |
| Sheese et al. (2007) | *N* = 45 | Impulsivity (P) ← parenting quality (O) × genetic variation of dopamine receptor D4* | n.a. | .15 |
| | 18–21 Months | | | |
| | Cross-sectional | | | |
| Siefer et al. (1996) | *N* = 49 | Difficulty (O)–maternal quality (O)* | .31 | |
| | 4–12 Months | Difficulty (O)–appropriateness (O)* | .32 | |
| | Longitudinal | | | |
| Silverman and Ragusa (1990) | *N* = 41 | Delay/impulsivity (O)–Maternal positive control (O)* | .25 | |
| | 24 Months | Delay/impulsivity (O)–Maternal strictness (O) | −.29 | |
| | Cross-sectional | Delay/impulsivity (O)–Maternal aggravation (O) | −.28 | |
| | | Delay/impulsivity (O)–Maternal encouragement of independence (O)* | .43 | |
| van den Boom (1989) | *N* = 30 | Irritability (O) → maternal sensitivity/responsiveness (O)* | n.a. | |
| | | Irritability (O) ← maternal sensitivity/responsiveness (O)* | | |
| | 1–6 Months | | n.a. | |
| | Intervention | | | |
| van den Boom and Hoeksma (1994) | *N* = 30 | Irritability (O) → maternal responsiveness (O)* | n.a. | |
| | 1–6 Months | | | |
| | Longitudinal | | | |
| *Preschool studies* | | | | |
| Belsky et al. (2000) | *N* = 125 US | Inhibition (O) → maternal encouraging withdrawal (O)* | | .24*/.24 |
| | *N* = 100 Korean | Inhibition (O) → paternal encouraging withdrawal (O) | | .05/– |
| | 3 Years | Inhibition (O) → maternal discouraging withdrawal (O)* | | .33*/.41* |
| | Cross-sectional | Inhibition (O) → paternal discouraging withdrawal (O) | | .20/– |
| | US/Korean | Inhibition (O) → maternal encouraging approach (O)* | | .34*/.25 |
| | | Inhibition (O) → paternal encouraging approach (O) | | .21/– |
| | | Inhibition (O) ← maternal encouraging withdrawal (O) | | −.09/.14 |
| | | Inhibition (O) ← paternal encouraging withdrawal (O) | | .03/– |
| | | Inhibition (O) ← maternal discouraging withdrawal (O) | | .05/.21 |
| | | Inhibition (O) ← paternal discouraging withdrawal (O) | | −.03/– |
| | | Inhibition (O) ← maternal encouraging approach (O) | | −.03/.27 |
| | | Inhibition (O) ← paternal encouraging approach (O) | | −.04/– |
| Cole et al. (2003) | *N* = 85 | Expression of anger emotion (O)–maternal positive response (O)* | .20/.65 | |
| | 5 Years | Child positive response (O)–maternal expression of positive versus anger emotion (O)* | .47/.38 | |
| | Cross-sectional | | | |
| | Boys/girls | | | |
| Karreman et al. (2008b) | *N* = 89 | Effortful control (O) → maternal positive control (O)* | | .38 |
| | 36 Months | Effortful control (O) → paternal positive control (O) | | .15 |
| | Cross-sectional | Effortful control (O) → maternal negative control (O) | | −.23 |
| | | Effortful control (O) → paternal negative control (O) | | −.20 |
| | | Effortful control (O) → maternal warmth (O) | | −.05 |
| | | Effortful control (O) → paternal warmth (O) | | −.10 |

**Table 1** continued

| Authors (Year) | Study design | Temperament and parenting relation (* indicates significant association) | *r* | *β* or partial *r* |
|---|---|---|---|---|
| Kimonis et al. (2006) | *N* = 49 | Aggression (T) ← corporal punishment (M)* | −.35 | |
| | 36–42 Months | Aggression (T) ← inappropriate expectations (M) | .00 | |
| | Longitudinal | Aggression (T) ← empathic awareness (M) | −.21 | |
| | | Aggression (T) ← role reversal (M) | −.16 | |
| Kyrios and Prior (1990) | *N* = 120 | Negative reactivity (M)–punishment (M, F)* | .22 | .17 |
| | 44 Months | Self-regulation (M)–use of rewards (M, F)* | −.29 | −.25 |
| | Cross-sectional | | | |
| Lengua et al. (2007) | *N* = 80 | Effortful control (O) ← limit setting (O)* | .27 | .20 |
| | 36–42 Months | Effortful control (O) ← scaffolding (O)* | .23 | .23 |
| | Longitudinal | Effortful control (O) ← warmth (O) | .04 | −.08 |
| | | Effortful control (O) ← negative affect (O) | −.17 | .04 |
| Lerner and Galambos (1985) | *N* = 89 | Difficult (M) ← maternal rejection (M)* | | .25 |
| | 2–4 Years longitudinal | Difficult (M) → maternal rejection (M)* | | .12 |
| Martini et al. (2004) | *N* = 94 | Fear (M) → maternal regulation of emotion (M)* | | n.a. |
| | 4.4 Years | Anger (M) → maternal regulation emotion (M)* | | n.a. |
| | Cross-sectional | | | |
| Mauro and Harris (2000) | *N* = 30 | Impulsivity (O) –teaching behaviors (focus on wait) (O)* | .41 | |
| | 51 Months | Impulsivity (O) –teaching behaviors (verbalizations) (O)* | .33 | |
| | Cross-sectional | | | |
| Porter et al. (2005) | *N* = 729 | *US* | | |
| | 4–6 Years | Emotionality (M, F)–father authoritarian (M)* | .18/.22 | |
| | Cross-sectional | Emotionality (M, F)–mother authoritarian (F)* | .38/.39 | |
| | Boys/girls | Emotionality (M, F)–father authoritative (M)* | −.19/−.02 | |
| | | Emotionality (M, F)–mother authoritative (F)* | −.32/−.01 | |
| | | *Chinese* | | |
| | | Emotionality (M, F)–father authoritarian (M)* | .25/.42 | |
| | | Emotionality (M, F)–mother authoritarian (F)* | .33/.31 | |
| | | Emotionality (M, F)–father authoritative (M) | −.04/−.16 | |
| | | Emotionality (M, F)–mother authoritative (F)* | −.18/.00 | |
| Rubin et al. (1999) | *N* = 60 | Shyness (M) → mother encouragement of independence (M)* | −.37 | |
| | 2–4 Years | Shyness (F) → father encouragement of independence (F)* | −.33 | |
| | Longitudinal | | | |
| Sheeber and Johnson (1992) | *N* = 77 | Difficult (M)–maternal competence (M)* | .28 | |
| | Cross-sectional | | | |
| | 3–4 Years | | | |
| *Mid-childhood/adolescent studies* | | | | |
| Bezirganian and Cohen (1992) | Longitudinal | Difficult temperament (M) ← maternal control (C)* | | .20/.10 |
| | *N* = 776 | Difficult temperament (M) ← maternal punishment (C)* | | .60/.37 |
| | 1–20 Years | Difficult temperament (M) ← maternal discipline(C)* | | .32/.17 |
| | Boys/girls | Difficult temperament (M) ← paternal discipline (C)* | | .13/.27 |
| Brody et al. (2002) | *N* = 150 | Self-regulation (T) ← maternal competence (M)* | | .35 |
| | 11 Years | | | |
| | Longitudinal | | | |

**Table 1** continued

| Authors (Year) | Study design | Temperament and parenting relation (* indicates significant association) | *r* | *β* or partial *r* |
|---|---|---|---|---|
| Brody et al. (2005) | *N* = 332 | Self-regulation (M) ← involved vigilant parenting (M)* | | .23 |
| | 11 Years | | | |
| | Intervention | | | |
| Colman et al. (2006) | *N* = 549 | Self-regulation (M) ← maternal warmth (M)* | .12 | .08 |
| | 4–9 Years | Self-regulation (M) ← punitive discipline (M)* | −.19 | −.08 |
| | Longitudinal | | | |
| Coplan et al. (2009) | *N* = 285 | Dysregulation → overprotection (M) | | .06 |
| | 6.25 Years | Dysregulation (M) → coercive parenting (M) | | .08 |
| | Cross-sectional | Dysregulation (M) → authoritative parenting (M)* | | −.15 |
| | | Shyness (M) → overprotection (M)* | | .16 |
| | | shyness (m) → coercive parenting (m) | | .08 |
| | | Shyness (M) → authoritative parenting (M) | | −.06 |
| Davidov and Grusec (2006) | *N* = 106 | Negative affect regulation (M) ← maternal responsiveness to distress (M)* | | .25 |
| | 6–8 Years | Negative affect regulation (M) ← maternal warmth (M) | | .14 |
| | Cross-sectional | Negative affect regulation (M) ← paternal responsiveness to distress (F)* | | .24 |
| | | Negative affect regulation (M) ← paternal warmth (F) | | .06 |
| Eisenberg et al. (1999) | *N* = 79 | Externalizing emotion 6–8 years (M,T) → parental reactions 8–10 years (M)* | | .21 |
| | 6–12 Years | Externalizing emotion 8–10 years (M,T) → parental reactions 10–12 years | | −.01 |
| | Longitudinal | (M) | | |
| | | Regulation 6–8 years (M) → punitive reactions 8–10 years (M)* | | −.19 |
| | | Regulation 8–10 years (M) → punitive reactions 10–12 years (M) | | −.05 |
| | | Regulation 6–8 years (M) → parental distress 8–10 years (M) | | −.03 |
| | | Regulation 8–10 years (M) → parental distress 10–12 years (M) | | −.02 |
| | | Externalizing emotion 8–10 years (M) ← parental reactions 6–8 years (M,T) | | .16 |
| | | Externalizing emotion 10–12 years (M) ← parental reactions 8–10 years | | .53 |
| | | (M,T)* | | |
| | | Regulation 8–10 years (M) ← punitive reactions 6–8 years (M) | | −.05 |
| | | Regulation 10–12 years (M) ← punitive reactions 8–10 years (M)* | | −.70 |
| | | Regulation 8–10 years (M) ← parental distress 6–8 years (M) | | −.14 |
| | | Regulation 10–12 years (M) ← parental distress 8–10 years (M) | | −.02 |
| Hawes and Dadds (2005) | *N* = 56 | Callous-unemotional (M) ← praise (I) | | n.s. |
| | 6 Years | Callous-unemotional (M) ← time out (I) | | n.s. |
| | Intervention | Callous-unemotional (M) ← harsh parenting (I) | | n.s. |
| Lengua (2006) | *N* = 190 | Fearfulness (M, C) → rejection (M, C)* | | −.19 |
| | 8–12 Years | Fearfulness (M, C) → inconsistency (M, C) | | −.16 |
| | Longitudinal | Irritability (M,C) → rejection (M, C) | | .08 |
| | | Irritability (M, C) → inconsistency (M, C)* | | .19 |
| | | Effortful control (M, C) → rejection (M, C)* | | −.38 |
| | | Effortful control (M, C) → inconsistency (M, C) | | −.12 |
| | | Fearfulness (M, C) ← rejection (M, C)* | | .15 |
| | | Fearfulness (M, C) ← inconsistency (M, C)* | | −.22 |
| | | Irritability (M, C) ← rejection (M, C)* | | .16 |
| | | Irritability (M, C) ← inconsistency (M, C) | | .03 |

**Table 1** continued

| Authors (Year) | Study design | Temperament and parenting relation (* indicates significant association) | *r* | *β* or partial *r* |
|---|---|---|---|---|
| | | Effortful control (M, C) ← rejection (M, C) | | .03 |
| | | Effortful control (M, C) ← inconsistency (M, C) | | .00 |
| Lengua and Kovacs (2005) | $N = 92$ | Fearfulness (M, C) → acceptance (M, C)* | | .17 |
| | 8–12 Years | Fearfulness (M, C) → involvement (M, C) | | .07 |
| | Longitudinal | Fearfulness (M, C) → inconsistent discipline (M, C) | | .02 |
| | | Irritability (M, C) → acceptance (M, C) | | −.08 |
| | | Irritability (M, C) → involvement (M, C) | | −.15 |
| | | Irritability (M, C) → inconsistent discipline* | | .18 |
| | | Self-regulation (M, C) → acceptance (M, C) | | .09 |
| | | Self-regulation (M, C) → involvement (M, C) | | −.08 |
| | | Self-regulation (M, C) → inconsistent discipline (M, C) | | −.02 |
| | | Fearfulness (M, C) ← acceptance (M, C) | | .12 |
| | | Fearfulness (M, C) ← involvement (M, C) | | −.03 |
| | | Fearfulness (M, C) ← inconsistent discipline (M, C)* | | .31 |
| | | Irritability (M, C) ← acceptance (M, C) | | −.01 |
| | | Irritability (M, C) ← involvement (M, C) | | .02 |
| | | Irritability (M, C) ← inconsistent discipline (M, C)* | | .21 |
| | | Self-regulation (M, C) ← acceptance (M, C) | | .00 |
| | | Self-regulation (M, C) ← involvement (M, C) | | −.03 |
| | | Self-regulation (M, C) ← inconsistent discipline (M, C) | | −.10 |
| Patridge (2003) | $N = 72$ | Inhibition (O)–empathy (M, F)* | −.36 | |
| | 5–6 Years | Inhibition (O)–appropriate expectations (M, F)* | −.37 | |
| | Cross-sectional | Inhibition (O)–positive parenting (M, F)* | −.28 | |
| Zhou et al. (2004) | $N = 425$ | Effortful control (M, F) ← authoritarian parenting (M, F)* | | −.31 |
| | 7–10 Years | Anger/frustration (M, F) ← authoritarian parenting (M, F)* | | .14 |
| | Cross-sectional | Effortful control (M, F) ← authoritative parenting (M, F)* | | .16 |
| | | Anger/frustration (M, F) ← authoritative parenting (M, F) | | .03 |

When two values are reported with a "/", they are described in the study design column (e.g., boys/girls)

*C* child report, *F* father report, *M* mother report, *N* neuropsychological assessment, *O* observation, *P* physiological indicator, *T* teacher

* $p \leq .05$

**Table 2** Studies examining interactions between parenting and temperament

| Authors (year) | Study design | Temperament and parenting interactions (* indicates significant association) | Outcome | $\Delta R^2$ | Low b or r | High b or r |
|---|---|---|---|---|---|---|
| *Infant/toddler studies* | | | | | | |
| Bakermans-Kranenburg and van Ijzendoorn (2006) | $N = 47$ | 7-Repeat DRD4 allele (P) × maternal sensitivity (O)* | Externalizing (M) | n.a. | n.a. | n.a. |
| | 10–54 Months | | Internalizing (M) | n.s. | | |
| | Longitudinal | | | | | |
| Bates et al. (1998) | Sample 1: | Sample 1: resistance (M) × maternal control (O)* | Externalizing (T) | n.a. | .27 | .09 |
| | $N = 90$ | Sample 2: resistance (M) × maternal control (O)* | Externalizing (M) | | .44 | .11 |
| | Infant-10 years | | Externalizing (T) | | .22 | .01 |
| | Sample 2: | | Externalizing (M) | | .53 | .21 |
| | $N = 156$ | | | | | |
| | 5–11 Years | | | | | |
| | Longitudinal | | | | | |
| Belsky et al. (1998) | $N = 125$ | Negative emotionality (M, O) × negative mothering (O) at age 2* | Externalizing (M, F) | .07 | – | −.07 |
| | 10–36 Months | Negative emotionality × negative mothering (O) at age 3* | Externalizing (M, F) | .08 | – | .40 |
| | Longitudinal | Negative emotionality × negative fathering (O) at age 2 | Inhibition (O) | .11 | – | −.13 |
| | | Negative emotionality × negative fathering (O) at age 3* | Inhibition (O) | .12 | – | −.45 |
| | | Negative emotionality × positive mothering (O) at age 2 | Externalizing (M, F) | .01 | – | .06 |
| | | Negative emotionality × positive mothering (O) at age 3 | Externalizing (M, F) | .02 | – | −.16 |
| | | Negative emotionality × positive fathering (O) at age 2 | Inhibition (O) | .07 | – | .18 |
| | | Negative emotionality × positive fathering (O) at age 3 | Inhibition (O) | .02 | – | .09 |
| Calkins (2002) | $N = 73$ | Aversive behavior (O) × positive guidance (O)* | Venting/aggression (O) | .22 | .43 | .01 |
| | 18–24 Months | Aversive behavior (O) × negative behavior (O) | Venting/aggression (O) | 00 | – | – |
| | Longitudinal | | | | | |
| Cipriano and Stifter (2010) | $N = 72$ | Exuberant (O) × ignoring (O) | Effortful control (M) | .07 | – | – |
| | 24–54 Months | Exuberant (O) × ignoring (O) | Effortful control (O) | .16 | – | – |
| | Longitudinal | Exuberant (O) × positive redirection (O) | Effortful control (M) | .16 | – | – |
| | | Exuberant (O) × positive redirection (O) | Effortful control (O) | .11 | – | – |
| | | Exuberant (O) × neutral redirection (O) | Effortful control (M) | .09 | – | – |
| | | Exuberant (O) × neutral redirection (O) | Effortful control (O) | .17 | – | – |
| | | Exuberant (O) × positive command (O)* | Effortful control (M) | .15 | n.s. | .57 |
| | | Exuberant (O) × positive command (O) | Effortful control (O) | .12 | – | – |
| | | Exuberant (O) × prohibitive (O) | Effortful control (M) | .07 | – | – |
| | | Exuberant (O) × prohibitive (O) | Effortful control (O) | .11 | – | – |

**Table 2** continued

| Authors (year) | Study design | Temperament and parenting interactions (* indicates significant association) | Outcome | $\Delta R^2$ | Low b or r | High b or r |
|---|---|---|---|---|---|---|
| Crockenberg and McClusky (1986) | $N = 48$ | Irritability (O × maternal responsiveness (O)* | Crying at separation (O) | n.a. | −.50 | n.s. |
| | 0–12 Months | Irritability (O) × sensitivity (O) | Crying at separation (O) | n.s. | – | – |
| | Longitudinal | | | | | |
| Crockenberg et al. (2008) | $N = 64$ | Frustration (M, O) × encourage to attend (O)* | Aggression (M) | .05* | n.a. | n.a. |
| | 5–31 Months | Frustration (M, O) × encourage to avoid (O) | Aggression (M) | n.s. | – | – |
| | Longitudinal | | | | | |
| Degnan et al. (2008a) | $N = 470$ | Frustration (O) × maternal control (O)* | Disruptive behavior problems (M) | n.a. | – | – |
| | 2–5 Years | | | | | |
| | Longitudinal | | | | | |
| Degnan et al. (2008b) | $N = 77$ | Reactivity (O) × solicitous behavior (O) | Social wariness | .13 | n.s. | n.s. |
| | XX | | | | | |
| | Longitudinal | | | | | |
| Eggum et al. (2009) | $N = 256$ | Fear (M, O) × maternal sensitivity (O) × sex* | Shyness (M) | .02 | .52/n.s. | n.s./n.s. |
| | 18–30 Months | Shyness (M) × maternal sensitivity (O) × sex* | Shyness (M) | .02 | .62/n.s. | .33/.54 |
| | Longitudinal | | | | | |
| | Boys/girls | | | | | |
| Feldman et al. (1999) | $N = 36$ | Difficult temperament (M, O) × synchrony (O)* | Self-control (O) | .10 | .25 | .65 |
| | 3–24 Months | | | | | |
| | Longitudinal | | | | | |
| Fowles and Kochanska (2000) | $N = 92$ | Fear (P) × attachment security (M)* | Conscience (O) | n.a. | .32 | .09 |
| | 32–48 Months | Fear (M, P) × attachment security (M)* | Conscience (O) | n.a. | .51 | .04 |
| | Longitudinal | Fear (P) × gentle discipline (O)* | Conscience (O) | n.a. | .20 | .36 |
| | | Fear (M, P) × gentle discipline (O)* | Conscience (O) | n.a. | .02 | .28 |
| Gilliom and Shaw (2004) | $N = 303$ | Negative emotionality (M, O) × negative control (O) | Internalizing (M) | n.s. | – | – |
| | 2–6 Years | Fear (O) × negative control (O)* | Externalizing(M) | n.s. | – | – |
| | Longitudinal | | Internalizing (M) | n.s. | – | – |
| | Interct./slope | Fear (O) × negative emotionality (M, O) × negative control (O)* | Externalizing (M) | n.a. | n.s./.01 | n.s. |
| | | | Internalizing (M) | n.a. | n.s. | .05/−.01 |
| | | | Externalizing (M) | n.a. | n.s. | .04/n.s. |

**Table 2** continued

| Authors (year) | Study design | Temperament and parenting interactions (* indicates significant association) | Outcome | $\Delta R^2$ | Low b or r | High b or r |
|---|---|---|---|---|---|---|
| Hastings et al. (2005) | $N = 88$ | Fear (O) × maternal protective parenting (M) × Sex* | Prosocial to mother (O) | .07 | n.a. | n.a. |
| | 2–4 Years | | Prosocial to exp (O) | .01 | – | – |
| | Longitudinal | Fear (O) × paternal protective parenting (F) × Sex | Prosocial to mother (O) | .01 | – | – |
| | | | Prosocial to exp (O) | .00 | – | – |
| | | Fear (O) × maternal authoritarian parenting (M) × sex* | Prosocial to mother (O) | .00 | – | – |
| | | | Prosocial to exp (O) | .08 | n.a. | n.a. |
| | | Fear (O) × paternal authoritarian parenting (F) × sex | Prosocial to mother (O) | .00 | – | – |
| | | | Prosocial to exp (O) | .00 | – | – |
| | | Fear (O) × maternal authoritative parenting (M) × sex* | Prosocial to mother (O) | .02 | – | – |
| | | | Prosocial to exp (O) | .07 | n.a. | n.a. |
| | | Fear (O) × paternal authoritative parenting (F) × Sex | Prosocial to mother (O) | .02 | – | – |
| | | | Prosocial to exp (O) | .00 | – | – |
| Karrass and Braungart-Rieker (2003) | $N = 102$ | Distress to limits (M) × responsiveness (O) | Language dev (M, N) | .01 | – | – |
| | 12–16 Months | Distress to novelty (M) × responsiveness (O)* | Language dev (M, N) | .01 | .32 | −.17 |
| | Longitudinal | | | | | |
| | Boys/girls | Distress to limits (M) × responsiveness (O) × gender | Language dev (M, N) | .01 | – | – |
| | | Distress to novelty (M) × responsiveness (O) × gender | Language dev (M, N) | .01 | – | – |
| | | Orienting (M) × responsiveness (O) | Language dev (M, N) | .03 | – | – |
| | | Smiling (M) × responsiveness (O) | Language dev (M, N) | .03 | – | – |
| | | Orienting (M) × responsiveness (O) × gender | Language dev (M, N) | .03 | – | – |
| | | Smiling (M) × responsiveness (O) × gender* | Language dev (M, N) | .03 | .48/n.s. | −.15/n.s. |
| Kochanska (1995) | $N = 103$ | Fear (O, M) × maternal gentle discipline (O)* | Internalization (O) | n.a. | −.12 | .51 |
| | 26–41 Months | Fear (O, M) × maternal gentle discipline (O)* | Compliance (O) | n.a. | .23 | .55 |
| | Cross-sectional | Fear (O, M) × maternal gentle discipline (M) | Internalization (O) | n.s. | −.01 | −.03 |
| | | Fear (O, M) × maternal gentle discipline (M) | Compliance (O) | n.s. | −.21 | −.13 |
| | | Fear (O, M) × maternal gentle discipline (O) | Internalization (M) | n.s. | .14 | .16 |
| | | Fear (O, M) × maternal gentle discipline (O)* | Internalization (M) | n.a. | .14 | .40 |
| Kochanska et al. (2005) | $N = 101$ | Anger (O) × maternal responsiveness (O)* | Cooperation (O) | n.a. | .12 | .38 |
| | 7–15 Months | Anger (O) × paternal responsiveness (O) | Cooperation (O) | n.s. | – | – |
| | Longitudinal | Anger (O) × maternal attachment (O) | Cooperation (O) | n.s. | – | – |
| | | Anger (O) × paternal attachment (O)* | Cooperation (O) | n.a. | −.63 | .22 |

**Table 2** continued

| Authors (year) | Study design | Temperament and parenting interactions (* indicates significant association) | Outcome | $\Delta R^2$ | Low b or r | High b or r |
|---|---|---|---|---|---|---|
| Kochanska et al. (2007) | Study 1: | Fear (O) × mother–child positive relationship (O)* | Moral self (O) | n.a. | .73 | −.43 |
| | $N = 106$ | Fear (O) × father–child positive relationship (O) | Moral self (O) | n.s. | – | – |
| | 22–56 Months | Fear (O) × maternal power assert (O)* | Moral self (O) | n.a. | .60 | −1.58 |
| | Longitudinal | Fear (O) × paternal power assert (O) | Moral self (O) | n.s. | – | – |
| | Study 2: | Fear (O) × mother–child positive relationship (O)* | Socialization (O) | n.a. | .55 | −.04 |
| | $N = 102$ | Fear (O) × father–child positive relationship (O) | Socialization (O) | n.s. | – | – |
| | 7–38 Months | Fear (O) × maternal power assert (O) | Socialization (O) | n.s. | – | – |
| | Longitudinal | Fear (O) × father power assert (O)* | Socialization (O) | n.a. | −.10 | −.95* |
| Lahey et al. (2008) | $N = 1{,}963$ | Fussiness (M) × responsiveness (O) | Conduct problems(M) | n.s. | – | – |
| | Infancy to adolescence | Fussiness (M) × spanking (M, O)* | Conduct problems(M) | n.a. | .10 | .00 |
| | Longitudinal | Fear (M) × responsiveness (O)* | Conduct problems(M) | n.a. | −.25 | −.09 |
| | | Activity level (M) × responsiveness (O) | Conduct problems(M) | n.s. | – | – |
| | | Positive affect (M) × spanking(M, O)* | Conduct problems(M) | n.a. | .10 | −.03 |
| Leerkes et al. (2009) | $N = 376$ | Reactivity (M) × distress sensitivity (O) | Behavior problems (M) | .01 | – | – |
| | 6–36 Months | Reactivity (M) × non-distress sensitivity (O) | | | – | – |
| | Longitudinal | Reactivity (M) × distress sensitivity (O) | Social competence (M) | .00 | – | – |
| | | Reactivity (M) × non-distress sensitivity (O) | | | – | – |
| | | Reactivity (M) × distress sensitivity (O)* | Affect dysregulation (O) | .04 | .20 | −.17 |
| | | Reactivity (M) × non-distress sensitivity (O)* | | | −.23 | −.16 |
| Nachmias et al. (1996) | $N = 77$ | Inhibition (O) × attachment classification (O)* | Elevated cortisol (P) | .06 | n.a. | n.a. |
| | 18 Months | | | | | |
| | Longitudinal | | | | | |
| Rubin et al. (2003) | $N = 104$ | Conflict aggression (O) × maternal negativity (O, M)* | Externalizing (M) | .03 | .19 | .42 |
| | 2–4 Years | Behaviora–-emotional undercontrol (O, M) × maternal negativity (O, M)* | Externalizing (M) | .04 | −.09 | .65 |
| | Longitudinal | Conflict aggression (O) × behavioral–emotional undercontrol (O, M) × maternal negativity (O, M) | Externalizing (M) | .01 | – | – |

**Table 2** continued

| Authors (year) | Study design | Temperament and parenting interactions (* indicates significant association) | Outcome | $\Delta R^2$ | Low b or r | High b or r |
|---|---|---|---|---|---|---|
| Rubin et al. (2002) | $N = 108$ | Behavioral inhibition (O) × intrusive (O) | Solitary-passive (O) | .10 | – | – |
| | 2–4 Years | Behavioral inhibition × derisive (O) | Solitary-passive (O) | | – | – |
| | Longitudinal | Peer inhibition (O) × intrusive (O)* | Solitary-passive (O) | | .19 | −.66 |
| | | Peer inhibition (O) × derisive (O)* | Solitary-passive (O) | | −.08 | −.31 |
| | | Behavioral inhibition (O) × intrusive (O) | Solitary-active (O) | .08 | – | – |
| | | Behavioral inhibition × derisive (O) | Solitary-active (O) | | – | – |
| | | Peer inhibition (O) × intrusive (O) | Solitary-active (O) | | – | – |
| | | Peer inhibition (O) × derisive (O) | Solitary-active (O) | | – | – |
| | | Behavioral inhibition (O) × intrusive (O) | Reticence (O) | .14 | – | – |
| | | Behavioral inhibition × derisive (O) | Reticence (O) | | – | – |
| | | Peer inhibition (O) × intrusive (O)* | Reticence (O) | | .05 | .67 |
| | | Peer inhibition (O) × derisive (O)* | Reticence (O) | | .16 | .38 |
| | | Behavioral inhibition (O) × intrusive (O) | Internalizing (M) | .18 | – | – |
| | | Behavioral inhibition × derisive (O) | Internalizing (M) | | – | – |
| | | Peer inhibition (O) × intrusive (O) | Internalizing (M) | | – | – |
| | | Peer inhibition (O) × derisive (O) | Internalizing (M) | | – | – |
| Rubin et al. (1998) | $N = 104$ | Emotion dysregulation (M, O) × negative dominance (O)* | Externalizing (M) | .00 | – | – |
| | 2 years | Emotion dysregulation × negative dominance × sex* | Aggression (O) | .06 | .08 | .37 |
| | Longitudinal | | Externalizing | .05 | .00/.35 | .45/.25 |
| | Boys/girls | | Aggression | .08 | .05/.30 | .40/−.11 |
| Schwebel et al. (2004) | $N = 1{,}041$ | Difficult temperament (M) × positive parenting (M)* | Injury history (M) | n.a. | – | – |
| | 6–36 Months | Activity level (O) × positive parenting | Injury history | n.s. | – | – |
| | Longitudinal | | | | | |
| Stright et al. (2008) | $N = 1364$ | Difficult temperament (M) × high parenting quality (O)* | Academic compet. (T) | .01 | 3.63 | 6.62 |
| | 6 Months–1st grade | | Social skills (T) | .01 | 3.10 | 6.75 |
| | Longitudinal | | Teacher relation (T) | .01 | 1.04 | 2.72 |
| | | | Peer status (T) | 0 | .42 | 1.04 |
| Van Ijzendoorn and Bakermans-Kranenburg (2006) | $N = 85$ | 7-Repeat DRD4 allele (P) × unresolved loss (O)* | Disorganized attachment (O) | .14 | n.a. | n.a. |
| | 8–15 Months | 7-Repeat DRD4 allele × maternal frightening (O) | Disorganized attachment (O) | n.s. | | |
| | Longitudinal | | | | | |
| Vitaro et al. (2006) | $N = 1{,}516$ | Negative emotionality (M,F) × harsh parenting (M, F) | Reactive aggr. (M, T) | n.s. | – | – |
| | 17–72 Months | Negative emotionality (M,F) × harsh parenting (M,F) × sex | proactive Aggr. (M, T) | n.s. | – | – |
| | Longitudinal | | Reactive aggr. (M, T) | n.s. | – | – |
| | | | proactive Aggr. (M, T) | n.s. | – | – |

**Table 2** continued

| Authors (year) | Study design | Temperament and parenting interactions (* indicates significant association) | Outcome | $\Delta R^2$ | Low b or r | High b or r |
|---|---|---|---|---|---|---|
| *Preschool studies* | | | | | | |
| Blair (2002) | $N = 985$ | Negative emotionality (M) × parenting intervention* | Internalizing (M) | n.a. | n.s. | −.12 |
| | Birth-36 months | Negative emotionality (M) × parenting intervention* | Externalizing (M) | n.a. | n.s. | −.29 |
| | Intervention | Negative emotionality (M) × parenting intervention* | Intelligence (N) | n.a. | n.a. | n.a. |
| | LBW/VLBW | Negative emotionality × parenting intervention × birth-weight* | Intelligence (N) | n.a. | .27/.11 | .32/.33 |
| Coplan et al. (2003) | $N = 122$ | Negative affect (M) × parenting hassles (M) | Internalizing (T, O) | n.s. | – | – |
| | 36–60 Months | | Externalizing (T) | n.s. | – | – |
| | Cross-sectional | | Social comp. (T, O) | n.s. | – | – |
| | | Inattention (M) × parental hassles* | Internalizing (T, O) | n.s. | – | – |
| | | | Externalizing (T, O) | n.s. | – | – |
| | | | Social comp. (T, O) | .03 | n.a. | n.a. |
| Cornell and Frick (2007) | $N = 87$ | Fear (M, T) × positive reinforcement (M) | Guilt (M) | .02 | – | – |
| | 3–5 Years | | Empathy (M) | .02 | – | – |
| | Cross-sectional | Fear × inconsistent discipline (M)* | Guilt (M) | .07 | −.32 | .13 |
| | | | Empathy (M) | .05 | −.33 | .11 |
| | | Fear × corporal punishment (M) | Guilt (M) | .02 | – | – |
| | | | Empathy (M) | .00 | – | – |
| | | Fear × authoritarian parenting (M)* | Guilt (M) | .06 | .38 | −.08 |
| | | | Empathy (M) | .02 | – | – |
| | | Fear × authoritative parenting (M) | Guilt (M) | .03 | – | – |
| | | | Empathy (M) | .01 | – | – |
| Dennis (2006) | $N = 113$ | Approach (M) × maternal warmth (O)* | Child persistence (O) | n.s. | – | – |
| | 3–4 Years | | Child frustration (O) | n.s. | – | – |
| | Cross-sectional | | Child compliance (M) | n.a. | .15 | .03 |
| | | Approach × maternal approach (O)* | Child persistence (O) | n.a. | −.07 | .05 |
| | | | Child frustration (O) | n.a. | .10 | −.02 |
| | | | Child compliance (M) | n.s. | – | – |
| | | Approach × maternal control (O) | Child persistence (O) | n.s. | – | – |
| | | | Child frustration (O) | n.s. | – | – |
| | | | Child compliance (M) | n.s. | – | – |
| | | Approach × maternal avoidance (O) | Child persistence (O) | n.s. | – | – |
| | | | Child frustration (O) | n.s. | – | – |
| | | | Child compliance (M) | n.s. | – | – |

**Table 2** continued

| Authors (year) | Study design | Temperament and parenting interactions (* indicates significant association) | Outcome | $\Delta R^2$ | Low b or r | High b or r |
|---|---|---|---|---|---|---|
| Hastings et al. (2008) | $N = 133$ | Baseline vagal (P) × father protective control (F) | Internalizing (T) | n.s. | – | – |
| | 2–5 Years | Baseline vagal (P) × father supportive parenting (F)* | Internalizing (T) | n.a. | −.30 | .13 |
| | Longitudinal | Baseline vagal × father protective control (O) | Internalizing (T) | n.s. | – | – |
| | | Baseline vagal × father supportive parenting (O) | Internalizing (T) | n.s. | – | – |
| | | Baseline vagal (P) × mother protective control (M) | Internalizing (T) | n.s. | – | – |
| | | Baseline vagal (P) × mother supportive parenting (M) | Internalizing (T) | n.s. | – | – |
| | | Baseline vagal (P) × mother protective control (O) | Internalizing (T) | n.s. | – | – |
| | | Baseline vagal (P) × mother supportive parenting (O) | Internalizing (T) | n.s. | – | – |
| | | Vagal regulation (P) × father protective control (F) | Internalizing (T) | .00 | – | – |
| | | Vagal regulation (P) × father supportive parenting (F) | Internalizing (T) | | – | – |
| | | Vagal regulation (P) × father protective control (O) | Internalizing (T) | .06 | – | – |
| | | Vagal regulation (P) × father supportive parenting (O)* | Internalizing (T) | | −.41* | .08 |
| | | Vagal regulation (P) × mother protective control (M)* | Internalizing (T) | .01 | −.38 | .10 |
| | | Vagal regulation (P) × mother supportive parenting (M) | Internalizing (T) | | – | – |
| | | Vagal regulation (P) × mother protective control (O)* | Internalizing (T) | .01 | .26 | −.20 |
| | | Vagal regulation (P) × mother supportive parenting (O) | Internalizing (T) | | – | – |
| | | Baseline vagal (P) × father protective control (F) | Fear (M) | n.s. | – | – |
| | | Baseline vagal (P) × father supportive parenting (F) | Fear (M) | | – | – |
| | | Baseline vagal × father protective control (O) | Fear (M) | n.s. | – | – |
| | | Baseline vagal × father supportive parenting (O) | Fear (M) | | – | – |
| | | Baseline vagal (P) × mother protective control (M) | Fear (M) | n.s. | – | – |
| | | Baseline vagal (P) × mother supportive parenting (M) | Fear (M) | | – | – |
| | | Baseline vagal (P) × mother protective control (O) | Fear (M) | n.s. | – | – |
| | | Baseline vagal (P) × mother supportive parenting (O) | Fear (M) | | – | – |
| | | Vagal regulation (P) × father protective control (F)* | Fear (M) | .08 | .40* | −.07 |
| | | Vagal regulation (P) × father supportive parenting (F) | Fear (M) | | – | – |
| | | Vagal regulation (P) × father protective control (O) | Fear (M) | .07 | – | – |
| | | Vagal regulation (P) × father supportive parenting (O)* | Fear (M) | | −.39* | .04 |
| | | Vagal regulation (P) × mother protective control (M) | Fear (M) | .00 | – | – |
| | | Vagal regulation (P) × mother supportive parenting (M) | Fear (M) | | – | – |
| | | Vagal regulation (P) × mother protective control (O) | Fear (M) | .02 | – | – |
| | | Vagal regulation (P) × mother supportive parenting (O) | Fear (M) | | – | – |
| | | Baseline vagal (P) × father protective control (F) | Social wariness (O) | n.s. | – | – |
| | | Baseline vagal (P) × father supportive parenting (F) | Social wariness (O) | n.s. | – | – |

**Table 2** continued

| Authors (year) | Study design | Temperament and parenting interactions (* indicates significant association) | Outcome | $\Delta R^2$ | Low b or r | High b or r |
|---|---|---|---|---|---|---|
| | | Baseline vagal × father protective control (O) | Social wariness (O) | n.s. | – | – |
| | | Baseline vagal × father supportive parenting (O) | Social wariness (O) | n.s. | – | – |
| | | Baseline vagal (P) × mother protective control (M) | Social wariness (O) | n.s. | – | – |
| | | Baseline vagal (P) × mother supportive parenting (M) | Social wariness (O) | n.s. | – | – |
| | | Baseline vagal (P) × mother protective control (O)* | Social wariness (O) | n.a. | −.38 | .10 |
| | | Baseline vagal (P) × mother supportive parenting (O) | Social wariness (O) | n.s. | – | – |
| | | Vagal regulation (P) × father protective control (F) | Social wariness (O) | .07 | – | – |
| | | Vagal regulation (P) × father supportive parenting (F) | Social wariness (O) | | – | – |
| | | Vagal regulation (P) × father protective control (O)* | Social wariness (O) | .09 | .25 | −.40* |
| | | Vagal regulation (P) × father supportive parenting (O) | Social wariness (O) | | – | – |
| | | Vagal regulation (P) × mother protective control (M)* | Social wariness (O) | .13 | −.27 | .38 |
| | | Vagal regulation (P) × mother supportive parenting (M) | Social wariness (O) | | – | – |
| | | Vagal regulation (P) × mother protective control (O) | Social wariness (O) | .04 | – | – |
| | | Vagal regulation (P) × mother supportive parenting (O) | Social wariness (O) | | – | – |
| Kimonis et al. (2006) | $N = 49$ | Fear × corporal punishment (M) | Aggression (T) | n.s. | – | – |
| | 2–5 Years | Impulsivity × corporal punishment | Aggression (T) | n.s. | – | – |
| | Cross-sectional | Fear × impulsivity × corporal punishment | Aggression (T) | n.s. | – | – |
| Kochanska (1997) | $N = 90$ | Fear (M, O) × attachment security (M)* | Conscience at age 4 (O) | n.a. | .41 | −.05 |
| | 2–5 Years | | Conscience at age 5 (O) | | .15 | .20 |
| | Longitudinal | Fear (M, O) × maternal responsiveness (O)* | Conscience at age 4 (O) | | .05 | −.02 |
| | | | Conscience at age 5 (O) | | .39 | −.06 |
| | | Fear (M, O) × maternal gentle discipline (O)* | Conscience at age 4 (O) | | .09 | .37 |
| | | | Conscience at age 5 (O) | | −.14 | .12 |
| Paterson and Sanson (1999) | $N = 74$ | Inflexibility (M) × warmth (M) | Social skills (M, T) | n.s. | – | – |
| | 5–6 Years | | Externalizing (M, T) | n.s. | – | – |
| | Cross-sectional | | Internalizing (M, T) | n.s. | – | – |
| | | Inflexibility (M) × punishment (M)* | Social skills (M, T) | n.s. | – | – |
| | | | Externalizing (M*, T) | .06 | n.a. | n.a. |
| | | | Internalizing (M, T) | n.s. | – | – |
| | | Inflexibility (M) × explanation (M) | Social skills (M, T) | n.s. | – | – |
| | | | Externalizing (M, T) | n.s. | – | – |
| | | | Internalizing (M, T) | n.s. | – | – |
| | | Inflexibility (M) × obedience (M) | Social skills (M, T) | n.s. | – | – |
| | | | Internalizing (M, T) | n.s. | – | – |
| | | | Externalizing (M, T) | n.s. | – | – |

**Table 2** continued

| Authors (year) | Study design | Temperament and parenting interactions (* indicates significant association) | Outcome | $\Delta R^2$ | Low b or r | High b or r |
|---|---|---|---|---|---|---|
| Sanson et al. (1991) | $N = 1{,}583$ | Difficult temperament (M) | Hostile-aggressive (M) | n.a. | – | – |
| | | × parent–child relationship (M)* | | | | |
| | 4–60 Months | | Hyperactive (M) | | – | – |
| | Longitudinal | | Internalizing (M) | | – | – |
| | | | Total problems (M) | | – | – |
| *Mid-childhood/adolescent studies* | | | | | | |
| Carlo et al. (1998) | $N = 80$ | Anger (M) × maternal support (M)* | Aggression (M) | .08 | – | – |
| | Cross-sectional | | Antisocial behavior (M) | ns | – | – |
| | | | Sympathy (C) | n.s. | – | – |
| | | | Prosocial behavior (C) | – | – | – |
| | | Anger (M) × paternal support (F) | Aggression (F) | n.s. | – | – |
| | | | Antisocial behavior (F) | n.s. | – | – |
| | | | Sympathy (C) | n.s. | – | – |
| | | | Prosocial behavior (C) | n.s. | – | – |
| | | Anger (M) × sociability (M) × maternal support (M)* | Aggression (M) | .06 | – | – |
| | | | Antisocial behavior (M) | ns | – | – |
| | | | Sympathy (C) | n.s. | – | – |
| | | Anger (M) × sociability (M) × paternal support (F)* | Prosocial behavior (C) | n.s. | – | – |
| | | | Aggression (F) | .06 | – | – |
| | | | Antisocial behavior (F) | .08 | – | – |
| | | | Sympathy (C) | .09 | – | – |
| | | | Prosocial behavior (C) | n.s. | – | – |
| Colder et al. (1997) | $N = 64$ | Fear (C) × harsh discipline (M)* | Aggression (T) | .05 | 2.09 | 9.65 |
| | 4–5th Grade | | Depression (C) | .09 | −2.73 | 4.95 |
| | Cross-sectional | Fear × parental involvement (M) | Aggression (T) | n.s. | – | – |
| | | | Depression (C) | .00 | – | – |
| | | Fear × curvilinear parental involvement* | Aggression (T) | ns | – | – |
| | | | Depression (C) | .06 | −1.85 | n.s. |

**Table 2** continued

| Authors (year) | Study design | Temperament and parenting interactions (* indicates significant association) | Outcome | $\Delta R^2$ | Low b or r | High b or r |
|---|---|---|---|---|---|---|
| Kiff et al. (2007) | $N = 214$ | Fear (M, C) × positive affect (O) | Anxiety (C) | n.a. | – | – |
| | 8–12 Years | | Depression (C) | | – | – |
| | Longitudinal | Fear (M, C) × negative affect (O)* | Anxiety (C) | | – | – |
| | Low/high parenting | | Depression (C) | | −1.2/1.5 | −.13/−1.2 |
| | | Fear (M, C) × respect for autonomy (O) | Anxiety (C) | | – | – |
| | | | Depression (C) | | – | – |
| | | Fear (M, C) × guidance and structure (O) | Anxiety (C) | | – | – |
| | | | Depression (C) | | – | – |
| | | Frustration (M, C) × positive affect (O) | Anxiety (C) | | – | – |
| | | | Depression (C) | | – | – |
| | | Frustration (M, C) × negative affect (O) | Anxiety (C) | | – | – |
| | | | Depression (C) | | – | – |
| | | Frustration (M, C) × respect for autonomy (O) | Anxiety (C) | | – | – |
| | | | Depression (C) | | – | – |
| | | Frustration (M, C) × guidance and structure (O) | Anxiety (C) | | – | – |
| | | | Depression (C) | | – | – |
| | | Effortful control (M, C) × positive affect (O) | Anxiety (C) | | – | – |
| | | | Depression (C) | | – | – |
| | | Effortful control (M, C) × negative affect (O)* | Anxiety (C) | | −2.3/−.7 | −.10/−1.5 |
| | | | Depression (C) | | – | – |
| | | Effortful control (M, C) × respect for autonomy (O)* | Anxiety (C) | | −2.1/−.8 | −.9/−1.6 |
| | | | Depression (C) | | – | – |
| | | Effortful control (M, C) × guidance and structure (O)* | Anxiety (C) | | – | – |
| | | | Depression (C) | | −.3/−1.5 | −.99/−.41 |
| King and Chassin (2004) | $N = 365$ | Behavioral undercontrol (C) × parental discipline (C) | Drug diagnosis (C) | n.s. | – | – |
| | 15–20 years | Behavioral undercontrol × parental support (C)* | Drug Diagnosis (C) | n.a. | – | – |
| | Longitudinal | | | | | |

**Table 2** continued

| Authors (year) | Study design | Temperament and parenting interactions (* indicates significant association) | Outcome | $\Delta R^2$ | Low b or r | High b or r |
|---|---|---|---|---|---|---|
| Lengua et al. (2000) | $N = 231$ | Negative emotionality (M,C) × rejection (M,C) | Depression (M,C) | .01 | – | – |
| | 9–12 Years | Negative emotionality (M,C) × inconsistent discipline (M,C) | | | – | – |
| | Cross-sectional | Negative emotionality (M,C) × rejection (M,C) | Conduct probs. (M,C) | .00 | – | – |
| | | Negative emotionality (M,C) × inconsistent discipline (M,C) | | | – | – |
| | | Positive emotionality (M,C) × rejection (M,C)* | Depression (M,C) | .02 | .28 | −.04 |
| | | Positive emotionality (M,C) × inconsistent discipline (M,C) | | | – | – |
| | | Positive emotionality (M,C) × rejection (M,C)* | Conduct probs. (M,C) | .02 | .34 | .06 |
| | | Positive emotionality (M,C) × inconsistent discipline (M,C) | | | – | – |
| | | Impulsivity (M,C) × rejection (M,C) | Depression (M,C) | .02 | – | – |
| | | Impulsivity (M,C) × inconsistent discipline (M,C)* | | | −.07 | .33 |
| | | Impulsivity (M,C) × rejection (M,C) | Conduct probs. (M,C) | .02 | – | – |
| | | Impulsivity (M,C) × inconsistent discipline (M,C)* | | | .11 | .35 |
| Lengua (2008) | $N = 188$ | Fear (O) × rejection (C) | Internalizing (M, C) | .02 | – | – |
| | 8–12 Years | Fear (O) × inconsistent discipline (C) × sex* | Internalizing (M, C) | | .08/n.s. | −.32/n.s. |
| | Longitudinal | Fear (O) × physical punishment (C) × sex | Internalizing (M, C) | | – | – |
| | | Frustration (O) × rejection (C) | Internalizing (M, C) | | – | – |
| | | Frustration (O) × inconsistent discipline (C)* | Internalizing (M, C) | | −.11 | .07 |
| | | Frustration (O) × physical punish. (C) × sex | Internalizing (M, C) | | – | – |
| | | Effortful control (O) × rejection (C) | Internalizing (M, C) | | – | – |
| | | Effortful control (O) × inconsistent discip.(C) | Internalizing (M, C) | | – | – |
| | | Effortful control (O) × physical punish. (C) | Internalizing (M, C) | | – | – |
| | | Fear (O) × rejection (C) | Externalizing (M, C) | .10 | – | – |
| | | Fear (O) × inconsistent discipline (C) × sex* | Externalizing (M, C) | | .12/n.s. | −.18/n.s. |
| | | Fear (O) × physical punishment (C) × sex* | Externalizing (M, C) | | .83/n.s. | .57/n.s. |
| | | Frustration (O) × rejection (C)* | Externalizing (M, C) | | −.01 | .08 |
| | | Frustration (O) × inconsistent discipline (C) | Externalizing (M, C) | | – | – |
| | | Frustration (O) × physical punish. (C) × sex* | Externalizing (M, C) | | .55/n.s. | −.83/n.s. |
| | | Effortful control (O) × rejection (C) | Externalizing (M, C) | | – | – |
| | | Effortful control (O) × inconsistent discip. (C)* | Externalizing (M, C) | | .07 | −.03 |
| | | Effortful control (O) × physical punish. (C)* | Externalizing (M, C) | | .04 | −.22 |

**Table 2** continued

| Authors (year) | Study design | Temperament and parenting interactions (* indicates significant association) | Outcome | $\Delta R^2$ | Low b or r | High b or r |
|---|---|---|---|---|---|---|
| Leve et al. (2005) | $N = 337$ | Fear (M) × harsh discipline (M, O)* (for girls only) | Internalizing (M) | n.s. | – | – |
| | 5–17 Years | | Externalizing* (M) | n.a. | – | – |
| | Longitudinal | Impulsivity (M) × harsh discipline (M, O)* (for girls only) | Internalizing (M) | n.s. | – | – |
| | | | Externalizing (M)* | n.a. | – | – |
| Maziade et al. (1985) | $N = 38$ | Difficult temperament (M) × behavior control (I)* | Psychiatric diagnosis (I) | n.a. | n.a. | n.a. |
| | 7–12 Years | | | | | |
| | Longitudinal | | | | | |
| Maziade et al. (1990) | $N = 38$ | Difficult temperament (M) × behavioral control (I)* | Psychiatric diagnosis (I) | n.a. | n.a. | n.a. |
| | 7–16 Years | | | | | |
| | Longitudinal | | | | | |
| Morris et al. (2002a) | $N = 40$ | Irritable distress (M) × hostility (C) | Internalizing (T) | n.s. | – | – |
| | 6–9 Years old | | Externalizing (T) | n.s. | – | – |
| | Cross-sectional | Irritable distress (M) × psychological control (C)* | Internalizing (T) | .11 | −.08 | .28 |
| | | | Externalizing (T) | n.s. | – | – |
| | | Effortful control (M) × hostility (C)* | Internalizing (T) | n.s. | – | – |
| | | | Externalizing (T) | .15 | .06 | .31 |
| | | Effortful control (M) × psychological control (C) | Internalizing (T) | n.s. | – | – |
| | | | Externalizing (T) | n.s. | – | – |
| Morris et al. (2002b) | $N = 40$ | Fear (M) × psychological control (C) | Internalizing (T) | n.s. | – | – |
| | 6–9 Years old | | Externalizing (T) | n.s. | – | – |
| | Cross-sectional | Irritable distress (M) × psychological control (C)* | Internalizing (T) | n.a. | −.08 | .28 |
| | Boys/girls | | Externalizing (T) | n.a. | .32/n.s. | .97/n.s. |
| Oldehinkel et al. (2006) | $N = 2,230$ | Fear (M) × rejection (C)* | Depression (M, C) | n.a. | n.a. | n.a. |
| | 10–12 Years old | Fear (M) × rejection (C) × sex* | Depression (M, C) | | | |
| | Cross-sectional | Fear (M) × overprotection (C) | Depression (M, C) | | | |
| | | Fear (M) × overprotection (C) × sex | Depression (M, C) | | | |
| | | Fear (M) × emotional warmth (C) | Depression (M, C) | | | |
| | | Fear (M) × emotional warmth (C) × sex | Depression (M, C) | | | |
| | | Frustration (M) × rejection (C) | Depression (M, C) | | | |
| | | Frustration (M) × rejection (C) × sex | Depression (M, C) | | | |
| | | Frustration (M) × overprotection (C)* | Depression (M, C) | | | |
| | | Frustration (M) × overprotection (C) × sex | Depression (M, C) | | | |
| | | Frustration (M) × emotional warmth (C)* | Depression (M, C) | | | |
| | | Frustration (M) × emotional warmth (C) × sex | Depression (M, C) | | | |

**Table 2** continued

| Authors (year) | Study design | Temperament and parenting interactions (* indicates significant association) | Outcome | $\Delta R^2$ | Low b or r | High b or r |
|---|---|---|---|---|---|---|
| Sentse et al. (2009) | $N = 2{,}230$ | Fear (M) × overprotection (C) | Internalizing (M, C) | .02 | – | – |
| | 11–13 Years | Fear (M) × rejection (C)* | Internalizing (M, C) | | .06 | .12 |
| | Longitudinal | Fear (M) × emotional warmth (C) | Internalizing (M, C) | | – | – |
| | | Frustration (M) × overprotection (C) | Internalizing (M, C) | | – | – |
| | | Frustration (M) × rejection (C) | Internalizing (M, C) | | – | – |
| | | Frustration (M) × emotional warmth (C) | Internalizing (M, C) | | – | – |
| | | Fear (M) × overprotection (C) | Externalizing (M, C) | .02 | – | – |
| | | Fear (M) × rejection (C) | Externalizing (M, C) | | – | – |
| | | Fear (M) × emotional warmth (C)* | Externalizing (M, C) | | .08 | .00 |
| | | Frustration (M) × overprotection (C) | Externalizing (M, C) | | – | – |
| | | Frustration (M) × rejection (C)* | Externalizing (M, C) | | .12 | .20 |
| | | Frustration (M) × emotional warmth (C)* | Externalizing (M, C) | | .20 | .12 |
| Stice and Gonzales (1998) | $N = 631$ | Negative affect (C) × maternal control (C)* | Antisocial behavior (C) | n.s. | – | – |
| | High school seniors | | Substance use (C) | n.a. | −.39 | −.22 |
| | Cross-sectional | | Alcohol use (C) | n.s. | – | – |
| | | Negative affect (C) × paternal control (C) | Antisocial behavior (C) | n.s. | – | – |
| | | | Substance use (C) | n.s. | – | – |
| | | | Alcohol use (C) | n.s. | – | – |
| | | Negative affect (C) × maternal support (C)* | Antisocial behavior (C) | n.s. | – | – |
| | | | Substance use (C) | n.a. | −.26 | −.03 |
| | | | Alcohol use (C) | n.s. | – | – |
| | | Negative affect (C) × paternal support (C)* | Antisocial behavior (C) | n.s. | – | – |
| | | | Substance use (C) | n.s. | – | – |
| | | | Alcohol use (C) | n.a. | −.15 | .05 |
| | | Behavioral undercontrol (C) × maternal control (C)* | Antisocial behavior (C) | n.a. | −.08 | −.23 |
| | | | Substance use (C) | n.s. | – | – |
| | | | Alcohol use (C) | n.s. | – | – |
| | | Behavioral undercontrol (C) × paternal control (C)* | Antisocial behavior (C) | n.a. | −.03 | −.19 |
| | | | Substance use (C) | n.s. | – | – |
| | | | Alcohol use (C) | n.s. | – | – |
| | | Behavioral undercontrol (C) × maternal support (C)* | Antisocial behavior (C) | n.a. | −.02 | −.18 |
| | | | Substance use (C) | n.s. | – | – |
| | | | Alcohol use (C) | n.s. | – | – |
| | | Behavioral undercontrol (C) × paternal support (C)* | Antisocial behavior (C) | n.a. | −.01 | .16 |

**Table 2** continued

| Authors (year) | Study design | Temperament and parenting interactions (* indicates significant association) | Outcome | $\Delta R^2$ | Low b or r | High b or r |
|---|---|---|---|---|---|---|
| | | | Substance use (C) | n.s. | – | – |
| | Alcohol use (C) | n.s. | – | – | | |
| van Brakel et al. (2006) | $N = 644$ | Behavioral inhibition (C) × attachment (C)* | Anxiety (C) | .00 | n.a. | n.a. |
| | 11–15 Years | Behavioral inhibition (C) × control (C) | Anxiety (C) | .00 | | |
| | Cross-sectional | Behavioral inhibition (C) × attachment (C) × control(C)* | Anxiety (C) | .01 | | |
| | | Behavioral inhibition (C) × anxious rearing (C) | Anxiety (C) | .00 | | |
| | | Behavioral inhibition (C) × anxious rearing (C) × attachment (C) | Anxiety (C) | .00 | | |
| Van Leeuwen et al. (2004) | $N = 600$ | Benevolence (M,F) × negative control (M,F)* | Internalizing (M, F) T1 | n.s. | – | – |
| | 15-Jul | | Externalizing (M, F) T1 | .05 | 8.80* | 1.3 |
| | Longitudinal | | Externalizing (M, F) T2 | .10 | 7.87* | −1.62 |
| | | Benevolence (M,F) × negative control (C)* | Internalizing (M, F) T1 | n.s. | – | – |
| | | | Externalizing (M, F) T1 | .01 | 4.21* | −.02 |
| | | | Externalizing (M, F) T2 | .06 | 5.19* | −2.08* |
| | | Benevolence (M,F) × positive parenting (M,F)* | Internalizing (M, F) T1 | n.s. | – | – |
| | | | Externalizing (M, F) T1 | .02 | -3.13* | 1.51 |
| | | | Externalizing (M, F) T2 | n.s. | – | – |
| | | Benevolence (M,F) × positive parenting (C) | Internalizing (M, F) T1 | n.s. | – | – |
| | | | Externalizing (M, F) T2 | n.s. | – | – |
| | | Conscientiousness (M,F) × negative control (M,F)* | Internalizing (M, F) T1 | n.s. | – | – |
| | | | Externalizing (M, F) T1 | .02 | 8.66* | 3.73* |
| | | | Externalizing (M, F) T2 | .03 | 7.48* | 1.98* |
| | | Conscientiousness (M, F) × negative control (C)* | Internalizing (M, F) T1 | n.s. | – | – |
| | | | Externalizing (M, F) T1 | .02 | 5.76* | 1.32 |
| | | | Externalizing (M, F) T2 | .04 | 6.48* | −.26 |
| | | Conscientiousness (M,F) × positive parenting (C)* | Internalizing (M, F) T2 | n.s. | – | – |
| | | | Externalizing (M, F) T2 | n.a. | – | – |
| | | Emotional stability (M, F) × negative control (C) | Internalizing (M, F) T2 | n.s. | – | – |
| | | | Externalizing (M, F) T2 | n.s. | – | – |
| | | Emotional stability (M, F) × positive parenting (C)* | Internalizing (M, F) T2 | n.s. | – | – |
| | | | Externalizing (M, F) T2 | n.a. | – | – |
| | | Extraversion (M, F) × negative control (C) | Internalizing (M, F) T2 | n.s. | – | – |
| | | | Externalizing (M, F) T2 | n.s. | – | – |
| | | Extraversion (M, F) × positive parenting (C)* | Internalizing (M, F) T2 | n.s. | – | – |
| | | | Externalizing (M, F) T2 | n.a. | – | – |

**Table 2** continued

| Authors (year) | Study design | Temperament and parenting interactions (* indicates significant association) | Outcome | $\Delta R^2$ | Low b or r | High b or r |
|---|---|---|---|---|---|---|
| | | Imagination (M, F) × negative control (C) | Internalizing (M, F) T2 | n.s. | – | – |
| | | | Externalizing (M, F) T2 | n.s. | – | – |
| | | Imagination (M, F) × positive parenting (C)* | Internalizing (M, F) T2 | n.s. | – | – |
| | Externalizing (M, F) T2 | | n.a. | – | – | |
| Veenstra et al. (2006) | $N = 2{,}230$ | Frustration (M) × overprotection (C) | Antisocial behav. (M, C) | n.s. | – | – |
| | 11 Years | Frustration (M) × rejection (C) | Antisocial behav. (M, C) | | – | – |
| | Cross-sectional | Frustration (M) × emotional warmth (C) | Antisocial behav. (M, C) | | – | – |
| | | Effortful control (M) × overprotection | Antisocial behav. (M, C) | | – | – |
| | | Effortful control (M) × rejection (C) | Antisocial behav. (M, C) | | – | – |
| | | Effortful control (M) × emotional warmth (C) | Antisocial behav. (M, C) | | – | – |
| Wootton et al. (1997) | $N = 166$ | Callous-unemotional (M, T) × ineffective parenting (M)* | Conduct problems (O) | .03 | – | – |
| | 6–13 Years | Callous-unemotional (M, T) × low positive parenting (M)* | Conduct problems (O) | .02 | – | – |
| | Cross-sectional | Callous-unemotional (M, T) × negative parenting (M) | Conduct problems (O) | .11 | – | – |
| Xu et al. (2009) | $N = 416$ | Frustration (M) × harsh parenting (M, F) | Proactive aggress. (T) | .41 | – | – |
| | 3rd–4th Grade | Frustration (M) × indulgent parenting (M, F) | Proactive aggress. (T) | | – | – |
| | Cross-sectional | Effortful control (M) × harsh parenting (M, F) | Proactive aggress. (T) | | – | – |
| | | Effortful control (M) × indulgent (M, F)* | Proactive aggress. (T) | | .32 | −.02 |
| | | Sensation seeking (M) × harsh (M, F)* | Proactive aggress. (T) | | −.01 | .26 |
| | | Sensation seeking (M) × indulgent (M, F)* | Proactive aggress. (T) | | −.01 | .33 |
| | | Frustration (M) × harsh parenting (M, F) | Reactive aggression (T) | .33 | – | – |
| | | Frustration (M) × indulgent parenting (M, F) | Reactive aggression (T) | | – | – |
| | | Effortful control (M) × harsh parenting (M, F) | Reactive aggression (T) | | – | – |
| | | Effortful control (M) × indulgent (M, F) | Reactive aggression (T) | | – | – |
| | | Sensation seeking (M) × harsh (M, F) | Reactive aggression (T) | | – | – |
| | | Sensation seeking (M) × indulgent (M, F) | Reactive aggression (T) | | – | – |

When 2 values are reported with a "/", they are described in the study design column (e.g., boys/girls)

*C* child report, *F* father report, *M* mother report, *N* neuropsychological assessment, *O* observation, *P* physiological indicator

* $p \leq .05$

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