ENVIRONMENTAL SENSITIVITY AND PERSON X ENVIRONMENT FIT: AN EXPLORATION OF MOTHERS' EARLY SUBJECTIVE EXPERIENCE OF CHILDREN'S TEMPERAMENT

By

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ABSTRACT

ENVIRONMENTAL SENSITIVITY AND PERSON X ENVIRONMENT FIT: AN EXPLORATION OF MOTHERS' EARLY SUBJECTIVE EXPERIENCE OF CHILDREN'S TEMPERAMENT

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As suggested by Thomas and Chess (1968), it is not temperament alone that determines the developmental course, but the interaction of the child's temperament with the adequacy of environmental responses to it. For very young children, much of their environment consists of their relationships with caregivers, and, for many, the mother-child relationship is of primary importance. These relationships are co-constructed (Weatherston, 2000), influenced not just by the child's reactive tendencies, but also by mothers' subjective experience, how they receive, accept, and respond to their children's reactivity. The developmental impacts of inborn traits like temperament may be best understood as a function of person x environment fit and the complex interplay between parent and child characteristics.

Proceeding from a person x environment fit perspective, the purpose of the first study was to examine patterns of stability and change in mothers' subjective experience of relational stress in the context of parenting children with varying degrees of temperamental reactivity. Dyads were classified into five patterns, one comprised of children with an easy temperament whose mothers reported very little relational stress, and four profiles of highly reactive children whose mothers experienced different patterns of relational stress throughout the course of early childhood. Membership in each profile was differentially related to mothers' knowledge of child development and their sense of personal mastery.

Considering the primacy of the mother-child relationship in early development and the evidence that temperamentally reactive children are more sensitive to environmental influences, the aim of the second study was to expand on the results of study 1 by examining mean differences on subsequent child outcomes for five distinct subgroups of mother-child dyads characterized by quantitative and

qualitative variation in mothers' subjective experience of relational stress in early childhood in response to children's individual differences in temperamental reactivity. Profiles were differentially related to children's academic and social-emotional outcomes at the transition to Kindergarten and in 5th grade. Profile comparisons provided some evidence of increased environmental sensitivity such that reactive children in least optimal environments fared worse than children in all other profiles and better, in some cases, that even their less sensitive, "easy" temperament, peers. For two of the eight outcomes of interest, these results were moderated by sex.

Findings confirm that there is distinct heterogeneity in maternal response to children's heightened reactivity, which suggests that there is wide variation in the relational environments experienced by highly reactive children. Results highlight the important role maternal perceptions and beliefs have in influencing both their own experience of and satisfaction in the parenting role as well as shaping the relational environments in which highly reactive children develop.

This dissertation is dedicated to the unflappable George Michael whose elegant brashness and sincerity repeatedly validated my worldview, often when I didn't know how much I needed it. The universe is a better place for having had you in it. You certainly have been loved.

And to all the ones they told were too sensitive.

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CHAPTER 1: INTRODUCTION

Background Considerations

Neither biological nor environmental factors constitute the determinants of behavior in isolation. Instead, development proceeds in a bidirectional exchange between innate individual characteristics and the external environment, often by way of interpersonal interaction with others. Such person x environment interactions with respect to biological influence can be thought of in terms of genotype wherein individual gene variants, alone or in concert with others, interact with the environment to influence development (Bakermans-Kranenburg & van IJzendoorn, 2007; A. Caspi et al., 2002; Avshalom Caspi et al., 2003; Suomi, 2011). It is also studied in terms of endophenotype in investigations of psychophysiological variations, such as cortisol reactivity or measures of respiratory sinus arrhythmia in response to external stressors (Dettling, Gunnar, & Donzella, 1999; Taylor et al., 2012). In addition, it is often examined in terms of phenotypic variation such as child temperament (Ivorra et al., 2010; Kochanska & Kim, 2012; Salley, Miller, & Bell, 2013), which will be the focus in this dissertation. These biologically based individual characteristics manifest as functionally significant only by way of interaction with the environment (Belsky & Pluess, 2009).

Environmental sensitivity. An understanding of person x environment interactions is particularly important in terms of variations in individual response to experience. Theories regarding variation in environmental sensitivity (sensory processing sensitivity: Aron, Aron, & Jagiellowicz, 2012; differential susceptibility: Belsky & Pluess, 2009; biological sensitivity to context: Ellis & Boyce, 2011) propose that certain biologically based individual characteristics increase individuals' sensitivity or susceptibility to environmental influence in a manner that increases the potential for both negative and positive outcomes beyond those experienced by their less susceptible peers depending on the context of their environment. In this case, one's biological make up moderates the effect of environmental influences on resulting development.

The main tenet of theories of environmental sensitivity (Aron et al., 2012; Belsky & Pluess, 2009; Ellis & Boyce, 2011) are that increased sensitivity to environmental influence is not a measure of vulnerability, but instead of plasticity. While this plasticity can be a result of genetic factors, biological mechanisms, temperament, or environmental alterations in stress response pathways, the key idea is that organismal plasticity functions in a "for better or for worse" manner. This added capacity to be affected by contextual factors may indeed result in dysfunction and dysregulation, but under certain circumstances, may also lead to enhanced outcomes. Plasticity is not inherently unfavorable, but could function as an advantage when coupled with the right environment.

In contrast, other individuals, rather than being endowed with increased susceptibility, are instead relatively resistant to environmental influence (Belsky & Pluess, 2013). In this way, the theory also suggests a reframing of the idea of resilience. The developmental trajectories of these individuals may be negligibly affected by supportive experiences and environments as well as adverse ones. This could mean that these individuals, while somewhat buffered from the deleterious effects of suboptimal circumstances, may not benefit from targeted interventions when needed.

Environmental sensitivity theories present an explanation of results that more accurately reflects the oft-divergent developmental and psychopathologic outcomes seen in individuals in seemingly similar circumstances. The theories suggest causal pathways and mechanisms by which certain individual differences lead to variations in response to comparable experiences. They also help explain why some individuals seem to show disproportionately more negative outcomes, while still others appear to emerge relatively unscathed by difficult circumstances.

Importance of person-centered methods. Often social science takes a variable-centered approach to research analyses. This can be done in a univariate or multivariate fashion and, with a focus on mean differences, results in describing relationships between independent and dependent variables for the "average" or typical member of the studied population. Variable centered approaches assume

homogeneity across the studied population in the level of impact of predictors on outcomes (von Eye & Bogat, 2006).

In contrast, theoretical models such as Bronfenbrenner's bioecological systems theory (Bronfenbrenner & Morris, 2007), relational-developmental-systems metatheory (Overton, 2015), and the idea of variation in environmental sensitivity (Belsky, 2005; Ellis & Boyce, 2008; Pluess, 2015) highlight the complexity of the person x environment interactions that underlie development. The effects of the environment on individual members of the population are not uniform in magnitude. As a consequence, some smaller subgroups of individuals either especially or near minimally affected by environmental influences may go unnoticed in analyses of mean differences (Connell & Frye, 2006).

Pursuant to viewing development from an ecological perspective, the study of individual differences in response to experience increasingly relies on the exploration of interactions between person and environment (von Eye & Bogat, 2006). A primary advantage of person-centered approaches is their ability to account for complex interactions which would quickly become unmanageable or uninterpretable with variable-centered techniques. By taking the person as the unit of analysis, the interactions between component variables are inherent in the identified classes (Little, Bovaird, & Card, 2007). A person-centered approach may be better equipped than traditional variable-centered approaches to capture the complexity of the person in context and provide a more holistic representation of individual variation in response to environmental effects (Laursen & Hoff, 2006; Sterba & Bauer, 2010).

(Person) Environmental sensitivity of temperamentally reactive children. Temperament is a biologically-based construct that remains relatively stable over time (Kagan & Snidman, 2009; Rothbart, Ahadi, & Evans, 2000). However, rather than being conceptualized as a fixed set of preprogrammed traits that lead necessarily to predictable behaviors or psychological outcomes, temperament may be more accurately considered a measure of tendencies. Variations in temperamental reactivity correspond

to variations in sensitivity to context such that reactive children experience heightened sensitivity to both positive and negative qualities of the environments in which they develop (Pluess & Belsky, 2010), and studies have shown correspondence between temperamental aspects categorized as difficult and both positive and negative child outcomes (Keiley, Lofthouse, Bates, Dodge, & Pettit, 2003; Kochanska, Aksan, & Joy, 2007). These mixed findings may be due, in part, to children's individual differences in response to the quality of their environments.

(Environment) Mothers' perceptions and relational stress. For very young children, much of their environment consists of their relationships with caregivers. In the context of children's heightened temperamental reactivity, these relationships are influenced not just by the child's reactive tendencies, but also by parents' subjective experience, how they receive, accept, and respond to their children's reactivity. Both reactive children's behaviors and mothers' appraisals of those behaviors influence mothers' experience of relational stress and their perceptions of and satisfaction with the dyadic interactions that shape the emerging parent-child relationship. In the current dissertation, mothers' relational stress is evidenced by their perceptions of the quality of dyadic interaction with their child, a component of parenting stress. Importantly, parenting stress, as conceptualized by Abidin (1995), reflects, in part, a mother's perception of her child or her child's behaviors that are discrepant with her prior expectations. If she views her child's behavior or the experience of parenting her reactive child as difficult, she may be more dissatisfied with the emerging parent-child relationship (Oddi, Murdock, Vadnais, Bridgett, & Gartstein, 2013; Östberg & Hagekull, 2000) and may, as a consequence, be more likely to respond to her child in non-supportive ways (Dalimonte-Merckling & Brophy-Herb, 2019; Lutz et al., 2012). Particularly for highly reactive children, the primacy of early caregiver responses in influencing the emerging internal working model of the self and the self in relation to others may be particularly integral as they are both more affected by their surrounding environments and plausibly more in need

of external support in order to develop and internalize the affective regulation necessary to thrive in the larger ecological context.

Prior work. Using the longitudinal Early Head Start Research and Evaluation Project (EHSREP) data (Love et al., 2005), reflecting an at-risk low income sample of parents and toddlers, Dalimonte-Merckling and Brophy-Herb (2019), identified three subgroups of children whose temperamental reactivity was paired with varying levels of parental distress and perceptions of relationship quality when children were 24 months old. While the majority of children were classified as having an "easy" temperament, which was coupled with very little parenting stress, two distinct profiles of mother-child dyads emerged consisting of highly reactive children distinguished by variation in mothers' experience of parental distress and report of dysfunctional interaction. In addition, profile membership was differentially associated with the level of maternal negative regard demonstrated toward the child during parent-child interactions from early childhood through the transition to Kindergarten. The profile comprised of highly reactive children whose mothers experienced pronounced stress showed markedly higher levels of negative regard at all timepoints relative to the other two profiles. While this work focused on parenting stress reported when children were 24 months old, it may be that mothers' subjective experience of their highly reactive infants change in meaningful ways as children and relationships develop.

Current Dissertation

Individual development is situated inside the complexity of a larger organizing system of proximal and distal components, each interdependent and co-acting on each other in reciprocal and dynamic ways (see Figure 1, adapted from Golding & Fitzgerald's, 2019 nested environments of relational developmental systems and informed by both relational systems metatheory; Overton, 2015, and Bronfenbrenner's bioecological framework; Bronfenbrenner & Morris, 2007). Acknowledging that there are broader influences at work, the purpose of the following studies was to focus on the specific

components of the developing individual in bidirectional interaction with the emerging mother-child relationship. Taken together, the two studies explore the concurrent influence of a child's reactivity on mother's subjective experience of relational stress between herself and her child along with the interaction of that relational environment with the child's reactivity on the child's developmental outcomes.

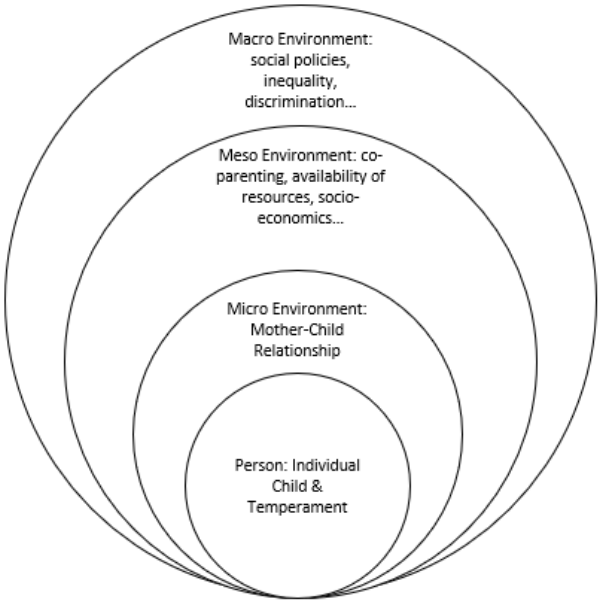

Figure 1.1 Systems View of Person and Environment.
Note: Adapted from Golding & Fitzgerald's, 2019 nested environments of relational developmental systems and informed by both relational systems metatheory; Overton, 2015, and Bronfenbrenner's bioecological framework; Bronfenbrenner & Morris, 2007.

Proceeding from a person x environment fit framework, the current dissertation utilizes a person-centered approach to examine stability and change in naturally-occurring patterns of child and parent characteristics. Given the primacy of the mother-child relationship in influencing children's development, the first study (Chapter 2) expands on prior work by exploring whether there are meaningful subgroups of children whose temperamental reactivity is paired with varying levels of relational stress from infancy through toddlerhood and whether, once early patterns are established, they persist over time. Additionally, study 1 seeks to understand what facilitated more positive responses to children's reactivity. Taken together with the developmental salience of interpersonal

interaction in early childhood, the relational environments characterized by variations in how mothers receive and respond to their child's temperament may be particularly impactful for children who are more sensitive to their surrounding context. Grouping dyads based on the longitudinal patterns emerging from the first study, the second study (Chapter 3) seeks to determine whether profile membership is differentially related to children's later achievement and adjustment. Child outcomes were tested across a range of domains associated with relational stress, including academic ability and achievement and social-emotional competence. In an effort to acknowledge and explore the potential for greater sensitivity of boys to relational stresses in early childhood due to biological and experiential variation (Golding & Fitzgerald, 2019), study 2 also considered possible sex differences in outcomes associated with profiles.

CHAPTER 2: A PERSON-CENTERED APPROACH TO UNDERSTANDING MOTHERS' SUBJECTIVE EXPERIENCE OF CHILDREN'S TEMPERAMENTAL REACTIVITY

Introduction

As suggested by Thomas and Chess (1968), it is not temperament alone that determines the developmental course, but the interaction of the child's temperament with the adequacy of environmental responses to it. For very young children, much of their environment consists of their relationships with caregivers, and, for many, the mother-child relationship is of primary importance. These relationships are co-constructed (Weatherston, 2000), influenced not just by the child's reactive tendencies, but also by mothers' subjective experience, how they receive, accept, and respond to their child's reactivity.

Child characteristics such as temperament influence infant reactions and behaviors, which, in turn, affect maternal responses (Kochanska, Friesenborg, Lange, & Martel, 2004). Some studies show that aspects of temperament relating to heightened reactivity evoke insensitive or harsh responses from mothers (Clark, Kochanska, & Ready, 2000; Jaffee et al., 2004). In other cases, highly reactive children have been shown to elicit greater maternal responsiveness and maternal involvement (Brown, McBride, Bost, & Shin, 2011; Kochanska et al., 2004; Pettit & Bates, 1984). These mixed findings suggest underlying heterogeneity in mothers' receipt of and response to children's temperamental reactivity that may be associated with both their behavior toward the developing child and their perceptions of the emerging parent-child relationship.

Proceeding from a person x environment fit perspective, this study employs a person-centered approach to examine naturally occurring patterns of child temperamental reactivity and stability and change in mothers' subjective experience of dyadic interactions with their children. The study aims to determine if there are distinct subgroups of children whose temperamental reactivity is paired with

varying levels of mothers' reported parent-child relational stress from infancy through toddlerhood and whether, once early patterns are established, they persist over time.

Perceptions of Temperament and Relational Stress

In the current study, mothers' relational stress is evidenced by their perceptions of the quality of dyadic interaction with their child, a component of parenting stress. Importantly, parenting stress, as conceptualized by Abidin (1995), reflects, in part, mothers' perceptions of their children or their children's behaviors that are discrepant with their prior expectations. Mothers who view their children's behavior as difficult or challenging often report distress and dissatisfaction with the parent-child relationship (Deater-Deckard, 1996; Oddi et al., 2013; Östberg & Hagekull, 2000). As well, experiencing higher levels of parenting stress contributes to mother's perceptions of their children as more difficult (Atella, DiPietro, Smith, & James-Roberts, 2003; Mäntymaa, Puura, Luoma, Salmelin, & Tamminen, 2006; Renk, Roddenberry, Oliveros, & Sieger, 2007; Sheinkopf et al., 2006) perhaps by engendering negative cognitions and beliefs which they come to associate with their children (Abidin, 1992). Both reactive children's behaviors and mothers' appraisals of those behaviors influence mothers' experience of relational stress and their perceptions of and satisfaction with the dyadic interactions that shape the emerging parent-child relationship.

Using the same data as the present study, Dalimonte-Merckling and Brophy-Herb (2019), identified three subgroups of children whose temperamental reactivity was paired with varying levels of parental distress and report of dysfunctional interaction when children were 24 months old. As expected, most children were classified as having an "easy" temperament characterized by low levels of reactivity, and their mothers reported experiencing very little parenting stress. However, two distinct profiles of mother-child dyads emerged consisting of highly reactive children distinguished by variation in mothers' experience of parental distress and perceptions of relationship quality. In addition, profile membership was differentially associated with the level of maternal negative regard demonstrated

toward the child during parent-child interactions over time. While the dyads including "easy" children and those with highly reactive children but mild parenting stress demonstrated low initial and subsequently declining levels of negative regard, the third profile, comprised of highly reactive children whose mothers experienced pronounced stress, showed markedly higher levels of negative regard at all timepoints relative to the other two profiles. While this work focused on parenting stress reported when children were 24 months old, it remains possible that the number or nature of these subgroups vary at other timepoints. Perhaps more importantly, it may also be that mothers' subjective experience of their highly reactive infants may change in meaningful ways as children and relationships develop.

Mothers' Subjective Experience Over Time

Toddlerhood represents a time of peak aggressive behavior and assertions of autonomy (Calkins, Blandon, Williford, & Keane, 2007; Tremblay, 2000). As such, maternal understanding and acceptance of their children's reactive tendencies may be most clearly distinguished at this time when toddlers' present some of their greatest challenges to parental authority. Perhaps at earlier timepoints, patterns of reactivity and response between children and parents are still forming, and there may be a broader variety of profiles earlier in development that later cohere at 24 months. While preservation of the basic delineation of profiles at each wave is anticipated, there is a need to examine stability or change in mother's subjective experience of the parent-child relationship over time.

It is possible that patterns of maternal response to child reactivity, once established, remain consistent over the course of toddlerhood. Both mothers and children are developing a sense (or lack) of self-efficacy as their relationship with one another evolves. Because relationship building is a bidirectional process, children's responses to mothers' behavior, along with mothers' interpretations of those responses, reinforce or inhibit mothers' sense of self-efficacy in the parenting role (Östberg, Hagekull, Lindberg, & Dannaeus, 2005; Semke, Garbacz, Kwon, Sheridan, & Woods, 2010). At the same time, the nature and frequency of maternal response to child bids may enhance or impede children's

growing sense of both agency and efficacy in being able to proactively get their needs met (Ammaniti & Gallese, 2014; Deater-Deckard, Ivy, & Smith, 2005). This could, in turn, influence the outward expression of their temperamental tendencies, particularly how they cope with and demonstrate their tendency toward heightened reactivity.

However, the few longitudinal studies of parenting stress, more broadly and in various contexts, give reason to believe that parent-child patterns established in early childhood may indeed change over time. For example, Spinelli and colleagues (2013) found that, for parents of preterm infants, parenting stress, measured as a combination of parent-child relational stress and general stress, increased slightly on average over the toddler period. Importantly, they noted significant variability in both the starting level and the trajectory of parenting stress over time based on maternal and child characteristics. Over the preschool period, when children were aged 2-5 years, with a low-income population similar to the current study, Williford and colleagues (2007) found an average decrease in parenting stress for the sample as a whole. However, this average trajectory, too, included significant variability in both starting point and change over time. Using growth mixture modeling and a subset of adolescent mothers from the current study sample, Chang and Fine (2007) found three trajectories of variation in parenting stress. Between children's first and third years, one group of adolescent mothers reported chronically high parenting stress while the other two groups showed changes over time with one increasing and one decreasing in reported stress. Using the largest group, characterized by decreasing stress over time, as reference, persistently high stress was more likely for adolescent mothers of reactive children, and membership in the groups with persistent or increasing stress trajectories was more likely for adolescent mothers with lower self-efficacy. This variation in parenting stress over time suggests that parent-child patterns evident in early childhood may not be immutable and that, not only is there clear heterogeneity in mothers' subjective experience as relationships develop, but that both child and parent characteristics contribute to stability and change over time.

Potential Facilitators of Change

If there exists a subgroup of mothers with highly reactive children who transition from highly stressed early only to mildly stressed over time, it will be important to discover which parent, child, or relationship qualities could facilitate that movement. Recognizing that parent-child relationship development is bidirectional, the variance in the experience of relational stress over time may come about as a result of children's skill acquisition in the form of communication or regulation strategies, which have been shown to be both impacted by parenting stress (Ayoub, Vallotton, & Mastergeorge, 2011; Harmeyer, Ispa, Palermo, & Carlo, 2016) and themselves contributors to parents' experience of distress and dissatisfaction in the parenting role (Östberg et al., 2005; Williford et al., 2007). Given that associations between parenting stress and children's behavior problems show stability over time (Neece, Green, & Baker, 2012), variation in children's expressed negativity toward or engagement of their mother may also lead to changes in mothers' subjective experience of relational stress over time.

As noted, relational stress is often a result of a mismatch between children's behaviors and reactions and parents' initial expectations (Abidin, 1995). Particularly in the case of individual differences in temperament, mothers with greater knowledge of infant and early childhood development may have more realistic expectations and may then be more accepting in response to their children's heightened reactivity (Grusec, Goodnow, & Kuczynski, 2000). Additionally, perhaps alterations in relational stress over time are a function of dispositional qualities (Chang & Fine, 2007; Crnic & Ross, 2017; Hassall, Rose, & McDonald, 2005; Raikes & Thompson, 2005) in the parents that more easily allow new understandings to reshape prior perceptions or attributions. A mother's feelings of personal control over her life circumstances, her own sense of agency or mastery, could contribute to her responses to her child's reactive tendencies. The current study examined whether mothers' knowledge related to child development or sense of personal mastery, as well as child vocabulary skills, regulatory

development, or behavior toward the mother predict stability and change in patterns of mothers' subjective experience of relational stress in response to their child's temperamental reactivity over time.

The Current Study

The first purpose of the current study was to expand on prior work by examining naturally-occurring subgroups of children whose temperamental reactivity is met with varying levels of relational stress, extended now across three waves of data collection from infancy through toddlerhood in an effort to determine whether mothers show different patterns of response in relation to their children's temperament over time. The second aim was to understand what facilitated variations in response to children's reactivity by examining whether patterns of change in relational stress could be predicted by variation in children's skill development (vocabulary and self-regulation) and behavior (engagement of and negativity toward their mothers), or mothers' own characteristics (knowledge and mastery).

Methods

Participants

Data for the current study come from the National Early Head Start Research and Evaluation (EHSRE) Project (Love et al., 2005), a 17 site evaluation of Early Head Start (EHS), a federally-funded program which serves families prenatally through age 3. Between 1996 and 1998 participants were enrolled and randomized to receive EHS services or to a comparison group. Data collected near children's 14, 24, and 36 month birthdays were utilized in the current study. The full study sample included 3,001 Early Head Start eligible children (1,510 males) and their primary caregivers (99% mothers). At enrollment, parents were a mean age of 22.6 (SD = 5.77) years with limited average annual income $9,277 (SD = $8,421) and education (74.4% with a high school education or less). Parents were 37% White, 34% African American, and 23% Hispanic/Latino, most with no more than a high school education (74.4%).

Measures

Profile dimensions.

Child temperamental reactivity. Mothers reported on their infants' temperamental reactivity via the Negative Emotionality subscale of the Emotionality, Activity, Sociability, and Impulsivity Temperament Survey (A. H. Buss & Plomin, 1984) at 14 months. The Negative Emotionality Subscale assesses the child's tendency to be quickly or intensely emotional or upset. For example, items inquire as to whether the child "gets upset easily", and "reacts intensely when upset," and are rated on a 5-point scale from (1) Not at all like my child to (5) Very characteristic of my child (α = .72).

Mothers' report of relational stress. The 24-item version of the Parenting Stress Index-Short Form (Abidin, 1995) was completed by mothers when children were 14, 24, and 36 months old. Following a factor analysis, Whiteside-Mansell and colleagues (2007) confirmed a 5 factor structure for the PSI within the EHSRE sample. We used the Dyadic Interaction scale (originally part of the Parent-Child Dysfunctional Interaction scale) (6 items, 14 months: α = .66; 24 months: α = .66; 36 months: α = .70) as assessment of mothers' perceptions of and dissatisfaction with their relationship with the specific target child. Sample items include, "When I do things for my child, I get the feeling that my efforts are not appreciated very much," and "Sometimes my child does things that bother me just to be mean." Items are rated from (1) Strongly Disagree to (5) Strongly Agree. This scale was created from item level data at the 14, 24, and 36 month waves.

Covariates. When characterizing differences between groups, we will first explore whether child sex, cumulative demographic risk, or program assignment differentiate between profile patterns. Demographic risk was assessed at study enrollment and reflected a summed score of the presence (1) or absence (0) of five risk factors (less than a high school education, single parenthood, adolescent parenthood, unemployment, and welfare status, specifically the receipt of Temporary Assistance for

Needy Families/Aid to Families with Dependent Children) ranging from 0 to 5. Program assignment reflects random assignment to receive EHS services (1) or to the comparison group (0).

Child characteristics.

Child vocabulary skills. At the 14 and 24 month assessments, child vocabulary was assessed using age-appropriate versions of the MacArthur Communicative Development Index. When children were 14 months old, parents were provided a list of 89 words and instructed to indicate which of the words the child understands, and, separately, which of the words the child says yielding count scores for both receptive and productive vocabulary. When children were 24 months old, parents were provided a list of 100 words and were asked to indicate which of the words the child says. Vocabulary production scores reflect a count of the number of items for which parents indicated the child says the listed word. At the 36 month assessment, vocabulary skills were measured as receptive vocabulary indicating children's knowledge of the meaning of spoken words by way of the Peabody Picture Vocabulary Test (PPVT-III: Dunn & Dunn, 1997). Age-adjusted scores standardized around a nationally normed mean of 100 were used.

Child self-regulation. At 14, 24, and 36 months, examiners administered the Bayley Mental Development Index. Immediately following, examiners rated children on 5 point scale relative to their behavior during the assessment procedure on behavior rating scales of the Bayley Scales of Infant Development, 2nd ed. (Bayley, 1993). The two subscales used are Orientation and Engagement, reflecting the child's cooperation with the examiner, and Emotion Regulation, reflecting negative affect, frustration with the tasks, and ability to transition between tasks and test materials (14 months: $\alpha = .62$; 24 months: $\alpha = .92$; 36 months: $\alpha = .90$). Higher scores indicate greater competence and fewer problems.

Child behavior toward parent. The "three bag" play task was utilized to assess the child's behavior toward the parent. Parents were given three bags of toys and asked to play with the toys with

their children beginning with the first bag. The 10-minute, videotaped play task was administered at the 14, 24, and 36 month assessments. Items were rated by trained observers on a 7-point scale from, (1) very low incidence of the behavior to (7) very high incidence of the behavior, reflecting the child's engagement of the parent and negativity toward the parent. The child engagement score is intended to capture the extent to which the child initiates or maintains interaction with the parent and demonstrates positive regard or affect toward the parent. Child negativity toward the parent reflects the degree of dislike, anger, or hostility directed at the parent.

Parent characteristics.

Knowledge of child development. Mother's knowledge of child development was assessed using a subset of items from the Knowledge of Infant Development Inventory (KIDI; (MacPhee, 1981). The KIDI is designed to measure parents' knowledge of child development milestones, parenting practices, and infant norms of behavior and was administered at the 14 and 24 month assessments. In the EHSRE study, parents were asked to report their level of agreement with items regarding child behavior and caregiver responses as well as timing of milestones. Fourteen items were included at the 14 month assessment (α = .62). Eight items were included at the 24 month assessments (α = .62).

Personal mastery. Mastery was measured at the 14 month assessment using the Pearlin Mastery Scale (Pearlin & Schooler, 1978). The scale consists of seven items designed to capture the extent to which individuals consider their life chances as being under their own control rather than determined by fate. The five negatively worded items were included in this study (α = .72). An example is " I have little control over the things that happen to me." Items are rated from (1) strongly agree to (4) strongly disagree. Higher scores indicate greater feelings of mastery.

Data Analyses

Pursuant to viewing development from an ecological perspective, the study of individual differences in response to experience increasingly relies on the exploration of interactions between

person and environment (von Eye & Bogat, 2006). A person-centered approach may be better equipped than traditional variable-centered approaches to capture the complexity of the person in context and provide a more holistic representation of individual variation in response to environmental effects (Laursen & Hoff, 2006; Sterba & Bauer, 2010).

All analyses were conducted in Mplus 7.3 (Muthén & Muthén, 1998-2012). Data analyses proceeded in three steps. First, a repeated measures latent profile analysis (RMLPA), an adaptation of repeated measures latent class analysis (RMLCA: Collins & Lanza, 2010), was conducted to investigate the presence of unobserved subgroups of mothers and children based on patterns of mothers' subjective experience of relational stress in the presence of their child's temperamental reactivity. RMLPA was conducted with data from the 14, 24, and 36 month waves. While growth mixture modeling presents a valid means of describing variation in trajectories of change over time, it requires fitting a specific functional form to that change. RMLPA, allows for the discernment of longitudinal patterns that may include high or low/no stress at only one timepoint rather than fit, for example, a distinctly increasing or decreasing trajectory to the data. Next, a series of multinomial logistic regressions were performed using the R3STEP command to assess whether differences in children's skill development (vocabulary and self-regulation) and behavior (engagement and negativity toward the parent) or mothers' own characteristics (knowledge and attitudes) might distinguish among the patterns profiled. Factors distinguishing between patterns were explored with a particular view toward comparing dyads with highly reactive children and low levels of relational stress to those with high levels at various timepoints. Full-information maximum likelihood (FIML) estimation was used to account for missing data.

Results

Descriptive Characteristics

Table 2.1 shows correlations between study variables. Profile dimensions and parent and child characteristics were associated in the expected directions.

Table 2.1 *Descriptive Statistics and Correlations among Study Variables*

		1	2	3	4	5	6	7	8	9	10	11	12	13	14
1.	Male	1													
2.	Maternal Risk	-.01	1												
3.	Program	-.03	.01	1											
4.	Temp. Reactivity	.03	.10**	.00	1										
5.	Relational Stress 14 m	.03	.14**	.01	.23**	1									
6.	Relational Stress 24 m	.05*	.11**	.02	.20**	.41**	1								
7.	Relational Stress 36 m	.04	.09**	.01	.19**	.39**	.45**	1							
Parent Characteristics															
	Knowledge of Child Dev.														
8.	14 month	.02	-.16**	.00	-.08**	-.23**	-.19**	-.13**	1						
9.	24 month	.01	-.16**	-.01	-.13**	-.20**	-.19**	-.14**	.46**	1					
	Personal Mastery														
10.	14 month	-.05**	-.09**	-.03	-.15**	-.37**	-.29**	-.25**	.12**	.12**	1				
Child Skills															
	Receptive Vocabulary														
11.	14 month	-.09**	-.01	.03	-.07**	-.05*	-.11**	-.08**	-.03	.01	.09**	1			
12.	36 month	-.09**	-.20**	.04	-.11**	-.12**	-.19**	-.08**	.24**	.17**	.15**	.18**	1		
	Vocabulary Production														
13.	14 month	-.07**	.03	.01	-.04	.01	-.04	-.05*	-.01	.03	.06**	.49**	.14**	1	
14.	24 month	-.14**	-.06**	.00	-.10**	-.11**	-.14**	-.08**	.07**	.07**	.13**	.39**	.31**	.36**	1
	Orientation/Engagement														
15.	14 month	-.05*	-.01	.00	-.10**	-.06**	-.06**	-.02	.10**	.08**	.07**	.11**	.14**	.12**	.16**
16.	24 month	-.06*	-.07**	.01	-.08**	-.06**	-.07**	.02	.18**	.11**	.06*	.14**	.30**	.06*	.24**
17.	36 month	-.07**	-.07**	.02	-.07**	-.09**	-.12**	-.04	.20**	.16**	.10**	.11**	.40**	.05	.21**
	Emotion Regulation														
18.	14 month	-.10**	-.07**	-.01	-.16**	-.05*	-.08**	-.06*	.02	.03	.06**	.04	.06*	.06**	.13**
19.	24 month	-.14**	-.09**	-.01	-.09**	-.04	-.10**	-.06**	.05*	.01	.05*	.09**	.28**	.05*	.24**
20.	36 month	-.17**	-.12**	.02	-.05	-.06*	-.06*	-.11**	.01	.04	.05*	.07**	.33**	.07*	.16**
Child Behavior															
	Obs. Child Engagement														
21.	14 month	-.12**	-.08**	.00	-.08**	-.13**	-.12**	-.05*	.12**	.12**	.08**	.11**	.21**	.11**	.20**
22.	24 month	-.05*	-.19**	-.03	-.07**	-.11**	-.16**	-.13**	.13**	.11**	.08**	.13**	.28**	.11**	.27**
23.	36 month	-.05*	-.11**	.07**	-.07*	-.13**	-.17**	-.15**	.15**	.11**	.08**	.06*	.25**	.03	.15**
	Obs. Child Negativity														
24.	14 month	.07**	.09**	-.04	.10**	.08**	.10**	.10**	-.14**	-.07**	-.04	.00	-.15**	-.01	-.07**
25.	24 month	.08**	.15**	.02	.03	.04	.07**	.04	-.03	-.02	-.05*	-.03	-.22**	-.03	-.09**
26.	36 month	.04	.03	-.05*	.03	.11**	.12**	.08**	-.02	.01	-.06*	-.09**	-.12**	.01	-.07*
	Mean	50.3%	2.68	50.1%	3.63	1.46	1.44	1.51	3.05	3.37	15.42	48.00	83.01	12.34	54.78
	SD		1.20		.93	.62	.60	.64	.41	.42	3.45	19.62	15.56	12.50	22.95

*p < .05, **p < .01, ***p < .001

Table 2.1 (cont'd)

		15	16	17	18	19	20	21	22	23	24	25	26
Child Skills *cont'd*													
	Orientation/Engagement												
15.	14 month	1											
16.	24 month	.28**	1										
17.	36 month	.25**	.40**	1									
	Emotion Regulation												
18.	14 month	.46**	.18**	.08**	1								
19.	24 month	.10**	.45**	.17**	.27**	1							
20.	36 month	.10**	.19**	.36**	.12**	.37**	1						
Child Behavior													
	Obs. Child Engagement												
21.	14 month	.14**	.18**	.18**	.14**	.19**	.17**	1					
22.	24 month	.09**	.20**	.17**	.11**	.25**	.17**	.28**	1				
23.	36 month	.05*	.16**	.22**	.06*	.15**	.19**	.17**	.28**	1			
	Obs. Child Negativity												
24.	14 month	-.04	-.09**	-.11**	-.14**	-.11**	-.11**	-.23**	-.12**	-.04	1		
25.	24 month	.00	-.07**	-.03	-.10**	-.19**	-.15**	-.10**	-.40**	-.15**	.16**	1	
26.	36 month	.04	-.03	-.04	-.06*	-.14**	-.21**	-.06*	-.14**	-.36**	.12**	.22**	1
	Mean	3.54	3.62	3.80	3.69	3.64	3.93	3.86	4.29	4.71	2.11	1.73	1.28
	SD	.74	.77	.73	.69	.80	.76	1.13	1.14	1.01	1.11	.98	.57

*p < .05, **p < .01, ***p < .001

Both parent and child level variables are weakly correlated with mothers' relational stress at all time points with parent characteristics showing stronger associations than child characteristics.

Repeated Measures Latent Profile Analysis

To determine the optimal number of profiles, model fit statistics were compared using information-based criteria, including Akaike's information criterion (AIC: Akaike, 1987), Bayesian information criterion (BIC: Schwarz, 1978), and Sample Size Adjusted BIC (SABIC: Sclove, 1987), as well as both the Lo-Mendell-Rubin likelihood ratio test (LMR: Lo, Mendell, & Rubin, 2001) and the Bootstrapped likelihood ratio test (BLRT: McLachlan & Peel, 2004), which evaluate the a preference for the current number of profiles over a solution with one less. Profile solutions with a progressively increasing number of classes were examined and evaluated based on corresponding fit statistics and interpretive quality. Table 2.2 presents fit statistics for four candidate profile models. A five profile solution best fit the data. Despite lower AIC and BIC values for the six profile model, the LMR indicated no preference for six profiles over five. Based on the results of the LMR and considerations of interpretability, a five profile structure was retained.

Table 2.2 *Fit Statistics for Profile Solutions*

# of Profiles	AIC	BIC	SABIC	LMR (p)	BLRT (p)	Entropy
2	17072.65	17149.04	17107.73	<.001	<.001	.90
3	16537.53	16643.76	16586.34	.02	<.001	.86
4	16103.42	16238.56	16165.48	.04	<.001	.86
5	**15831.38**	**15995.91**	**15906.94**	**.02**	**<.001**	**.86**
6	15573.90	15767.80	15662.95	.48	<.001	.86

Note: AIC = Akaike Information Criterion; BIC = Bayesian Information Criterion; SABIC = Sample-Size adjusted BIC; LMR = Lo-Mendell-Rubin likelihood ratio test; BLRT = Bootstrapped likelihood ratio test.

Parameter estimates for the groups were compared and interpreted to provide conceptual descriptions of the profiles. The five patterns consisted of one expected large group of children with an easy temperament and mothers with consistently low levels of relational stress from 14 to 36 months, labelled Easy and encompassing 78% of dyads, and four groups characterized by heightened temperamental reactivity and various patterns of mothers' subjective experience of the emerging

parent-child relationship over time, representing the remaining 22% of dyads. These patterns include highly reactive temperament paired with consistently mild relational stress (Mild Stable, 10.4% of dyads), highly reactive temperament with early (at the 14 month timepoint only) but not persistent relational stress (Early only, 4.4% of dyads), highly reactive temperament with late onset (at the 36 month timepoint only) relational stress (Late onset, 4.3% of dyads), and highly reactive temperament with chronic relational stress (Chronic, 3% of dyads). Follow up analyses conducted to compare means among profiles revealed that, with regard to temperamental reactivity, an omnibus Wald test of potential parameter equalities for all four highly reactive profiles shows no evidence of significant differences in level of reported negative emotionality among the groups (*p*. = .07).

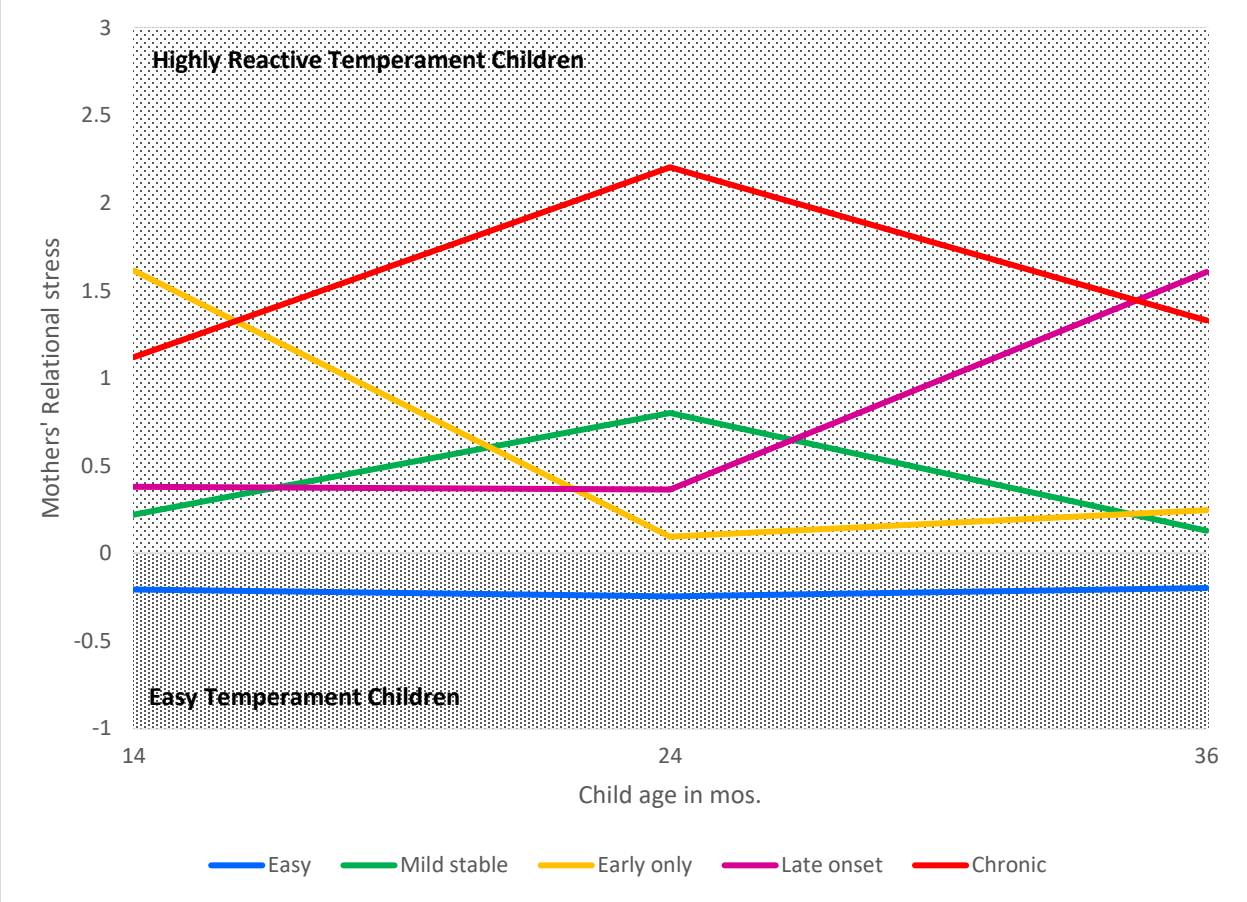

Figure 2.1 Profiles of Child Temperament and Mothers' Relational Stress Over Time.
Note: Profile variables are mean-centered such that values above 0 = higher than average and below 0 = below average.

As seen in Figure 2.1, at the 14 month timepoint, mothers could be classified into three basic levels, low, mild, and high, with respect to their report of relational stress. With regard to the four profiles characterized by similarly high levels of child reactivity, levels of reported relational stress at 14 months that look similar in the figure (mild stable with late onset; early only with chronic) are, in fact, not significantly different from one another. By 24 months, patterns among the dyads containing highly reactive children had diversified into four statistically distinct groups with three patterns showing relative consistency with 14 month levels and one whose mothers' early subjective experience changes substantially over time. By 36 months, patterns have, again, coalesced into low, mild, and high levels of relational stress with another profile (Late onset) now showing substantial change from the prior assessment, experiencing high relational stress (at levels similar to those with chronically high stress) only at this later time period. The other variable profile, originally characterized by very high relational stress at 14 months (Early only), now showed lower levels comparable those who experience consistently mild levels of relational stress.

Predictors of Profile Patterns

The automatic three strep approach via the R3STEP command in Mplus 7.3 (Muthén & Muthén, 1998-2013) was used to assess potential predictors of profile membership. This method provides the advantage of estimating the five profile RMLPA solution and then considering mostly likely profile membership while taking into account classification error rate when determining whether variation in predictor variables results in an increased likelihood of belonging to one profile over another. The R3STEP procedure, by default, employs listwise deletion. As a result, to account for missing data on potential predictors of profile membership, multiple imputation was employed to generate 10 sets of complete data to be used in subsequent analyses. Due to the nature of and very small quantity of missing data on sex (43 cases. 1.43%) and program assignment (24 cases 0.8%), these variables were not imputed. TYPE=IMPUTATION and R3STEP were subsequently used with all 10 datasets to examine

predictors of profile membership and present combined results. Data imputation was able to original profile delineation while allowing profile pattern prediction to be carried out with complete data.

Preliminary analyses of proposed covariates revealed no differences among profiles based on Early Head Start program assignment or sex. Maternal risk positively predicted the likelihood of belonging to the early only relational stress group over both the easy temperament group (odds ratio = 1.49) and the profile characterized by high reactivity and consistently lower relational stress (odds ratio = 1.59). Subsequent models retained maternal risk as a covariate of other potential predictors.

Table 2.3 presents R3STEP results for comparisons of interest. Each of the parent characteristics tested significantly contributed to the probability of belonging to at least one pattern over another. However, the only child characteristics to predict profile membership of any type were 14 month vocabulary production and 36 month observed negativity toward and engagement of the mother.

Table 2.3 *Predictors of Profile Patterns*

	Highly Reactive Temperament						Easy Temperament			
	Mild Stable v. Chronic	Late onset v. Chronic	Early only v. Chronic	Mild Stable v. Late onset	Mild Stable v. Early only	Late onset v. Early only	Easy v. Mild Stable	Easy v. Late onset	Easy v. Early only	Easy v. Chronic
Parent Characteristics										
Knowledge of Child Development										
14 month	1.17*	0.77	-0.25	0.39	1.42***	1.02*	0.08	0.48	1.5***	1.25**
24 month	0.63	0.19	0.78	0.44	-0.15	-0.59	0.46*	0.9*	0.32	1.09**
Personal Mastery	0.16**	0.15*	0.07	0.01	0.09*	0.08	0.17***	0.18***	0.25***	0.33***
Child Skills										
Receptive Vocabulary										
14 month	0.02	0.00	0.01	0.01	0.01	0.00	0.00	0.01	0.01	0.01
36 month	-0.01	0.01	0.00	-0.01	0.00	0.01	0.01	-0.01	0.00	0.00
Vocabulary Production										
14 month	-0.01	-0.02	0.02	0.00	-0.03*	-0.04	0.00	0.01	-0.03*	-0.01
24 month	0.01	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.01	0.01
Orientation/Engagement										
14 month	0.47	0.34	0.36	0.13	0.11	-0.02	-0.15	-0.02	-0.03	0.32
24 month	-0.68	-0.14	-0.60	-0.15	-0.08	0.46	0.11	-0.43	0.03	-0.57
36 month	-0.03	0.22	-0.13	-0.54	0.10	0.35	0.00	-0.25	0.10	-0.04
Emotion Regulation										
14 month	0.19	0.34	0.24	0.17	-0.05	0.11	0.11	-0.04	0.06	0.30
24 month	0.17	0.00	0.23	-0.25	-0.06	-0.23	0.02	0.19	-0.04	0.19
36 month	-0.07	-0.41	-0.06	0.35	-0.01	-0.36	-0.01	0.34	-0.02	-0.08
Child Behavior										
Obs. Child Engagement										
14 month	-0.05	0.13	-0.11	-0.11	0.05	0.24	0.07	-0.11	0.13	0.02
24 month	0.12	0.00	0.21	0.12	-0.09	-0.21	0.08	0.20	-0.01	0.21
36 month	0.05	-0.22	0.20	0.26	-0.16	-0.42	0.10	0.37*	-0.06	0.15
Obs. Child Negativity										
14 month	0.00	0.11	-0.25	-0.11	0.25	0.36	-0.11	-0.22	0.14	-0.11
24 month	-0.16	-0.29	-0.09	0.14	-0.07	-0.20	0.12	0.26	0.05	-0.04
36 month	-0.62*	-0.76	-0.60	0.15	-0.02	-0.17	0.06	0.20	0.04	-0.56*

Note: Values are estimates from the R3STEP logistic regression analyses. Positive values indicate that increases in the predictor value increase the likelihood of belonging to the top profile of the column pair; negative values indicate that increases in the predictor value decrease the likelihood of being in the top profile of the column pair.
*p < .05, **p < .01, ***p < .001

Comparison of Profiles of Highly Reactive Children

With regard to proposed predictors of profile patterns, mothers' knowledge of child development and feelings of personal mastery, appear to protect mothers of highly reactive children from experiencing chronically high relational stress. Mothers with greater knowledge of child development and a greater sense of personal mastery at 14 months were more likely to report consistently mild rather than consistently high levels of relational stress. Personal mastery appears to contribute to a more understanding and satisfying experience of dyadic interactions with highly reactive children in infancy and early toddlerhood. The greater a mother's sense of personal mastery, the more likely she was to demonstrate a pattern of consistently low relational stress, or at least of lower stress during all but the last timepoint. In contrast, less knowledge of child development and a lower sense of personal mastery appears to contribute to heightened stress, particularly early on, as parents reporting lower levels of these characteristics were more likely to experience distress related to dyadic interactions at 14 months, which either did or did not persist beyond that.

In addition, the only child characteristic distinguishing between mothers of highly reactive children reporting consistently low versus consistently high levels of dissatisfaction with the parent-child relationship was observed child negativity expressed toward the parent at the 36 month timepoint. Mothers with chronically high relational stress had children who showed higher levels of expressed negativity toward their mother during the later observed interaction than those whose subjective experience was consistently more positive throughout early childhood. Child vocabulary was the only child characteristic distinguishing between mothers experiencing heightened relational stress early on and those with consistently mild stress. In this case, a broader productive vocabulary at 14 months actually contributed to the likelihood of experiencing early relational stress over consistently lower levels.

In terms of characteristics that distinguish between early only and late only relational stress, mothers' knowledge of child development at 14 months appears to positively influence mothers' early subjective experience, while child engagement of the mother at 36 months appears to protect against late onset relational stress. None of the proposed predictors distinguished between mothers of highly reactive children experiencing early but not persistent and chronically high relational stress or those experiencing consistently mild and late onset relational stress.

Comparison of Profiles of Highly Reactive to Easy Children

As to factors beyond children's temperamental reactivity that predict the likelihood of belonging to the easy profile (which is coupled with consistently low levels of relational stress) over any of the patterns of mothers' subjective experience of their relationships with their highly reactive children, the maternal characteristics of knowledge of child development and a sense of personal mastery contribute to the likelihood of being in the easy + low relational stress profile over both the chronically high and consistently mild relational stress patterns. As with the likelihood of being in the consistently mild stress profile over the chronically highly stressed group, only higher expressed child negativity when children were 36 months old increased the probability of experiencing chronically high relational stress over consistently low stress. In general, these results demonstrate that mothers' characteristics contribute more to patterns of their subjective experience of the parent-child relationship over time than do children's behaviors or developing skills; in particular, maternal knowledge and attitudes are important components of mothers' perception of the relationship developing with their highly reactive children.

Discussion

The present study examined patterns of stability and change in mothers' subjective experience of relational stress in the context of parenting children with varying degrees of temperamental reactivity. Dyads were classified into five patterns, one comprised of children with an easy temperament whose mothers reported very little relational stress, and four profiles of highly reactive children whose

mothers experienced different patterns of relational stress throughout the course of early childhood. Two of the groups which included highly reactive children showed stability of stress levels across the study period with one group of dyads experiencing consistently mild relational stress and the other chronically high levels. The remaining two profiles show variation in levels of mothers' reported relational stress over time indicating that change in mothers' early perceptions of parenting their highly reactive children is possible. However, while one group showed apparent improvement in that they exhibited early but not persistent relational stress, the other profile with evidence of change reported late onset relational stress occurring when children were 36 months old. Membership in each profile was differentially related to mothers' knowledge of child development and the degree to which they believed their life circumstances to be under their own control. In addition, the breadth of children's vocabulary at 14 months and their observed behavior toward their mothers at 36 months varied between certain profiles.

Parent Knowledge and Dispositions as Predictors of their Subjective Experience

Both knowledge of child development and mothers' sense of their own personal mastery appear to positively contribute to mothers' subjective experience of parenting regardless of child temperament, plausibly making them key targets of intervention. As levels of mothers' knowledge and mastery increased, they were more likely to be in either of the consistently lower stress profiles whether they were parenting children with low or high reactivity. While parenting children with "easy" temperaments is associated with little relational stress in general, perhaps the finding that knowledge and mastery contribute to consistently low stress irrespective of temperament is indicative of the bidirectional nature of the parent-child relationship. Particularly with respect to mastery, perhaps what began as a mother-centered attitude about her control over her life circumstances is reinforced by parenting an "easy" child. In the same way, perhaps parents who are better able to accept and respond to their highly reactive children, due in part to this personal sense of agency, have this responsiveness reciprocated.

Such mutual responsiveness could then lead children to develop skills to effectively manage and utilize their reactive tendencies (Kim & Kochanska, 2012), thus reinforcing their mothers' sense of parental self-efficacy.

Child Vocabulary

The finding that children with a broader vocabulary at 14 months are more likely to have mothers who report concurrent relational stress may be a result of discordance between children's communication or language abilities and mothers' expectations. Highly reactive infants, who display greater emotional expression, both positive and negative, and more frequently make requests for their mothers' assistance and support, develop greater language skills (Moreno & Robinson, 2005; Robinson & Acevedo, 2001). It may be, though, that infants who are more reliant on their mothers may cause an early elevation in relational stress, particularly if this is discrepant with mothers' initial expectations of the relationship. In addition, as these highly reactive infants develop more advanced language ability early on, mothers might come to expect more verbal communication or an increased ability to use verbal communication strategies rather than emotional ones before children are capable of such higher order emotion regulation strategies. As a result, these mothers may be less responsive to their children's emotional expressions, thereby exacerbating negative expression and increasing relational stress early on.

There is also some evidence that mothers are more likely to attempt to regulate their children's emotional expressions and to use a broader range of regulatory strategies when children are younger than in late toddlerhood (Spinrad, Stifter, Donelan-McCall, & Turner, 2004). Highly reactive children likely present more frequent and varied opportunities for mothers to respond to expressions of negativity. Because these maternal responses may be verbal in nature, they may be contributing to children's own early vocabulary production. While such verbal responses may be sensitive and co-regulatory in nature, it may also be the case that these verbal responses are intended to dismiss or

minimize infants expressions of negativity (Scaramella & Leve, 2004; Spinrad et al., 2004). This may, in fact, be increasing children's emotional arousal and failing to assist infants in regulating their feelings (Scaramella & Leve, 2004; Spinrad et al., 2007), which in turn contributes to mothers' dissatisfaction with dyadic interactions at this early stage.

Relational Stress and Children's Observed Behavior

The only child characteristic distinguishing between mothers of highly reactive children reporting consistently low versus consistently high levels of dissatisfaction with the parent-child relationship was observed child negativity expressed toward the mother at the 36 month timepoint. It is possible that this represents a child contribution to heightened stress in relation to heightened reactivity. At the same time, it is worth noting that child negativity toward the mother at 14 and 24 months did not contribute to the likelihood of being in the chronically highly stressed group. This could be an indication that the relational environment created by mothers who were less understanding and accepting of their children's reactive tendencies is instead contributing to children's expressed negativity later on.

In keeping with the idea of goodness-of-fit, the experience of relational stress is related to both individual child characteristics and to the mother’s subjective experience of her child’s reactions and behaviors (Deater-Deckard, 2008; Gavita, David, & DiGiuseppe, 2014; Greene, Abidin, & Kmetz, 1997; Webster-Stratton, 1990) and highlights the importance of considering how parents' perceptions can affect their experience of parenting. As previously noted, there were no associations between heightened relational stress and observed expressed child negativity at 14 or 24 months. In addition, children's regulatory ability at any stage did not increase the likelihood of being in any one group over another. Taken together, these results reinforce the idea that it is mothers' subjective experience, her perceptions of how "difficult" her highly reactive child is and not necessarily her child's actual reactive behaviors, that determine the quality of the emerging relationship.

While study results demonstrate that early patterns of interaction between children's temperamental reactivity and mothers' subjective experience of parenting are not inalterable, we were unable to detect specific maternal or child characteristics that facilitated certain patterns of change. We were interested in predicting likelihood of being in the early but not persistent relational stress profile as opposed to the chronically highly stressed profile since both start out with very high relational stress, but the early only mothers' subjective experience seems to improve over time. Unfortunately, none of the candidate facilitators of change presented the key to improving mothers' subjective interpretation of their highly reactive children's behaviors. Future work will be needed to determine how best to lower relational stress for mothers of highly reactive children who experience high levels of dissatisfaction with dyadic interactions early on.

We also looked for differences between the late onset profile and mothers who reported a consistently positive experience of dyadic interaction with their highly reactive children in order to determine what might be changing for those mothers experiencing elevated stress just at 36 months. Again, none of the candidate predictors provided any insight here. This may be due in part to the fact that the parent predictors were only captured at 14 and 24 months, and, while we did measure the child level predictors at 36 months, child characteristics, in general, do not appear to be the primary drivers of mothers' subjective experience.

The internal reliability of our measure of mothers' knowledge of child development was low (α = .62). As such, results relating to the predictive quality of child development knowledge should be interpreted with caution. Because methods to increase parents' knowledge, perhaps with a particular view toward individual differences in temperament, may be comparatively easy to implement, we believe it remains a worthwhile target for interventions aimed at improving parent-child relationship quality.

Additionally, while the current study set about to specifically explore variations in the relational stress that results from mothers' perceptions of their highly reactive children, we acknowledge that, particularly for our predominantly low income sample, the stresses associated with the larger ecological context of poverty and scarcity of resources cannot be overlooked. Although the demographic risk composite was included in the models, and higher risk did add to the likelihood of experiencing early, but not necessarily persistent, relational stress, other contextual characteristics likely exert critical influence on the parent-child dyad. For example, risk factors associated with impoverished communities such as neighborhood violence may lead parents to restrict children's autonomy and independent mobility (Foster, Villanueva, Wood, Christian, & Giles-Corti, 2014) and alter parents' disciplinary styles in ways that may or may not be adaptive for children's later outcomes (Fitzgerald, McKelvey, Schiffman, & Montañez, 2006; Valentino, Nuttall, Comas, Borkowski, & Akai, 2012). Because development is a function of dynamic interrelated and co-acting systems, each of these factors is likely also intertwined with considerations of race and ethnicity as well as the degree of co-parental support and fathers' direct influence which, while beyond the scope of the current study, are important considerations that can inform our understanding of the larger context and complexity in which our study families are situated.

Conclusions

These findings confirm that there is distinct heterogeneity in maternal response to children's heightened reactivity, which suggests that there is wide variation in the relational environments experienced by highly reactive children. Not only did some mothers experience pronounced relational stress while others did not in response to similar levels of child reactivity at various points throughout early childhood, but these patterns of stability and change in relational stress over time were primarily influenced by maternal knowledge and dispositions rather than variation in children's behavior or skills. Results highlight the important role maternal cognitions and beliefs have in influencing both their own

experience of and satisfaction in the parenting role as well as shaping the relational environments in which highly reactive children develop.

CHAPTER 3: CHILDREN'S ENVIRONMENTAL SENSITIVITY TO MOTHER'S SUBJECTIVE EXPERIENCE: PERSON X ENVIRONMENT FIT IN RELATION TO CHILDREN'S LONGITUDINAL OUTCOMES

Introduction

Current research indicates that quite often, neither biological nor environmental factors solely constitute the determinants of behavior. Instead, development reflects a bidirectional exchange between innate individual biology and the external environment, often by way of interpersonal interaction with others (Overton, 2015; Porges & Furman, 2011; Schore, 2001, 2012; Siegel, 2001). Child temperament is no exception. Temperament is a biologically-based construct that remains relatively stable over time (Kagan & Snidman, 2009; Rothbart et al., 2000). However, rather than being conceptualized as a fixed set of preprogrammed traits that lead necessarily to predictable behaviors or psychological outcomes, temperament may be more accurately considered a measure of tendencies. These tendencies do not determine the future, but rather provide the foundational potential for future success or challenge based on the qualities of their interaction with the environment. In addition, variations in temperamental reactivity correspond to variations in sensitivity to context such that reactive children experience heightened sensitivity to both positive and negative qualities of the environments in which they develop (Pluess & Belsky, 2010).

The developmental impacts of inborn traits like temperament may be best understood as a function of person x environment fit and the complex interplay between parent and child characteristics. Prior temperament research has produced mixed findings regarding its relation to parenting wherein some studies find characteristics associated with "difficult" temperament to be associated with negative parenting behaviors (Perry, Dollar, Calkins, & Bell, 2018; van den Akker, Dekovic, Prinzie, & Asscher, 2010) while others find no influence of temperament (Padilla & Ryan, 2019) or associations with more positive parenting behaviors (Brown et al., 2011) suggesting variation in parents' response to children's reactivity. Because relationships are co-constructed, parental

perceptions of the child and of the emerging parent-child relationship are important factors affecting both parenting behavior (Dalimonte-Merckling & Brophy-Herb, 2019; Haskett, Ahern, Ward, & Allaire, 2006) and children's later development (Alink, Cicchetti, Kim, & Rogosch, 2009; Burt, McGue, Iacono, & Krueger, 2006; Haskett et al., 2006). Alterations over time in parents' subjective experience of the emerging relationship with their highly reactive child also have the potential to impact subsequent child outcomes.

Considering the primacy of the mother-child relationship in early development and the evidence that temperamentally reactive children are more sensitive to environmental influences, the aim of the current research is to specify environmental, in this case parent-child relational, conditions that characterize a good fit with temperamental reactivity as it relates to children's later academic and social-emotional outcomes. Previous work (Paper 1 - formal citation to be included later) has established distinct patterns of variations in children's temperamental reactivity and mothers' subjective experience of the parent-child relationship. Some highly reactive children have mothers who accept and respond favorably to their heightened intensity while others have mothers who experience pronounced dissatisfaction with the emerging relationship at varying points in early childhood (Dalimonte-Merckling & Brophy-Herb, 2019; Paper 1 - formal citation to be included later). Because we know highly reactive children are more sensitive to their environments (Belsky & Pluess, 2009), an important continuation of this work is to explore whether these longitudinal patterns of interaction between temperamental reactivity and mothers' perceptions of the parent-child relationship differentially impact reactive children's achievement and adjustment in later childhood. Further, given the evidence that boys are more sensitive to relational stresses in early childhood due to biological and experiential variation (see Golding & Fitzgerald, 2019 for a review), we also consider possible sex differences in associations between patterns of temperamental reactivity and relational stress and children's later academic and social-emotional outcomes. What follows is a review of some the processes and mechanisms by which

biology and environment interact to shape individual experience and behavior, particularly for those with heightened environmental sensitivity.

Environmental Sensitivity of Highly Reactive Children

Studies have shown correlations between temperamental aspects categorized as difficult and both positive and negative child outcomes (Keiley et al., 2003; Kochanska et al., 2007). These mixed findings may be due, in part, to children's individual differences in response to experience. There have been a number of studies showing that children with reactive temperaments experience heightened sensitivity to the effects of parenting quality or variations in parenting behaviors (Belsky, 1997; Belsky & Pluess, 2009; Pluess & Belsky, 2010; Scarr & McCartney, 1983). With regard to the interactions, or co-actions, between biology and environment, some individuals experience greater sensitivity to environmental influences as a result of their biological make up (Belsky & Pluess, 2009; Ellis & Boyce, 2008, 2011). Under this framework, certain biological traits may confer added risk in adverse environments, but also added benefit under enriched conditions. (Bakermans-Kranenburg & van Ijzendoorn, 2011; Belsky, 2005; Kochanska, Kim, Barry, & Philibert, 2011). There is a wealth of evidence suggesting that particular variations in temperament phenotype (Aron et al., 2012; Belsky & Pluess, 2009; Kim & Kochanska, 2012; Pluess & Belsky, 2010) represent just such markers of sensitivity to the environment. Taken together with the developmental salience of interpersonal interaction in early childhood, the relational environments characterized by variations in how parents receive and respond to their child's temperament may be particularly impactful for these children who are more sensitive to their surrounding context.

Early Sensitivity of Boys

Evidence suggests that, by way of differences in both biology and social experience, boys may be more sensitive than girls to certain environmental conditions (Schore, 2017), particularly relational stresses such as maternal depression (Carter, Garrity-rokous, Chazan-cohen, Little, & Briggs-gowan,

2001) and disruptions in emerging attachment relationships (Paquette & Dumont 2013). Studies show differential outcomes for boys in terms of behavior problems (Mileva-Seitz et al., 2015; Pasco Fearon & Belsky, 2011) and the attentional and executive functioning (Mileva-Seitz et al., 2015) skills needed for academic performance.

Right brain development, which is facilitated by interpersonal interaction, is slower for male infants (Schore, 2017) than females, rendering males sensitive, and therefore more vulnerable, over a longer period to experiences of relational stress. Such protracted vulnerability to interactive stresses may be one mechanism by which variations in parent-child relational dynamics over time differentially impact boys' later outcomes. Also, for both boys and girls, early physiological and emotional regulation is affected by, even managed by, infants' interactions with caregivers. However, boys may have more difficulty regulating their own emotional state as infants and require even more support from their mothers than girls (Tronick, 2007, p. 340). If boys, in general, have slower rates of right brain development and greater inherent difficulty regulating their emotional states, then heightened reactivity in boys may present a type of double jeopardy, wherein the quality of the emerging parent-child relationship as well as changes in the quality of interactions over time may have an even more profound impact on later developmental outcomes than that hypothesized for highly reactive girls.

Mothers' Subjective Experience and Child Outcomes

Mothers' subjective experience and ensuing parent-child relationship quality has been shown to impact child outcomes both directly and by way of its impact on mothers' behavior toward the developing child. High levels of parental distress and perceived parent-child dysfunctional interaction are associated with increased child behavior problems (Haskett et al., 2006; Mogro-Wilson, Negroni, & Hesselbrock, 2013), child depressive symptoms (Huth-Bocks & Hughes, 2007) and decreased social competence (Anthony et al., 2005). In addition, the quality of early mother-child relationships is

foundational for later academic performance both directly and by impacting the development of children's regulatory skills (Chazan-Cohen et al., 2009; Harmeyer et al., 2016)

Relational stress inhibits mothers' ability to accurately interpret and respond to children's cues (Molfese et al., 2010). As a result, the experience of parent-child interactional stress is typically associated with less optimal parenting behaviors, including harsh or ineffective discipline and less nurturing parenting (Anthony et al., 2005; Haskett et al., 2006). In response to children's heightened reactivity, greater relational stress is also associated with higher levels of negative regard toward the child persisting throughout early childhood through the preschool period (Dalimonte-Merckling & Brophy-Herb, 2019). As such, relational stress could also impact children's later outcomes by way of its deleterious effects on parenting behavior, which is consistently shown to be a key contributor, not only to children's social-emotional development (Kochanska, Murray, & Harlan, 2000), but also to children's academic achievement and adjustment, both directly (Downer & Pianta, 2006; NICHD ECCRN, 2002) and in relation to the development of the self-regulation skills necessary for school success (Blair, 2002b; Brophy-Herb, Zajicek-Farber, Bocknek, McKelvey, & Stansbury, 2013; Montroy, Bowles, Skibbe, & Foster, 2014). Given the bidirectional nature of the parent-child relationship, these adversely impacted parenting behaviors could serve to amplify the challenging behaviors children exhibit in response to their reactive tendencies, compounding the effect on mothers' dissatisfaction with the emerging relationship. It is, therefore, important to explore how stability or change over time in the interaction between reactive child temperament and mothers' experience of the emerging relationship differentially impacts subsequent children's outcomes.

Prior Work

Using a person-centered analysis, Dalimonte-Merckling (Paper 1 - formal citation to be included later) previously identified five naturally-occurring profiles of mother-child dyads distinguished by either low or high child reactivity and variations in patterns of mothers' subjective experience of the parent-

child relationship through infancy and toddlerhood. One profile was comprised of children with easy temperaments and mothers who experienced very little relational stress. The other four profiles included children with heightened reactivity and various patterns of mothers' perceptions of the emerging parent-child relationship in early childhood. While there were no statistically significant differences in children's temperamental reactivity among these four profiles, patterns of mothers' perception of the emerging relationship over time varied. Two profiles were characterized by stability of mothers' subjective experience, one with chronic relational stress and one with consistently low reports of dissatisfaction with the emerging relationship. There were also two groups of children whose mothers' subjective experience of parenting their highly reactive child changed over time, one group with early but not persistent relational stress and one group experiencing only late onset relational stress. Pursuant to exploring person x environment fit in understanding how relational environments differentially impact environmentally sensitive children's development, the current study examined subgroup differences in children's academic and social-emotional outcomes at the transition to Kindergarten and when children were 10 years of age, both as they relate to comparisons between highly reactive children whose mothers' subjective experience of the relationship varies, and as they relate to comparisons between boys and girls.

The Current Study

The current study extends prior findings (Dalimonte-Merckling & Brophy-Herb, 2019; Paper 1 - formal citation to be added later) by further examining relational environments characterized by chronic or changing experiences of relational stress to identify the consequences of dyads' differing developmental pathways. The first purpose was to examine profile differences in academic and social-emotional outcomes at ages 5 and 10 years for reactive children whose mothers were persistently highly stressed across the toddlerhood period as compared to those whose mothers remained only mildly stressed as well as to the less reactive children. Through the reciprocal nature of relationship building,

stability may be beneficial for dyads characterized by low child reactivity and low stress or high reactivity and mild stress. At the same time, because we know that parents who experience heightened parenting stress in response to their highly reactive children display less optimal parenting behaviors (Dalimonte-Merckling & Brophy-Herb, 2019) and have seen longitudinal transactional effects between parenting stress and child behavior (Mackler et al., 2015), such stability may prove detrimental to these dyads. In the interest of person x environment interaction, we examine whether better parent-child "fit", as evidenced by mothers' greater understanding and acceptance of their child's heightened reactivity and therefore less reported relational stress, contributes to better child outcomes as compared to those reactive children with chronically highly stressed parents. We also explore whether the experience of pronounced relational stress at only one timepoint results in comparatively better achievement and adjustment at later school age. The aim is to ascertain whether, even for those who initially experience pronounced distress and dissatisfaction, an improvement in mothers' subjective experience of the emerging relationship results in better outcomes for children relative to highly reactive children whose mothers were in the chronically highly stressed group. Alternatively, it may be that lower stress in the early years provides a buffer against negative child outcomes even when higher relational stress is experienced later. Given the evidence that highly reactive children are more sensitive to both positive and negative environmental conditions, comparisons were also conducted to investigate whether these paths result in positive outcomes that exceed the competencies of their less susceptible peers in the low reactivity group. We suspect a good match between child reactivity and mothers' subjective response to it constitutes the type of contextual environment that would allow highly reactive (more environmentally sensitive) children to flourish at levels above their less reactive peers. Child outcomes tested encompass a range of domains, both academic and social emotional in nature, known to be impacted by parent-child relationship quality and whose trajectories, established prior to school entry, tend to be maintained as children enter adolescence. Finally, possible sex differences in comparative

outcomes were explored with a view toward establishing whether patterns vary according to the proposed increased vulnerability of boys.

Methods

Participants

Data for the current study are part of the national Early Head Start Research and Evaluation (EHSRE) Project which enrolled participants between 1996 and 1998 (Love et al., 2005). Seventeen research sites across the United States participated in an evaluation of Early Head Start, a federally-funded comprehensive family support and child development program.

At enrollment, mothers were primarily Caucasian (37%), African American (34%), and Hispanic/Latino (23%), 22.6 years of age (SD = 5.77), with limited education (74.4% with no more than a high school education). Annual gross income averaged only $9,277 (SD = $8,421). The full study sample included 3,001 Early Head Start eligible children (1,510 males) and their primary caregivers (99% mothers). Data used in the current study were collected near children's 14, 24, and 36 month birthdays, within six months of Kindergarten enrollment, and when children were in the 5th grade. Sample size was limited to respondents who remained the same mother at each wave of data collection used in the original profile delineation.

Measures

Profile dimensions.

Parent report of child temperament. Temperamental reactivity was measured with the Negative Emotionality subscale from the parent-reported of the Emotionality, Activity, Sociability, and Impulsivity Temperament Survey (A. H. Buss & Plomin, 1984) at 14 months. The Negative Emotionality Subscale captures children's tendency to be quickly or intensely emotional. Items, including “gets upset easily”, and “reacts intensely when upset,” are rated on a 5-point scale from (1) Not at all like my child to (5) Very characteristic of my child (α = .72).

Mothers' subjective experience of relational stress. Maternal report of the extent to which her child does not meet her expectations and her dissatisfaction with the emerging parent-child relationship was measured when children were 14, 24, and 36 months old with the Dyadic Interaction subscale (Whiteside-Mansell et al., 2007) of the Parenting Stress Index-Short Form (Abidin, 1995). Following a factor analysis, Whiteside-Mansell et al. confirmed a 5 factor structure for the PSI. Sample items include, "Most times I feel my child does not like me and does not want to be close to me," and "My child smiles at me much less than I expected." Items are rated from (1) Strongly Disagree to (5) Strongly Agree (6 items: $\alpha = .66$; $\alpha = .66$; $\alpha = .70$).

Outcomes measured at pre-Kindergarten and grade 5

Academic achievement. At the pre-Kindergarten wave, the Woodcock-Johnson Letter-Word and Applied Problems assessments (Woodcock & Johnson, 1989) were administered to assess children's reading and mathematics knowledge. The Letter-Word test is designed to capture children's ability to identify isolated letters and words ($\alpha = .84$). Standard scores with a mean of 100 and a standard deviation of 15 were used. The Applied Problems score represents children's emerging arithmetic and numeracy skills ($\alpha = .85$). In 5^{th} grade, assessments from the Early Childhood Longitudinal Study, Kindergarten Cohort study (ECLS-K: Pollack, Najarian, Rock, Atkins-Burnett, & Hausken, 2005) were used. The reading subtest is an adaptive assessment measuring basic skills such as phonemic awareness along with vocabulary and comprehension. IRT-generated scores were used. The mathematics assessment is designed to capture conceptual and procedural knowledge, as well as problem solving performance. The math routing test consisted of the same 18 items administered to all children. Scores reflect the number answered correctly.

Academic ability. Academic ability was assessed at grade 5 via the Matrix Reasoning subtest of the Wechsler Intelligence Scale for Children (WISC-IV: Williams, Weiss, & Rolfhus, 2003), a 35 item test designed to measure children's fluid reasoning by asking them to complete a presented matrix by

choosing the best of five provided responses. Split-half and test-retest reliabilities from the published measure are .88 and .79 respectively. Age-appropriate scale scores were used.

Child socio-emotional competence. At pre-Kindergarten, the Leiter-R Examiner Rating Scales (Roid & Miller, 1997) were used to assess children's socio-emotional competence. The Cognitive-Social composite score is derived from the Attention, Impulse Control, Activity Level, and Sociability subscales and reflects focus, thoughtfulness, and likeability (α = .96), The Emotion Regulation composite score is derived from the Energy and Feelings, Mood and Regulation, Anxiety, and Sensory Reactivity subscales and is meant to reflect the child's emotion regulation and indistractibility (α = .93). After interacting with the child during the assessment, subscale items were rated by the examiner on a 4-point scale with high scores indicating higher self-regulation and attention during the tasks. At 5th grade social emotional competence was measured with the Self-Control subscale Social Skills Rating System - Teacher Report. Teachers were asked to rate children on 7 items pertaining to ability to respond appropriately in situations of peer aggression or teasing, controlling temper in conflict situations, and propensity toward self-directed cooperation and compromise (α = .92). Responses choices included never, sometimes, or very often.

Data Analyses

All analyses were carried out using Mplus version 7.3 (Muthén & Muthén, 1998-2012). Full-information maximum likelihood (FIML) estimation was employed to account for missing data. The automatic three step approach in Mplus using the DU3STEP command was used to compare outcomes across profiles obtained using repeated measures latent profile analyses (RMLPA). The RMLPA approach was adopted to capture variations in patterns of mothers' subjective experience of parenting in relation to individual differences in their children's temperamental reactivity without imposing restrictions on those patterns across time. Prior analysis revealed 5 distinct profiles: easy temperament + low relational stress, highly reactive temperament + consistently mild relational stress, highly reactive temperament +

late onset relational stress, highly reactive temperament + early but not persistent relational stress, and highly reactive temperament + chronic relational stress. The automatic three step approach, using DU3STEP, consists of first estimating the RMLPA (a replication of prior results) (1) classifying dyads into their most likely profile membership based on posterior probabilities (2), and accounting for possible classification error (3) while testing mean differences between profiles on outcomes of interest. DU3STEP is designed to be used with continuous outcomes and is recommended when distal outcome variances are unequal across profiles (Asparouhov & Muthén, 2014) The four profiles comprised of highly reactive children but whose mothers differed in their subjective experience of relational stress over time were compared with a view toward understanding outcomes associated with variations in relational stress for those children with heightened sensitivity to their environments. In the interest of differential susceptibility, additional comparisons between profiles of highly reactive children and their less environmentally sensitive peers were also explored. Finally, all models were rerun using the manual three step approach, in order to incorporate KNOWNCLASS option to explore possible sex differences. This method required testing differences in the specific profile comparisons via the Model Constraint command to explore whether any differences in outcomes found conformed to the same pattern for boys and girls or whether there appeared to be additional environmental sensitivity for boys.

Results

Descriptive Characteristics

Table 3.1 shows correlations between study variables for the full sample. Profile dimensions and child outcomes were associated in the expected directions.

Table 3.1 *Descriptive Statistics and Correlations among Study Variables*

		1	2	3	4	5	6	7	8	9	10	11	12
Profile Dimensions													
1.	Temperamental Reactivity	1											
2.	14m Relational Stress	.23**	1										
3.	24m Relational Stress	.20**	.41**	1									
4.	36m Relational Stress	.19**	.39**	.45**	1								
Pre-Kindergarten Outcomes													
	Academic Achievement												
5.	Prek Reading	-.07**	-.07**	-.08**	-.07**	1							
6.	PreK Mathematics	-.09**	-.10**	-.11**	-.09**	.81**	1						
	Social-emotional												
7.	PreK Emo. Regulation	-.02	-.12**	-.09**	-.04	.15**	.21**	1					
8.	PreK Cognitive-Social Skills	-.06*	-.11**	-.10**	-.09**	.21**	.27**	.74**	1				
5th Grade Outcomes													
	Academic Achievement												
9.	Grade 5 Reading	-.10**	-.12**	-.18**	-.10**	.23**	.38**	.30**	.35**	1			
10.	Grade 5 Mathematics	-.09**	-.10**	-.13**	-.10**	.19**	.36**	.21**	.28**	.68**	1		
	Academic Ability												
11.	Grade 5 Matrix Reasoning	-.05	-.09**	-.11**	-.07**	.14**	.27**	.21**	.27**	.49**	.53**	1	
	Social-emotional												
12.	Grade Self-Regulation	-.07	-.10**	-.14**	-.14**	.01	.02	.11**	.22**	.25**	.24**	.20**	1
	Mean	2.96	1.46	1.44	1.51	81.29	81.05	91.14	93.61	127.56	8.38	8.44	1.46
	SD	.95	.62	.60	.64	21.08	23.46	9.80	10.47	28.00	4.66	3.29	.49

*p < .05, **p < .01, ***p < .001

Child temperamental reactivity was weakly negatively associated with academic achievement outcomes at both the pre-Kindergarten assessment and 5th grade, as well as with teacher report of children's pre-Kindergarten cognitive-social skills. Children's temperamental reactivity is not associated with academic ability, pre-Kindergarten emotion-regulation, or 5th grade self-regulation.

Profile Differences in Child Outcomes

The DU3STEP command was used to examine group differences in children's academic and social emotional outcomes at Kindergarten entry and age 10. Results for comparisons of interest are shown in Table 3.2 and summarized in Figure 3.1.

Table 3.2 *Results of Equality of Means Testing for Child Outcomes*

	Highly Reactive Temperament						Easy Temperament			
	Mild Stable v. Chronic	Late onset v. Chronic	Early only v. Chronic	Mild Stable v. Late onset	Mild Stable v. Early only	Late onset v. Early only	Easy v. Mild Stable	Easy v. Late onset	Easy v. Early only	Easy v. Chronic
Pre-Kindergarten										
Reading	1.75	0.25	0.02	0.58	1.72	-0.16	0.36	2.11	4.49*	3.92*
Mathematics	4.61*	0.27	0.21	2.7	3.24†	0.004	1.67	8.82**	9.42**	10.76**
Cognitive-Social	15.02***	1.04	1.24	3.61†	3.61†	-0.02	-3.04†	2.03	1.68	11.70**
Emotion Regulation	10.24**	9.95**	9.00**	0.03	0.42	0.14	0.03	0.23	1.63	16.84***
Grade 5										
Reading	10.25**	0.04	1.35	9.15**	0.82	-1.14	0	11.63**	1	12.75***
Mathematics	4.95*	1.99	0.68	0.69	3.15†	0.54	0.45	2.13	6.64*	7.72**
Matrix Reasoning	14.74***	0.66	3.96*	8.43**	3.12†	-1.63	-2.84†	7.25**	0.93	12.18***
Self-regulation	1.25	0.01	0.10	0.64	0.07	-0.71	0.05	2.99†	0.57	5.18*

Note: Values are differences between column profiles obtained from the DU3STEP equality of means analyses.
†p < .10, *p < .05, **p < .01, ***p < .001

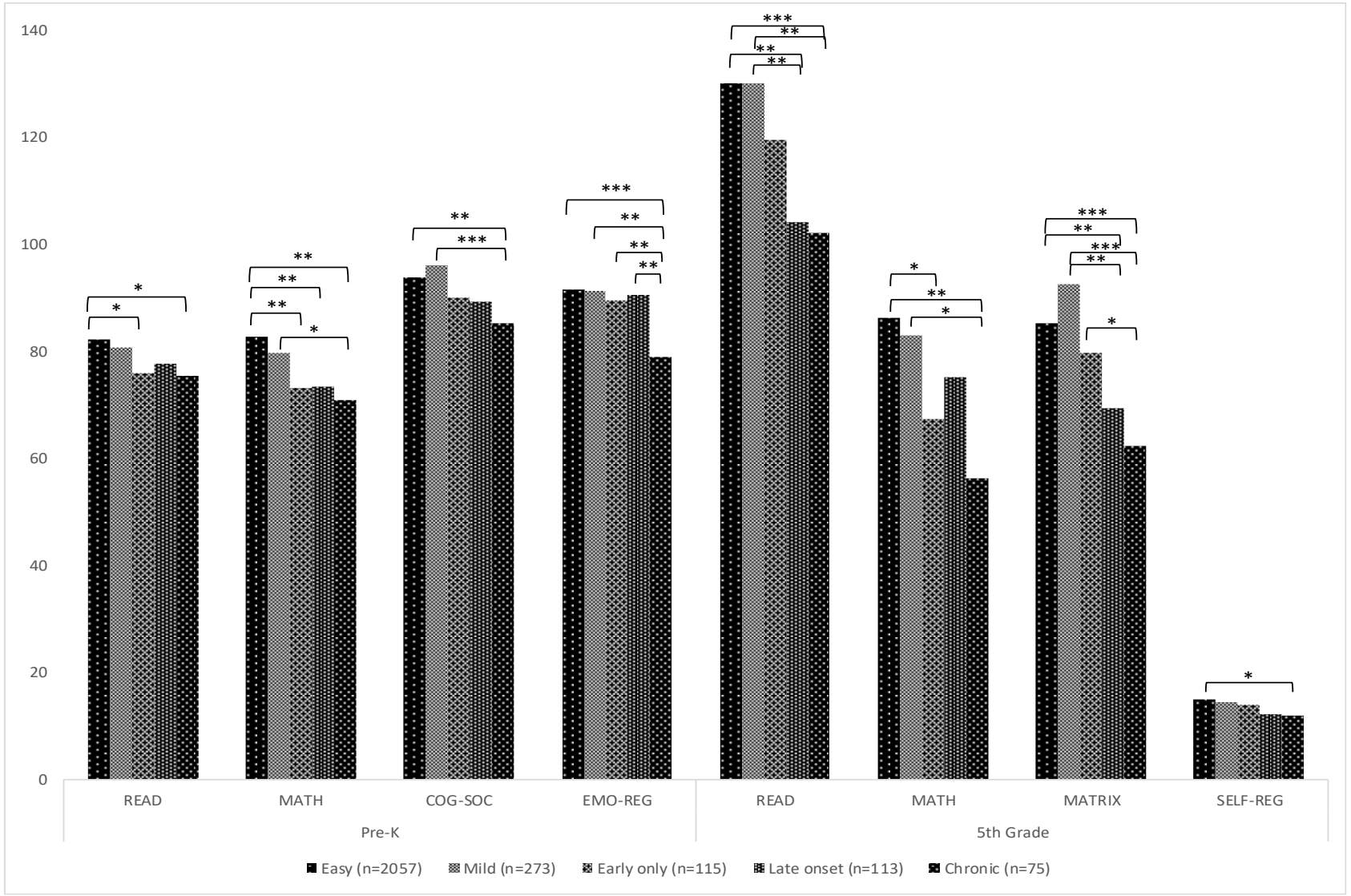

Figure 3.1 Equality of Means Comparisons for Pre-K and 5th Grade Child Outcomes

Note: Values for 5th grade Mathematics, Matrix Reasoning, and Self-regulation have been multiplied by 10 to aid in visual representation.
*p < .05, **p < .01, ***p < .001

Academic achievement. There were no mean differences between any of the groups comprised of highly reactive children on pre-Kindergarten reading. By the 5th grade reading assessment, highly reactive children with mothers reporting chronically high or late onset relational stress scored lower than those in the consistently mild stress group. Amongst the profiles of highly reactive children, the only mean differences in mathematics scores were between the two extremes, with the chronically high stress profile scoring significantly lower than the consistently mildly stressed profile, at both pre-Kindergarten and grade 5. There were also mean differences on achievement scores between some of the highly reactive profiles compared to the easy temperament children. Heightened temperamental reactivity combined with higher relational stress at any time point was associated with lower Kindergarten math scores than children in the easy temperament profile, and both early and chronic relational stress for highly reactive children was associated with lower than easy children's Kindergarten reading scores and 5th grade math scores. For the 5th grade reading assessment, highly reactive children whose mothers reported chronic or late onset stress had significantly lower scores than those for easy children. There was, however, no difference in academic achievement between children with easy temperaments and highly reactive children whose mothers were never highly stressed, indicating that highly reactive kids do just as well on reading and math when parent perceptions of the relationship are positive and dyadic interactions are satisfying.

Academic ability. On the other hand, variation in mothers subjective experience of the parent-child relationship over time is associated with a number of subgroup differences in academic ability. Among groups consisting of highly reactive children, consistently low relational stress is associated with higher matrix reasoning relative to all other highly reactive profiles, including those with late onset (effect size: Hedges' g = .43), early by not persistent (Hedges' g = .25), and chronically high relational stress (Hedges' g = .58). None of these other three highly reactive profiles are significantly different from one another, indicating that heightened maternal dissatisfaction with the emerging parent-child

relationship is associated with lower academic ability whether it is variable or persistent. In addition, children with reactive temperaments show evidence of differential susceptibility related to academic ability in that highly reactive children whose environment consists of little relational stress outperformed their less environmentally sensitive peers on the matrix reasoning assessment. Mean scores for matrix reasoning were highest among highly reactive children whose mothers experienced consistently low parenting stress, beyond the scores of those children with easy temperaments, although not enough to reach statistical significance (p = .09, Hedges' g = .19).

Social-emotional competence. Like the results for academic ability, high levels of relational stress at any of the measured time points throughout early childhood is associated with lower pre-Kindergarten cognitive-social scores for highly reactive children, with chronic and early stress being the most detrimental. Consistent with the theory of differential susceptibility, not only do highly reactive children have lower cognitive-social scores in the context of relational stress, but they also exceed the scores of their less susceptible, easy peers to a small degree when mothers' perception of the emerging relationship is positive (p = .08, Hedges' g = .17). In terms of rank order, highly reactive children whose mothers consistently rate their subjective experience as positive show the highest cognitive-social scores, followed by children with easy temperaments and highly reactive children whose mothers experience heightened relational stress at the latter time point only. Highly reactive children whose mothers report early relational stress, whether it persists or dissipates, demonstrate the lowest cognitive-social scores.

Heightened relational stress appears to be detrimental to children's development of emotion regulation in pre-Kindergarten only when it is chronic in nature. The other three highly reactive profiles (Mild stable, Early only, and Late onset) and the profile of easy temperament children have statistically similar scores and are all significantly higher on emotion regulation than the chronically stressed group. While there is no evidence of mean differences on 5th grade self-regulation between the other three

subgroups, highly reactive children whose mothers report chronic relational stress do show significantly lower teacher reported self-regulation than those with easy temperaments (Hedges' g = .48).

Sex Differences

Means and standard deviations for overall sex differences on outcomes are listed in Table 3.3.

Table 3.3 *Descriptive Statistics for Outcome Variables by Sex M(SD)*

	Girls	Boys	*t*	*p-value*
Pre-K				
Socio-emotional				
Cognitive-social skills	96.07(9.59)	91.21(10.74)	10.13	< .001
Emotion regulation	92.96(9.35)	89.36(9.90)	7.91	< .001
Academic achievement				
Reading	83.63(21.10)	79.11(20.80)	4.99	< .001
Mathematics	82.93(22.76)	79.33(23.97)	3.56	< .001
5th Grade				
Socio-emotional				
Self-regulation	1.55(.44)	1.37(.51)	5.35	< .001
Academic achievement				
Reading	130.22(25.33)	125.06(30.11)	3.63	< .001
Mathematics	8.06(4.41)	8.67(4.87)	-2.55	.01
Academic ability				
Matrix reasoning	8.58(3.23)	8.31(3.34)	1.6	n.s.

Girls' values were significantly higher on average for each tested socio-emotional outcome as well as all academic achievement outcomes with the exception of 5th grade math, where boys scored significantly higher. This is in line with what we know about girls' more advanced early regulatory development (Kochanska, Coy, & Murray, 2001; K. E. Williams, White, & MacDonald, 2016) as well as the school age gender gap in mathematics achievement favoring boys (K. E. Williams et al., 2016). Notably, there is no significant difference on matrix reasoning, our measure of academic ability, and the one that more closely captures fluid intelligence. When RMLPA models were compared in a multigroup format, the two pre-Kindergarten socio-emotional outcome models showed significant improvement in model fit when parameters were freed to vary between boys and girls (pre-K cognitive-social: $\Delta\chi^2$(10, N

= 2680) = 62.60, p < .001; pre-K emotion regulation: $\Delta\chi^2(10, N = 2681) = 42.84$, p < .001). Table 3.4 shows the results of comparisons of interest in pre-Kindergarten socio-emotional outcomes separately by sex.

Girls. As seen in Table 3.4 and Figure 3.2, for girls, patterns showed interesting deviations from those of the sample as a whole. In both of the outcome models wherein sex differences were evident, easy temperament girls and highly reactive girls whose mothers reported late onset relational stress scored highest, higher than highly reactive girls whose mothers reported only mild relational stress throughout the study period. For emotion regulation, chronically high and early but not persistent relational stress had the most negative impact on scores and were statistically indistinguishable from one another.

For cognitive-social skills, highly reactive girls whose mothers reported chronically high relational stress had the lowest scores. In this case, however, they were statistically indistinguishable not only from those in the early but not persistent profile, but also from those whose mothers reported consistently mild stress. In addition, highly reactive girls whose mothers showed late onset stress scored significantly higher than those in every other profile, including the easy temperament profile (*M* = 99.75 *SD* = 6.67; *M* = 97.20, *SD* = 13.74, Hedges' *g* = .19). This suggests highly reactive girls demonstrated the potential to outperform their less sensitive, easy peers, but they did so when mothers reported heightened stress at 36 months alone.

Table 3.4 *Results of Equality of Means Testing for Pre-K Socio-Emotional Outcomes for Girls and Boys*

	Highly Reactive Temperament						Easy Temperament			
	Mild Stable v. Chronic	Late onset v. Chronic	Early only v. Chronic	Mild Stable v. Late onset	Mild Stable v. Early only	Late onset v. Early only	Easy v. Mild Stable	Easy v. Late onset	Easy v. Early only	Easy v. Chronic
Girls										
Cognitive-Social	0.52	10.05**	2.89	9.52***	-2.37	7.15**	6.98***	-2.54*	4.61*	7.50*
Emotion Regulation	2.18	3.70	-1.06	-1.52	3.25†	4.77*	1.66	0.14	4.90***	3.84
Boys										
Cognitive-Social	11.84 **	5.63	6.26	6.21	5.58	-0.63	-2.8	3.4	2.78	9.04**
Emotion Regulation	9.12	6.40	2.16	2.72**	6.96	4.24	-0.45	2.27***	6.51	8.67

Note: Values are differences between column profiles obtained from the manual 3-step Model Constraint tests of equality of mean differences.
*p < .05, **p < .01, ***p < .001

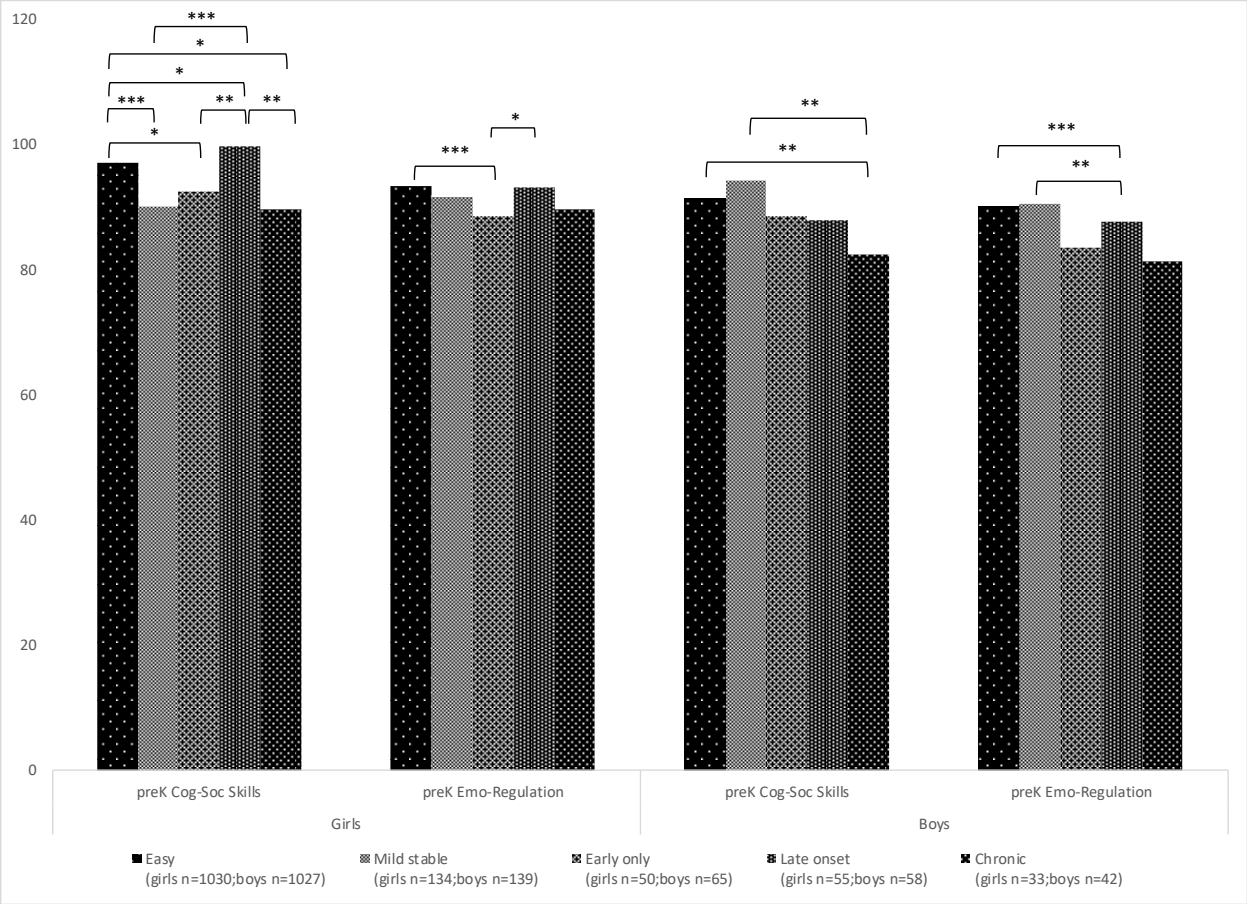

Figure 3.2 Equality of Means Comparisons for Girls and Boys on Pre-K Socio-Emotional Outcomes
*$p < .05$, **$p < .01$, ***$p < .001$

Boys. For both measures of socio-emotional competence at pre-Kindergarten, boys showed patterns consistent with a differential susceptibility hypothesis wherein highly reactive children in what was considered the most optimal environment, that of consistently lower relational stress, had the highest scores, although still lower than the two highest profiles of girls. For emotion regulation, boys' scores in the mild stable profile were indistinguishable from those in the easy temperament profile. In the case of cognitive-social skills, however, they outperformed their less environmentally sensitive peers in the easy profile to a small degree ($M = 94.26$ $SD = 22.90$; $M = 91.46$, $SD = 15.19$, Hedges' $g = .17$). Highly reactive boys whose mothers experienced consistent dissatisfaction with parent-child interactions, ostensibly the "worst" environment, scored lowest. While girls scored higher than boys on

cognitive-social skills on average, the distance between the mean scores in the highest and the lowest scoring profiles was greater for boys. Post-hoc tests for homogeneity of variance reveal significantly greater variance in boys scores over girls (F = 13.20, p. < .001). Combined with lower mean scores, this increased variability results in both an underrepresentation of boys in the high tail (χ^2 (1) = 22.58, *p.* < .001; ratio of girls to boys: 1.95:1) and a significantly higher representation of boys in the low tail of the score distribution (χ^2 (1) = 42.28, *p.* < .001; ratio of girls to boys: 1:2.63). As relational stress can be seen to impact boys' later cognitive-social skills, the greater variability in boys' scores may suggest, in part, that highly reactive boys are particularly sensitive to their relational environments relative to this outcome prior to formal school entry.

Discussion

The present study examined mean differences on subsequent child outcomes for five distinct subgroups of mother-child dyads characterized by quantitative and qualitative variation in mothers' subjective experience of relational stress in early childhood in response to children's individual differences in temperamental reactivity. Profiles were differentially related to children's academic and social-emotional outcomes at the transition to Kindergarten and in 5th grade. Profile comparisons provided some evidence of increased environmental sensitivity such that reactive children in least optimal environments fared worse than children in all other profiles and better, in some cases, than even their less sensitive, "easy" temperament, peers. For two of the eight outcomes of interest, these results were moderated by sex.

Academic

Overall, group differences for academic achievement, as indicated by reading and math performance prior to school entry and by middle childhood, reflect the expected negative impact of relational stress at any point throughout early childhood and the particularly deleterious effect of chronic relational stress. Previous research presents mixed findings regarding the association between

temperament and academic performance (A. Collins, O'Connor, & McClowry, 2017; Supplee, Shaw, Hailstones, & Hartman, 2004) with evidence pointing to the importance of considering reactivity in interaction with the context in which the child develops (Obradović, Bush, Stamperdahl, Adler, & Boyce, 2010). In the current study, temperamental reactivity was weakly associated with academic achievement both prior to school entry and in late childhood when looking at the sample as a whole. However, further exploration of person x environment interaction reveals that highly reactive children perform just as well as their easy temperament peers in environments of low relational stress.

In addition, consistent with differential susceptibility research (Blair, 2002a), highly reactive children had the potential to score higher than their less environmentally sensitive peers on matrix reasoning, the measure most closely related to intelligence, in optimal environments. Many of the qualities that typically characterize difficult or challenging temperaments, including heightened reactivity and emotional intensity, are often associated with gifted children (Mendaglio, 2002; Wellisch & Brown, 2013). Current results provide additional evidence that the heightened environmental sensitivity experienced by highly reactive children can also be associated with advanced cognitive ability.

Social-emotional

Concurrent observed child regulation did not contribute to profile membership (Paper 1 - formal citation to be included later). However, by age 5 years, the relational environments experienced by children differentially impacted their regulatory ability. Again, study results confirm the differential susceptibility hypothesis in that those high in temperamental reactivity demonstrated better and worse outcomes than the comparison groups depending on the quality of the developmental context. Highly reactive children had particularly low socio-emotional competence scores, whether measured as cognitive-social skills or emotion regulation at pre-Kindergarten or self-regulation at grade 5, but only if those children experienced an environment characterized by relational stress. Confirming the increased potential for positive outcomes, children high in temperamental reactivity outperformed their less

susceptible peers in terms of pre-Kindergarten cognitive-social skills, a measure of focus, thoughtfulness, and sociability, if they experienced more optimal parent-child relationships.

Unmanaged reactivity is likely an unwelcome and uncomfortable experience for a child and could be self-perpetuating. Such susceptible individuals may eventually become anxious in anticipation of being anxious knowing they have few resources with which to cope. Their sense of self-efficacy in their ability to handle events could be adversely affected, even their belief in whether they have any control over their circumstances. Development of emotion regulation, a skill linked to inhibitory control and compliance (Dennis, 2006; Koole, 2008; Vohs & Baumeister, 2013), may be particularly amenable to a differential susceptibility model as it has been shown to be significantly affected by early experience (Thompson, Easterbrooks, & Padilla-Walker, 2003). Perhaps in environments characterized by particularly supportive parenting, a high-quality parent-child relationship may have assisted highly reactive children in developing strategies for managing emotion (Bocknek, Brophy-Herb, & Banerjee, 2009). An ability to regulate emotion could contribute significantly to an ability to inhibit a dominant behavioral response as well as allow for the attentional focus necessary for successful compliance and social interactions.

Sex Differences

The two socio-emotional outcome models at the transition to Kindergarten showed evidence of sex differences in the relative impact of profile membership on outcomes. Boys' pattern of profile differences in outcomes mirrors that of the sample as whole with boys in early environments characterized by consistently lower relational stress showing the highest regulatory ability at the transition to Kindergarten. In the case of cognitive social skills, examiners rated highly reactive boys whose mothers experienced consistently lower relational stress as demonstrating the most focus, organization, and sociability. One possible explanation for why this pattern was apparent for boys but not girls may be that early on higher distress leads infant boys to seek proximity and contact from their

mothers (Buss, Brooker, & Leuty, 2008) and that they may be better able to take advantage of mothers' co-regulation efforts (Haley & Stansbury, 2003). Haley and Stansbury (2003) found that infant boys showed greater regulation during reunion following the stress-inducing still-face episode. Regulation in Haley and Stansbury's study was defined as a combination of infants' willingness to return to socially attending to their mothers and essentially whether this strategy was effective at decreasing infants' negative affect. These findings are in line with prior research suggesting that boys are more socially-oriented than girls in still-face episodes (Weinberg, Tronick, Cohn, & Olson, 1999). For plausibly double sensitive highly-reactive boys who, when distressed, are particularly in need co-regulatory support, this social orientation may indicate a proclivity for proactively seeking that support and benefitting from it. This may be especially true when early relational environments characterized mutually reinforcing mother-child interactions have generated an expectation of supportive response. These early skills may establish particularly positive trajectories in some boys regulatory abilities. Once established, these early foundations of regulatory ability likely persist.

With respect to profile comparisons of pre-Kindergarten regulatory ability, girls with easy temperaments and highly reactive girls whose mothers report late onset relational stress had the highest scores on both examiner-rated cognitive-social skills and emotion regulation. By nature, easy temperament individuals experience less reactivity and are, therefore, likely to appear more regulated and easily sociable. Late toddlerhood often presents as a time of increased expression of negativity and protests of restriction as toddlers assert their autonomy (Brophy-Herb, Bocknek, Choi, Senehi, & Douglas, 2018). This may be especially true of highly reactive children, and girls in particular may express more frustration in response to limit setting (Paquette & Dumont, 2013). Rather than study results suggesting that an environment of late onset relational stress leads to better cognitive-social skills, it may be instead that highly reactive girls who are poised to have the most well-developed cognitive-social skills later on are particularly "difficult" for mothers during late toddlerhood. It is important to

remember that mothers in the late onset profile are mothers who were generally understanding and accepting of their children's reactive tendencies at the earlier waves. Because of this early maternal support, these environmentally sensitive girls have likely developed their own sense of agency and may consequently exert higher levels of resistance and willful noncompliance at this later timepoint as they work to integrate and internalize maternal demands with their own autonomous desires.

Additionally, mothers may expect children to be moving from co-regulation toward self-regulation as children enter their third year (Raikes, Robinson, Bradley, Raikes, & Ayoub, 2007). This may be especially so for girls, for whom society often has higher expectations for socio-emotional competence. Highly reactive girls, however, may continue to need more co-regulation than their "easy" temperament counterparts. If discrepant with mothers' expectations, this could lead mothers' to experience higher levels of relational stress in late toddlerhood than they reported previously. Still these girls go on to develop more advanced regulatory ability than their peers, in part, as a result of these initially accepting mothers' conceivable continued regulatory support despite this decrease in their feelings of satisfaction with dyadic interactions during late toddlerhood. Perhaps, as a result of the opportunities presented by increased temperamental reactivity, by the transition to Kindergarten, these girls have learned, out of necessity, how to employ resources to regulate their emotion or attention that other children have not yet had a need for and may have a sort of running start on applying those same skills in increasingly more complex situations.

Although it was beyond the scope of the study to evaluate mechanisms by which relational stress impacts later child outcomes, study results provide clear evidence that variation in the relational environment created by maternal dissatisfaction with the emerging parent-child relationship in combination with children's reactive tendencies differentially impacts children's development. In addition, in order to effectively distinguish between person x environment interactions that represent cases of diathesis-stress versus those that evidence differential susceptibility, it is necessary to

formulate studies with expanded environments, which include exposure to both positive and beneficial contexts as well as adverse and potentially detrimental conditions. Our study was limited instead to the absence of mothers' dissatisfaction with the parent-child relationship as it forms. We may have detected further evidence of differential susceptibility if our measure encompassed a broader range of positive maternal perceptions.

While a portion of the influence of mothers' subjective experience of parenting on later child outcomes is surely a function of growing up in a relational environment characterized by acceptance and understanding versus one of dissatisfaction and disappointment, such relational stress may also impact mothers' willingness to seek out and take advantage of available resources (Abidin, 1992). In this way, even for mothers' who respond favorably to their reactive tendencies, the availability of resources, or lack thereof in our at-risk sample, may still prevent children from exercising their full potential. Along with programs designed to improve mothers' perceptions of their highly reactive children and satisfaction with emerging parent-child relationship, we must recognize the broad stressors and persistent disparities that remain if we don't engage in larger efforts to lift families out of poverty and alleviate persistent inequality in economic security and opportunity.

Conclusions

The idea that individuals vary in their sensitivity to environmental influences has important implications for research, practice, and policy. Theories associated with variations in environmental sensitivity, such as those relating to differential susceptibility and the related idea of biological sensitivity to context as well as sensory processing sensitivity, suggest a reframing of the ideas of both risk and resilience. As such, an understanding of the manner in which early parent-child relationship quality is associated with children's outcomes is important in order to highlight individual differences in children's academic achievement and ability as well as developing social emotional competencies as a result of exposure to relational stress at varying points throughout early childhood.

In the current study, highly reactive children were found to be particularly vulnerable to environments characterized by chronic relational stress. In some cases, they were also capable of outperforming their less sensitive peers. Thus, special attention should be given to designing interventions to increase mothers' knowledge and understanding of temperamental variation and the increased potential for both positive and negative outcomes for their highly reactive children. In addition, mothers of highly reactive children may derive particular benefit from programs aimed to enhance social support. The results of the current study also underscore the value of using a person-centered approach to the study of person x environment fit. A person-centered approach may particularly important to the study of variations in environmental sensitivity as it is precisely these variations in the degree to which individuals are affected by external influences that may be masked in studies of mean differences and sample averages.

CHAPTER 4: INTEGRATED DISCUSSION

Study 1 examined patterns of stability and change in mothers' subjective experience of relational stress in the context of parenting children of varying degrees of temperamental reactivity. Dyads were classified into five patterns, one comprised of children with an easy temperament whose mothers reported very little relational stress, and four profiles of highly reactive children whose mothers experienced different patterns of relational stress throughout the course of toddlerhood. Two of the groups that included highly reactive children showed stability of stress levels across toddlerhood with one group of dyads experiencing consistently mild relational stress and the other chronically high levels. The remaining two profiles show variation in levels of mothers' reported relational stress over time indicating that change in mothers' early perceptions of parenting their highly reactive children is possible. However, while one group showed apparent improvement in that they exhibited early but not persistent relational stress, the other profile with evidence of change reported late onset relational stress occurring when children were 36 months old. Membership in each profile was differentially related mothers' knowledge of child development and their sense of personal mastery. In addition, the breadth of children's vocabulary at 14 months and their observed behavior toward their mothers at 36 months varied between certain profiles.

Study 2 expanded on the results of study 1 by examining mean differences on subsequent child outcomes for the five naturally occurring subgroups of mothers and children characterized by both level and stability or change mothers' relational stress in response to children's reactivity. Profiles were differentially related to children's academic and socio-emotional outcomes at the transition to Kindergarten and in 5th grade. Profile comparisons provided some support of differential susceptibility such that reactive children in least optimal environments, those characterized by chronic relational stress, fared worse than children in all other profiles and better, in some cases, that even their less

sensitive, "easy" temperament, peers. For two of the eight outcomes of interest, these results were moderated by sex.

Integrated Interpretation

Maternal Perceptions

Taken together, the results of these studies emphasize the importance of considering maternal perceptions and mothers' subjective experience of parenting their highly reactive children. Results highlight the important role maternal cognitions and beliefs have in influencing both their own experience of and satisfaction in the parenting role as well as shaping the relational environments in which highly reactive children develop. If children's reactive tendencies are perceived as difficult or challenging, mothers experience dissatisfaction with interactions with their children and may conceivably attempt to minimize, dismiss, or punish emotional expression (Root & Rasmussen, 2017). Highly reactive children who are more sensitive to their surrounding environments may grow up in contexts characterized by frustration and negative feedback. On the other hand, if highly reactive children are understood and accepted, mothers may provide the optimal interactions needed for these environmentally sensitive children to thrive and excel. These maternal perceptions may also be shaped by differential expectations for girls versus boys. When children's behavior is discrepant with these preconceptions, particularly with respect to expressions of temperamental reactivity, the trajectory of the emerging parent-child relationship may be altered in ways that impact girls and boys differently.

Environmental Sensitivity

The above studies explore selected aspects of environmental sensitivity. Given the evidence that highly reactive children are more sensitive to their developmental context, the combined results of these studies confirm there is distinct variation in mothers' experience of the emerging parent-child relationship and that those differing patterns of mothers' relational stress over time differentially impact children's outcomes. This helps us understand that not only does the experience of chronic relational

stress have a deleterious impact on children's outcomes, but heightened stress even at only one timepoint in early childhood can lead to lower academic achievement and regulatory ability later in childhood. At the same time, the results of study 2 provide some support for the idea that temperamentally reactive children are more sensitive to positive environments as well, particularly in the areas of academic ability and the development of cognitive social skills. In many ways, environmental sensitivity is a question of potential. Certain individuals may have a biological predisposition to be negatively impacted by even normative levels of environmental adversity. However, that same sensitivity to context appears to bring with it an increased capacity for cognitive, emotional, and ultimately social benefit if paired with a sensitive, responsive, stimulating environment well within the plausible range of parenting or caregiver behaviors.

Value of a Person-centered Approach to the Study of Individual Differences

The studies in this dissertation demonstrate that person-centered approaches can be used as a means to properly investigate goodness of fit with respect to parent-child relationships. By examining mother and child level characteristics in combination, the analyses in study 2 revealed that the joint contribution of mothers and children is important in determining later child outcomes. As suggested by Thomas and Chess (1968), optimal outcomes arise from a good match between the demands and expectations of the environment and the child's own characteristics and capacities. Because of the fundamental ability of person-centered approaches to capture complex interactions as well as the allowance of model specification, it is possible to simultaneously examine parent and child characteristics in one mixture model to potentially reveal parent-child "matches" that are more or less effective in preventing risk or facilitating success.

Because the interrelationship between an individual and his or her contextual environment is central to development from an ecological perspective, the study of interaction effects is of particular interest. Person-centered approaches inherently capture the interactions among multiple variables

without the need to choose a specific moderating variable (Van Horn et al., 2009). Approaches that establish latent classes have been shown to be useful for modeling complex and even non-linear relationships in ways that facilitate interpretability (Lanza, Rhoades, Greenberg, & Cox, 2011; Little et al., 2007). These approaches are able to reveal both quantitative and qualitative differences among the different subgroups providing a richer view of developmental processes in context.

Implications

The findings from study 1 confirm that there is heterogeneity in maternal response to children's heightened reactivity, which suggests that there is wide variation in the relational environments experienced by highly reactive children. Not only did some mothers experience pronounced relational stress while others did not in response to similar levels of child reactivity at various points throughout early childhood, but these patterns of stability and change in relational stress over time were primarily influenced by maternal knowledge and dispositions rather than variation in children's behavior or skills. Rather than a function of the frequency or intensity of the expression of children's reactive tendencies, how mothers' perceive their children is driving force behind their experience of relational stress in the emerging parent-child relationship. Both knowledge and mastery emerged as important predictors of mothers' perceptions. Each has important implications for future intervention design. Knowledge represents an important target for intervention, perhaps particularly with respect to normative individual differences in temperamental reactivity. Providing parents with knowledge of the potential for temperamentally reactive children to excel may help reshape parents expectations and interpretations of their children's behavior.

The finding that mothers' own sense of personal control over her circumstances, her sense of agency, is an integral component in defining her parenting experience, particularly when faced with an intense, reactive child, is vitally important to our understanding of mothers' subjective experience and has important implications when viewed from within the larger ecological context, particularly for

mothers families navigating a constellation of stressors. Not only may the circumstances of poverty disrupt parent-child relationship development by way of the additional stresses associated with economic insecurity, time restrictions, health disparities, and lack of resources and access to systems of support, but the milieu associated with context of poverty is often characterized by a lack of respect from multiple sources that can strain an individual's sense of agency and even self-worth. Interventionists may be able to take steps to promote parents' sense of agency and mastery directly, but policymakers need to carefully consider the assault on dignity presented by our systems of service, particularly the design and implementation of our current social safety net meant to assist and uplift families in need.

Conclusions

Results add to our understanding of the antecedents and consequences of variations in fit between children's temperamental reactivity and mothers' perceptions and subjective experience of the emerging parent-child relationship. Developmental processes are not determined by biology, but rather individual biologically-based differences contribute to the level of impact experiences have on outcomes. Environmental sensitivity theories provide a new perspective on the concepts of both risk and resilience. It is possible that some of what we currently conceptualize as risk should be seen as increased potential for greatness. Perhaps certain traits that would result in negative outcomes when paired with suboptimal environments would also be the means by which certain individuals are able to achieve exceptionality. Perhaps resilience ought also to be reframed as a resistance to environmental influence. This may be an underlying explanation of how some children seem able to maintain positive outcomes in the face of suboptimal circumstances. At the same time, these same children may also not benefit from intervention when it is needed.

It has long been accepted that individuals vary in their response to environmental stimuli. While some children suffer the adverse effects of harsh environments, others are able to maintain positive

outcomes despite suboptimal circumstances. Population heterogeneity requires consideration of statistical methods that go beyond variable-centered strategies which assume uniform effects of predictors on outcomes. As with any research looking to examine small subsets of the population, it can be difficult to design studies that adequately capture, with statistical power, the phenomenon under investigation. Person-centered approaches are able to reveal small, but important, subgroups that may disappear in traditional investigations of mean differences and may prove to be an important tool in enabling us to better understand those differentially impacted by particular contexts (Connell & Frye, 2006; von Eye & Bogat, 2006).

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