RUNNING HEAD: TEMPERAMENT DEVELOPMENT AND PSYCHOPATHOLOGY RISK

Temperament Development and Early Temperament Predictors of Psychopathology: Examination of Developmental Trajectories of Increased Temperament Risk for Psychopathology and the Direct and Indirect Effects of Infant Temperament on Toddler Psychopathology Outcomes

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TEMPERAMENT DEVELOPMENT AND EARLY TEMPERAMENT PREDICTORS OF PSYCHOPATHOLOGY: EXAMINATION OF DEVELOPMENTAL TRAJECTORIES OF INCREASED TEMPERAMENT RISK FOR PSYCHOPATHOLOGY AND THE DIRECT AND INDIRECT EFFECTS OF INFANT TEMPERAMENT ON TODDLER PSYCHOPATHOLOGY OUTCOMES

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Abstract

Previous research has noted the link between temperament and psychopathology. However, there is a relative lack of research during the earliest years of life (i.e. infancy) that examines factors impacting temperament development toward increased risk for psychopathology as well as research examining models of psychopathology with the inclusion of temperament. The purpose of the current investigation is to address these limitations by examining 1) predictors (maternal depression, negative affect, parenting stress) of growth trajectories of infant positive emotionality/affect (PA), negative emotionality/affect (NA), and regulatory capacity from 4 to 12 months of age and 2) to examine the role of temperament measured in the first year of life (8 and 12 months of age) on toddler externalizing and internalizing difficulties at age 24 months in the context of other known risk factors of behavioral problems (i.e. maternal depression, anxiety, parenting stress, negative parenting, and negative affect). One-hundred fifty-eight families from WA, OR, ID, MT, and NV with a 4-month old infant agreed to participate in this 20 month long investigation. Analyses utilized latent growth modeling (LGM; Study 1) and structural equation modeling (SEM; Study 2). Results of the first study identified normative developmental patterns of infant PA, NA, and regulatory capacity in the first year of life and implicated maternal depression and stress in interindividual differences in PA and NA growth trajectories. Findings in Study 2 indicated the direct effect of lower 12 month infant regulatory capacity on increased externalizing and internalizing difficulties. Furthermore, analyses suggest that the impact of infant NA on internalizing and externalizing difficulties is partially mediated through regulatory capacity and that the effect of infant PA on externalizing and internalizing difficulties is fully mediated through

regulatory capacity. Additional findings are discussed as well as implications for future research, models of early emerging psychopathology, and early prevention and intervention efforts.

Psychopathology in childhood (e.g. depression, conduct problems, and ADHD) is associated with significant costs to society and frequently precedes psychological difficulties in adulthood. Identification of contributors (i.e. risk and protective factors) to the development of childhood psychopathology present early in life could significantly contribute to intervention and prevention efforts, which would likely result in considerable reductions in societal costs (National Advisory Mental Health Council [NAMHC] Workgroup, 2001). Although considerable attention has been given to some risk factors, such as economic factors (e.g. Dodge, Pettit, & Bates, 1994; McLoyd, 1998), parental psychopathology (e.g. Brennan, Hammen, Katz, & Le Brocque, 2002; Connell & Goodman, 2002; Fendrich, Warner, & Weissman, 1990; McCarty, McMahon, & Conduct Problems Prevention Research Group, 2003), caregiver personality (e.g. Ellenbogen & Hodgins, 2004; Prinzie et al., 2004), and parenting (e.g. Baumrind, 1968; DeVito & Hopkins, 2001; Strassberg, Dodge, Pettit, & Bates, 1994), it is only recently that the contributions of child temperament to the development of psychopathology have started to receive wide spread attention. For example, a Special Section in the Journal of Clinical Child and Adolescent Psychology (JCCAP) was devoted to examining the contributions of temperament to the development of psychopathology in children (Frick, 2004).

In the introduction to the JCCAP special section on temperament and psychopathology, Frick (2004) outlined the importance of examining the effects of temperament on the development of psychopathology. For example, it was noted that a clearer understanding of the role of infant and early childhood temperament in the later development of psychopathology could allow for early prevention efforts, with such efforts having the potential for significant positive change in the outcome of children.

Furthermore, Frick (2004) noted the importance of considering moderation of temperament by environmental influences as well as the mediational role of environmental and developmental processes in the examination of temperament to psychopathology relationships. Others' have also noted the need for longitudinal research examining mediational processes through which temperament may impact adjustment outcomes (e.g. Rothbart & Bates, 1998). These examples reflect the increasing importance and implications of considering temperament in models of developmental psychopathology.

The purpose of the current study is to examine temperament, how temperament develops, and evidence for the role of temperament in the development of psychopathology. Furthermore, it will be noted that temperament operates in the context of other established risk factors. To that end, other risk factors, such as parent and environmental factors, will be examined.

Temperament & Temperament Development

Broadly defined, temperament is considered to reflect individual differences in reactivity and self-regulation that have a constitutional basis (Rothbart & Derryberry, 1981; for a review of other definitions of temperament see Goldsmith et al., 1987). Structural definitions of temperament encompass a variety of higher order temperament constructs, such as negative emotionality/affect, positive emotionality/extraversion, and effortful control/regulatory capacity (Gartstein & Rothbart, 2003; Rothbart & Bates, 1998; Rothbart, 1989), which are closely tied to the later development of personality (Goldsmith, Lemery, Aksan, & Buss, 2000; Rothbart, Ahadi, & Evans, 2000). These broad temperament constructs are comprised of more fine-grained temperament constructs. For example, negative emotionality typically consists of dimensions of sadness, anger, irritability, and

fear. Dimensions of positive emotionality/extraversion typically consist of approach, smiling and laughter, activity level, and sociability. Early in life, regulatory capacity reflects orienting and self-soothing; later in life, effortful control reflects the ability to inhibit a prepotent response and consists of perceptual sensitivity and attentional control (For reviews of the dimensions of these temperament constructs see Goldsmith et al., 1987; Rothbart & Bates, 1998; Rothabart, Ellis, Rueda, Posner, 2003; Rothbart, 1989).

Certain aspects of temperament (e.g. positive emotionality, negative emotionality, regulatory capacity, and activity level) may be particularly important early predictors of risk for psychopathology because of their early emergence (i.e. infancy). Infant behaviors that reflect positive emotionality include smiling, laughing, displaying pleasure, and approaching novel stimuli (Gartstein & Rothbart, 2003; Rothbart, 1989). Positive emotionality is frequently used interchangeably with the term positive affect (e.g. Rothbart & Ahadi, 1994), which typically reflects behaviors/characteristics such as outgoing, enthusiasm, alertness, and activity. Furthermore, individuals higher in positive affect have the tendency to be engaged, rather than disengaged, with their environment (Lonigan, Phillips, & Hooe, 2003), presumably because of increased approach tendencies.

Positive emotionality usually begins to be displayed through smiling and laughter by the third month of life (Rothbart, 1989). Continued development of positive emotionality occurs throughout the first year of life (Rothbart, 1989), which has been documented with home observations, parent reports, and laboratory tasks (Kochanska, Coy, Tjebkes, & Husarek, 1998; Rothbary, 1986, 1987). Other evidence suggests that positive emotionality becomes increasingly stable as age increases with most characteristics of positive emotionality identifiable by toddlerhood (Lemery, Goldsmith, Klinnert, Mrazek,

1999). Given the similarity of the positive emotionality construct with extraversion, it is not surprising that investigators (e.g. Rothbart and Ahadi, 1994) have started to think of positive emotionality as a developmental precursor to the adult personality construct of extraversion.

Negative emotionality generally consists of irritability, fear, sadness, anger, frustration, and discomfort (Gartstein & Rothbart, 2003; Rothbart & Ahadi, 1994; Rothbart, Ahadi, & Evans, 2000; Rothbart, 1989). Similar to positive emotionality, negative emotionality has been measured using parent, observer, and laboratory tasks (e.g. Belsky, Hsieh, & Crnic, 1996; Kochanska et al., 1998). Developmentally, negative emotionality is unique in that it is one of the first aspects of temperament to emerge. Thus, aspects of negative emotionality have been measured and have demonstrated stability as early as 1 month of age (e.g. Rothbart, 1989), with other investigations noting some changes during infancy and stability in negative emotionality constructs by the toddler years (e.g. Lemery et al., 1999). It should also be noted that negative emotionality has been referred to as negative affect and has been linked conceptually to the personality trait of neuroticism in adulthood (Rothbart & Ahadi, 1994).

There has been occasional debate as to whether positive and negative emotionality reflect two different constructs or are opposite poles on one dimension of emotionality. Evidence seems to suggest that these constructs are related, but distinct. For example, Belsky, Hsieh, and Crnic (1996) found a moderate negative relationship between positive and negative emotionality constructs. Furthermore, they found that negative emotionality was a better longitudinal predictor of future negative emotionality than positive

emotionality and that positive emotionality was a better longitudinal predictor of future positive emotionality than negative emotionality.

Similar to negative emotionality, activity level (i.e. the degree to which infants engage in physical movements), is an early emerging temperamental characteristic (Rothbart & Bates, 1998). Although activity level has been measured at various stages of development, there is some question as to whether it is a unique construct or if it is an aspect of positive or negative emotionality. For example, Escalona (1968) noted that newborns tend to engage in more motor activity when in a negative rather than positive state. More recently, activity level loaded onto the Surgency/Extraversion factor of the Infant Behavior Questionnaire, Revised (IBQ-R; Gartstein & Rothbart, 2003), which is designed for infants at least three months of age.

Effortful control is a higher order regulatory aspect of temperament that is responsible for suppression of a dominant response in favor of performing a subdominant response (Rothbart, Ellis, Rueda, & Posner, 2003). Thus, effortful control serves to override a prepotent response as well as initiate and/or maintain an alternative behavioral or emotional response (Kochanska, Murray, & Harlan, 2000). Effortful control is also involved in the ability to shift attention and to voluntarily alter one's focus from one location to another (Valiente, et al. 2003). Currently, it is believed that effortful control comes online in the second half of the first year of life, which coincides with rapid development of the anterior attentional mechanisms (Rothbart, Derryberry, & Posner, 1994). Others have suggested that executive attention, which is controlled by cortical (e.g. prefrontal cortex and anterior cingulate) and subcortical areas (e.g. basal ganglia), may play a part in effortful control (Rothbart et al., 2003).

Effortful control continues to develop throughout the toddler and preschool time period (Rothbart et al., 2003) and can be measured with a variety of tasks and questionnaires. For example, effortful control has been measured with key press and eye movement tasks (Rothbart et al., 2003), a puzzle completion task (Valiente et al., 2003), a spatial conflict task (Gerardi-Caulton, 2000), delay tasks and go-no-go tasks (Murray & Kochanska, 2002), the Toddler Behavior Assessment Questionnaire (TBAQ; Goldsmith, 1996) and the Child Behavior Questionnaire (CBQ; Goldsmith & Rothbart, 1991). Factor analytic studies of the CBQ indicate that effortful control is comprised of items that tap into focused attention, perceptual sensitivity, inhibitory control, and low intensity pleasure (Rothbart, Ahadi, Hershey, & Fisher, 2001). Given the range of abilities in which effortful control plays an important role, it is not surprising that effortful control has been implicated in the development of conscience (Kochanska, et al., 2000), coping abilities (Shoda, Mischel, & Peake, 1990), and aggression (Kochanska, Murray, & Coy, 1997). Effortful control has also been implicated in the internalization of rules (Kochanska, Coy, & Murray, 2001), as a protective factor.

Increasingly, evidence suggests that reactive and effortful control processes may play an important part in the regulation of emotional tendencies. For example, Gonzalez, Fuentes, Carranza, and Estevez (2001) noted that self-regulatory abilities impacted the effect of anger on executive attention. Specifically, Gonzalez et al. found that children high in anger and low in inhibitory control had reduced attentional control whereas children high in both constructs did not exhibit lower attentional control abilities. Eisenberg et al. (1998) concluded that increased levels of behavioral regulation was important in the regulation of empathy for boys that demonstrated higher emotional intensity.

Temperament and Psychopathology

Given the importance of emotionality and regulatory abilities in psychopathology in general (e.g. Keenan, 2000; Barkley, 1998), it is not surprising that the temperament constructs briefly reviewed above have been linked to psychopathology in children. For example, studies examining the tripartite model of depression and anxiety in children and adolescents, suggest that higher levels of negative emotionality/affect are related to increased anxiety and depression (e.g. Jacques & Mash, 2004; Anthony, Lonigan, Hooe, & Phillips, 2002; Phillips, Lonigan, Driscoll, & Hooe, 2002; Joiner & Lonigan, 2000). The broader constructs of internalizing and externalizing behaviors have also demonstrated links with negative emotionality. For example, Lengua and Long (2002) observed direct relationships between negative emotionality and both internalizing and externalizing difficulties. Negative emotionality also has been implicated in the development of adolescent substance use (e.g. Wills, Sandy, Yaeger, & Shinar, 2001).

Relative to research investigating the link between negative emotionality and psychopathology, the link between positive emotionality/affect and psychopathology has only recently been investigated in children and adolescents. Much of this research has been in an effort to downwardly extend the tripartite model of depression and anxiety in adults, which implicates low positive affect in the development of depression (Clark & Watson, 1991; Clark, Watson, & Mineka, 1994). Consistent with findings in the adult literature, studies using children and adolescents and a variety of methods (e.g. longitudinal, concurrent, multitrait-multimethod, and community and clinical samples) found that low positive affect was associated with increases in depressive symptoms (Anthony et al., 2002; Jacques & Mash, 2004; Joiner & Lonigan, 2000; Lonigan et al., 2003; Phillips et al., 2002).

Although some of these studies noted no or minimal associations between anxiety and positive affect (e.g. Anthony et al., 2002; Lonigan et al., 2003; Phillips et al., 2002), others (e.g. Jacques & Mash, 2004; Joiner & Lonigan, 2000) noted moderate associations between low positive affect and increases in symptoms of anxiety. Few studies have examined the relationship between positive emotionality and externalizing difficulties. One noted exception is a study conducted by Lengua, Sandler, West, Wolchik, and Curran (1999), which found low positive emotionality/affect to be related to increases in conduct problems.

Although there is some debate as to whether activity level is an independent temperament construct or part of the higher order constructs of negative or positive emotionality, research has demonstrated links between activity level and behavioral difficulties. Rende (1993) found a significant relationship between activity level and attention problems in boys. Others (e.g. Bussing et al., 2003; Diener & Kim, 2004; Mesman & Koot, 2000; Nelson, Martin, Havill, & Kamphaus, 1999) have also found significant relationships between various externalizing constructs (e.g. aggression, hyperactivity, inattention, conduct problems, and general externalizing indices) and activity level. Although Colder, Mott, and Berman (2002) and Rende (1993) found no relationship between activity level and internalizing difficulties in their samples, Mesman and Koot (2000) noted a significant relationship between boys internalizing difficulties and activity level and Bussing et al. (2003) noted significant positive relationships between parent reported activity level and child self-reported depression and anxiety measures.

Similar to studies examining links between positive and negative emotionality and child psychopathology, a number of studies have investigated the role of effortful control in

the development of behavioral difficulties in this population. Using maternal reports of child behavior, Gartstein and Fagot (2003) found that lower effortful control remained a significant predictor of increased externalizing difficulties after controlling for maternal depression, child gender, parental coercive behavior, and marital adjustment. A similar finding was obtained with paternal reports of child effortful control and externalizing difficulties (Gartstein & Fagot, 2003). Using a longitudinal design, Kochanska and Knaack (2003) found, after controlling for WPPSI-R Information score and gender, that effortful control explained 8% of the variance in the development of externalizing difficulties. Similarly, using a longitudinal design, Valiente et al. (2003) found that effortful control contributed unique variance to the prediction of externalizing behavior problems (lower effortful control was related to increases in behavior problems). Eisenberg et al. (2001) found that children who had externalizing and internalizing difficulties tended to be low on effortful control, although children with internalizing symptoms were generally not as low on effortful control as children with externalizing behavioral difficulties. Using a longitudinal design, Eisenberg et al. (2004) also noted negative relationships between effortful control and internalizing and externalizing behavior problems. Other studies (e.g., Zhou, Hofer, Eisenberg, Reiser, Spinrad, & Fabes, 2007; Olson, Sameroff, Kerr, Lopez, & Wellman, 2005) have also noted the consistent relationship between effortful control and behavioral difficulties. Collectively, these studies suggest that the temperament characteristic of effortful control plays an important role in the development of both internalizing and externalizing behavior problems.

Moderated and Meditated Effects of Temperament on Psychopathology

As noted above, previous research has established direct effects models explaining relationships between various temperament constructs and psychopathology. However, interactions and indirect effects involving different temperament constructs and environmental factors are also potentially important. For example, Morris et al. (2002) found an interaction between irritable stress, a component of negative emotionality, and negative parenting, such that children high in irritable stress who experienced maternal hostility had significantly more teacher reported externalizing behavior than children high in irritable stress who did not experience maternal hostility. The Morris et al. study represents an example of a temperament-by-environment interaction, demonstrating that parenting risk factors (e.g., maternal hostility) can accentuate negative effects of child temperament risk factors (e.g., irritability). Kochanska (1991, 1995) demonstrated a significant interaction between child fearfulness and maternal control, such that non-power-assertive maternal discipline predicted higher levels of internalizing difficulties, but only for children high in fear. Interactions between high negative emotionality, negative maternal control, and low fearfulness have been found to contribute to initially high, non-decreasing growth trajectories of externalizing behaviors; high negative maternal control, negative emotionality, and fearlessness were associated with increasing growth trajectories of internalizing difficulties (Gilliom & Shaw, 2004). Lengua, Wolchik, Sandler, and West (2000) found that maternal rejection had a more potent effect on child behavioral difficulties for children low in positive emotionality relative to those high in positive emotionality.

Temperament-by-temperament interactions may also impact the development/maintenance of behavior problems (Rothbart & Bates, 1998). For example,

Eisenberg et al. (2001) found that children with behavior problems were more likely to exhibit externalizing behaviors when they scored higher on anger and low on regulation (e.g. effortful control) than non-behavior problem controls. Using a longitudinal design, Belsky, Friedman, and Hsieh (2001) found that infants low in attentional persistence and high in negative emotionality experienced greater difficulties in social competence 16 months later than infants high in attentional persistence. In another example of temperament-by-temperament interactions, Eisenberg et al. (2004) found that child anger moderated the relationship between effortful control and externalizing difficulties, such that children higher in anger and lower in effortful control had higher externalizing difficulties than children lower in anger.

While indirect effects have been hypothesized (e.g. difficult temperament leads to poor parenting, which then results in poor adjustment), research examining potential mediation has not been widespread (Rothbart & Bates, 1998). Furthermore, some research that examined potential indirect effects has found direct effect models to provide a better fit to the data than indirect models (e.g. McClowry, et al., 1994). However, some evidence exists which suggests that mediated effects may be important to consider when examining the relationships between temperament and child psychopathology. In one of the few studies conducted with children, Prinzie et al. (2004) found that child personality characteristics of benevolence and emotional stability predicted concurrently measured externalizing difficulties both directly and indirectly through parenting practices. This model fit the data better than a fully mediated model. Additional evidence based on the adult personality literature also suggests the importance of examining mediational pathways. For example, Finch and Graziano (2001) found that the effects of agreeableness

and extraversion on depression in college students were mediated through negative social interactions and social support. In this study, neuroticism was found to have both direct and indirect (through negative social interactions) effects on depression.

Parental and Environmental Contributors to Early Psychopathology

Although temperament appears to be emerging as an important early indicator of risk for psychopathology (e.g. Frick, 2004), temperament does not operate in a vacuum in determining risk for psychopathology. Furthermore, as noted above, models with temperament-by-environmental/parental interactions and mediational models with temperament demonstrating indirect effects on the emergence of psychopathology may be particularly important for gaining a better understanding of how psychopathology in children develops. Because factors that have already demonstrated contributions to emerging psychopathology are more likely to be important to include in models with temperament, some of these factors (e.g. existing parental psychopathology, parental personality, parenting practices, attachment, and SES) are briefly reviewed.

Parental & Environmental Influences

Research suggests that several factors associated with parents can impact the development of psychopathology in their children. For example, Brennan, Hammen, Katz, and Brocque (2002) found that the presence of maternal and paternal depression had additive effects on adolescent externalizing problems and resulted in increased risk of adolescent depression. Other studies also have consistently noted higher rates of internalizing and externalizing behavior problems in children and adolescents of parents with psychopathology (e.g. Schaughency & Lahey, 1985; Campbell, 1994; Fendrich & Warner, 1990; McCarty, McMahon, & Conduct Problems Prevention Research Group,

2003; Connell & Goodman, 2002). Although few studies have examined parental psychopathology and its impact on child psychopathology in the first few years of life those that have (see Carter et al., 2001 and Cicchetti, Rogosch, & Toth, 1998 for exceptions) typically find that the presence of parental psychopathology is related to child internalizing and externalizing problems.

Negative parenting practices (e.g. permissive, harsh, inconsistent discipline practices, and use of coercion) also have been related to behavior problems in children. DeVito and Hopkins (2001) found that permissive parenting practices accounted for a significant amount of the variance in disruptive behavior in children. Similarly, Muris, Bogels, van der Kamp, and van Oosten (1996) found a significant relationship between negative parenting and externalizing behavior difficulties. In a meta-analysis examining the relationship between parenting and externalizing behaviors, which utilized only studies based on non-clinical samples, a significant effect was found such that parenting that was characterized by guidance, absence of coercive control, approval, synchrony, and the use of motivational strategies was negatively related to externalizing difficulties (Rothbaum & Weisz, 1994).

Studies have also shown relationships between parental personality (e.g. neuroticism) and child behavior difficulties. Ellenbogen and Hodgins (2004) found that higher parental neuroticism was directly and indirectly (through parenting and psychosocial functioning) related to internalizing and externalizing behavior problems in children. Other studies have also noted a direct relationship between parental neuroticism/negative emotionality and child behavior problems. For example, Kochanska, Clark, and Goldman

(1997) found that higher maternal negative emotionality was related to higher levels of anger and defiance in their children.

Attachment is also likely to play an important early role in the development of psychopathology. Infants and toddlers are typically classified into one of four attachment categories based on the classic strange situation paradigm (Ainsworth, Blehar, Waters, & Wall, 1978; Bretherton, 1992). The majority of infants fall into the category of secure attachment, which means that they demonstrate behaviors consistent with missing the parent, such as crying, greets the parent upon return, and then relatively quickly calms down and returns to play activities. However, some infants are categorized into several attachments categories, avoidant (avoids parent after the parent returns to a room after being absent), resistant (demonstrates preoccupation with the parent and does not calm down and resume play when parent returns to room), and disorganized (vacillates between wanting and interacting with the parent to not wanting and not interacting with the parent upon return), that have implications for the development of psychopathology (Main, 1996). In a relatively recent meta-analysis, van Ijzendoorn, Schuengel, and Bakermans-Kranenburg (1999) found that disorganized attachment was related to externalizing behavioral difficulties. Other studies have also noted the relationship between attachment and psychopathology. For example, DeVito and Hopkins (2001) found that a coercive attachment pattern was predictive of disruptive behavior in a sample of preschool children. Others (e.g. Fagot & Pears, 1996) have also noted the link between coercive attachment and disruptive behavior. The relationship between internalizing difficulties and attachment has not been frequently examined. However, Speltz, Greenburg, and DeKlyen (1990)

found that securely attached children had significantly fewer externalizing and internalizing difficulties relative to insecurely attached children.

SES has consistently been linked (directly and indirectly) to child behavior problems (Dodge, Pettit, & Bates, 1994; Dubow & Ippolito, 1994). Specific risk factors associated with low SES include: poverty/low income, lower educational attainment of parents, increased exposure to environmental stressors (e.g. negative peer influences & crime), increased unemployment, and reduced access to child care (McLoyd, 1998). In addition to directly and indirectly impacting the child, these difficulties may lead to increased punitive parental discipline practices and increased parental psychopathology and stress (McLoyd, 1998). As noted above, negative parenting and parental psychopathology are associated with increases in child behavior problems. Thus, it appears that low SES and the associated environmental stressors are likely to result in higher rates of behavior problems in young children.

Temperament and Parental/Environmental Risk Factors for Psychopathology

To date, studies have largely studied the impact of temperament on the development of psychopathology in isolation from the parental and environmental risk factors noted above. Although there are notable exceptions (e.g. Morris et al., 2002; Gilliom & Shaw, 2004; Kochanska, 1991, 1995), these studies have typically examined interactions between temperament and parenting factors (e.g. supporting parenting practices and negative parenting). No studies were identified in the current review that examined the impact of temperament, SES, parental psychopathology, and parental personality is the same model.

Research Directions

Although temperament appears to be an important factor to consider when examining developmental models of psychopathology, several lines of additional research are needed to further enhance this area of research. In the studies reviewed above, clear relationships between temperament and psychopathology were indicated. However, there are several studies that have failed to find relationships between temperament constructs and measures of psychopathology (e.g. Belsky, Hsieh, & Crnic, 1998; Coplan, Bowker, & Cooper, 2003; Keenan, Shaw, Delliquadri, Giovannelli, Walsh, 1998). To further clarify the direct relationships between temperament characteristics and psychopathology a meta-analysis of existing studies would be useful. Such an analysis would not only determine overall effects across studies, but also allow examination of potentially important methodological characteristics across studies, such as different theoretical approaches to temperament and measurement techniques, that may account for some of the discrepancies in findings across studies.

Several studies have noted that some temperament and psychopathology measures contain similar items, with such overlap resulting in inflated indices of association between temperament and psychopathology constructs (e.g. Lemery, Essex, & Smider, 2002; Lengua, West, & Sandler, 1998; Sanson, Prior, & Kyrios, 1990). Although these studies continued to find significant relationships between temperament and psychopathology after the removal of overlapping items, Lahey (2004) suggested that efforts be devoted to developing measures of temperament that are specifically designed for use in psychopathology research. These instruments would allow for a less confounded examination of temperament/psychopathology relationships. Another approach that would minimize the effects of potentially confounded constructs would be to obtain

measurements of temperament at a point in time, such as in the first year of life, prior to the emergence of child psychopathology as posited by existing developmental psychopathology models. Relatively few studies have attempted to do so (for exceptions see Andersson & Sommerfelt, 1999; Colder, Mott, Berman, 2002; Olson et al., 2000). Such studies would also have important implications for intervention and prevention efforts. For example, should temperament in the first year demonstrate the ability to predict the later development of psychopathology, intervention efforts could be aimed at ameliorating the effects of temperament characteristics that increase risk of later psychopathology. Alternatively, intervention efforts could be directed at facilitating the development of temperament characteristics that reduce the risk of later developing psychopathology.

Some existing studies that examine temperament-psychopathology relationships are limited in their ability to make causal conclusions for one of two reasons: 1) temperament and psychopathology relationships are examined concurrently rather than longitudinally (for exceptions see Belsky, Friedman, & Hsieh, 2001; Eisenberg et al., 2004; Lonigan et al., 2003; Valiente et al., 2003) or 2) studies employ longitudinal models, but are limited by narrowly examining the temperament-psychopathology relationships rather than examining these relationships in the context of other factors known to impact the development of psychopathology in children (e.g. parental psychopathology, parental neuroticism, SES, and negative parenting). Furthermore, most longitudinal studies examine temperament at a point in time after infancy. Thus, additional longitudinal studies are needed that examine temperament in infancy and then examine links to psychopathology later in life.

A second avenue of longitudinal research that may be important for examining the contributions of temperament to the development of psychopathology are investigations of

how temperamental growth trajectories may be increased toward greater risk for psychopathology as a result of parental and environmental influences. Several studies have demonstrated the implications of such research, although they have not directly examined growth trajectories. For example, Pauli-Pott, Mertesacker, and Beckmann (2004) found that mothers whoreported high depression and anxiety when infants were 4 months of age in conjunction with high maternal emotional/social support, had infants displayed higher levels of fear and withdrawal at 12 months. If growth modeling had been utilized in this study, the authors would have been able to determine if the interaction of maternal social/emotional support and depression/anxiety when infants were 4 months of age resulted in increasing growth trajectories of infant fear and withdrawal. Susman, Schmeelk, Ponirakis, and Gariepy, (2001) also demonstrated the impact of early maternal characteristics (e.g. hormones, emotions, and parenting practices) on later child temperament outcomes. However, these studies are limited by relatively smaller sample sizes and the use of methods that do not allow fine grained examinations of growth trajectories and how such trajectories may be altered.

There are several existing data analytic methods that would allow for a relatively sophisticated approach to longitudinally examining the connections between temperament and psychopathology. For example, structural equation modeling (SEM) would allow for more precise models of developmental psychopathology that include temperament. Although some investigators have utilized SEM to examine longitudinally temperament/psychopathology connections (e.g. Eisenberg, et al., 2001; Lonigan, et al., 2003; Valiente, et al., 2003), these studies are generally the exception rather than the rule. SEM models have noted advantages over more traditional data analytic approaches because

of their ability, among other advantages, to take into account more precisely measurement error and compare competing models to determine the model that has the best fit and greatest explanatory ability (Tomarken & Baker, 2003). Such models would be well suited for examination of temperament/psychopathology links while taking into account other known risk factors for the development of psychopathology in children. Furthermore, as previously noted, investigations have largely focused on moderators of the temperament/psychopathology relationship whereas relatively few studies have examined mediational models examining factors through which temperament may impact the development of psychopathology. Longitudinal SEM applications would substantially enhance mediational investigations (for a review and discussion see Cole & Maxwell, 2003).

Another SEM based analytical technique, latent growth modeling (LGM), is well suited for examining change across time. Byrne and Crombie (2003) noted LGM is superior to many other methods of longitudinal data investigation, such as panel designs, because of more effective examination of interindividual change differences. In particular, LGM would allow investigators to determine if interindividual differences in temperament growth trajectories exist and then allow investigation of parental and environmental factors that impact such trajectories. For example, given that direct relationships between negative emotionality and psychopathology indicators have been identified, an LGM examination of factors that resulted in accelerated trajectories of negative emotionality would be beneficial, and would likely lead to identification of areas that can be targeted for preventative intervention efforts. To this authors' knowledge, no studies to date have

utilized a LGM paradigm to examine temperament development and factors that may impact such development.

Conclusions

Inclusion of temperament in models of psychopathology, along with the other factors reviewed above, will significantly enhance existing models of developmental psychopathology. These models will in turn further current understanding of the development and maintenance of psychopathology. Additionally, although a substantial amount of research has been conducted, additional studies examining temperament in conjunction with other contributors to the development of psychopathology, as well as moderators and mediators of the temperament/psychopathology relationships, need to be undertaken. Research utilizing longitudinal methods and focusing on temperament in the first 2 years of life is likely to be particularly useful and lead to progress in this area. This early childhood focus has important implications for early intervention and prevention efforts. Given the potential societal benefits of early intervention, it is clear that a better understanding of the role of early temperament development, and its relationship to parenting/familial factors in contributing to psychopathology is needed. Thus, in sum, although an understanding of the role of temperament in the development of psychopathology is emerging, the complete picture has not yet crystallized and this area of research is in need of continued empirical attention.

The Current Study

The current study addresses several of the substantive questions noted above. In study 1, the growth trajectories of infant emotionality and regulatory abilities were examined in the context of factors that may alter the developmental trajectories of these

constructs toward increased risk for psychopathology. In study 2, the contributions of temperament measured in the first 12 months of life to the development of psychopathology at age 2 years were examined in models simultaneously considering the potential contributions of other known risk factors for developmental psychopathology. Because temperament measures were taken at a time when traditionally defined psychopathology has not yet emerged, the potential for inflated relationships between temperament and psychopathology due to overlapping content of measurement instruments was minimized. Furthermore, in study 2, the role of temperament regulation and negative parenting as mediators through which temperament and maternal characteristics effect the development of psychopathology were examined.

Goals/Hypotheses. The first goal of the current study is to examine growth trajectories associated with the development of temperament between 4 and 12 months of age, to determine if interindividual differences in the development of temperament are present. Once the presence of interindividual differences was determined, the second goal of the current investigation was to examine parental and home-environment factors that may impact the growth trajectories of temperament in the first year of life. It was predicted that higher levels of parental psychopathology (i.e., depression), parenting stress, and parental neuroticism would result in slowed development of infant positive emotionality, increases infant negative emotionality, and slowed development of infant regulatory ability relative to lower/minimal levels of these parental factors. Alterations in temperament growth trajectories as a function of single parent households and presence/absence of siblings also were examined in a series of exploratory analyses.

The third goal of the current study was to utilize longitudinal structural equation modeling to examine the impact of positive emotionality, negative emotionality, and regulatory capacity in infancy, within the context of other factors (e.g. SES, parental psychopathology, parental negative affect, and negative parenting), on the development of behavior problems at 2 years of age. A nested model testing approach was utilized to compare SEM models that 1) allowed direct effects from parental neuroticism, infant positive and negative emotionality, as well as regulatory ability, parental psychopathology, and negative parenting on child internalizing and externalizing difficulties at 2 years of age, 2) allowed only mediational effects from parent factors and infant positive and negative emotionality temperament factors through infant regulation and negative parenting to internalizing and externalizing difficulties, and 3) allowed a combination of direct and mediational pathways to child internalizing and externalizing difficulties. It was anticipated that combinations of both direct and mediational effects will provide the best fit to the data. Furthermore, models examining internalizing and externalizing difficulties were compared to determine if differences in pathways to the expression of behavior problems existed. Hypotheses generated (i.e., increased maternal internalizing problems, negative affect, and negative parenting and increased infant NA would be related to increases in externalizing problems whereas lower SES, infant PA, and infant regulatory capacity would be related to increased externalizing difficulties) were largely based on literature examining externalizing outcomes. Although different pathways were expected for internalizing problems, specific a priori hypotheses regarding such differences could not be generated due to the paucity of research in this area relative to research examining externalizing difficulties.

Method

Because the current study is essentially one study conducted over a two year time frame, the method section is presented as one section. However, because the results obtained in the study are extensive in terms of their scope and statistical methods, statistical findings are presented as study 1 and study 2.

Participants

One-hundred fifty-eight families from Washington, Oregon, Idaho, Montana, and Nevada with a 4-month old infant agreed to participate. Families were recruited from these locations via birth announcements located in newspapers and on hospital websites. Primary caregivers, mean of age 30.31 years (SD = 4.81), identified as being mostly Caucasian (92.4%) and coming from diverse economic (Family Income M = $61,072; $8,000 - $130,000) and educational backgrounds (Years of Education M = 15.17, SD = 2.70; 10 – 25). Approximately equal numbers of male (43.9%) and female (56.1%) infants were enrolled. Only families with healthy full-term 4-month-old infants were eligible to participate; families with infants that were premature, experienced significant medical difficulties or birth complications, or were identified as being developmentally delayed or disabled were not eligible to participate.

Participant attrition was minimized in several ways. The 158 families who agreed to participate were paid $10 for the completion of each assessment wave as compensation for their time and effort. Participants were provided with an email address and phone number that they could have utilized to ask questions about the study or report a change of address or phone number. Personalized post cards and when necessary, phone calls were utilized to encourage participants to complete each assessment wave. Although families

that declined to participate were encouraged to complete demographics questionnaires via phone to facilitate comparison of those that agreed to participate to those that declined participation, nearly all families that declined participation also did not agree to the brief telephone interview.

Measures

IBQ-R. The Infant Behavior Questionnaire-Revised (IBQ-R) is a parent-report measure of infant temperament that is appropriate to utilize between the ages of 3 and 12 months. Scores can be obtained for 14 scales and three higher order factors (Extraversion/Surgency, Negative Affectivity, and Regulation/Orienting). The Extraversion/Surgency factor consists of the Approach, Vocal Reactivity, High Intensity Pleasure, Smiling and Laughter, Activity Level, and Perceptual Sensitivity scales, which have internal consistency reliabilities ranging from .70 to .87. The Negative Affectivity factor consists of the Sadness, Distress to Limitations, Fear, Falling Reactivity scales, with Falling Reactivity having a negative loading. Internal consistency reliability for these scales range from .71 to .90. The Regulation/Orienting factor consists of Low Intensity Pleasure, Cuddliness, Duration of Orienting, and Soothability scales, which have internal consistency reliabilities ranging from .77 to .87. Research has also supported the validity of the IBQ-R (Gartstein, Putnam, Becken-Jones, & Rothbart, 2002; Gartstein & Rothbart, 2003).

SES. SES was measured in several ways. First, Sociometric Index scores were calculated for each family using the Revised Duncan Sociometric Index (Stevens & Featherman, 1981). Additionally, information, that can be utilized as indicators of SES, such as years of education, income, occupation, age, and marital status were also obtained.

Parenting Stress. Parenting stress was measured with scales from the Parent Domain of the Parenting Stress Index (PSI; Abidin, 1995). Specifically, the PSI scales of Competence (i.e. how competent a parent feels in the parenting role), Attachment (i.e. how close the parent feels toward the child), Role Restriction (i.e. do parents feel that the parenting role keeps them from maintaining their identity), and the Spouse scale (i.e. do parents feel supported in the parenting role by their spouse) were utilized. These scales have demonstrated good internal consistency reliability (.83 to .75) and the Parent Domain in general has demonstrated relationships with child adjustment difficulties (e.g. Abidin, Jenkins, & McGaughey, 1992). These scales were selected because they reflect the parenting stress constructs most relevant to the development of temperament and manifestations of behavior problems in early childhood (Bateman, Gartstein, & Krisztal, 2003).

Parental Negative Affect. The Adult Temperament Questionnaire (ATQ) was utilized to obtain a measure of parental negative affect (Evans & Rothbart, 2003). Development of ATQ constructs of Negative Affect, Extraversion, Effortful Control, and Orienting Sensitivity were based on the Physiological Reactions Questionnaire (PRQ; Derryberry & Rothbart, 1988) and on the Child Behavior Questionnaire (CBQ; Rothbart, Ahadi, Hershey, & Fisher, 2001). The Negative Affect factor, consisting of Fear, Sadness, Discomfort, and Frustration subscales from the short form of the Adult Temperament Questionnaire was utilized in the current investigation. These scales have internal consistency reliability coefficients ranging from .62 to .72 (Evans & Rothbart, 2003).

Parental Psychopathology. Psychopathology in parents was measured using the Beck Depression Inventory-II (BDI-II; Beck, Steer, & Brown, 1996) and the Beck Anxiety

Inventory (BAI; Beck & Steer, 1990). Both measures have demonstrated excellent reliability and validity (see Osman et al., 2002; Beck, 1996; Beck & Steer, 1990).

Negative Parenting. The Parenting Scale (PS; Arnold, O'Leary, Wolff, & Acker, 1993) was utilized as a measure of negative parenting. This measure was chosen because of its brevity (30 items) and because it can be utilized in families with children as young as 18 months of age. The PS consists of three subscales: Overreactivty, which characterizes power assertive parenting that is consistent with the authoritarian parenting style, Laxness, which is consistent with the permissive parenting style (Baumrind, 1968), and Verbosity, which is believed to reflect discipline styles that may lead to parents giving attention to misbehavior, and therefore unintentionally reinforcing misbehavior. Internal consistency reliability for the Laxness scale is .83, for the Verbosity scale .63, and for the Overreactivity scale .82 (two week test-retest reliability for the three scales range from .79 to .83). The validity of the PS has also been demonstrated. For example, clinic referred mothers obtained significantly higher scores on the Laxness and Overreactivity scales that non-clinic referred mothers (no difference was found between clinic and non-clinic mothers on the Verbosity scale). All three PS scales have demonstrated small to moderate relationships with the Child Behavior Checklist (Arnold et al., 1993).

Child Psychopathology. Child psychopathology was measured using the Child Behavior Checklist (CBCL). Of particular interest in the current investigation were the broad Internalizing and Externalizing scales. The Internalizing factor consists of the Emotionally Reactive, Anxious/Depressed, Somatic Complaints, and Withdrawn scales. These scales have 12-month test-retest reliability coefficients ranging from .53 to .64. The Externalizing factor consists of the Attention Problems and Aggressive Behavior scales,

which have 12-month test-retest reliabilities of .58 and .62, respectively (Achenbach & Rescorla, 2000). The CBCL has been widely utilized in child psychopathology research.

Procedure

After a participant agreed to take part in the study, a brief interview was conducted to ensure that families met inclusion criteria (e.g. rule out the presence of premature birth, infants with CNS conditions, and/or infants with chronic medical conditions). Participants meeting inclusion criteria were sent the first packet of information, which contained 4 month measures, a consent form, and an envelope with a return address and postage.

When infants were 4 months of age, primary caregivers completed demographic and SES questionnaires, the ATQ (Evans & Rothbart, 2003), the PSI (Abidin, 1995), the BDI-II (Beck et al., 1996), the BAI (Beck & Steer, 1990), and the IBQ-R (Gartstein & Rothbart, 2003). Primary caregivers completed the IBQ-R when their infants were 6, 8, 10, and 12 months of age. When infants were 18 months of age primary caregivers completed the Parenting Scale (Arnold et al., 1993) and when toddlers were 24 months of age, primary caregivers completed the CBCL (Achenbach & Rescorla, 2000). Measurement time periods were selected in order to conform with the aims of study 1 (i.e. to examine the growth of temperament in the first 12 months of life and determine environmental/parenting factors that may effect temperament growth trajectories) and study 2 (i.e. to establish a longitudinal design to allow for mediational tests). Because rapid emotional and physical growth occurs over the time period during which the current investigation took place, caregivers were asked to complete each wave of measures within a two-week time period (i.e. +/- 1 week) of their child's 4, 6, 8, 10, 12, 18, and 24 month birthdays.

Analytic Strategy

In Study 1, EQS 6.1 (Bentler, 2004) was utilized to examine growth trajectories of the Extraversion, Negative Affect, and Regulation factors measured by the IBQ-R at the 4, 6, 8, 10, and 12 month data collection points. LGM involves several stages. First, consistent with Goal 1, a growth curve was fitted to repeated measures for each individual, which represents intraindividual change over time on the variable of interest (e.g. temperament) (Curran & Hussong, 2003; Byrne & Crombie, 2003). Once intraindividual changes over time have been modeled, the focus of LGM changes to interindividual changes over time (i.e. that growth trajectories vary across time as a function of different slopes and intercepts), addressed in Goal 2. Of particular interest at this stage of the analysis were the residual terms associated with the slopes and intercepts of the Negative Affect, Extraversion, and Regulatory temperament constructs. The residual terms in question represent potential deviations from the average intercepts and slopes of the temperament constructs. If the residuals were significant, then interindividual changes over time are indicated, which suggests that additional analyses should be conducted to examine the potential impact of parent and environmental factors on the growth trajectories of the temperament constructs that will be examined. When predictors are incorporated into the LGM model, the residual terms associated with the slopes and intercepts represent the degree of interindividual change remaining after controlling for the predictors. Furthermore, examination of the parameter estimates for the predictor variables will indicate whether a given predictor accounts for interindividual differences in the model (Curran & Hussong, 2003; Byrne & Crombie, 2003; Duncan, Duncan, Strycker, Li, & Alpert, 1999).

When conducting LGM analyses, several conditions must be met. First, measurements for each individual must be taken a minimum of three times (Byrne & Crombie, 2003). Obtaining three or more measurements allows for examination/testing of nonlinear growth trajectories. Furthermore, it has been noted that the precision of parameter estimates typically increases as the number of measurements increase (Duncan et al., 1999). In the current study, five measurements were obtained at 4, 6, 8, 10, and 12 months of age. This allowed for increased precision in parameter estimation and also allow for examination of linear, quadratic, and cubic growth trajectories. Next, it is important that the spacing of measurements be the same for all individuals (Bryne & Crombie, 2003). Therefore, in the current study all participants were encouraged to complete temperament assessments within a two week time period. Finally, it is necessary that the outcome variable be continuous in nature (Bryne & Crombie, 2003). The temperament measure utilized in the current study, the IBQ-R, conforms to this requirement (also see Curran & Hussong, 2003 for a discussion of these issues).

In study 2, EQS 6.1 (Bentler, 2004) was utilized to test a series of longitudinal models predicting the occurrence of internalizing and externalizing difficulties at age 2 years, consistent with Goal 3. When infants were 4 months of age, latent constructs of adult negative affect/neuroticism, parenting stress, and SES were entered into the model. When infants were 6 months of age parental psychopathology was entered into the model. Latent constructs of infant positive emotionality/extraversion and negative emotionality/affect were entered into the model when infants were 8 months of age. When infants were 12 months of age the latent construct of infant regulation was entered into the equation. Finally, at toddler age of 18 months the latent construct of negative parenting was entered

into the model. Latent variables were entered in this order to establish 1) the longitudinal nature of the design, and 2) to establish the necessary mediational/partial-mediational pathways. When toddlers were approximately 2 years of age, CBCL measurements were obtained and scales from the CBCL were utilized to create latent constructs of internalizing and externalizing difficulties.

The full model in study 2 was initially tested. In a subsequent analysis, all non-significant pathways were removed (pathways that exhibited trends in the expected direction were retained as well) to result in the most parsimonious model of developmental psychopathology that included temperament. Finally, if remaining pathways suggested the presence of mediation or partial mediation, a nested model approach was utilized to examine the appropriateness of the mediated pathway in the model (Loehlin, 2004). Thus, a number of models, nested within the hypothesized partially mediated model could have been potentially examined if all prerequisite direct effects were present. For example, if maternal internalizing difficulties did not demonstrate a direct effect on regulatory capacity after examination of the initial model, then there would be no need to examine the effect of maternal internalizing difficulties on toddler externalizing problems through 12 month infant regulatory ability.

In the nested model approach, pathways of importance can be examined by examining the model fit after a given pathway is constrained to 0. If there is a significant decrement in the fit of the nested model relative to the hypothesized model, as indicated by a change in chi-square test, then the constrained path should be allowed to freely vary. This indicates that the pathway in question is appropriate and the existence of a partially mediated effect exists. However, if there is no decrement in fit, then the pathway in

question is not needed and should be eliminated from further analyses (Holmbeck, 1997; Loehlin, 2004).

In SEM it is generally recommended that several fit indices be utilized to evaluate the fit of a proposed model. For both studies 1 and 2 the following fit indices were utilized: chi-square goodness of fit, adjusted goodness of fit index (AGFI), comparative fit index (CFI), Akaike Information Criterion (AIC), and the root mean square error of approximation (RMSEA) (See Akaike, 1987; Bentler, 1990; Browne & Cudeck, 1993; Raykov & Marcoulides, 2000 for complete descriptions of these fit indices). The use of these measures of fit will allow for a comprehensive examination of model fit in the proposed study.

There has been considerable debate as to sample sizes necessary in SEM applications to obtain relatively sound results. Typically, it is recommended that analyses using SEM methods have a minimum sample size of 200 (Boomsma & Hoogland, 2001). Although efforts were made in the current investigation to initially recruit and then retain a minimum of 150 to 200 participants at each wave of assessment, significant difficulties with recruitment and retention did ultimately occur. For example, given the time frame necessary for completion of the current research and the difficulties encountered using birth announcements for recruitment (i.e., many phone numbers obtained did not work), only 158 families were initially enrolled. Furthermore, as is typical in longitudinal studies attrition also occurred, which resulted in 52 families remaining in the study by the completion of the 24 month assessment. Despite these potential drawbacks to the sample size in the current investigation, SEM analyses with small samples have been successful (e.g. Eisenberg et al., 2001; Milan et al., 2004; Wood & Repetti, 2004).

Study 1

Results

Preliminary Analyses. Families that completed the 6, 8, 10, and 12 month assessments did not differ from families that only completed the 4 month assessment in terms of maternal age, years of education, income, and BDI-II scores (See Table 1). Families that completed the 6 month assessment reported significantly higher socioeconomic index scores ($M = 38.51$) than families that did not complete the 6 month assessment ($M = 27.80$; $t\ (148) = 2.24$, $p = .03$). Families that completed the 4 month assessment but not the 8, 10, and 12 month assessments were not statistically different from families that completed the 8, 10, and 12 month assessments on socioeconomic index measured at the 4 month assessment (See Table 1). Families that completed the 6, 8, 10, and 12 month assessments did not differ from families that only completed the 4 month assessment on infant birth weight, positive emotionality/surgency, negative emotionality/affect, or regulatory capacity/orienting (See Table 2). Responders vs. non-responders were not significantly different from each other at other time points (e.g., comparing responders vs. non-responders at 8, 10, and 12 month assessments on 6 month temperament characteristics) with only one exception. Maternal caregivers that responded at the 12 month assessment reported significantly lower infant regulatory capacity at the 8 month assessment ($M = 17.47$) than 12 month non-responders ($M = 18.68$; $t\ (99) = -2.68$, $p = .009$; See Table 3). In sum, only two comparisons out of 54 contrasting responders and non-responders at various time points to measurements taken at earlier time points were significant. Although there was attrition over the study time frame, these findings suggest that attrition had no systematic impact on findings in the current investigation.

Mean levels of infant PA and NA increased from 4 to 12 months of age; however, levels of Regulatory Capacity decreased from 4 to 12 months of age (See Figure 1). Significant relationships were observed between maternal depression and parenting stress and between maternal negative affect and parenting stress, but not between maternal depression and negative affect. As might be anticipated, maternal ratings of infant PA from 4 to 12 months of age were significantly related, maternal ratings of infant NA from 4 to 12 months of age were significant related, and maternal ratings of infant Regulatory Capacity from 4 to 12 months of age were significantly related (See Tables 4, 5, and 6 for correlation matrices of predictors and infant PA, NA, and Regulatory Capacity, respectively).

Latent Growth Analyses Examining Positive Affect/Surgency. Results of LGM examining the trajectory of infant PA from 4 to 12 months of age were conducted such that a linear initial status model was first tested. Next, a linear spline LGM was examined. The linear spline growth model can best be described as a piecewise linear curve that often resembles a crooked line (Stoolmiller, Duncan, Bank, & Patterson, 1993). This type of growth model is still a linear model, but is a more general form of linear model than a non-spline linear model because it allows for some types of non-linear growth patterns because only the first and final factor loadings are fixed with all other factor loadings allowed to feely vary (Leve, Kim, & Pears, 2005; Stoolmiller et al., 1993). Following a similar procedure as Leve et al. (2005), linear spline models in the current investigation were fit by fixing the 4 month assessment at 0 and the 12 month assessment at 1 and letting the factor loadings associated with the 6, 8, and 10 month assessments freely vary. Finally, the assumption of linearity, or approximate linearity in the case the linear spline model was tested by fitting quadratic and cubic latent growth models.

For PA, the initial linear growth model did not fit the data well, χ^2 (df = 10) = 109.30, $p < .001$, CFI = .96, $AGFI$ = .87, AIC = 89.30, $RMSEA$ = .12 (90% Confidence .07 to .18). The linear spline model was a significant improvement in fit relative to the initial linear model, $\Delta \chi^2$ (df = 3) = 88.96, $p < .01$ (See Table 7 for other fit indices associated with the linear spline model). Relative to the linear spline model, the quadratic and cubic models resulted in significant decrements in model fit (Table 7). Thus, for infant PA, a linear spline model provides the best fit to the data.

Examination of the PA linear spline model provides several additional important pieces of information. First, the path from the constant to the slope factor of the PA LGM (See Figure 2) is statistically significant (z = 20.10, $p < .01$), which indicates that the rate of change over time was such that from 4 to 12 months of age, infant PA significantly increased. Next, residuals associated with the Intercept and Slope factors were statistically significant (z = 6.85, $p < .01$ and z = 3.58, $p < .01$, respectively). This indicates that there are significant interindividual differences in initial levels of infant PA and rates of change in infant PA from 4 to 12 months of age. This justifies fitting subsequent models examining predictors of initial status and rate of change in infant PA. Finally, the covariance between the residuals is statistically significant, z = -3.93, $p < .01$. The significant, negative relationship between residuals indicates that infants who had lower levels of PA at 4 months of age tended to have greater rates of increases in PA from 4 to 12 months of age than infants that have initially higher levels of PA.

As specified in the hypotheses, given significant interindividual differences in initial levels of and rate of changes in infant PA, a predictor linear spline LGM was fit to the data examining the impact of maternal parenting stress, maternal depression, and

maternal negative affect on individual differences in initial levels of infant PA and in change in infant PA over time. The predictor model did not fit the data well, χ^2 (df = 19) = 53.14, p < .001, *CFI* = .96, *AGFI* = .89, *AIC* = 15.14, *RMSEA* = .09 (90% Confidence .05 to .12). Furthermore, although maternal depression accounted for significant variance in rate of change in infant PA from 4 to 12 months of age (z = -1.70, p < .04, one-tailed), maternal negative affect and maternal parenting stress did not account for change, maternal depression, parenting stress, and negative affect did not account for variance in initial levels of infant PA. Because the data was a poor fit to the model, non-significant predictors were dropped from the model and the revised model was submitted for analysis. Results indicated a significant improvement in model fit, $\Delta \chi^2$ (df = 9) = 30.91, p < .01 and fit indices indicated a good fit to the data for the revised predictor model (See Table 7 for fit indices of the Revised Predictor Model). Findings did not change regarding maternal depression. Namely higher maternal depression was associated with significantly slower change in infant PA over time, z = -1.81, p < .04, one-tailed, which supported the hypothesis regarding the effect of maternal depression on infant PA (Figure 3).

Latent Growth Analyses Examining Negative Affect. The initial linear LGM demonstrated an adequate fit to the data, χ^2 (df = 10) = 36.40, p < .01, *CFI* = .99, *AGFI* = .96, *AIC* = 16.40, *RMSEA* = .04 (90% Confidence .00 to .11), however, given the relatively high Chi Square, there was room for improved model fit. The linear spline LGM provided a significant improved model fit, $\Delta \chi^2$ (df = 3) = 26.55, p < .01 (See Table 7 for Fit indices associated with the NA linear spline model). Relative to the linear spline model, the quadratic and cubic NA growth models demonstrated a significant decrement in model fit (See Table 7), indicating that the linear spline model fit the data best (Figure 4).

Examination of the linear spline LGM for infant NA indicated a well fitting model. Furthermore, the loading from the constant to the slope was statistically significant, $z = 11.33$, $p < .001$, indicating that infant NA significantly increases over time. Residuals associated with initial levels of infant NA and change in infant NA from 4 to 12 months were also significant, $z = 6.57$, $p < .01$ and $z = 4.16$, $p < .01$, respectively, which indicated significant interindividual differences in initial levels of infant NA as well as changes in NA over time. Finally, the covariance between intercept and slope residuals was statistically significant, $z = -2.91$, $p < .05$, which indicates that infants who had initially lower levels of NA experienced greater increases in NA from 4 to 12 months of age than infants who started off initially higher on NA.

Given the significant residuals associated with the intercept and slope factors a predictor linear spline model, consistent with the current investigations hypotheses was examined. Results indicated a relatively inadequate fitting model (See Table 7); however, findings also suggested that maternal parenting stress accounted for higher initial levels of infant NA, $z = 3.01$, $p < .01$, and that there was a significant trend such that higher levels of maternal depression accounted for steeper increases in infant NA, $z = 1.39$, $p = .08$. Given the relatively inadequate fit to the data, a revised linear spline predictor model was fit to the data with maternal NA removed because it did not account for variance in initial levels or change in infant NA. The revised model resulted in a significant improvement in model fit, $\Delta \chi^2$ ($df = 5$) = 21.42, $p < .01$, and an overall model that adequately fit the data (See Table 7). Results regarding maternal parenting stress and maternal depression were consistent with hypotheses and were essentially unchanged. Namely, maternal parenting stress was associated with higher initial levels of infant NA, $z = 3.61$, $p < .01$, one-tailed, and maternal

depression demonstrated a significant trend such that higher levels of maternal depression were associated with steeper/faster increases in infant NA over time, $z = 1.47$, $p < .07$, one-tailed (Figure 5).

Latent Growth Analyses Examining Regulatory Capacity/Orienting. The initial linear LGM for infant Regulatory Capacity fit the data relatively well, χ^2 ($df = 10$) = 20.24, $p < .05$, *CFI* = 1.00, *AGFI* = .97, *AIC* = 0.24, *RMSEA* = .00 (90% Confidence .00 to .09); however, similar to findings regarding infant PA and NA, the linear spline model provided a significant improvement in model fit, $\Delta \chi^2$ ($df = 3$) = 7.80, $p = .05$, χ^2 ($df = 7$) = 12.44, $p > .05$, *CFI* = .99, *AGFI* = .95, *AIC* = -1.56, *RMSEA* = .05 (90% Confidence .00 to .14). The quadratic model resulted in a significant decrement in model fit relative to the linear spline model (See Table 7); however, the cubic model was essentially equivalent to the linear spline model in terms of fit, χ^2 ($df = 7$) = 13.67, $p > .05$, *CFI* = 1.00, *AGFI* = .97, *AIC* = -0.33, *RMSEA* = .00 (90% Confidence .00 to .10).

In LGM, as well as SEM in general, when two models are relatively equivalent in terms of fit, it is typically recommended to discard the least parsimonious of the two models unless there are theoretical or substantive reasons for not doing so. In the current study, the linear spline model had two fewer factors than the cubic model and was thus the more parsimonious of the two models. Furthermore, it also could be argued that the linear spline LGM Regulatory Capacity model is consistent with the linear spline models identified regarding infant NA and PA and provides a more substantive reason for retention of the spline model over the cubic model. Finally, examination of EQS 6.1 output for the cubic model indicates several parameters and variances set to or constrained to zero, which was suggestive of model specification difficulties. In sum, the overwhelming weight of

evidence in terms of parsimony, substantive reasons, and analytic reasons argues for the retention of the linear spline model as the best fitting and most representative growth model for infant regulatory capacity.

Examination of the infant regulatory capacity linear spline LGM (Figure 6) indicates that infant regulatory capacity significantly decreased over time, $z = -6.93$, $p < .01$. Residuals associated with the intercept and slope factors indicated that significant interindividual differences exist in initial levels of infant regulatory capacity, $z = 6.23$, $p < .01$, but not in changes in regulatory capacity across time, $z = 1.90$, $p = .056$. Additionally, unlike models for infant NA and PA, the covariance between residuals was not significant, $z = -.38$, $p > .05$, which indicated that initial levels of infant regulatory capacity did not impact rate of change in infant regulatory capacity.

Given that significant interindividual differences in initial status of infant regulatory affect were identified, a subsequent predictor model examining the effects of maternal depression, parenting stress, and negative affect was fit to the data. In the current investigation, only potential predictors of initial status of infant regulatory capacity were focused on because significant interindividual differences in change over time in this construct were not indicated. Results of the predictor linear spline LGM model did not fit the data well, χ^2 ($df = 19$) = 52.38, $p < .01$, $CFI = .93$, $AGFI = .88$, $AIC = 14.38$, $RMSEA = .09$ (90% Confidence .05 to .13). Furthermore, the predictors, maternal depression ($z = -.52$, $p > .05$), parenting stress ($z = -.21$, $p > .05$), and negative affect ($z = -.48$, $p > .05$) did not account for variance in initial levels of infant regulatory capacity (Figure 7). Because all predictors failed to account for variance in initial status of infant regulatory capacity, a revised predictor model was not examined.

Exploratory LGM Analyses. Examining two predictors, number of siblings and parental marital status, on initial levels and change in infant PA, NA, and regulatory capacity was proposed as an exploratory set of analyses and were examined separately from directional hypotheses. One proposed predictor, marital status was not examined because of the lack of variability in different states of marital status obtained in the current sample. Namely, 93.2% of parents identified as being currently married. No data was obtained from divorced families, 2.3% of mothers reported being single, 1.5% identified as being remarried, and 3% identified as "living together." In sum, there were not sufficient numbers of single parent/divorced households to warrant examination of this variable as a predictor of temperament constructs.

A wide range of the number of siblings of infants examined in the current study was obtained (0 – 10; $M = 1.46$). Results of LGM analysis of the impact of number of siblings on infant PA indicated a well fitting model, χ^2 ($df = 10$) = 25.59, $p < .01$, $CFI = .98$, $AGFI = .92$, $AIC = 5.57$, $RMSEA = .08$ (90% Confidence .00 to .14). Furthermore, there was a significant negative trend for number of siblings to predict initial levels of infant PA, $z = -1.41$, $p = .14$. This suggests that higher numbers of siblings was related to lower initial levels of infant PA than fewer siblings. No effect was found for changes in infant PA over time. A well fitting model was obtained for infant NA, χ^2 ($df = 10$) = 14.53, $p = .15$, $CFI = .99$, $AGFI = .95$, $AIC = -5.47$, $RMSEA = .02$ (90% Confidence .00 to .10). No effect of number of siblings on initial levels of infant NA was obtained. Although in a compelling direction, $z = 1.17$, $p = .24$, no effect was found for the impact of number of siblings on changes in infant NA over time. Finally, a well fitting model was obtained for infant regulatory capacity, χ^2 ($df = 19$) = 13.98, $p = .17$, $CFI = 1.00$, $AGFI = .96$, $AIC = -6.02$,

RMSEA = .00 (90% Confidence .00 to .09); however, number of siblings did not account for variance in initial levels of infant regulatory capacity.

Discussion

Findings in Study 1 are consistent with previous work examining the development of temperament and extends previous findings by examining predictors of the developmental trajectories of infant positive emotionality, negative emotionality, and regulatory capacity. Previous investigations have noted that positive emotionality/affect develops through the first year of life (e.g., Rothbart, 1989) and becomes stable as age increases towards toddlerhood (e.g., Lemery et al., 1999). Visual examination of the growth trajectory of PA in the current investigation is consistent with these findings. The greatest increases in PA in the current investigation occurred between 4 and 8 months of age with a leveling off occurring between 8 and 12 months of age. This suggests that although smaller increases in PA may occur after the 8 month age range, the early period from 4 to 8 months may be developmentally important.

Previous findings regarding the normal developmental trajectory of PA in the early childhood time period were also extended in the current study. For example, this is one of the first studies to utilize a LGM analytic strategy. In addition to identifying a linear spline developmental trajectory, the current investigation found that infants who initially have higher levels of PA tend to have lower rates of increase than infants who were initially lower on PA who exhibited greater increases in PA over time.

An additional advantage of the LGM framework is the ability to examine predictors of change and initial status of constructs. In the current study, significant individual differences in both rate of change in and initial levels of infant PA were indicated. It was

anticipated that the maternal characteristics of depression, parenting stress, and negative affect would have negative associations with initial levels of infant PA and changes in infant PA over time. That is to say, higher levels of maternal depression, negative affect, and parenting stress would account for variance such that lower initial levels of infant PA and slower levels of change over time would occur. Out of the hypothesized relationships, only the anticipated association between maternal depression and change in infant PA occurred. Specifically, higher levels of maternal depression when infants were 4 months of age was associated with slower rates of change for infant PA from 4 to 12 months of age. This finding has several important implications. First, this finding demonstrates that the developmental trajectories of infant PA can be negatively impacted by maternal depression. Although not examined in the current study, one would suspect and previous studies would suggest (Cummings & Davies, 1994; Downey & Coyne, 1990) that the effect of maternal depression on changes in infant PA is mediated through infant-mother interactions. This finding would also suggest that intervention with maternal caregivers who have more frequent and severe symptoms of depression could have beneficial effects for infant emotional development.

Although maternal depression accounted for some variance in change in infant PA over time, maternal depression did not account for a sufficient amount of variance to reduce the slope residual to a non-significant value. Additionally, none of the predictors in the current study accounted for the significant interindividual variability in initial levels of infant PA. This suggests that future investigations may want to examine other potential predictors of initial levels and change over time in infant PA.

Findings related to infant NA are also somewhat consistent with previous findings (e.g., Lemery et al., 1999). In the current investigation, visual examination of the linear spline growth trajectory of infant NA indicates a small increase from 4 to 6 months of age, the greatest increases occurring from 6 to 10 months of age, and a leveling off from 10 to 12 months of age. This observation may indicate that the period from 6 to 10 months of age may be a developmentally important period for emerging negative affect. Additionally, the significant negative relationship between initial status and slope residuals indicates that infants who are initially higher in NA have lower/slower rates of growth while infants initially lower on NA have steeper increases in NA over time.

Two findings while examining hypothesized predictors of initial levels of infant NA and changes in infant NA over time were particularly important. First, higher maternal parenting stress was associated with higher initial levels of infant NA. A significant trend ($p < .10$) also emerged indicating that maternal caregivers experiencing higher levels of depressive symptoms when infants were 4 months of age had infants who experienced steeper/faster increases in NA from 4 to 12 months of age. This finding is consistent with studies that have examined the impact of maternal depression on negative affect and related constructs. For example, Whiffen and Gotlib (1989) found that infants of depressed maternal caregivers demonstrated increased levels of negativity in the context of cognitive testing. Pauli-Pott, Mertesacker, and Beckman (2004) found that a combination of maternal anxiety and depression predicted increases in infant fearfulness, which is a subscale of the negative affect measure used in the current investigation. Findings related to maternal depression and parenting stress suggest that parental characteristics have implications for infant emotional development and have clear implications for early intervention programs.

It should be noted that maternal depression did not account for initial levels of infant NA, maternal parenting stress did not account for changes in infant NA, and that maternal negative affect did not account for initial levels of or changes in infant NA in the current investigation. Furthermore, the residuals associated with initial status and changes in infant NA over time remained statistically significant after variance related to maternal parenting stress and depression was accounted for. This suggests that additional predictors of interindividual differences in initial levels of and in changes over time in infant NA are worth examining.

For infant regulatory capacity, a linear spline model again fit the data well. One interesting finding in particular can be observed by visual examination of the growth trajectory of infant regulatory capacity. Significant decreases over time in this construct were observed, most notable from 4 to 10 months of age, with a leveling off occurring from 10 to 12 months of age. This is somewhat unexpected given previous work examining the developmental trajectories of regulatory related processes early in life. For example, Johnson, Posner, and Rothbart (1991), using laboratory tasks, found that infants had gained greater control of attentional engagement and disengagement and demonstrated increases in orienting skill by 4 months of age. In a laboratory study examining regulatory processes from 3 to 13 months of age, Rothbart, Ziaie, and O'Boyle (1992) found increases in infant abilities such orienting away from distressing stimuli, decreases in passive self-soothing, a more primitive form of regulation, and increases in active approach and body self-stimulation.

One possible explanation for the discrepant findings in the current investigation may be the use of maternal report measures rather than laboratory measures of regulatory

processes. For mothers who are noticing significant increases in both infant positive and negative emotions, a finding from examination of the growth trajectories of infant PA and NA in the current study, it may appear that their infants are having greater difficulties in regulating their emotional states. Furthermore, while investigators and those knowledgeable about developmental milestones for regulatory abilities, such as the ability to disengage attention, recognize such milestones as growth or increases in ability, casual observation by caregivers may lead to the conclusion that infants are less able to hold attention in one location, leading to reports of decreases in regulatory abilities. Although this is a plausible explanation, future studies should examine this possibility by obtaining both maternal ratings and laboratory measures of infant regulatory capacity.

Other developmental findings related to infant regulatory capacity in the current investigation are also noteworthy. For example, the covariance between the intercept and slope residual was not statistically significant, which suggests that initial level of infant regulatory capacity is not related to changes in regulatory capacity over time. Additionally, unlike findings for infant PA and NA, only the residual associated with initial levels of infant regulatory capacity was significant. Thus, significant interindividual differences were found in initial levels of this construct, but not in changes in regulatory capacity over time. Unfortunately, predictors in the current study failed to account for significant interindividual differences in initial levels of regulatory capacity.

Findings in study 1 have several implications for development. Previous studies have identified that PA and NA play a role in the later development of internalizing difficulties, such as anxiety and depression (e.g., Jacques & Mash, 2004; Anthony, Lonigan, Hooe, & Phillips, 2002; Phillips, Lonigan, Driscoll, & Hooe, 2002; Joiner &

Lonigan, 2000). Previous findings have also implicated lower levels of PA in conduct difficulties (e.g., Lengua et al., 1999) and higher levels of NA in the development of externalizing difficulties as well as substance abuse (e.g., Lengua & Long, 2002; Wills et al., 2001). Results obtained in the current study, higher levels of maternal depression were related to slower increases in infant PA over time and steeper increases in infant NA over time and maternal parenting stress predicting initial levels of infant NA, suggest that the risk for anxiety and depression conveyed by higher levels of NA and lower PA may begin in infancy. Similarly, these results also suggest that risk for externalizing difficulties may begin developing during the infant period.

In considering the practical value of these results, there are clear implications for both early risk identification and early prevention and intervention programs. Given the associations noted above connecting PA and NA to internalizing and externalizing difficulties, programs aimed at identification of at risk families (e.g., families with caregivers experiencing significant symptoms of depression and stress), and subsequent referral to early prevention and intervention programs could reduce later risk for the development of psychopathology in toddlers, children, and adolescents.

As noted above, early intervention programs may have a significant impact on early emerging temperament risk factors for internalizing and externalizing difficulties later in life. These types of intervention programs should focus on maternal parenting stress and depression and presumably the effects that these maternal experiences have on attachment security as well as mother-infant interactions. The focus should likely be placed here, as previous studies have identified these aspects to be most likely impacted by maternal depression (Cummings & Davies, 1994; Downey & Coyne, 1990). Other areas of focus

would likely include psychoeducation about the impact of maternal depression/stress on the family, recognition of signs/symptoms of depression, the importance of treatment, and stress management.

The current investigation has several limitations that should be considered. First, the study is based on a community sample. On the one hand, this could be considered a strength given that effects were seen at non-clinical levels. However, effects may be of a different magnitude in a clinical sample. Furthermore, the use of a clinical sample may further clarify the role, if any, of predictors in the current study that failed to be retained in the find LGM predictor models. Findings in the current study are also restricted to mothers. Although it is often the case that mothers are the primary caregiver and spend more time interacting with infants, on average, there may be additive effects on infants when both primary and secondary caregivers are, for example, depressed. Future studies can address this limitation by utilizing clinical and non-clinical samples and comparing those samples development trajectories and by including information from both caregivers.

Some critics of parent report may suggest that findings in the current study are limited by the sole us of parent reported data. Although the validity of parent report has been questioned, there are significant benefits to the use of this method. (e.g., wide range of behaviors seen by parents, objective validity of parent reports have been demonstrated, parents are able to better comment on and observe infant reactions to low frequency events; See Rothbart & Bates, In Press). Furthermore, a recent study (e.g., Gartstein & Bridgett, Manuscript Submitted) obtained similar findings for mother only report and laboratory assessment fear regarding the impact of maternal depression on fear growth trajectories in the first year of life. This suggests that findings in the current study may not be limited by

the sole use of parent report methods. Nevertheless, convergent support for findings in the current study would be bolstered by similar findings with the use of laboratory assessed temperament constructs.

As is the case with most longitudinal studies there was significant attrition from 4 to 12 months of age. Although information from responders and non-responders was compared at all time points, and only 2 out of 54 comparisons were significant, it may be that there were unmeasured differences between responders and non-responders. Finally, although efforts were made to recruit a diverse sample of participants, most families recruited were from intact Caucasian backgrounds and from middle class backgrounds. Thus, findings may not generalize to families with infants from lower SES backgrounds or from different ethnic backgrounds. Future studies can address this limitation by recruiting strategies designed to specifically target families from underrepresented populations.

Study 2

Results

Preliminary Analyses. Families that completed the 18 month assessment (n = 69) did not differ from families that did not complete the 18 month assessment in terms of socioeconomic index, 6 month maternal depression, income, maternal age, 12 month infant negative affect, and 12 month infant regulatory capacity. However, families that completed that 18 month assessment obtained significantly lower 12 month infant PA (M = 32.01) than 18 month non-responders (M = 29.99; t [78] = -2.59, $p < .05$). Families that completed the 24 month assessment (n = 52) were not different from 24 month non-responders in terms of socioeconomic index, 6 month maternal depression, income, maternal age, 12 month infant PA, NA, and regulatory capacity, or 18 month toddler negative parenting

indicators (i.e., reactivity, verbosity, and laxness). Thus, despite the relatively small sample sizes obtained at the 18 and 24 month follow-up evaluations, there is no pattern of findings indicating any consistent systematic difference between responders and non-responders at these time points.

Next, latent constructs were constructed. The latent construct of maternal negative affect consisted of ATQ maternal fear, sadness, and discomfort; the latent construct of maternal parenting stress was constructed using the PSI competence, restriction, and relationship subscales; the latent construct of maternal psychopathology was constructed using maternal BDI-II and BAI scores. Infant temperament latent constructs were constructed as follows: Positive affect (smiling and laughter, high intensity pleasure, vocalizations, and approach), NA (distress to limitations, sadness, and falling reactivity), and regulatory capacity (duration of orienting, low intensity pleasure, and cuddliness). The latent construct of negative parenting was constructed using the Parenting Scale scales of laxness, verbosity, and over reactivity. Finally, the latent construct of toddler behavior problems was constructed using the CBCL scales of attention problems, aggressive behavior problems, and emotionally reactive problems subscales. The latent construct of toddler internalizing difficulties was constructed using the Affective Problems, Somatic Problems, and Withdrawn Problems scales of the CBCL. Although findings are not presented here because it is not the primary focus, all latent constructs were constructed via a series of confirmatory factor analyses with observed variables removed if a significant improvement of fit was indicated (See Tables 8 – 11 for correlations between all retained observed variables). This process resulted in the removal of the SES construct from

predictive SEM analyses due to poor fit. The poor fit of any one CFA model would ultimately have a significant negative impact on the subsequent predictor model(s).

Because of the small sample size and a large percentage of missing data by the 24 month assessment, an estimation procedure that took into account missing data was necessary. Under the circumstances in the current study, maximum likelihood (ML) estimation and the use of maximum likelihood estimators was the best available means of handling missing data. However, in order to do so in EQS, the mean and covariance structure must be analyzed. This required a constant to be added to the equation(s) and this constant is available in EQS. Pathways from the constant to every observed and latent variable are necessary. Following the examples presented in Byrne (2006), pathways from the constant to every observed variable were allowed to freely vary; however, pathways from the constant to the latent factors were constrained to 0. Because the means, which are reflected as the values associated with each constant to variable pathway are not the primary interest in the current investigation and the addition of 32 pathways to an already visually complex model takes away from pathways of substantive interest, the constant and pathways from the constant to observed and latent variables have been omitted from all diagrams.

SEM analysis of externalizing difficulties model. As a starting point, an initial SEM analysis was conducted utilizing the proposed model (See Figure 8). Results indicated that this model fit the data well, χ^2 (df = 229) = 354.05, $p < .001$, *CFI* = 1.00, *AGFI* = .92, *AIC* = -103.95, *RMSEA* = .057 (90% Confidence .044 to .069). However, there were also a number of pathways that were not statistically significant and/or did not demonstrate a significant trend. This yielded a model that was not parsimonious. These pathways were

eliminated and the resulting model was submitted for analysis. Again, a well fitting model, and more parsimonious model, resulted (See Figures 9 and 10), χ^2 (*df* = 238) = 357.74, $p < .001$, *CFI* = 1.00, *AGFI* = .92, *AIC* = -118.26, *RMSEA* = .053 (90% Confidence .04 to .065). With regard to prediction of externalizing difficulties at age 24 months, prediction from infant 8 month positive affect and maternal NA were not significant in the first run of the original model and were dropped from consideration in the subsequent model. The only infant variable to predict 24 month externalizing difficulties was 12 month regulatory capacity (z = -1.92, p = .02); although in the anticipated direction, 8 month infant NA (z = 1.13, p = .12) was not a significant predictor of 24 month externalizing difficulties. As anticipated, maternal internalizing difficulties (depression and anxiety) when infants were 6 months of age was a significant predictor of 24 month toddler externalizing difficulties (z = 1.72, p = .04). However, an unexpected finding was the trend that higher levels of negative parenting practices when toddlers were 18 months of age predicted lower levels of 24 month externalizing difficulties (z = -1.27, p = .10). Overall, retained effects in the final externalizing model accounted for 38% of the variance in externalizing difficulties (this includes all effects including trends).

Other effects of substantive interest include the effects of infant and maternal variables on negative parenting practices at 18 months of age. Results indicated that none of the maternal characteristics were significant predictors maternal negative parenting practices. Specifically, the effects of maternal NA, while not significant, were in the opposite direction anticipated (z = -1.13, p = .12); however, the impact of maternal internalizing difficulties on maternal negative parenting practices was a trend in the anticipated direction (z = 1.30, p = .09). In contrast to the lack of effects on parenting

practices by maternal characteristics, the infant temperament characteristics of 8 month NA ($z = 2.18$, $p = .01$) and 12 month regulatory capacity ($z = -2.41$, $p = .008$) were significant predictors of negative parenting practices when toddlers were 18 months of age. Overall, retained effects in the final model accounted for 56% of the variance in negative parenting practices (this includes all effects including trends). The only maternal characteristic significantly predicting an infant temperament construct was the impact of maternal internalizing difficulties when infants were 6 months of age on infant 8 month negative affect ($z = 2.08$, $p = .02$).

Externalizing model mediator analyses. Mediation analyses examining the impact of maternal characteristics on externalizing difficulties through 12 month infant regulatory capacity and 18 month negative parenting practices were proposed. However, the nature of the current findings do not allow for examination of these mediational effects because the prerequisite direct effects were absent. For example, a significant direct effect, in the anticipated direction, for 18 month negative parenting practices on 24 month externalizing difficulties did not emerge. The lack of this anticipated direct effect means that the effect of 6 month maternal internalizing difficulties on 24 month externalizing difficulties through 18 month negative maternal parenting practices cannot be examined.

On the other hand, evidence based on the final externalizing model suggests that 8 month infant PA may impact externalizing difficulties through 12 month regulatory capacity. A series of SEM analyses were conducted to examine this possibility (unless otherwise, noted, all analyses resulted in a well fitting model and decisions about mediation were made based on examination of individual pathways). The path from infant 8 month PA to 24 month externalizing difficulties was removed in the final model because it was

not statistically significant (z = -.68, p > .05). A significant effect such that infant 8 month PA predicted infant 12 month regulatory capacity (z = 1.87, p < .05) and 12 month infant regulatory capacity predicting 24 month toddler externalizing difficulties (z = -1.92, p = .02) was also obtained in the final externalizing model. In two subsequent models the effect of 12 month regulatory capacity on 24 month externalizing difficulties was examined without the influence of 8 month infant PA and the impact of 8 month infant PA on 24 month externalizing difficulties was examined without the influence of 12 month infant regulatory capacity. Results of these analyses indicated a significant direct effect of 8 month infant PA on 24 month externalizing difficulties (z = -1.93, p < .05) and a significant direct effect of regulatory capacity on 24 month externalizing difficulties (z = -1.85, p < .05). The results of this series of analyses indicates that in the final externalizing model, the effect of 8 month infant PA on 24 month externalizing difficulties is fully mediated through 12 month infant regulatory capacity. In sum, higher levels of 8 month infant PA predicts higher levels of 12 month infant regulatory capacity and higher levels of infant 12 month regulatory capacity predicts lower levels of 24 month externalizing difficulties.

A second series of analyses were conducted to examine the possible mediation of the effect of 8 month infant NA on 24 month externalizing difficulties by 12 month infant regulatory capacity. It was already established that 12 month regulatory capacity had a direct effect on 24 month externalizing difficulties. An analysis examining the direct impact of 8 month infant NA on 12 month regulatory capacity indicated a significant negative effect (z = -1.80, p < .05). Another analysis, with the path from 8 month NA to 12 month regulatory capacity constrained to 0, indicated that the direct effect of 8 month infant NA on 24 month externalizing difficulties was significant (z = 1.81, p < .05);

however, this model was a poor fit to the data (χ^2 [*df* = 240] = 493.40, $p < .001$, *CFI* = .45, *AGFI* = .46, *AIC* = -13.40, *RMSEA* = .20 [90% Confidence .17 to .22]). Given the final externalizing model that indicates a significant effect of 8 month infant NA on 12 month regulatory capacity ($z = -1.86$, $p < .05$), the significant effect of 12 month regulatory capacity on 24 month externalizing difficulties ($z = -1.92$, $p = .02$), and the trend, at best, for 8 month infant NA predicting 24 month externalizing difficulties ($z = 1.13$, $p = .12$), and the information yielded from the analyses noted above, it appears that a conservative interpretation of the overall pattern of findings is that the effect of 8 month infant NA on toddler externalizing difficulties is partially mediated through 12 month infant regulatory capacity.

SEM analysis of internalizing difficulties model. As an initial starting point, a modified version of the final externalizing model was run with the following changes: 1) the latent construct of internalizing difficulties was substituted for the latent construct of externalizing difficulties and 2) pathways from maternal negative affect, maternal internalizing difficulties, infant PA, NA, and regulatory capacity, and maternal negative parenting were predicting toddler internalizing difficulties (note that these six pathways correspond to the pathways predicting externalizing difficulties in the initial externalizing model examined above). Using the modified model above as the starting point for internalizing analyses has the benefit of taking advantage of information regarding paths from the final externalizing model, which eliminated all non-significant pathways.

The internalizing model fit the data well, χ^2 (*df* = 236) = 324.15, $p < .001$, *CFI* = 1.00, *AGFI* = .92, *AIC* = -147.85, *RMSEA* = .045 (90% Confidence .030 to .058). In the initial model, pathways from 6 month maternal internalizing difficulties, 8 month infant

PA, and 18 month maternal negative parenting to 24 month toddler internalizing difficulties were not significant and did not demonstrate significant trends. Thus, these paths were removed and the modified model was submitted for analysis. The modified internalizing model (Figures 11 and 12) fit the data well and provided a model that was more parsimonious than the original model, χ^2 (*df* = 239) = 326.64, $p < .001$, *CFI* = 1.00, *AGFI* = .92, *AIC* = -151.36, *RMSEA* = .044 (90% Confidence .029 to .057). Examination of the remaining paths predicting internalizing difficulties at 24 months yield three significant trends and First, significant trends emerged for the infant variables of 8 month NA (z = 1.19, p = .11) and 12 month regulatory capacity (z = -1.61, p = .06). Maternal NA also demonstrated a significant trend in the anticipated direction (z = 1.38, p = .08).

Internalizing model mediator analyses. Similar to the findings with the externalizing model, findings with the internalizing model suggest the possibility of 12 month regulatory capacity serving as a mediator for infant 8 month NA and PA. A series of analyses were conducted to examine this possibility. First, the direct effect of 12 month infant regulatory capacity on 24 month internalizing difficulties was examined. This analysis yielded a significant trend such that lower levels of 12 month regulatory capacity were related to increased levels of internalizing difficulties (z = -1.59, p = .06). Next the effects of infant 8 month PA and NA on internalizing difficulties were examined. Findings indicated that without the presence of 12 month regulatory capacity in the model, 8 month PA was a significant predictor of 24 month internalizing difficulties (z = -1.99, $p < .05$) and that a significant trend existed such that higher 8 month NA was related to higher 24 month internalizing difficulties (z = -1.51, p = .07). Finally, both infant 8 month NA and PA were significant predictors of 12 month infant regulatory capacity (z = -1.71, $p < .05$ and z =

1.84, $p < .05$, respectively). Importantly, when the pathways from 8 month infant PA and NA to 12 month infant regulatory capacity and the pathways from 8 month infant PA, NA, and 12 month regulatory capacity to 24 month internalizing difficulties were included in the model 1) the pathway from infant PA to internalizing difficulties was no longer significant ($z = -.63$, $p > .05$), which led to the removal of this path in the final model and 2) the effect of 8 month infant NA on 24 month internalizing difficulties was reduced to a trend ($z = 1.19$, $p = .11$).

These findings must be interpreted cautiously as several trends were interpreted, such as the trend for 12 month regulatory capacity to predict 24 month internalizing difficulties. However, it appears that the impact of 8 month PA on 24 month internalizing difficulties may be fully mediated through 12 month regulatory capacity such that higher 8 month PA is related to higher 12 month regulatory capacity and higher 12 month regulatory capacity is related to decreases in 24 month internalizing difficulties. It also appears that the effect of infant 8 month NA on 24 month internalizing difficulties may be partially mediated through 12 month regulatory capacity. That is to say, in addition to a direct effect on internalizing difficulties, albeit a trend in the current study, higher levels of 8 month infant NA is related to decreases in 12 month infant regulatory capacity with lower levels of 12 month regulatory capacity related to increased 24 month internalizing difficulties.

Discussion

The findings in study 2 were mixed. With regard to the externalizing model, consistent with predictions, lower levels of infant regulatory capacity at 12 months of age were related to higher levels of externalizing difficulties when toddlers were 24 months of age. This finding is consistent with the body of research examining the relationship

between effortful control, which is developmentally related to regulatory capacity, and externalizing difficulties (Eisenberg et al., 2001, 2004; Olson et al., 2005; Zhou et al., 2007). Also consistent with expectations and previous findings (Carter et al., 2001; Cicchetti, Rogosch, & Toth, 1998), higher levels of maternal internalizing difficulties when infants were 6 months of age were related to increased levels of externalizing difficulties. Although in the expected direction, infant NA at 8 months of age was not predictive of externalizing difficulties (p = .12) nor was 8 month infant PA. However, the caveat to this finding is the role that 12 month infant regulatory capacity appears to mediate the effects of 8 month infant PA and NA on 24 month externalizing difficulties.

Specifically, it appears that the protective impact of early infant PA on the development of toddler externalizing difficulties is mediated through the effect that infant PA has on regulatory abilities at the end of the first year of life. A similar story emerged for the effect of infant NA on toddler externalizing difficulties, with the caveats that NA is a risk, rather than a protective factor, and that a conservative interpretation of the data suggests a partially mediated effect such that even after the mediated effect through regulatory capacity at the end of the first year of life, a trend remained for a direct effect of infant NA on toddler externalizing difficulties. Despite the evidence of mediated and partially mediated effects, the absence of strong direct effects of PA and NA on externalizing difficulties is not consistent with previous research (Lengua & Long, 2002; Lengua et al., 1999). This may be due in part to the current investigations ability to examine mediation through regulatory abilities as no previous studies have examined such a possibility.

Although findings related to prediction of externalizing difficulties were the primary focus, there are several other noteworthy findings. First, the only significant predictors of negative parenting practices at 18 months of age were infant 8 month NA and 12 month regulatory capacity such that higher 8 month NA was predictive of higher levels of negative parenting practices and lower 12 month regulatory capacity was predictive of increases in 18 month negative parenting practices. These finding are consistent with previous research that demonstrates a consistent relationship between negative emotionality and negative parenting (e.g., Paulussen-Hoogeboom, Stams, Hermanns, & Peetsma, 2007) and positive associations between effortful control and positive parenting practices, such as scaffolding (e.g., Lengua, Honorado, & Bush, 2007). There also was a trend, in the expected direction, such that higher maternal internalizing difficulties when infants were 6 months of age were related to increases in 18 month negative parenting practices. This finding also is consistent with previous investigations (e.g., Cummings & Davies, 1994; Downey & Coyne, 1990; Hoffman, Crnic, & Baker, 2006). Given previous findings that negative parenting practices are related to increased behavioral difficulties in children, findings in the current study shed considerable light on how early infant emotional and regulatory abilities may impact how a parent interacts with their child at an age when toddlers begin to gain rapid independence from caregivers due to increased motor and speech abilities. The current findings also suggest that early intervention with parents who have infants that are higher in NA and lower in regulatory capacity may impact in positive ways how these parents interact later with their toddlers, which may reduce risk for later behavioral difficulties.

Perhaps the most surprising finding in the current study is the significant trend such that higher levels of 18 month negative parenting practices were related to lower levels of 24 month externalizing difficulties. A large body of literature suggests that higher levels of negative parenting practices is consistently related to higher levels of externalizing difficulties (DeVito & Hopkins, 2001; Muris et al., 1996; Rothbaum & Weisz, 1994). Thus, there is a large discrepancy between the trend identified in the current study and previous research. Because a likely explanation for this finding may be the constructs chosen to represent negative parenting practices and externalizing difficulties, the simple correlations between measured variables were examined (See Tables 8 – 11). Although not significant, maternal over reactivity, which corresponds to the authoritarian parenting style, was positively related to 24 month CBCL Attention Problems (r [38] = .13, $p > .05$), Aggressive Behavior Problems (r [38] = .26, $p = .05$), and Emotionally Reactive Problems (r [38] = .09, $p > .05$). The direction of these findings is consistent with what would be anticipated based on previous research. The negative parenting construct of Laxness, which corresponds to the permissive parenting style, was not related to Attention Problems (r [38] = -.06, $p > .05$) or Aggressive Behavior Problems (r [38] = -.04, $p > .05$), and demonstrated a non-significant negative relational trend with Emotionally Reactive Problems (r [38] = -.16, $p > .05$). The strength and direction of the association between Laxness and externalizing difficulties is not in the anticipated direction (or strength) based on previous studies (e.g., Harvey, Danforth, Ulaszek, & Eberhardt, 2001). Finally, the negative parenting aspect of Verbosity, which is the tendency of a parent to engage in verbal "overkill" when disciplining and parenting and the use of strategies that may reinforce undesired behaviors, demonstrated negative relationships with Attention Problems (r [38] =

-.24, p = .06) and Emotional Reactivity (r [38] = -.13, p > .05) and no relationship with Aggressive Behavior Problems (r [38] = -.03, p > .05).

The pattern of the simple relationships between negative parenting constructs measured when toddlers were 18 months of age and externalizing construct when toddlers were 24 months of age suggests an interesting possibility. As expected based on previous research, over reactive and more restrictive/authoritarian parents in the current study reported more behavioral difficulties in their toddlers. Higher levels of Verbosity were related to a trend toward lower attention problems, and lower difficulties with emotional reactivity. Keeping in mind the negative relationship between 12 month regulatory capacity and negative parenting (i.e. infants at 12 months of age that demonstrated poor behavioral/emotional regulation had primary caregivers who reported increased use of negative parenting practices), this pattern of findings may suggest that at this early age, parents who have more under regulated infants tend to engage in more verbal regulation 6 months later, which may offer some protection against early attention difficulties. While this is interesting speculation, supported by the pattern of findings in the current study, it is important to note, that with one exception, all relationships were not significant. Thus, this pattern of findings only provides evidence of the need for additional research, using a larger sample, to examine the possibility noted above.

Another, relatively unique, aspect of the current study is that this is one of the first studies to examine connections between infant temperament, parenting, and early behavioral problems, with the added aspect that measurement of the negative parenting practices reflecting authoritarian/restrictive parenting, verbosity, and laxness/permissiveness were measured at 18 months and earlier than most previous studies.

With this in mind, another possibility is that at this early age, a time when toddlers are gaining rapid independence, more monitoring and use of verbal strategies to aid toddlers in understanding the dangers of the environment, may be developmentally beneficial. However, based on previous research it is clear that at some point in time such strategies increase risk for behavioral difficulties. Furthermore, evidence in the current study suggests that over reactivity and authoritarian/restrictive parenting even at this early age may be starting to have a negative impact.

Results for the internalizing model suggest that lower regulatory capacity at 12 months, higher infant NA at 8 months, and higher levels of maternal NA are potential risk factors for early internalizing difficulties. Although these findings are in the expected direction based on previous research (e.g., Ellenbogen & Hodgins, 2004; Eisenberg et al., 2001, 2004; Lengua & Long, 2002; Jacques & Mash, 2004), the findings are tempered by the fact that only trends were evident when the internalizing model was evaluated. Based on the internalizing model, it appears that infant PA, maternal internalizing difficulties, and negative parenting practices are not direct risk factors for early internalizing difficulties. However, a potential pattern of mediation, similar to the pattern noted for externalizing difficulties, appears to qualify the effect of infant PA and NA on toddler internalizing difficulties. Specifically, it appears that the protective effect of infant PA on toddler internalizing difficulties is mediated through 12 month regulatory ability and that the effect of infant NA on toddler internalizing difficulties may be both direct and partially mediated through regulatory capacity at the end of the first year of life.

In the context of previous evidence for the tripartite model of depression/anxiety, which indicates that low levels of PA and high levels NA are risk factors for internalizing

difficulties, findings in this study suggest that higher NA may be the most salient direct and indirect, early characteristic for internalizing risk while early PA plays a indirect role. Based on findings that suggest low levels of PA plays a direct role in depression/anxiety difficulties later in life (Jacques & Mash, 2004; Anthony, et al., 2002; Phillips, et al., 2002; Joiner & Lonigan, 2000) and in the context of findings in the current study, it may be that PA plays a more important, direct role for internalizing risk later in life. It was somewhat surprising that maternal internalizing difficulties did not predict toddler internalizing difficulties. This suggests that this risk factor may be more important later in life than during the early years when internalizing difficulties can first emerge.

Examination of the externalizing and internalizing models suggests some similarities. In both models two infant variables were consistent predictors of internalizing and externalizing difficulties. Infant NA measured at 8 months of age demonstrated a compelling trend in both models ($p = .12$ and $p = .11$, respectively), such that higher infant NA is related to higher levels of both internalizing and externalizing difficulties. This is finding is consistent with Lengua and Long's finding (2002), along with findings in other investigations (e.g., Phillips et al., 2002) that child negative emotionality is directly related to externalizing and internalizing difficulties Furthermore, in both models infant regulatory capacity at 12 months was a significant predictor of difficulties with lower levels of 12 month regulatory capacity predicting higher levels of 24 month externalizing difficulties ($p = .02$) and higher levels of internalizing difficulties ($p = .06$). Identification of regulatory capacity at the end of the first year of life as a risk factor for toddler behavioral difficulties (internalizing and externalizing) is consistent with Eisenberg et al. (2001, 2004), who found that lower levels of effortful control were related to externalizing problems and to a

less degree, internalizing difficulties. Furthermore, a similar pattern of mediation and partial mediation of PA and NA through regulatory capacity was identified in both the internalizing and externalizing models. Thus, it appears that high levels of infant NA and low levels of infant regulatory capacity are general risk factors for early behavioral difficulties (both internalizing and externalizing) with the effects of NA on behavior difficulties also occurring indirectly through regulatory capacity and with protective effects of PA on behavior problems being fully mediated through regulatory capacity at the end of the first year of life.

Differences between internalizing and externalizing models also were present. For example, it appears that early maternal internalizing difficulties is a risk factor for early externalizing problems but not internalizing problems. This is largely consistent with the body of literature that finds maternal depression is a risk factor for behavioral difficulties (Carter et al., 2001; Cicchetti, Rogosch, & Toth, 1998) and that such risk is related to how the mother interacts with their child (e.g. increases in both intrusiveness and unavailability; Cummings & Davies, 1994; Downey & Coyne, 1990). Previous investigations have found positive associations between parental neuroticism and internalizing and externalizing difficulties (e.g., Ellenbogen & Hodgins, 2004). In the current investigation, maternal NA was only related to increases in internalizing difficulties. This suggests that higher levels of maternal NA may be a risk factor for early internalizing difficulties with the impact of maternal NA on risk for externalizing difficulties occurring later in life. On the other hand, it may be that maternal NA impacts early internalizing difficulties directly and early externalizing difficulties indirectly through maternal internalizing problems, which in the

current study was predicted by both maternal NA and parenting stress, and in turn impacted directly infant NA and toddler externalizing difficulties.

This study has several limitations. First, it must be acknowledged that trends in this study were examined and cautiously interpreted. This was done due to the small sample size (n = 52) that was available at the 24 month assessment due to attrition that occurred over a 20 month time span. On the other hand, this could be considered a strength. In light of the complexity of the model, the significant effects and trends that did emerge may have been stronger had a larger sample been retained throughout the course of the study. That being said, more subtle effects, but nonetheless important may have been obscured due to low power.

Some proposed mediator effects also were not able to be examined. In the current study, mediator effects were to be examined, with regulatory capacity and negative parenting serving as mediators of the effects of other maternal characteristics and infant temperament characteristics on externalizing and internalizing difficulties. Negative parenting practices in the current study were ultimately not suitable to serve as a mediator because the effects of negative parenting on externalizing difficulties were in the opposite direction of what was anticipated based on previous studies. However, with the exception of maternal NA, parenting stress, and infant PA, all other effects, infant and maternal, on negative parenting practices were in the expected direction, with the noteworthy significant effects of infant NA and regulatory capacity. With regard to infant regulatory capacity, it was anticipated that the effects of some maternal characteristics on externalizing and internalizing difficulties would be mediated through 12 month infant regulatory capacity. However, none of the maternal characteristics examined in the current study were

significant predictors of 12 month infant regulatory capacity. Although some of the proposed mediation analyses were not able to be conducted, findings in this study, keeping in mind limited power, suggest that the effects of infant temperament on internalizing and externalizing difficulties are both direct and partially mediated (NA), fully mediated (PA), and direct (regulatory capacity). Future research with larger samples may be able to examine more carefully the potential for temperament to serve as mediators for the effects of family and parental characteristics on behavioral difficulties and for the effects of temperament on behavioral problems to be mediated through parenting practices.

The current study utilized only mother report for maternal characteristics, infant temperament characteristics, parenting practices, and behavior problems. Although these findings may be limited by potential reporting bias (e.g., over reporting of good characteristics and under reporting of behavioral difficulties) several features of the current study help minimize the risk of reporting bias. First, the longitudinal nature of the study is such that, with the exception of maternal characteristics and infant temperament, mothers were not reporting on temperament, parenting, and behavior problem constructs at the same time. Furthermore, mothers reported on their characteristics (e.g., NA, stress, and internalizing difficulties) a minimum of 12 months before reporting on parenting practices and a minimum of 18 months before toddler behavior problems. In addition to minimizing potential reporting bias, measurement of temperament characteristics prior to an age when behavioral problems/psychopathology can be measured reduced the chances that relationships between temperament and behavior problems were inflated due to items that were similar in content (see Lemery, et al., 2002, Lengua, et al., 1998, & Sanson, et al., 1990, for examples and discussion of this issue). Finally, evidence is beginning to

accumulate that suggests parental reports of temperament are consistent with laboratory measures of temperament in the prediction of behavioral difficulties. For example, Hayden, Klein, and Durbin (2005) found that mother reports and laboratory assessments of anger (an aspect of negative emotionality) at 2.5 years of age both predicted teacher reported disruptive school behavior at age 4 years.

Other analyses may have been important to conduct, but were ultimately not conducted due to the small sample size. For example, gender differences in the externalizing and internalizing models would have been interesting to examine given gender differences in externalizing and internalizing difficulties (e.g., Gross et al., 2006; Hoffman, Powlishta, & White, 2004). However, splitting an already small sample would have severely impacted the ability to interpret results. Along related lines, the current study utilized relatively broad constructs rather than utilizing a fine-grained approach. For example, the use of a broad negative parenting construct may have obscured specific findings related to each individual negative parenting construct. Similarly, fine-grained aspects of temperament may ultimately prove more useful in identifying early risk for behavioral difficulties rather than examination of broad temperament constructs.

Future research can address the noted limitations by recruiting and retaining a larger sample, utilizing laboratory measures of infant temperament rather than or in addition to parent report, obtaining laboratory measures of parenting, and independent reports of toddler behavior problems (e.g., close family friends). Future research can also expand on the current study by including additional constructs that may be important to consider in early models of developmental psychopathology. For example, inclusion of attachment, neighborhood characteristics, quality of early sibling relationships, and

information about paternal difficulties (e.g., depression and antisocial behavior) may yield additional important findings. The current study also utilized a community sample. Future studies also should consider at risk samples as findings may be different in the at risk population (e.g., low income, family history of mental health issues).

Despite the limitations noted above, there are several important implications of the findings in the current study. This is one of the first studies to examine a relatively comprehensive set of infant and maternal characteristics in the first year of life and their subsequent impact on early behavioral difficulties. Gaining a better and clearer understanding of the process involved in the development of behavior problems has implications for prevention, early problem identification, and early intervention. For example, based on findings in the current study, early interventions aimed at improving infant and toddler ability to regulate emotions and behaviors may have long term benefits for reducing risk for behavioral difficulties, especially in those infants and toddlers that are lower in regulatory capacity. Such interventions, that would likely involve parents and caregivers, and may incorporate the use of play, may also convey benefits to the parent-child relationship by reducing the use of negative parenting practices. Although future studies that have the benefit of a larger sample need to examine the potential role of positive affect on parenting and behavioral difficulties, findings in the current study are important because of the clear relationships between infant NA and regulatory capacity and negative parenting practices and between regulatory capacity and NA on later behavioral difficulties. Given these findings, this study suggests that temperament and psychopathology are separate constructs and that temperament functions as a risk factor for behavioral difficulties rather than behavioral difficulties representing the extreme

continuum of temperament dimensions. This study also provides another critical piece of evidence for the place of temperament in models of developmental psychopathology.

Finally, this is one of the first studies to consider the possibility of mediated effects of temperament on behavioral difficulties through parenting and other temperament characteristics (i.e., regulatory capacity at the end of the first year of life). Findings in this study are compelling and suggest that additional investigative efforts should be made to more fully examine mediators in models containing both temperament and psychopathology.

Intervention implications. Interventions aimed at reducing negative emotionality and increasing regulatory ability and positive emotionality are important given findings in the current study as well as previous findings that suggest that these temperament constructs are related to higher levels of internalizing and externalizing difficulties, either directly, indirectly, or both (e.g. Caspi et al., 1995; Eisenberg et al., 2000; Lengua et al., 1998; Lonigan et al., 2003). Although research examining the impact of various interventions on temperament is relatively sparse, findings do suggest that some aspects of temperament may be impacted by intervention. For example, Blair (2002) found that in a low birth weight infant group characterized by high levels of overall negativity that was provided an educational and parenting intervention showed both significant reductions in negative emotionality as well as in behavioral difficulties at age 3 years relative to a non-intervention group. However, Blair also found that the more specific constructs of anger and fearfulness remained relatively unchanged in the intervention group as well as the non-intervention group and conveyed risk for behavioral difficulties.

van den Boom (1994) utilized a 3 month intervention aimed at parents of irritable infants, starting when infants were 6 months of age, targeting maternal sensitivity and the quality of the mother-child interaction. Relative to non-intervention groups, intervention groups obtained higher scores on self-soothing behaviors, exploration, and sociability and displayed reductions in crying relative to non-intervention groups at 12 months of age. Consistent with Blair's (2002) findings, these results suggest that interventions targeting parenting can have effects on temperament outcomes which in turn reduces the risk of later behavioral difficulties.

Given that the initial intervention research is promising, additional work in this area is warranted. Such efforts will be enhanced by continued research, such as that noted above, that further delineates direct relationships between temperament constructs and psychopathology as well as mediators and moderators of the temperament/psychopathology link. Results of these studies would likely enhance the specificity of temperament targets for intervention studies.

Conclusion

Three goals were outlined for the current investigation. To meet goals one and two, study 1 examined the growth trajectories of infant PA, NA, and regulatory capacity from 4 to 12 months of age and, given that significant interindividual differences were identified, examined predictors of change over time of these constructs. Most notably, changes in infant PA were predicted by maternal depression measured when infants were 4 months of age. The nature of this relationship was such that higher levels of maternal depression were related to slower changes in PA across time. A significant trend, such that maternal depression predicted steeper increases in infant NA over time, was identified in the NA

growth model. Furthermore, higher maternal parenting stress predicted initially higher levels of infant NA. No predictors of change in infant regulatory capacity were identified in the current study. Given pervious research (e.g., Carter et al., 2001; Cicchetti, Rogosch, & Toth, 1998), findings regarding the impact of maternal depression on changes in infant NA and PA have implications for increased risk for behavioral difficulties.

To meet goal three, which was to address the relative lack of research investigating the impact if infant PA, NA, and regulatory capacity on toddler internalizing and externalizing difficulties, in the context of other risk factors, and to expand on findings in the first study, study two was conducted. Findings indicated that higher levels of externalizing difficulties at 24 months of age were predicted by lower 12 month regulatory capacity, higher levels of maternal internalizing difficulties, and higher levels of 8 month infant NA (trend). Furthermore, the impact of infant PA on externalizing problems was fully mediated by 12 month infant regulatory capacity and the impact of 8 month infant NA on externalizing difficulties was partially mediated through 12 month regulatory capacity. The nature of the mediation and partial mediation was such that higher infant PA and lower infant NA were related to increases in infant regulatory capacity, which in term was related to decreases in externalizing behaviors. A similar set of findings was obtained in the internalizing model (See above for differences) albeit the effects were not as strong as those obtained in the externalizing model.

Considered together, findings in Study 1 and Study 2 have implications for developmental models of psychopathology, especially for the role of temperament in these models. Study 2 establishes that all three broad temperament constructs measured in infancy by the IBQ-R are risk factors, either directly or indirectly, for both internalizing

and externalizing difficulties. Findings in the first study suggest that maternal characteristics, such as depression and stress, early in the first year of life, can begin to impact the growth trajectories of infant PA and NA toward increased risk for behavioral difficulties. Thus, findings in these studies suggest a complex process by which factors in the first year of life, such as parental characteristics, influence risk for early behavioral difficulties directly (See Study 2) and through their influence on how early positive and negative emotions are developing. These studies point to the potential for early intervention and prevention programs to interrupt the complex process by which early behavioral difficulties may emerge. Given that early difficulties are a risk factor for later behavioral problems, and that behavioral difficulties at all ages can result in the need for treatment, sometimes extended treatment, involvement with the judicial system, reduced school and work performance, relationship difficulties, and increased utilization of health care resources, early prevention and intervention programs would have the potential for significantly reducing societal, personal, and family costs.

For the benefit of early prevention and intervention programs to be fully realized, additional work is needed that examines models of early emerging behavioral difficulties. The studies reported here should be viewed as a starting point. Future investigators should seek to improve the current investigation, utilizing some of the points noted above, and expand the current investigation by including a larger sample, samples from disadvantaged and at risk populations, and including additional important variables that may impact directly, or indirectly, behavioral difficulties in the early years of life.

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Table 1

Comparison of Responders and Non-Responders on Maternal and Family Variables

Maternal Characteristic[1]	6 Month Assessment	8 Month Assessment	10 Month Assessment	12 Month Assessment
Age				
Responder	M = 30.38	M = 30.43	M = 30.45	M = 30.12
Non-Responder	M = 30.09	M = 30.10	M = 30.09	M = 30.51
Statistic	t (148) = .31, p = .76	t (148) = .40, p = .69	t (148) = .45, p = .65	t (148) = -.50, p = .62
Years of Education				
Responder	M = 15.20	M = 15.04	M = 15.18	M = 15.12
Non-Responder	M = 15.06	M = 15.40	M = 15.14	M = 15.22
Statistic	t (147) = .27, p = .79	t (147) = -.78, p = .44	t (147) = .10, p = .92	t (147) = -.22, p = .83
Socioeconomic Index				
Responder	M = 38.51	M = 37.43	M = 37.61	M = 35.32
Non-Responder	M = 27.80	M = 33.54	M = 33.59	M = 36.37
Statistic	t (148) = 2.24, p = .03	t (148) = .92, p = .36	t (148) = .96, p = .34	t (148) = -.38, p = .70
Income				
Responder	M = $60,187.81	M = $60,706.18	M = $63,257.67	M = $62,639.43
Non-Responder	M = $64,097.00	M = $61,744.98	M = $57,526.42	M = $59,482.61
Statistic	t (137) = -.72, p = .47	t (137) = -.22, p = .83	t (137) = 1.22, p = .23	t (137) = .69, p = .49
Depression				
Responder	M = 8.81	M = 8.60	M = 9.20	M = 8.22
Non-Responder	M = 8.89	M = 9.24	M = 8.25	M = 9.43
Statistic	t (151) = -.06, p = .95	t (151) = -.53, p = .60	t (151) = .81, p = .42	t (151) = -1.05, p = .30

1. All Maternal Characteristics were assessed when infants were 4 months of age

Table 2

Comparison of Responders and Non-Responders at 6, 8, 10, and 12 months of age on 4 month Infant Characteristics

Infant Characteristic[1]	6 Month Assessment	8 Month Assessment	10 Month Assessment	12 Month Assessment
Birth Weight[2]				
Responder	M = 121.55	M = 122.02	M = 121.43	M = 119.86
Non-Responder	M = 118.63	M = 118.77	M = 120.07	M = 121.86
Statistic	t (130) = .69, p = .49	t (130) = .87, p = .38	t (130) = .38, p = .71	t (130) = -.56, p = .58
Positive Emotionality/Surgency				
Responder	M = 24.74	M = 24.78	M = 24.70	M = 24.71
Non-Responder	M = 25.26	M = 25.05	M = 25.15	M = 25.03
Statistic	t (152) = -.63, p = .53	t (152) = -.35, p = .73	t (152) = -.61, p = .55	t (152) = -.43, p = .67
Negative Emotionality/Affect				
Responder	M = 3.60	M = 3.60	M = 3.59	M = 3.80
Non-Responder	M = 3.05	M = 3.20	M = 3.25	M = 3.12
Statistic	t (154) = 1.23, p = .22	t (154) = .99, p = .32	t (154) = .86, p = .39	t (154) = 1.78, p = .08
Regulatory Capacity/Orienting				
Responder	M = 18.35	M = 18.47	M = 18.37	M = 18.29
Non-Responder	M = 19.03	M = 18.61	M = 18.76	M = 18.75
Statistic	t (154) = -1.72, p = .09	t (154) = -.37, p = .71	t (154) = -1.11, p = .27	t (154) = -1.30, p = .20

1. Infant Characteristics as examined in this table were assessed when infants were 4 months of age
2. Birth Weight is in ounces

Table 3

Comparison of Responders and Non-Responders on Infant Temperament Characteristics at Various Study Time Points

Infant Characteristic		8 Month Assessment	10 Month Assessment	12 Month Assessment
6 Month Positive Emotionality/Surgency				
	Responder	$M = 27.52$	$M = 27.30$	$M = 27.43$
	Non-Responder	$M = 28.19$	$M = 28.76$	$M = 28.09$
	Statistic	$t\ (121) = -.83$, $p = .41$	$t\ (121) = -1.87$, $p = .07$	$t\ (121) = -.91$, $p = .37$
6 Month Negative Emotionality/Affect				
	Responder	$M = 4.00$	$M = 4.19$	$M = 4.22$
	Non-Responder	$M = 3.80$	$M = 3.31$	$M = 3.55$
	Statistic	$t\ (121) = .37$, $p = .71$	$t\ (121) = 1.70$, $p = .09$	$t\ (121) = 1.48$, $p = .16$
6 Month Regulatory Capacity/Orienting				
	Responder	$M = 18.27$	$M = 18.15$	$M = 18.22$
	Non-Responder	$M = 18.39$	$M = 18.68$	$M = 18.41$
	Statistic	$t\ (121) = -.30$, $p = .76$	$t\ (121) = -1.36$, $p = .18$	$t\ (121) = -.53$, $p = .60$
8 Month Positive Emotionality/Surgency				
	Responder	NA	$M = 29.60$	$M = 29.42$
	Non-Responder	NA	$M = 29.96$	$M = 30.22$
	Statistic	NA	$t\ (99) = -.40$, $p = .69$	$t\ (99) = -1.06$, $p = .29$
8 Month Negative Emotionality/Affect				
	Responder	NA	$M = 5.10$	$M = 5.37$
	Non-Responder	NA	$M = 4.81$	$M = 4.36$
	Statistic	NA	$t\ (99) = .43$, $p = .67$	$t\ (99) = 1.86$, $p = .07$

8 Month Regulatory Capacity/Orienting				
	Responder	NA	M = 17.79	M = 17.47
	Non-Responder	NA	M = 18.11	M = 18.68
	Statistic	NA	t (99) = -.57, p = .57	t (99) = -2.68, p = .009
10 Month Positive Emotionality/Surgency				
	Responder	NA	NA	M = 30.29
	Non-Responder	NA	NA	M = 30.65
	Statistic	NA	NA	t (95) = -.44, p = .66
10 Month Negative Emotionality/Affect				
	Responder	NA	NA	M = 5.81
	Non-Responder	NA	NA	M = 5.85
	Statistic	NA	NA	t (95) = -.07, p = .95
10 Month Regulatory Capacity/Orienting				
	Responder	NA	NA	M = 17.10
	Non-Responder	NA	NA	M = 17.21
	Statistic	NA	NA	t (95) = -.22, p = .83

Table 4

Correlations between Predictors and Infant Positive Affect at 4, 6, 8, 10, and 12 Months

Predictor/ Temperament Assessment	Mat. Dep.[1]	Mat. PSI[2]	Mat. NA[3]	4 Month PA[4]	6 Month PA	8 Month PA	10 Month PA	12 Month PA
Maternal Dep.		.240*	.046	.002	-.030	.052	.026	.010
Maternal PSI			.336*	-.070	-.018	-.041	-.113	-.022
Maternal NA				.005	.034	.065	.026	.010
4 Month PA					.753*	.654*	.583*	.561*
6 Month PA						.841*	.689*	.768*
8 Month PA							.734*	.773*
10 Month PA								.850*

1. Maternal Depression as measured by the BDI-II
2. Maternal Parenting Stress as measured by the PSI
3. Maternal Negative Affect as measured by the ATQ
4. Infant Positive Affect

*$p < .01$

Table 5

Correlations between Predictors and Infant Negative Affect at 4, 6, 8, 10, and 12 Months

Predictor/ Temperament Assessment	Mat. Dep.[1]	Mat. PSI[2]	Mat. NA[3]	4 Month NA[4]	6 Month NA	8 Month NA	10 Month NA	12 Month NA
Maternal Dep.		.240**	.046	.030	-.008	.116	.231*	.122
Maternal PSI			.336**	.313**	.194*	.369**	.354**	.454**
Maternal NA				.172*	.063	.201*	.063	.248*
4 Month NA					.628**	.640**	.419**	.486**
6 Month NA						.624**	.602**	.506**
8 Month NA							.659**	.683**
10 Month NA								.793**

1. Maternal Depression as measured by the BDI-II
2. Maternal Parenting Stress as measured by the PSI
3. Maternal Negative Affect as measured by the ATQ
4. Infant Negative Affect

*$p < .05$
**$p < .01$

Table 6

Correlations between Predictors and Infant Regulatory Capacity at 4, 6, 8, 10, and 12 Months

Predictor/ Temperament Assessment	Mat. Dep.[1]	Mat. PSI[2]	Mat. NA[3]	4 Month Reg[4]	6 Month Reg	8 Month Reg	10 Month Reg	12 Month Reg
Maternal Dep.		.240*	.046	.008	-.122	.070	-.008	-.104
Maternal PSI			.336*	-.100	-.005	.018	.048	.131
Maternal NA				-.125	.029	-.123	-.151	-.059
4 Month Reg					.632*	.549*	.561*	.343*
6 Month Reg						.691*	.697*	.657*
8 Month Reg							.776*	.525*
10 Month Reg								.644*

1. Maternal Depression as measured by the BDI-II
2. Maternal Parenting Stress as measured by the PSI
3. Maternal Negative Affect as measured by the ATQ
4. Infant Regulatory Capacity/Orienting

*$p < .01$

Table 7

Fit Indices for Positive Affect, Negative Affect, and Regulatory Capacity Baseline and Predictor Latent Growth Models

Temperament Factor	LGM Model	Chi-Square	Δ Chi-Square	CFI	AGFI	AIC	RMSEA (90% Confidence)
Positive Emotionality/ Surgency							
	Linear	109.30***	NA	.96	.87	89.30	.12 (.07 to .18)
	Linear Spline	20.34**	88.96**	.98	.90	6.34	.10 (.03 to .12)
	Quadratic	32.54***	76.76**	.97	.90	21.05	.10 (.04 to .16)
	Cubic	33.32***	75.98**	.97	.89	18.32	.11 (.05 to .17)
	Predictor	53.14***	NA	.96	.89	15.14	.09 (.05 to .12)
	Rev. Predictor	22.23*	30.91**	.99	.93	2.23	.06 (.00 to .13)
Negative Affect							
	Linear	36.40***	NA	.99	.96	16.40	.04 (.00 to .11)
	Linear Spline	9.85	26.55**	.99	.95	-4.15	.04 (.00 to .14)
	Quadratic	36.23***	0.17	.98	.93	18.23	.08 (.00 to .14)
	Cubic	23.92**	12.48**	.97	.92	9.92	.09 (.02 to .15)
	Predictor	47.28***	NA	.94	.88	9.28	.09 (.05 to .12)
	Rev. Predictor	25.86*	21.42**	.98	.92	-2.14	.06 (.00 to .11)
Regulatory Capacity/ Orienting							
	Linear	20.24*	NA	1.00	.97	0.24	.00 (.00 to .09)
	Linear Spline	12.44	7.80*	.99	.95	-1.56	.05 (.00 to .14)
	Quadratic	20.93**	0.69	1.00	.97	2.93	.00 (.00 to .09)
	Cubic	13.67	6.57	1.00	.97	-0.33	.00 (.00 to .10)
	Predictor[1]	52.38***	NA	.93	.88	14.38	.09 (.05 to .13)

1. A revised predictor model was not fit because none of the predictors accounted for variance in initial status of Regulatory Capacity/Orienting

*$p < .05$; ** $p < .01$; ***$p < .001$

Table 8

Correlations between Maternal 4 and 6 Month Observed Variables

Variable	PSI Comp.	PSI Restrict	PSI Relation	M. Fear	M. Sad	M. Discomfort	M. BDI	M. BAI
PSI Comp.		.35**	.33**	.26**	.13*	.20**	.41**	.32**
PSI Restrict.			.41**	.08	.28**	.18*	.40**	.34**
PSI Relation.				.28**	.30**	.22**	.49**	.34**
M. Fear					.35**	.40**	.35**	.51**
M. Sad						.33**	.19*	.29**
M. Discomfort							.21**	.31**
M. BDI								.61**

* $p < .05$
** $p < .01$

Table 9

Correlations between Maternal 4 and 6 Month Observed Variables and Infant 8 and 12 Month Temperament Variables, 18 Month Negative Parenting Variables, and 24 Month Externalizing and Internalizing Constructs

Variable	PSI Comp.	PSI Restrict	PSI Relation	M. Fear	M. Sad	M. Discomfort	M. BDI	M. BAI
Infant Smile	-.02	-.07	-.14	-.03	-.01	.01	.00	.09
Infant High P.	-.07	-.02	-.10	-.04	.02	.11	-.00	.04
Infant Vocal	.08	-.07	-.16	-.01	.03	.09	.15	.03
Infant App.	.00	-.11	-.02	.08	.14	.19*	.03	-.01
Infant Distress	.17*	.25**	.24**	.19*	.11	.11	.28**	.17
Infant Fall R.	-.16*	-.10	-.20*	-.05	-.25**	-.09	-.13	-.09
Infant Sadness	.31**	.24**	.22*	.15	.15	.20*	.36**	.17
Infant Dur. O.	.13	.17	.17	.02	-.02	.11	.19	.13
Infant Low P.	.05	.12	-.13	-.14	-.08	.14	.01	-.02
Infant Cuddle	.01	.12	-.05	-.08	-.14	-.07	-.12	-.08
M. Laxness	.16	-.05	.06	.04	.01	-.28**	.19	.10
M. Reactivity	.18	.12	.13	.11	.03	.02	.26*	.27*
M. Verbosity	.07	.06	.01	.06	-.06	-.22*	.15	.11
T. Attn Problem	.21	-.12	-.06	.13	.03	.16	.03	.15
T. Aggress Prob.	.34**	.21	.07	.17	.02	.05	.18	.18

T. Emotion R.	.40**	.20	-.13	.34**	.20	.31**	.17	.30*
T. Somatic	.10	.05	.09	.15	.08	.06	.07	.13
T. Withdrawn	.38**	.07	.08	.32**	.05	.13	.22	.27*
T. Affect Prob.	.28*	.17	-.00	.38**	.23*	.09	.01	.14

* $p < .05$
** $p < .01$

Table 10

Correlations between 8 and 12 Month Infant Temperament Variables, 18 Month Negative Parenting Variables, and 24 Month Externalizing and Internalizing Variables

Variable	Smile	High P.	Vocal	Approach	Distress	Fall R.	Sad	D. Orient	Low P.	Cuddle
Smile										
High P.	.52**									
Vocal	.65**	.55**								
Approach	.36**	.53**	.46**							
Distress	-.16*	-.05	.06	.06						
Fall R.	.25**	.17*	.05	.01	-.62**					
Sad	.00	.05	.14	.10	.65**	-.39**				
D. Orient	.35**	.39**	.37**	.13	.02	.11	.06			
Low P.	.14	.36**	.28**	.15	-.24*	.32**	-.13	.36**		
Cuddle	.19	.33**	.15	.09	-.08	.26*	-.04	.21*	.39**	
Laxness	-.38**	-.30**	-.23*	-.15	.33**	-.22*	.20	-.20	-.44**	-.33**
Reactivity	-.37**	-.10	-.11	-.04	.44**	-.32**	.32**	-.09	-.10	-.13
Verbosity	-.18	.02	.04	.07	.49**	-.24*	.20	-.19	-.32**	-.06
T. Attn Prob.	-.04	-.19	-.09	-.21	.10	-.15	.04	-.18	-.30*	-.23
T. Aggress	-.15	-.25*	-.08	-.31*	.28*	-.30*	.29*	-.14	-.22	.-.33**

T. Emotion R.	-.08	-.15	-.06	-.27*	.15	-.03	.36**	.05	-.21	-.06
T. Somatic	-.03	-.04	.09	.15	.30*	-.37**	.11	.01	-.28*	-.09
T. Withdrawn	-.14	-.15	-.10	-.17	.06	.05	.05	-.08	-.18	-.08
T. Affect P.	-.22	-.16	-.19	-.31*	.30*	-.23	.26*	-.13	-.37**	-.19

* $p < .05$
** $p < .01$

Table 11

Correlations between 18 Month Negative Parenting Variables and 24 Month Externalizing and Internalizing Variables

Variable	Laxness	Over-Reactivity	Verbosity	Attn. P.	Aggressive P.	Emotion R.	Somatic P.	Withdrawn	Affect P
Laxness		.40**	.69**	-.07	-.04	-.16	-.05	.05	.12
Over-R.			.49**	.13	.26*	.09	.07	.19	.18
Verbosity				-.24	-.03	-.13	-.14	-.12	-.03
Attn. P.					.67**	.52**	.36**	.42**	.45**
Agg. P.						.61**	.33**	.41**	.61**
Emotion R.							.30*	.42**	.60**
Somatic P.								.11	.42**
Withdrawn									.51**

* $p < .05$
** $p < .01$

Figure Captions

Figure 1. Mean Growth Trajectories of Infant Positive Emotionality/Affect, Negative Emotionality/Affect, and Regulatory Capacity/Orienting From 4 to 12 Months of Age

Figure 2. Linear Spline Latent Growth Trajectory of Positive Affect from 4 to 12 Months of Age

Figure 3. Predictor Linear Spline Latent Growth Trajectory of Positive Affect from 4 to 12 Months of Age

Figure 4. Linear Spline Latent Growth Trajectory of Negative Affect from 4 to 12 Months of Age

Figure 5. Predictor Linear Spline Latent Growth Trajectory of Negative Affect from 4 to 12 Months of Age

Figure 6. Linear Spline Latent Growth Trajectory of Regulatory Capacity from 4 to 12 Months of Age

Figure 7. Predictor Linear Spline Latent Growth Trajectory of Regulatory Capacity from 4 to 12 Months of Age

Figure 8. Proposed Model Predicting Externalizing Difficulties at 24 Months of Age

Figure 9. Predictor Model for 24 Month Externalizing Difficulties Depicting Standardized Factor Loadings, Factor Residuals, and Observed Variable Residuals

Figure 10. Final Model Showing Standardized Path Coefficients Predicting Externalizing Difficulties at 24 Months of Age

Figure 11. Predictor Model for 24 Month Internalizing Difficulties Depicting Standardized Factor Loadings, Factor Residuals, and Observed Variables Residuals

Figure 12. Final Model Showing Standardized Path Coefficients Predicting Internalizing Difficulties at 24 Months of Age

Figure 1

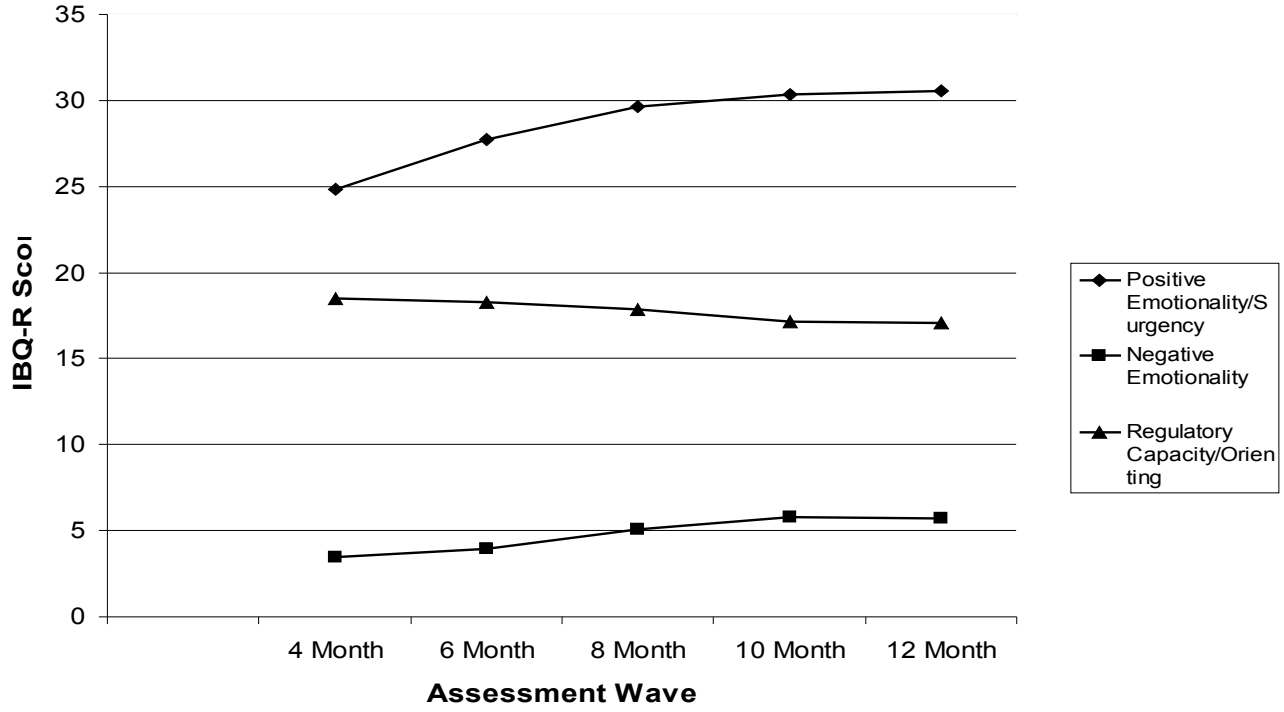
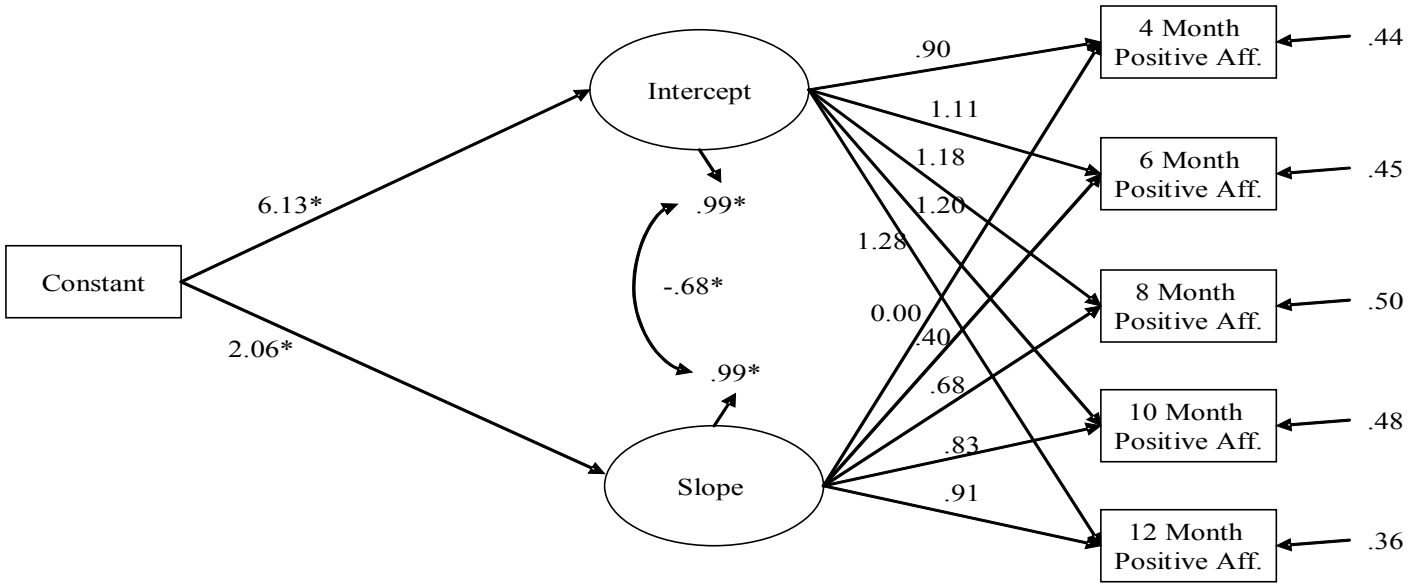
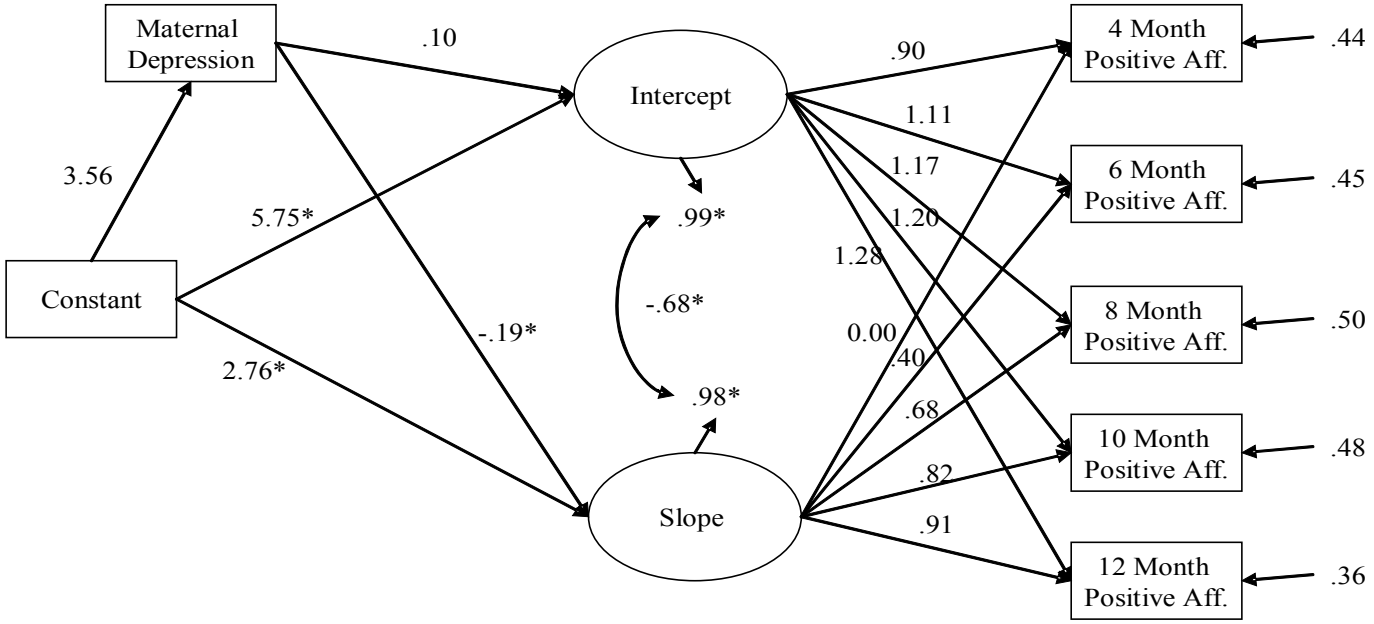

35
30
25
20
15
10
5
0
IBQ-R Scol
4 Month
6 Month
8 Month
10 Month
12 Month
Assessment Wave
Positive Emotionality/Surgency
Negative Emotionality
Regulatory Capacity/Orienting

Figure 2


Constant
6.13*
2.06*
Intercept
Slope
.99*
-.68*
.99*
.90
1.11
1.18
1.20
1.28
0.00
.40
.68
.83
.91
4 Month Positive Aff.
6 Month Positive Aff.
8 Month Positive Aff.
10 Month Positive Aff.
12 Month Positive Aff.
.44
.45
.50
.48
.36

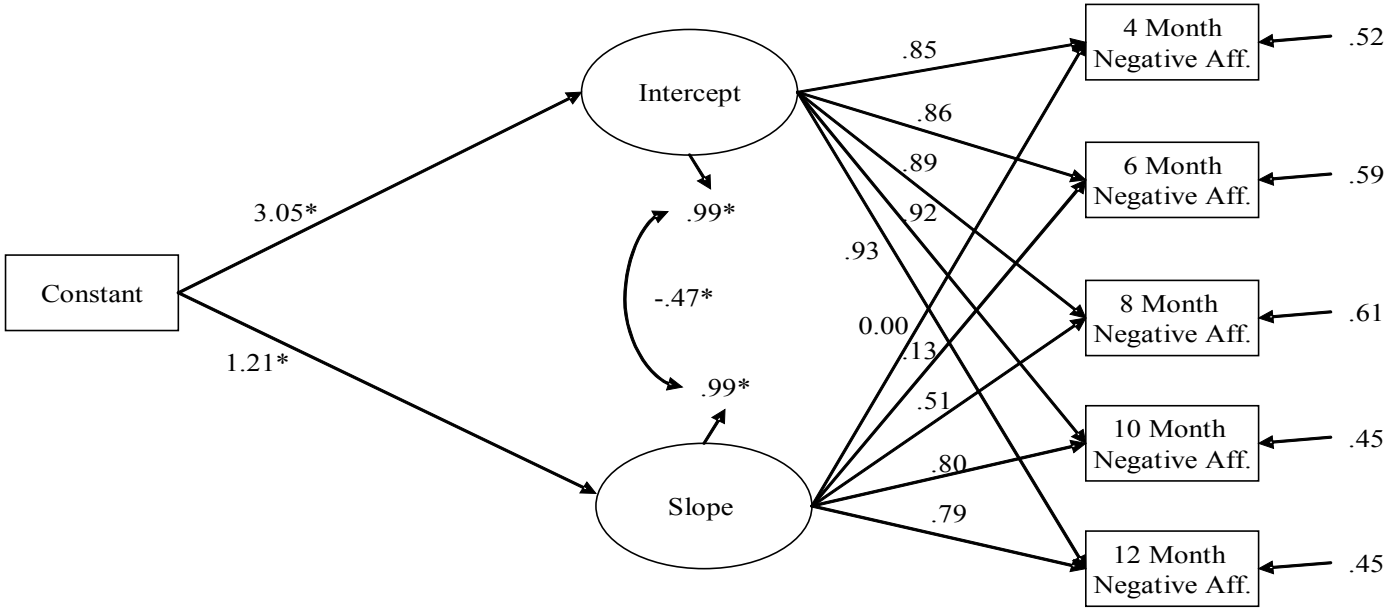
*p <.05

Figure 3


Maternal Depression
Constant
Intercept
Slope
4 Month Positive Aff.
6 Month Positive Aff.
8 Month Positive Aff.
10 Month Positive Aff.
12 Month Positive Aff.
.10
3.56
5.75*
2.76*
-.19*
.99*
-.68*
.98*
.90
1.11
1.17
1.20
1.28
0.00
.40
.68
.82
.91
.44
.45
.50
.48
.36

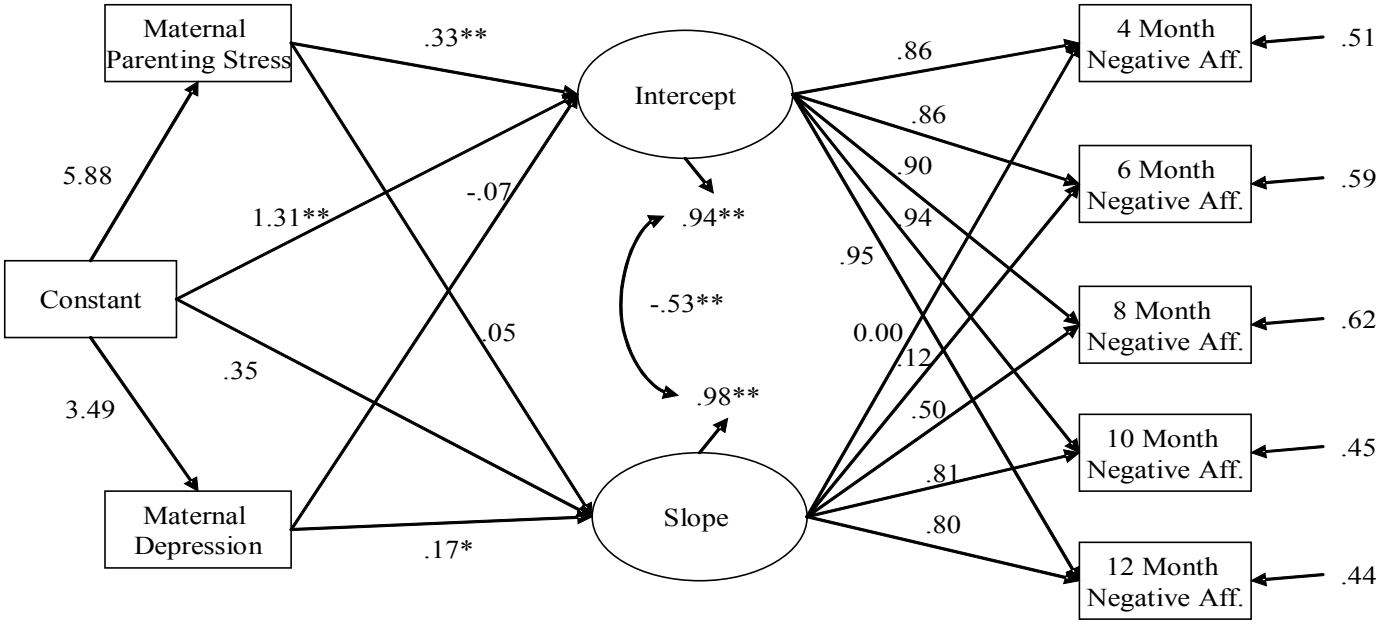
*p <.05

Figure 4


Intercept
Slope
Constant
3.05*
1.21*
.99*
-.47*
.99*
.85
.86
.89
.92
.93
0.00
.13
.51
.80
.79
4 Month Negative Aff.
6 Month Negative Aff.
8 Month Negative Aff.
10 Month Negative Aff.
12 Month Negative Aff.
.52
.59
.61
.45
.45

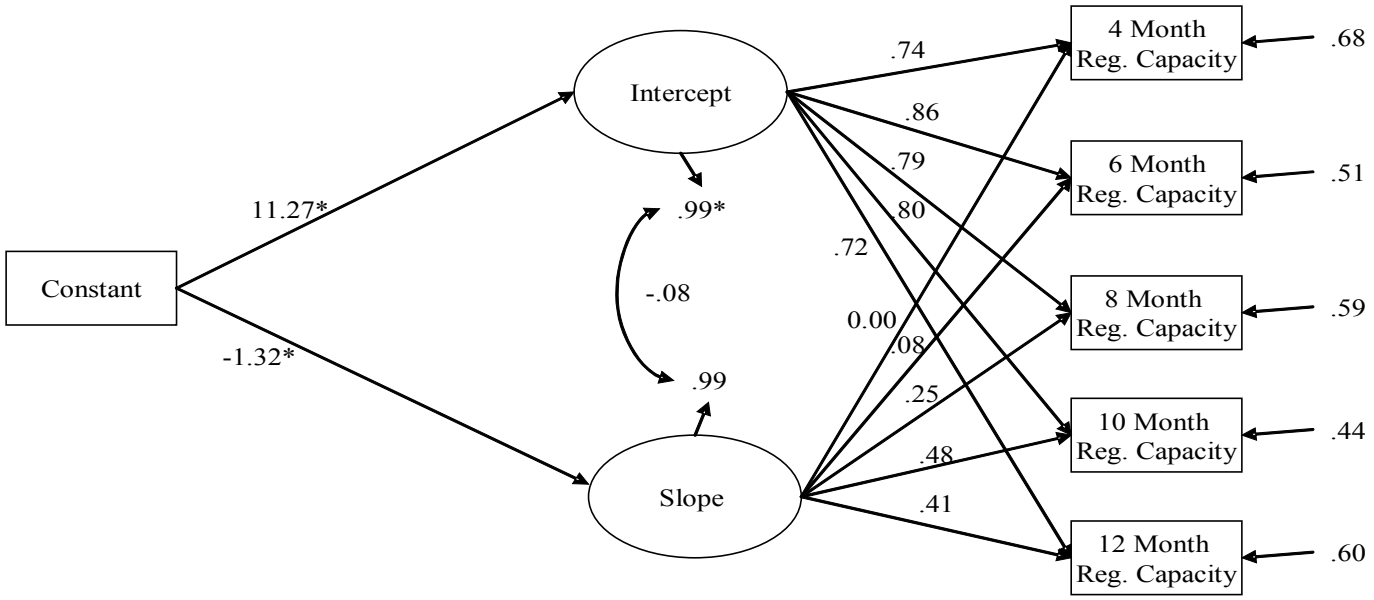
*p <.05

Figure 5



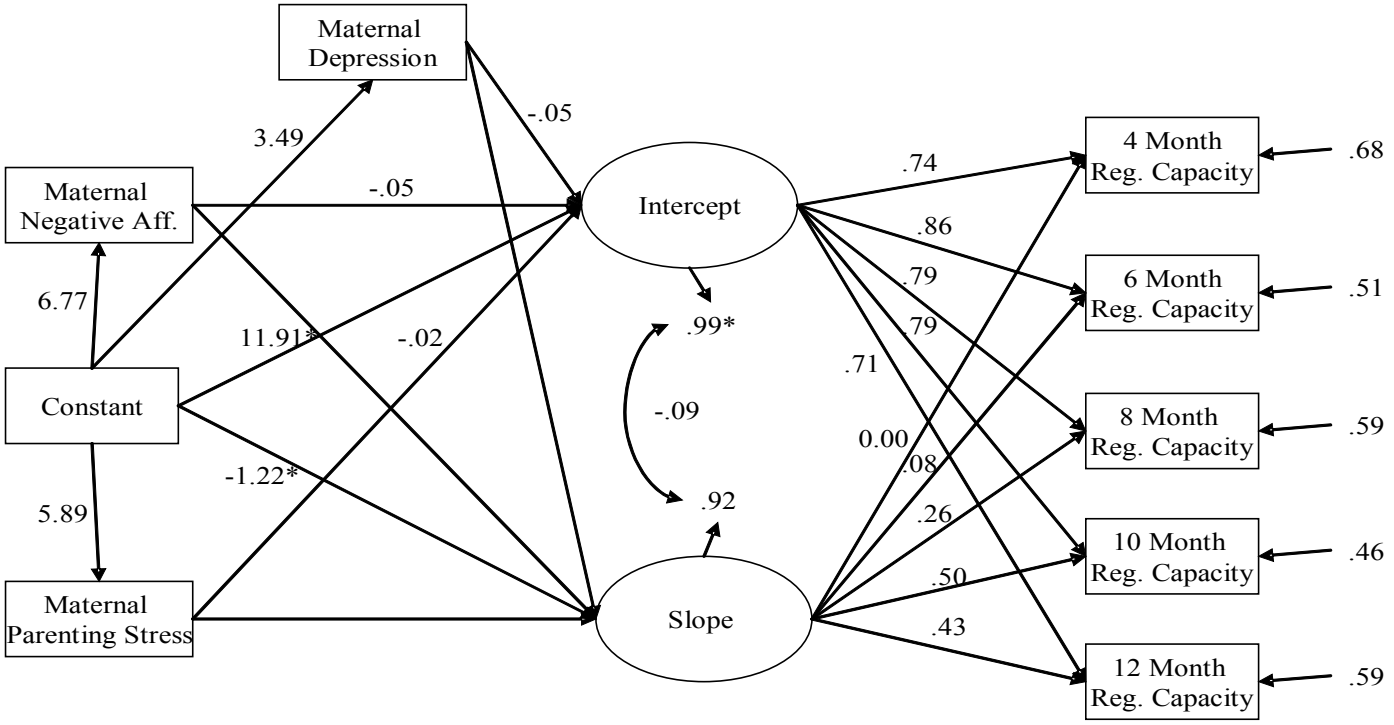
*p <.10
**p <.05

Figure 6


Constant
11.27*
-1.32*
Intercept
Slope
.99*
-.08
.99
.74
.86
.79
.80
.72
0.00
.08
.25
.48
.41
4 Month Reg. Capacity
6 Month Reg. Capacity
8 Month Reg. Capacity
10 Month Reg. Capacity
12 Month Reg. Capacity
.68
.51
.59
.44
.60

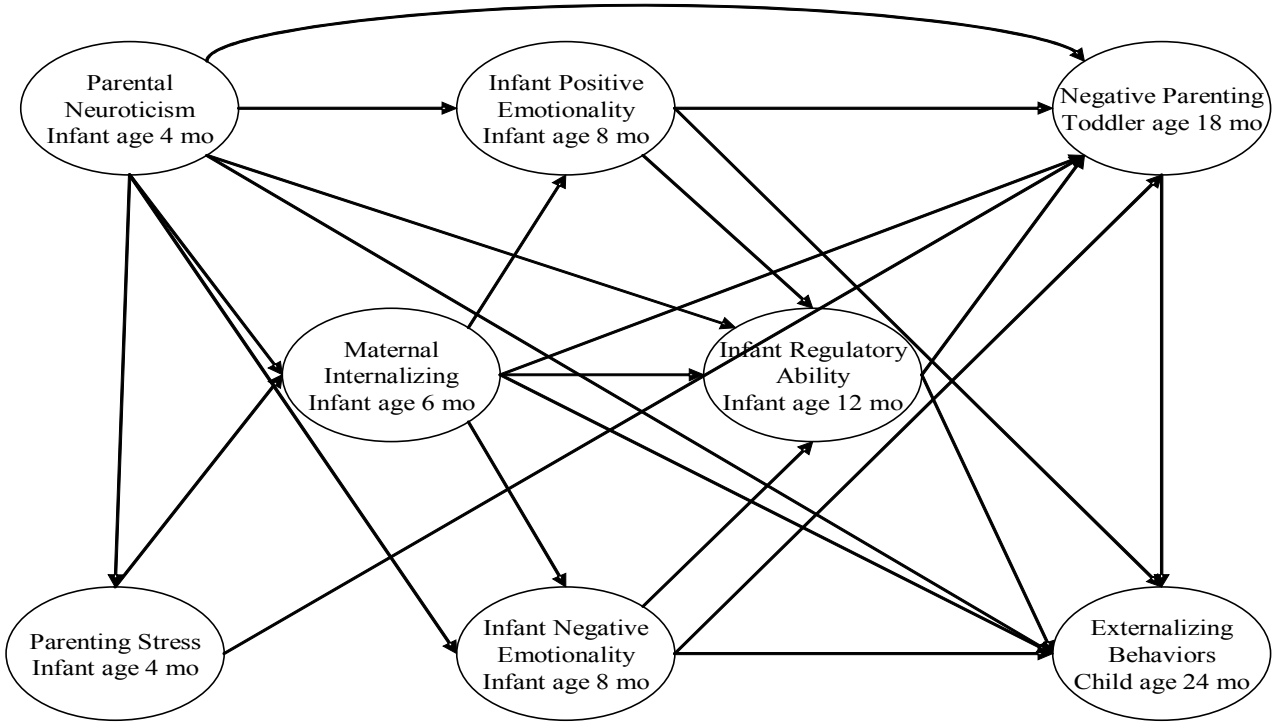
*p <.05

Figure 7



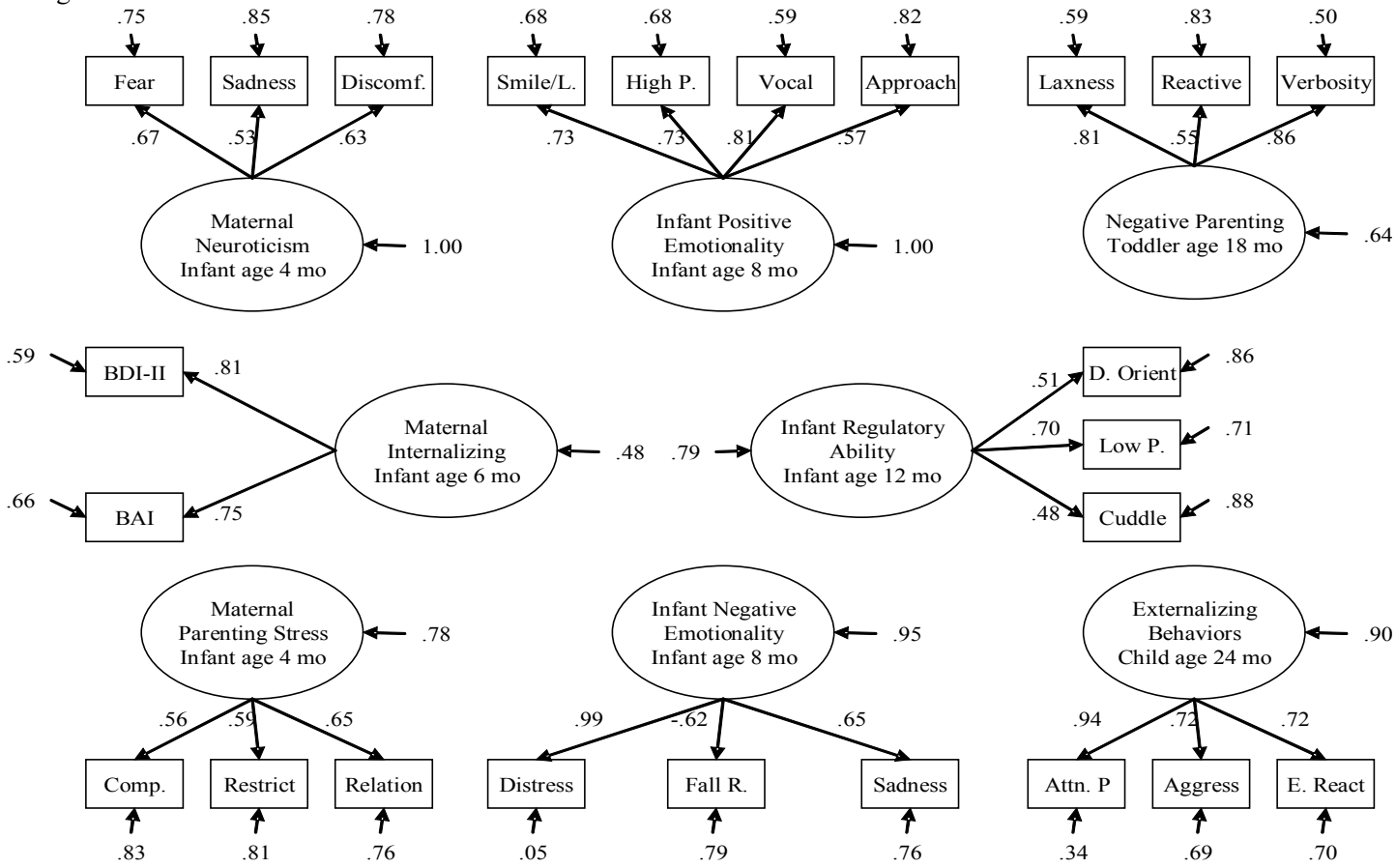
For Clarity Coefficients From Predictors to Regulatory Capacity Slope have been Omitted because variance associated with slope did not indicate Presence of significant interindividual differences in growth trajectory
*p <.05

Figure 8



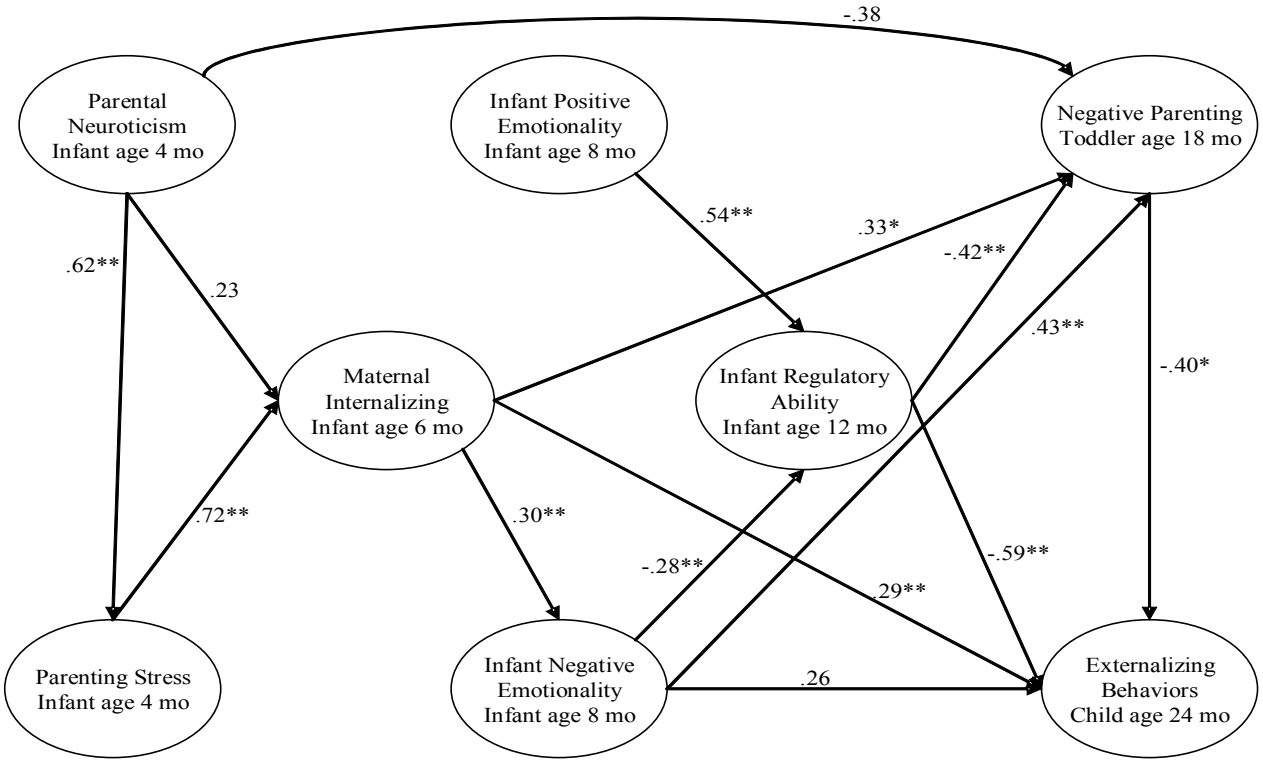
Observed variables and residuals have been omitted for clarity.

Figure 9



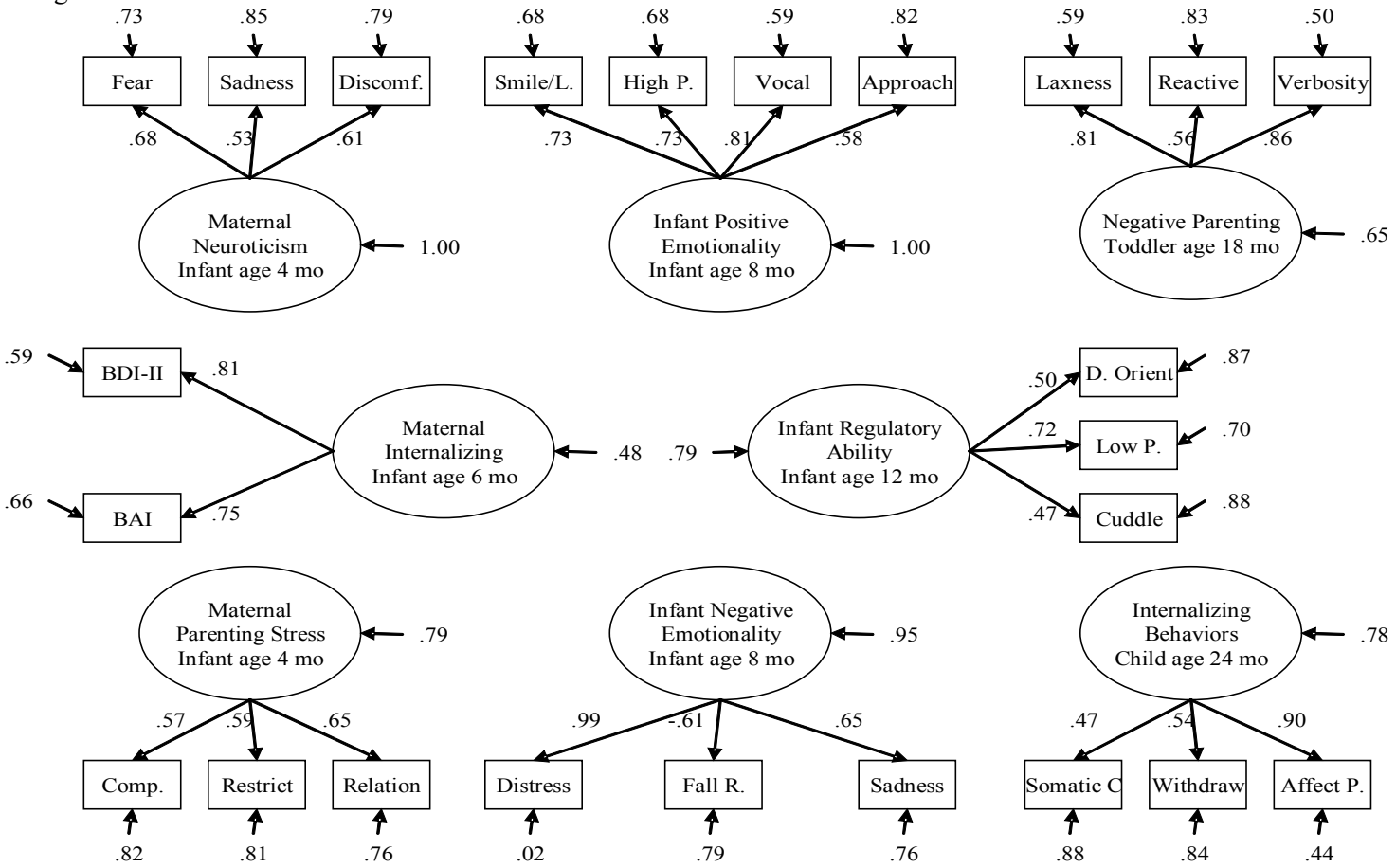
Pathways between Latent Variables have been omitted for clarity. Constant and Associated Pathways have been omitted for Clarity.

Figure 10



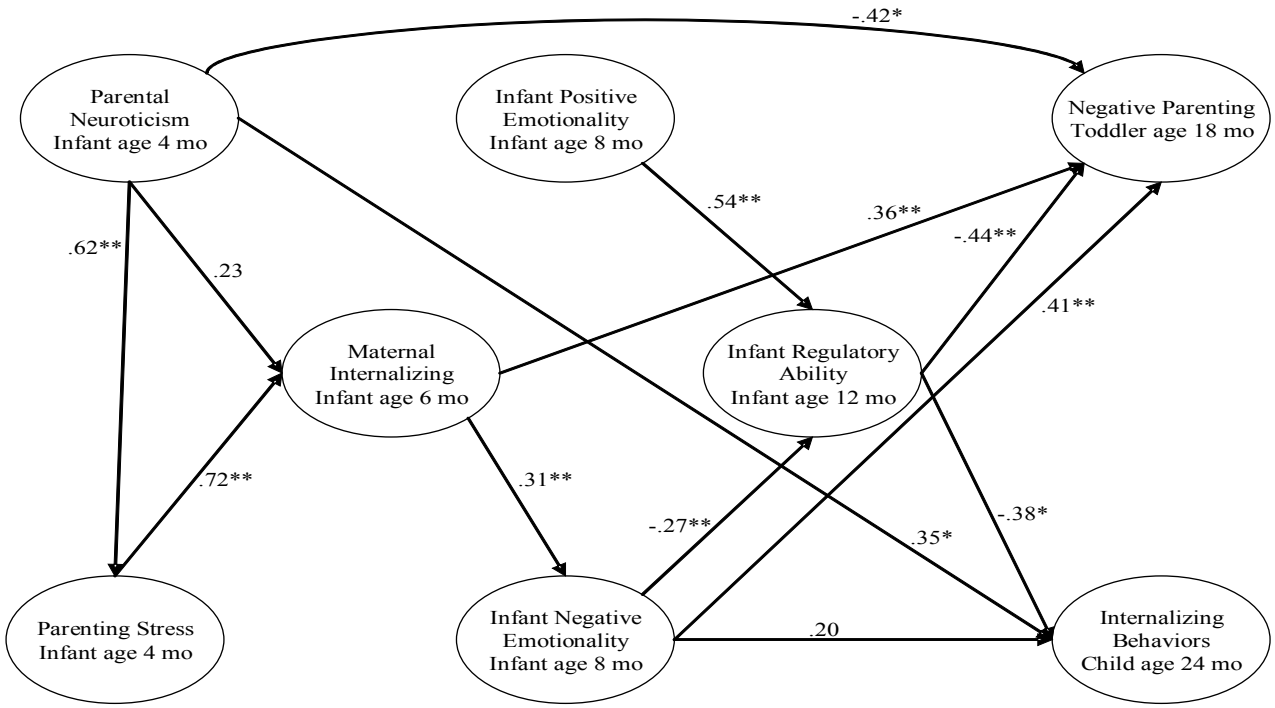
* p < .10; ** p < .05
Constant and pathways emanating from constant have been omitted for clarity. Observed variables
As well as factor residuals have been omitted for clarity. These may be viewed in Figure 9

Figure 11



Pathways between Latent Variables have been omitted for clarity. Constant and Associated Pathways have been omitted for Clarity.

Figure 12



* p < .10; ** p < .05
Constant and pathways emanating from constant have been omitted for clarity. Observed variables As well as factor residuals have been omitted for clarity. These may be viewed in Figure 11.