

CHILDREN'S ATTENTIONAL AND BEHAVIORAL PERSISTENCE AND  
THE DEVELOPMENT OF EXTERNALIZING BEHAVIOR PROBLEMS:  
A PROCESS ORIENTED PERSPECTIVE SPANNING EARLY CHILDHOOD  
THROUGH THE SCHOOL-AGE YEARS

by

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DEDICATION

To My Beloved Family

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## ABSTRACT

### CHILDREN'S ATTENTIONAL AND BEHAVIORAL PERSISTENCE AND THE DEVELOPMENT OF EXTERNALIZING BEHAVIOR PROBLEMS: A PROCESS ORIENTED PERSPECTIVE SPANNING EARLY CHILDHOOD THROUGH THE SCHOOL-AGE YEARS

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Effortful control is comprised of regulatory processes that are dynamically organized in real time to achieve situational and interpersonal goals. Yet, we know little about how the levels of children's effortful control change over a relatively short span of time and what implications such patterns may have for children's adjustment. In the present study, individual differences in preschoolers' effortful control processes during a cognitively challenging task were examined using a latent class growth analysis. Child and family risk factors were included in the model as potential predictors of different effortful control profiles. Concurrent and longitudinal associations between effortful control profiles and externalizing behavior problems also were explored. Participants were 235 children (113 girls) at elevated risk for conduct problems. Mother-child dyads were

assessed for the child's effortful control and the mother's emotional and behavioral responsiveness via a videotaped, challenging block design task completed at home when children were 3 years old. Parents and teachers reported on child externalizing problems at the ages 3, 6, and 10 years. Child gender, child IQ, and family socioeconomic status were also incorporated in the analysis. Our analysis revealed three distinct patterns of changes in child effortful control during the block task: high-persistence (58%), declining persistence (14%), and low-persistence (28%). In each trajectory, child characteristics predicted the initial levels of effortful control whereas maternal behavioral responsiveness was associated with the maintenance of effortful control throughout the task. High- and low-persistence profiles were differentiated by child IQ and maternal behavioral responsiveness in the expected directions. Children in the three identified classes showed different levels of aggressive behavior during the block task. Furthermore, boys in the high-persistence class exhibited higher levels of externalizing behavior problems on teacher-ratings than those in the low-persistence class at ages 6 and 10. Generally, the identified effortful control profiles did not show significant relations to externalizing problems in girls, a finding that suggests gender-differentiated developmental pathways to externalizing behaviors. Results are discussed with respect to the value of microanalyses of children's early effortful control behaviors for prevention of externalizing behavior problems.

## CHAPTER I

### INTRODUCTION

The ability to regulate one's behaviors and affect in accord with social standards and contextual demands is among the hallmarks of successful development in childhood. Such set of abilities define the construct of self-regulation, which has been proposed as a key element of understanding children's successful and pathological adjustment (Kopp, 1982; Posner & Rothbart, 2000). Self-regulation consists of a wide array of processes that draw from both executive function and emotion regulation capacities, which are interrelated and activated for goal achievement. Researchers have distinguished between reactive and effortful mechanisms that comprise self-regulation (Derryberry & Rothbart, 1997; Posner & Rothbart, 2000). The reactive component refers to relatively automatic regulatory processes that emerge early in life, and includes the child's natural tendency to react in certain ways to environmental stimuli (Derryberry & Rothbart, 1997). These initial forms of regulation are supplemented by more voluntary, effortful forms of regulation as the child gets older with neurological maturation of the attentional network system (Rothbart, Adahi, & Evans, 2000; Rothbart & Bates, 2006). Although basic processes for effortful regulation begin to develop in infancy (e.g., shifting attention), its major development takes place during the toddler years and becomes more complex and stable by the preschool period (Calkins & Fox, 2002; Campbell, 2002). These later

developing regulatory processes assist the child in regulating emotional and motivational reactions (e.g., anger, approach for reward) that have dominated the child earlier in life. Not surprisingly, individual differences in self-regulation have shown links to various realms of adaptive functioning in children and adolescents. Deficits in early regulatory abilities have been associated with both externalizing (Zhou et al., 2007) and internalizing problems (Buckner, Mezzacappa, & Beardslee, 2009), decreased school readiness (Blair, 2002) and academic achievement (Buckner et al., 2009), and problematic peer relations (Spinrad et al., 2004). These findings highlight self-regulation as a risk factor for later maladjustment and as a potential target for early intervention for children and families.

It is widely accepted that parent-child interaction is the primary context for the development of self-regulation (Kopp, 1989). As noted, the development of children's regulatory systems takes place in early childhood, a period when children are largely dependent on their parents for their physical and emotional needs. As children grow, they learn to be their own agents of regulating their emotional and behavioral reactivity, a process aided by cognitive maturation and internalization of parental values and standards (Dix, 1991; Hoffman, 1983). Accordingly, early parent-child interaction and parenting practices have been shown to have a strong impact on children's later ability to self-regulate behaviors and affect (Cicchetti & Toth, 1997; Gottman & Katz, 2002). Thus, in order to better understand the development of children's self-regulation abilities, it would be important to focus on the early childhood years and to take into account parent-child interpersonal contexts and interaction qualities.

Although the importance of self-regulation for children's adjustment has been

broadly recognized, and much research has studied children's self-regulation in the context of parent-child interaction, to the best of my knowledge, no study has conducted a microanalysis of the relationship between parenting behaviors and momentary changes in self-regulation. It would be valuable to know whether children's levels of self-regulation change over time during a problem solving task, and whether and how these patterns contribute to individual differences in early childhood psychopathology. The present longitudinal study addressed these questions by examining time-sequential changes of regulatory processes in children during mother-child challenging interactions when children were three years old and their relationship to children's externalizing behavior problems when they were three, six, and ten years old. Maternal behaviors during the interaction were also included in the study as potential factors of influence on children's self-regulation. Finally, given that research has documented gender differences in self-regulation (Else-Quest, Hyde, Goldsmith, & Van Hulle, 2006; Kochanska, Murray, & Harlan, 2000), externalizing behavior problems (Card, Stucky, Sawalani, & Little, 2008; Keenan & Shaw, 1997; Kerr, Lopez, Olson, & Sameroff, 2004), and parental socialization of children (Lytton & Romney, 1991; Maccoby, Snow, & Jacklin, 1984; Smetana, 1989), differences in these relations by child gender were explored.

For this dissertation, I will focus on the construct of "effortful control" (EC) which is a willful, voluntary form of self-regulation (versus automatic, reactive regulation) that underlies emotional, behavioral, and social adjustment. In what follows, I will review prior research on the construct of effortful control, the parent-child relationship as a primary context for the development of effortful control, and

externalizing behavior problems as an outcome of deficits in effortful control<sup>1</sup>. Gender differences in each of these topics will also be summarized. Some gaps in the current literature will be noted, with a proposal as to how they will be addressed in this study.

### The Construct of Effortful Control

Effortful control (EC) is defined as “the efficiency of executive attention, including the ability to inhibit a dominant response and/or to activate a subdominant response, to plan, and to detect errors” (Rothbart & Bates, 2006, p. 129). Children with high EC abilities are more persistent in their goal-directed behaviors and less distracted. They are able to wait for preferred, but delayed, rewards and not react impulsively to immediate rewards. EC is a key construct of self-regulation and is comprised of two components, attention regulation and inhibitory control, both of which are reviewed below.

According to temperament theorists, a central mechanism by which children develop self-regulation is attentional control (Derryberry & Rothbart, 1988). In the early months, infants rely on their caregivers for regulatory needs. As infants develop abilities in attention orientation and motor control, they gradually learn primitive ways to regulate their reactions (e.g., by shifting attention away from distressing stimuli and focusing on less distressing ones in their environment). Such abilities in attention regulation become the bases for the development of EC in the toddler and preschool years (Rothbart et al., 2000). Empirical evidence supports the link between earlier abilities in attentional control

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<sup>1</sup> Please note that not all studies reviewed here refer to voluntary, willful form of self-regulation as “effortful control.” Studies that use other terms (“regulation,” “self-regulation,” “inattention,” “attention regulation,” “persistence,” “inhibitory control”) are included in the review if the authors measured attentional regulation and/or inhibitory control (the two subcomponents of effortful control) of their participants.

and later individual differences in children's EC (Barkley, 1997; Sethi, Mischel, Aber, Shoda, & Rodriguez, 2000). For example, Kochanska and colleagues (Kochanska et al., 2000) reported that children's focused attention at 9 months predicted later variability in children's EC in the expected direction. Children's attentional regulation becomes more voluntary and complex as their cognitive skills and neurological systems mature throughout the preschool years and beyond (Derryberry & Rothbart, 1997; Kochanska, Coy, & Murray, 2001; Rueda, Posner, & Rothbart, 2005).

Children's ability to regulate attentional processes reflects neurological development in the early years. The "anterior attention network" that involves the anterior cingulate cortex (ACC) shows major maturation during the preschool period which is accompanied by children's increased ability in voluntary and planful regulation of behavior and affect (Rothbart et al., 2000). The ACC connects the limbic system (motivational and emotional system) and the prefrontal region (planning and controlling system), and is a core site for executive attention (Derryberry & Rothbart, 1997; Fox & Calkins, 2003). The ACC also has close ties with the motor system. Hence, it has direct effects on behavioral output (Derryberry & Rothbart, 1997). A growing body of research supports co-development of executive attention and effortful control in early childhood (Jones, Rothbart, & Posner, 2003; Posner & Rothbart, 1998, 2000; Rothbart, Ellis, Rueda, & Posner, 2003).

The other aspect of effortful control is inhibitory control which develops in conjunction with attentional regulation. Inhibitory control refers to children's ability to engage in cognitive or behavioral tasks and to inhibit impulsive behaviors to meet situational demands. Toddlers and preschoolers display inhibitory control abilities which

help them restrain automatic responses and follow verbal instructions (Kochanska, Murray, & Coy, 1997; Olson, 1989; Olson, Bates, & Bayles, 1990). Inhibitory control plays a critical role in successful adjustment in that it helps the child to refrain from socially undesirable behaviors (e.g., physical aggression) and to initiate adaptive ones instead (e.g., verbal negotiation) in emotionally challenging circumstances (e.g., conflict with peers). With the development of effortful control skills, children become increasingly more able to modulate their behaviors and affect effectively and flexibly in cognitive, emotional, and social contexts.

Effortful control undergoes major development between ages 2 and 3 years during which children show large improvement in regulating their attention and behaviors (Carlson, Mandell, & Williams, 2004; Derryberry & Rothbart, 1997; Kochanska et al., 2000). Children's EC skills continue to improve as they get older, with less improvement occurring beyond 4 years (Jones et al., 2003; Murphy et al., 1999). Individual differences in EC emerge during the toddler and preschool years (Diamond & Taylor, 1996; Kochanska, Murray, Jacques, Koenig, & Vandegest, 1996) and show moderate levels of stability across childhood and adolescence (Eisenberg et al., 2003; 2005; Kochanska et al., 2000; Kochanska, 1997; Kochanska et al., 1996; Li-Grining, 2007; Murphy, Eisenberg, Fabes, Shepard, & Guthrie, 1999; Murray & Kochanska, 2002; Shoda, Mischel, & Peake, 1990), suggesting that children with low EC tend to continue to struggle with this difficulty. For instance, Kochanska and Knaack (2003) reported that the stability of EC between 33 and 45 months was equivalent to that of IQ. In a meta-analysis that examined the stability of personality traits, the stability greatly increased between 3 to 6 years (from .35 during 0-2.9 years to .52 during 3-5.9 years) (Roberts & DelVecchio, 2000).

The authors attributed relative instability in the first three years to the rapid development of the attentional system and effortful control. These findings suggest that the early childhood years are critical in understanding the development of EC.

A recent study by Zhou and colleagues is noteworthy in that they examined the developmental trajectories of the two indices of EC – attention focusing, and attentional and behavioral persistence on a challenging task (which is a more complex ability than attention focusing) – across the school-age period (ages 5-10) (Zhou et al., 2007). Three trajectories for attention focusing (low stable, moderate stable, and high stable) and persistence (high stable, moderate generally stable, low increasing) were identified. Different patterns of stability of the two measures of EC (i.e., attention focusing showing high stability over time, persistence showing some fluctuation over time) suggested that these abilities may develop and stabilize at different ages (Zhou et al., 2007). As the child's persistence on a frustrating task requires both attentional regulation and inhibitory control, it makes sense that this index of EC continues to change beyond the stabilization of attention focusing earlier in childhood.

Although the construct of effortful control has been highlighted with its relevance to various child outcomes, and its development across early childhood has been studied, there is more to learn about children's effortful control from a process-oriented, person-centered approach. Most studies have treated child EC as a trait-like or personality-like factor and have examined its relations to other variables (e.g., parenting, child outcomes) from a variable-centered approach. While prior research has advanced our understanding of EC and its implications for children's adjustment (and EC, as a temperament factor, certainly has trait-like qualities), studying children's EC as a *process*

that may show time-sensitive variations during a challenging task could further our knowledge of children's self-regulation. The importance of analyzing time-sequential data to understand family interactions has also been underscored (Howe, Dagne, & Brown, 2005). Thus this dissertation is an effort to address this missing piece in the literature by investigating time-sequential changes in child EC and their relations to other factors that may have influence on or may be affected by child EC. Children's regulatory abilities are examined during a parent-child interactive problem-solving task in the child's natural environment (i.e. home).

#### Parent-Child Interaction as a Context for the Development of Effortful Control

Caregiving environment and quality have been heavily researched in relation to children's development (Keenan, 2000). It is not surprising that parent attitudes and behaviors are associated with children's behavioral and emotional adjustment, because children are almost wholly dependent on their parents in infancy and childhood – a period during which children acquire many abilities for successful development. It is clear that early parenting has a lasting impact on children's well-being during the transition to school and into the early school years (Keenan & Shaw, 1995; Patterson, Reid, & Dishion, 1992; Shaw, Owens, Giovanelli, & Winslow, 2001). This is no exception in the self-regulation literature. Although regulatory abilities such as effortful control are based on neurological maturation, it is noteworthy that brain development has been shown to be influenced by the child's experience, especially in the early years of life (Bavelier & Neville, 2002; Calkins, Smith, Gill, & Johnson, 1998; Carlson, 2005). Accordingly, parenting has been studied as a key contributor in the development of children's regulatory abilities (Kopp, 1989; Thompson, 1994).

Infants rely on their parents for behavioral and emotional regulation because they lack abilities and resources for self-regulation (Kopp, 1989; Thompson, 1994). As infants mature, parents' attitudes and regulatory strategies are internalized (Kopp, 1982) and become resources to draw from as they learn to regulate their own behaviors and affect (thus, the emergence of *self*-regulation). Therefore, parents' capacity to facilitate this process is critical for successful development of self-regulation in children. Empirical studies have shown that parents use different soothing techniques as children mature (Campos, 1994; Cohen, 2002; Gormally et al., 2001; Kopp, 1989), and that sensitive application of such skills promote children's regulatory abilities (Cohn & Tronick, 1983; Gable & Isabella, 1992; Jahromi, Putnam, & Stifter, 2004). Parental soothing behaviors have also been reported to facilitate the development of infants' early forms of attentional control, a foundation for the growth of more complex, effortful forms of regulation (Korner & Grobstein, 1966; Stevenson, ver Hoeve, Roach, & Leavitt, 1986). For example, maternal vocalization has been shown to motivate the infant to shift its attention away from aversive stimuli (D'Entremont & Muir, 2000). These findings are consistent with Kopp's (1989) conceptualization in which, by providing external support and regulation, parents help infants recognize and distinguish between affect states, link causes and consequences of their feelings and actions, and acquire skills for more voluntary regulation of their behaviors and affect.

Parents continue to play a major role in assisting children to better regulate their behaviors and affect beyond infancy. Parents use diverse strategies (e.g., guiding, modeling, correcting children's behaviors) to help toddlers and older children regulate their reactivity (Eiden, Edwards, & Leonard, 2004; Garstein & Fagot, 2003; Grolnick,

Kurowski, McMenamy, Rivkin, & Bridges, 1998; Stansbury & Sigman, 2000), resulting in individual differences in children's regulatory capacities (Spinrad, Stifter, Donelan-McCall, & Turner, 2004). The extant research supports the original work of Baumrind (1967) in which a parenting style combining warmth with positive control (e.g., clear limit-setting) was conceptualized to promote children's socialization. Specifically, parents' responsiveness towards children and clear, non power-assertive control have shown concurrent and longitudinal associations with higher self-regulation abilities in children (Brody & Ge, 2001; Brody, Kim, Murry, & Brown, 2003; Garner, 1995; Gilliom, Shaw, Beck, Schonberg, & Lukon, 2002; Karreman, van Tuijl, van Aken, & Deković, 2006; 2008). Eisenberg and her colleagues have consistently found support for the link between high levels of parents' positive emotional expressivity<sup>2</sup> and more advanced regulatory skills in children (Eisenberg, Gershoff et al., 2001; Eisenberg, Losoya et al., 2001; Eisenberg, Valiente et al., 2003; Valiente, Eisenberg, et al., 2006). In contrast, harsh and punitive discipline, including yelling, overt expression of anger and threats, and physical punishment, has shown concurrent and longitudinal relations with decreased levels of self-regulation in children (Carson & Parke, 1996; Eisenberg et al., 1999).

Researchers have also distinguished between emotional responsiveness and behavioral responsiveness<sup>3</sup> (Matas, Arend, & Sroufe, 1978; Wakschlag & Keenan, 2001). Because this conceptualization was originally developed to systematically observe parent behavior during a problem solving task, it was particularly relevant to the present study.

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<sup>2</sup> Emotional expressivity refers to parents' tendencies to express their positive and negative emotions in general (not necessarily towards the child) and compares with parenting behaviors in that the latter reflects how parents interact with the child. However, parents' expressivity and parenting behaviors often show considerable overlap in research and reality. Thus, it has relevance to the current study.

<sup>3</sup> Matas and colleagues (1978) originally referred to "emotional responsiveness" as "supportive presence" and "behavioral responsiveness" as "quality of assistance."

Additionally, empirical studies have found associations between lower maternal responsiveness and children's dysregulation of behavior (e.g., Wakschlag & Keenan, 2001). Emotional responsiveness is defined as the parent's ability to read the child's emotional cues and respond appropriately. For example, when a child shows early signs of frustration (e.g., frowning), an emotionally responsive parent may acknowledge the child's emotional state by labeling feelings, responding sympathetically, and offering encouragement. In such situation, a parent who fails to respond to the child's negative affect, even if the parent's responses are positive in content, would not be emotionally responsive. Emotional responsiveness may also include the parent's ability to proactively prevent the child's negative feelings by creating a positive emotional context. Behavioral responsiveness is defined as the parent's ability to flexibly adjust the level of involvement and assistance according to the child's immediate and developmental needs. It is concerned with how good a parent is as a teacher in helping the child to learn how to problem solve a task. For example, a behaviorally responsive parent may allow a child to work independently on a task if the child is able to do so. Offering assistance in such situations is not only unnecessary but also carries a risk of hampering the child's development of autonomy. If the child struggles with the task, a behaviorally responsive parent may intervene with well-timed, developmentally appropriate assistance (e.g., breaking the task down into small steps). In general, parents' use of strategies that teach children to complete the task on their own (e.g., giving hints rather than directives) reflects good behavioral responsiveness. For a child who finds the task too difficult, however, a behaviorally responsive parent may adjust the level and form of assistance, perhaps by giving direct, concrete help (e.g., modeling). In sum, the conceptualization of

emotional and behavioral responsiveness has provided a meaningful lens through which to observe the quality of parenting in a problem solving task such as the block design task used in the present study.

Possible mechanisms through which parenting behaviors may influence children's development of self-regulation have been theorized. It has been proposed that parents' warmth, responsiveness, and sensitivity foster children's sense of emotional security which facilitates positive parent-child attachment, which serves as the foundation for the development of children's self-regulation (Bowlby, 1980; Cassidy, 1994; Contreras, Kerns, Weimer, Gentzler, & Tomich, 2000; Cummings & Davies, 1996; Sroufe, 1983). Secure attachment may motivate the child to willingly internalize parental values and standards including parents' expectations as to how best to behave in challenging situations (Dix, 1991; Hoffman, 1983; MacDonald, 1992). Indeed, empirical studies have found that securely attached children show more advanced regulatory abilities than those with insecure attachments (Kochanska, 2001). Conversely, power-assertive discipline such as physical punishment may disrupt the parent-child relationships which in turn hampers children's ability to self-regulate (Gottman & Katz, 2002; Grusec & Goodnow, 1994). Internalizing of parents' values is not facilitated because harsh punishment does not allow children to learn alternative responses and to understand the reasons for behaving properly (Hoffman, 1983; Smetana, 1997). Additionally, punitive discipline may arouse children more than the optimal level necessary for them to engage in complex cognitive processes to internalize parental messages and acquire regulatory skills (Blair, 2002; Carson & Parke, 1996; Hoffman, 1983). Parents who use power-assertive techniques may also interfere with their

children's acquisition of regulatory abilities by modeling dysregulation of their affect and behaviors (Bandura & Walters, 1959). Patterson and colleagues proposed a "coercive cycle" between the parent and the child in which parental use of power assertion leads to both parties' escalation in their negative, dysregulated behaviors to control each other's behavior (Patterson, 1982; Reid, Patterson, & Snyder, 2000).

In sum, parent-child interaction as a primary context for the development of self-regulation, and parenting quality as a predictor of individual differences in these abilities have been well-supported. Potential processes by which parents may facilitate or hamper children's growth in regulatory skills have also been theorized. However, due to the relative lack of studies on processes of self-regulation (including effortful control), little is known about the relationship between parenting behaviors and momentary changes in children's regulatory processes.

#### Other Sources of Individual Differences in Effortful Control

Socioeconomic status. Poverty has been highlighted in research as a distal risk factor for decreased child ability in effortful control. Exposure to economic hardship may compromise regulatory competence by continually placing heavy burden on children's neuroendocrine systems that influence their response to stress and regulatory demands. Empirical studies have provided evidence that children from socioeconomically disadvantaged families tend to show lower levels of EC compared to their more affluent peers (Eisenberg et al., 2001; Evans & English, 2002; Howse, Lange, Farran, & Boyles, 2003; Hughes & Ensor, 2005; Mezzacappa, 2004; Noble, Norman, & Farah, 2005). Although the present study did not include families experiencing severe economic hardship, potential associations between more subtle differences in the family's

socioeconomic status and the child's moment-to-moment variations in effortful control were explored.

Child's intellectual ability. Children's cognitive abilities may influence how they are able to navigate through their environments and learn self-regulation (e.g., Calkins & Fox, 2002). The child's IQ was of particular concern in this dissertation because the child's level of persistence on a cognitive task was used as a behavioral index of EC. Thus, to test the possibility that the child's ability to perform well on the task (i.e., child IQ) has effects on the child's ability to persist on the task (i.e., child EC), the child's cognitive ability as measured by a standardized intelligence test was included as a predictor of EC.

#### Effortful Control and Externalizing Behavior Problems

As reviewed, EC helps the child to persist in tasks that are not immediately gratifying and to regulate more reactive emotions such as fear and anger (Belsky, Friedman, & Hsieh, 2001; Rothbart, Derryberry, & Posner, 1994), and accordingly has been shown to contribute to various child competencies, including socio-emotional competence, empathic responsiveness, and school readiness/academic competence (Blair, 2002; Buckner, Mezzacappa, & Beardslee, 2009; Kochanska, Tjebkes, & Forman, 1998; Kochanska, Murray, & Coy, 1997; Kochanska, Murray, & Harlan, 2000; NICHD Early Child Care Research Network, 2004; Rothbart, Ahadi, & Hershey, 1994; Valiente, Lemery-Chalfant, Swanson, & Reiser, 2008). In particular, effortful control has been highlighted in relation to the development of children's externalizing behaviors (e.g., Olson, Sameroff, Kerr, Lopez, & Wellman, 2005), a relation that will be further explored in this dissertation.

Externalizing behaviors are a broad group of problems of “under-regulation” such as other-directed aggression, impulsivity, temper tantrums, disruptive behavior, and noncompliance and represent the most commonly observed problems in young children (Achenbach, 1990). These problems are assessed with behavioral rating scales most commonly completed by mothers, reflecting assumptions that they are the most accurate source of information about children’s behaviors and convenience of accessing them in research as mothers are more likely to participate than fathers (Phares, 1997; Loeber, Green, & Lahey, 1990). However, it has been argued that multi-informant assessment of children may offer a more comprehensive understanding of children’s problems (Kagan, Snidman, McManis, Woodward, & Hardway, 2002), and that modest to moderate strength of correlations across informants and across settings (Achenbach, Edelbrock, & Howell, 1987; Grietens et al., 2004; Offord et al., 1996) may reflect true variations in children’s behaviors across different settings and interpersonal relationships (Kerr, Lunkenheimer, & Olson, 2007; Stanger & Lewis, 1993; Merrell, 1999). Mothers and fathers may be good informants of children’s behaviors in less structured, intimate relational contexts. Teachers are valuable source of information in that they have access to children’s behaviors outside of the home environment, develop norms about child development based on their experience with multiple children, and observe children in more structured, problem-solving settings that pull for regulatory skills (Saudino, Ronald, & Plomin, 2005; Fagot & Leve, 1998; Hayden, Klein, & Durbin, 2005).

For many children, externalizing behaviors represent a part of normative development with these behaviors naturally declining as children get older (Campbell, Shaw, & Gilliom, 2000; Campbell, 2002; Tremblay, 2000). For others, such difficulties

are early signs of later maladjustment such as conduct problems, academic failure, substance abuse, and peer rejection (Campbell et al., 2000; Keenan, Shaw, Delliquadri, Giovannelli, & Walsh, 1998; King, Iacono, & McGue, 2004). For example, in a longitudinal study across 20 years, externalizing behavior problems in childhood predicted academic underachievement in adolescence, which in turn increased internalizing symptoms in young adulthood (Masten et al., 2005). It should also be noted that as children reach school-age and adolescence, externalizing problems tend to become more stable and serious, making treatment more difficult (Kazdin, 1993). Accordingly, interventions implemented before children reached school-age have shown higher rates of success (Dishion & Patterson, 1992). Thus, identifying early risk factors and markers for externalizing behavior problems are crucial for early, effective prevention. Deficit in effortful control is a risk factor that has been shown to contribute to externalizing behavior problems.

A robust body of research supports concurrent and longitudinal associations between effortful control and externalizing behavior problems across childhood and adolescence (Calkins & Dedmon, 2000; Eisenberg et al., 2000; 2001; 2005; Hill et al., 2006; Muris & Ollendick, 2005; Murray & Kochanska, 2002; Oldehinkel, Hartman, De Winter, Veenstra, & Ormel, 2004; Spinrad et al., 2006; Valiente et al., 2003). For example, Olson and colleagues (2005) found that child EC measured by mother-report and lab assessment predicted concurrent levels of externalizing behaviors at home and in preschool even after controlling for the effects of child IQ and family risk. Longitudinal associations between deficits in EC in toddlers and behavior problems upon school entry have also been reported (Kochanska & Knock, 2003).

Zhou and colleagues made a unique contribution by examining developmental trajectories of both EC and behavior problems in school-age children. They reported that high and stable patterns of EC were associated with low and stable patterns of externalizing behaviors which is generally consistent with the studies that have used variable-centered analyses (Eisenberg et al., 2004; Kochanska & Knaack, 2003; Olson et al., 2005). Conversely, low or fluctuating trajectories of EC were related to a more diverse pattern of externalizing trajectories. Specifically, some children on low and/or fluctuating EC trajectories tended to fall in the moderate to high and stable externalizing trajectories, whereas other children on the same EC trajectories exhibited low externalizing in early childhood but showed an increase through the elementary years. These findings suggest that distinct EC developmental trajectories may relate to externalizing behaviors differently (Zhou et al., 2007). This dissertation is an effort to broaden our current understanding of the associations between children's effortful control and externalizing behavior problems by conducting a microanalysis of EC at child age 3 and testing whether and how these patterns relate to externalizing problems at the ages 3, 6, and 10.

#### Differences by Child Gender

In this dissertation, child gender as a potential moderator of moment-to-moment fluctuations in children's effortful control and their relations to a set of predictors and outcomes will be explored. Research generally points to gender differences in effortful control (Else-Quest, Hyde, Goldsmith, & Van Hulle, 2006; Olson et al., 2005), parent-child interaction or parental socialization (Maccoby et al., 1984), and externalizing behavior problems (Keenan & Shaw, 1997; Kerr et al., 2004), which are summarized in

the following.

Prior findings on child EC converge in that girls have been found to possess more sophisticated EC skills than boys (Else-Quest et al., 2006; Kochanska et al., 1997; 2000; Kochanska & Knaack, 2003; Olson et al., 2005; Valiente et al., 2004). For example, girls showed greater degree of EC measured by a behavioral battery at both 22 and 33 months than boys (Kochanska et al., 2000). A recent meta-analysis on gender differences in child temperament including EC also found support for higher levels of EC in girls compared to boys (Else-Quest et al., 2006). More generally, girls have shown to develop faster than boys in physical, verbal, socioemotional domains of functioning (Eme, 1992; Taylor, 1985). Such gender differences have been reported to emerge around toddlerhood and increase with age so that by school entry, girls are about 1 year ahead of boys in these abilities (Eme, 1992). Girls' faster maturation in regulatory abilities may facilitate easier adjustment through developmental transitions.

Prior research also suggests that characteristics and qualities of parent-child interaction, a primary context for the development of children's effortful control, may be moderated by child gender. Studies have shown that parents may respond to girls and boys differently (Keenan & Shaw, 1997; Smetana, 1989). For example, it has been reported that boys receive more physical punishment than girls (Mahoney, Donnelly, Lewis, & Maynard, 2000). Mothers have been shown to engage in positive teaching with temperamentally difficult<sup>4</sup> girls than boys (Maccoby, Snow, & Jacklin, 1984).

Interestingly, children with difficult temperaments are more susceptible to parental

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<sup>4</sup> "Difficult temperament" has been defined in different ways across studies but usually included deficits in subcomponents of effortful control.

discipline (both positive and negative) compared to those with relatively easy temperaments (Belsky, 1997a, 1997b). Similarly, boys are more vulnerable to suboptimal parenting (e.g., lack of maternal responsiveness) than girls (Shaw et al., 1998). Together, these findings suggest a possibility that boys, who, in general, show lower regulatory abilities than girls, may be more susceptible to parenting behaviors (Van Zeijl et al., 2007), but may also be receiving less than optimal parenting (Maccoby et al., 1984), which could lead to gender differences in negative outcomes such as externalizing behavior problems.

As for the child's intellectual ability, the findings generally point to no gender differences in early childhood (Finegan, Niccols, & Sitarenios, 1992; Harrington, Kimbrell, & Dai, 1992). For example, Harrington and colleagues (1992) found that 3-, 4-, and 5-year-old girls and boys did not differ in their cognitive abilities as measured by the Wechsler Preschool and Primary Scale of Intelligence and the Woodcock-Johnson Psychoeducational Battery. With regards to verbal ability and language development, studies have demonstrated a female advantage (Maccoby & Jacklin, 1974; Morisset, Barnard, & Booth, 1995), which has led to gender differences in the child's intellectual ability in some studies (e.g., Brooks-Gunn, 1986).

Lastly, differential associations between child gender and externalizing problems are well documented. It has been reported that boys manifest more behavioral problems than girls, and that more boys than girls display chronic, high levels of externalizing behaviors (Card, Stucky, Sawalani, & Little, 2008; Côte et al., 2001, 2002, 2006; Deater-Deckard, Dodge, Bates, & Pettit, 1998; Romano et al., 2005; Schaeffer et al., 2006). Additionally, boys and externalizing problems are more likely to be referred for treatment

than girls or internalizing problems (Green, Clopton, & Pope, 1996). Three to four times more boys than girls are diagnosed with attention deficit hyperactivity disorder, oppositional defiant disorder, and conduct disorder (Barkley, 1996; Campbell, 2000; Hinshaw & Anderson, 1996; McCabe, Rodgers, Yeh, & Hough, 2004). When do these gender differences emerge in childhood? Stable gender differences in externalizing behavior problems have been reported to emerge around the ages of 3 or 4 and continue throughout childhood (Keenan & Shaw, 1997; Loeber & Hay, 1997). Findings are less consistent with toddler-age children (Archer & Lloyd, 2002), but a growing number of studies have demonstrated that gender differences are present even in toddlerhood in the expected direction (Archer, 2004; Côte et al., 2006; Fagot & Leve, 1998; Romano et al., 2005; Rubin et al., 2003; Tremblay et al., 1999; Zahn-Waxler, Iannotti, Cummings, & Denham, 1990). In one recent study, gender differences were found in 17-month-old children with five percent of boys but only one percent of girls in the sample displaying aggressive behaviors (Baillargeon et al., 2007). However, there is a possibility that externalizing behavior problems may be associated with different predictors. For example, more precursors to the development of externalizing behavior problems have been found for boys than girls in the first three years of life (Shaw, Keenan, & Vondra, 1994). Additionally, externalizing problems may lead to different consequences by child gender. In a longitudinal study with children between the ages 5-15, the continuity in problem behavior from childhood to adolescence has only been found for boys but not for girls (Broidy et al., 2003). All of the findings described in this section point to the importance of considering child gender as potential factor that may have effects on the levels of each variable and the relations among them.

## Conclusions of the Literature

In conclusion, research has offered empirical support for the importance of understanding self-regulation in children's development and psychopathology (Posner & Rothbart, 2000). The construct of effortful control has been theorized as a temperament factor of voluntary, willful regulation that develops in early childhood along with neurological maturation in the attentional system (Kochanska et al., 2000; Rothbart & Bates, 2006). EC is comprised of multiple regulatory processes (e.g., attentional regulation, inhibitory control) that are systematically organized for goal-directed behavior (Murray & Kochanska, 2002). It has also been documented that individual differences in EC shows moderate stability across childhood (Kochanska and Knaack, 2003), although its subcomponents may stabilize at differing ages (Zhou et al., 2007). Gender differences in effortful control abilities are well documented in that girls have consistently shown higher levels of EC than boys (e.g., Else-Quest et al., 2006), indicating that girls would have easier time regulating their behaviors and affect to meet situational demands. For the most part, researchers have utilized a macroscopic analysis in studying EC, focusing on its stability and change over the years of time and its relations to other variables of interest.

Researchers have also argued that the early development of children's self-regulation takes place in the parent-child interpersonal context (Kopp, 1989). Empirical studies have shown that parental attitudes and behaviors (e.g., responsiveness) may facilitate or hamper children's regulatory skills in early childhood (Brody & Ge, 2001; D'Entremont & Muir, 2000). In general, parents' warmth and responsiveness have shown to predict higher levels of children's self-regulation (Brody et al., 2003), whereas parents'

harsh and punitive discipline have been associated with lower regulatory abilities (Eisenberg et al., 1999). Additionally, researchers have distinguished between emotional responsiveness and behavioral responsiveness to systematically observe parents' flexibility in adjusting their responses to meet children's changing emotional and behavioral needs during a problem solving task (Matas et al., 1978; Wakschlag & Keenan, 2001). Possible mechanisms by which parenting may influence children's regulation have also been proposed, with foci on parent-child attachment (Bowlby, 1980), internalization of parental values and standards (Hoffman, 1983), social learning (Bandura & Walters, 1959), and coercive exchanges between the parent and child (Patterson, 1982). In terms of gender-moderation in parent-child interactions, studies have found that parents may respond to boys and girls differently (Keenan & Shaw, 1997), and that boys may be more vulnerable to less than optimal parenting than girls (Shaw et al., 1998). It has also been documented that children with difficult temperament including deficits in EC may be more easily influenced by parenting compared to those with relatively easy temperament (Van Zeijl et al., 2007). Together, these findings suggest that boys with low EC may be more likely to receive and be affected by negative parenting behaviors.

With regard to children's developmental outcomes of deficits in self-regulation, findings converge that deficits in child EC lead to externalizing behavior problems (e.g., Kochanska & Knock, 2003), which in turn predict other negative consequences such as academic failure and socioemotional problems (e.g., Campbell et al., 2000; Masten et al., 2005). Researchers also have found support for the value of using ratings from multiple informants to assess children's behaviors in different settings (e.g., home, school), because each informant may contribute unique (albeit overlapping) information regarding

child adjustment (Kerr et al., 2007). Studies on gender differences converge in that boys manifest higher, chronic levels of externalizing behaviors than girls (e.g., Schaeffer et al., 2006), and are more likely to be referred for mental health services for such problems (Green et al., 1996). Stable gender differences in externalizing problems have been found to emerge around 3 or 4 years of age (Keenan & Shaw, 1997), although a growing number of studies have demonstrated that such differences can be observed even in toddlers (e.g., Romano et al., 2005). Finally, it has been proposed that a different set of predictors may be associated with externalizing behavior problems in girls and boys (Shaw et al., 1994).

### The Present Study

Specific aims. The first aim of the present study was to examine children's effortful control at a micro processes level. By definition, EC is comprised of regulatory *processes* that are dynamically organized in real time to achieve a goal (e.g., completing a challenging task). Thus, it is expected that the child's level of EC may vary across even a short span of time. To date, however, very little is known about momentary changes in child EC during a challenging task, because most studies have focused on the trait-like aspect of EC (i.e., treating EC as a characteristic of the child, with stability over time). Such imbalance in the level of analysis in research may lead to incomplete understanding of child EC. Indeed, researchers have highlighted the advantages of utilizing both macro- and micro-levels of analysis and integrating different insights from each approach (Dumas, Lemay, & Dauwalder, 2001; Maccoby & Martin, 1983). They have also emphasized the value of analyzing time-sequential data to interpersonal dynamics (Howe et al., 2005). In the present study, the paucity of research on effortful control as processes

was addressed by modeling time-sensitive profiles of child EC during a cognitively challenging task. Such profiling was expected to provide with understanding about the heterogeneity of children's effortful control skills (e.g., even among children with high EC, some may show stable pattern of EC across time, whereas others may show fluctuations). Data were analyzed using a person-centered approach (e.g., latent class growth analysis) which proved to be helpful in modeling trajectories across time and finding heterogeneous subgroups of individuals who follow distinct trajectories (Nagin & Tremblay, 1999, 2001; Zhou et al., 2007).

The second aim was to identify variables linked to momentary variations in children's effortful control. A set of proximal and distal factors known to contribute to EC was included in the present study as potential predictors of EC profiles: child gender, child IQ, socioeconomic status, and parental emotional and behavioral responsiveness (Calkins & Fox, 2002; Hill et al., 2006; Karreman et al., 2008; Noble et al., 2005). The latent class growth analysis procedure allowed for a more detailed examination of the effects of each of these variables on children's EC trajectories during a challenging task. Specifically, possibly differential effects of the predictors on each trajectory's initial status (i.e., child's EC at the beginning of the task) and change over time (i.e., child's ability to maintain EC during the task) were tested. These relations were investigated in the context of a parent-child interactive, problem-solving task administered at the child's home for increased ecological validity of the findings. It was hoped that the findings would help generate hypotheses about parents' behaviors that contribute to fluctuations in child EC, which may have important implications for effective prevention and treatment efforts of children's regulatory problems.

Third, the present study represented an attempt to replicate and expand findings on concurrent and longitudinal outcomes of deficits in children's effortful control abilities. Variable-centered studies have offered empirical evidence that children with lower EC skills tend to show higher levels of externalizing behavior problems later (e.g., Kochanska & Knock, 2003). It was hoped that linking children's effortful control profiles (assessed at the age of 3 years) to externalizing problems (assessed at 3, 6, and 10 years) would provide more refined insight about the relations between the two constructs. For example, children who struggle to get started on a task may differ from those who have difficulty persisting their regulatory efforts throughout the task in terms of their behavioral outcomes in larger developmental contexts. Because we focused on exploring whether within-task EC had any significant relations to externalizing problems, other factors that may have effects on children's behavioral adjustment were not included in the analysis. Yet, it should be noted that multiple risk factors conjointly influence the development of children's externalizing behavior problems (e.g., Leve, Kim, & Pears, 2005). It was hoped that a better understanding of EC processes in a challenging interaction would serve as a basis on which more complex hypotheses are generated. In the present study, children's externalizing behaviors reported by multiple informants (mothers, fathers, and teachers) across different settings (home, school) were included to capture the variability of children's behaviors in diverse relational and environmental contexts (Kerr et al., 2007). The periods covered in the present study include some important developmental transitions in childhood such as kindergarten and school entry, and progression to more structured, cognitively demanding curricula in 3-4<sup>th</sup> grades. Thus, it was possible to observe how children on distinct EC profiles were able to draw from

their regulatory skills and resources to adjust to these transitions.

The final goal of the present study was to contribute to our understanding of gender differences in children's effortful control, parental socialization, and externalizing behavior problems and the relations among these variables. In general, the extant body of research suggests that gender differences do exist in the levels of child EC (Olson et al., 2005) and externalizing problems (Kerr et al., 2004), and in certain aspects of parental responses to children (Maccoby et al., 1984). However, the literature is not without mixed findings especially with preschoolers and regarding the time when these differences begin to emerge (Archer & Lloyd, 2002). Additionally, studies have suggested a possibility that different factors may be associated with deficits in effortful control or high levels of externalizing problems in boys and girls (e.g., Hill et al., 2006). In the present study, child gender was considered as a potential predictor of children's effortful control profiles. Additionally, concurrent and longitudinal outcomes (i.e., externalizing behavior problems) of these EC profiles were examined separately for girls and boys to capture possible gender-moderated patterns. Investigating these patterns closely in early childhood (and then relating them longitudinally across childhood) was expected to be particularly valuable given that gender differences have been known to emerge or increase during this period (e.g., Keenan & Shaw, 1997).

For a number of reasons, the early childhood period provides an important context for the study of effortful control and its implications: a) child EC develops rapidly during this period, b) a group of children begins to show a more stable pattern of externalizing problems (i.e., those not following the normative decline in such behaviors after age 2), c) children are dependent on their parents for both physical and emotional

support during this period, thus the quality of parenting may be of particular importance, and d) gender differences in EC profiles or in the pattern of relations among the variables may emerge or increase during this period.

Research questions and hypotheses. The present study was designed to answer the following questions:

1) Do coherent individual differences in children's effortful control behaviors, operationalized as the child's level of persistence on a challenging task, exist in early childhood (children aged 3 years)? This research question was exploratory as the present study was among the first attempts to model momentary variations of preschoolers' effortful control skills. Since effortful control involves a set of interrelated regulatory processes that are integrated in real time to achieve cognitive, affective, and interpersonal goals, it was hypothesized that distinct patterns of EC would emerge in microanalysis. Additionally, to make sure that the child's persistence on a challenging task was indeed a measure of effortful control, independently-assessed laboratory scores of EC were also included in the analysis. In terms of individual differences, it was expected that heterogeneous group of children would be identified based on their EC profiles. Although children as a whole (i.e., collapsing all children's trajectories together) were likely to show a decreasing pattern of EC during the task due to increased task difficulty over time, it was believed that children would be classified into subgroups based on their EC trajectories.

2) For each identified effortful control trajectory, what are the predictors of its initial status and change over time? What predictors distinguish between different EC profiles? Based on prior research, child gender, child IQ, socioeconomic status, and

parental emotional and behavioral responsiveness were tested for their effects on EC profiles (e.g., Calkins & Fox, 2002). Although it was expected that these variables would influence children's EC trajectories, specific patterns were not hypothesized due to a paucity of research on microanalysis of EC. It is possible that different predictors may have effects on different aspects of an EC profile. Specifically, variables that predict the initial level of EC may not be the same as those that predict the change in EC over time. Likewise, the identified EC profiles may be differentiated from one another with different sets of predictors. Again, specific hypotheses could not be generated. More generally, however, consistent with the extant research, it was believed that boys (Else-Quest et al., 2006), children low in intellectual ability (Calkins & Fox, 2002), children of lower socioeconomic status families (Noble et al., 2005), and children of parents with lower emotional and behavioral responsiveness (Karreman et al., 2008) would belong to more dysfunctional EC trajectories. Conversely, girls, children high in intellectual ability, children of higher socioeconomic status families, and children of parents with higher emotional and behavioral responsiveness were expected to show more positive patterns of EC profiles.

3) Do children in different groups of effortful control trajectories show differing levels of externalizing behavior problems? In the present study, we attempted to test whether and how EC profiles at the age of 3 years predict externalizing problems across childhood (at the ages 3, 6, and 10). Consistent with prior findings (e.g., Zhou et al., 2007), it was hypothesized that dysfunctional EC profile(s) would predict higher levels of externalizing problems whereas non-problematic EC profile(s) would be associated with lower externalizing behaviors. Depending on the kinds of trajectories identified, more

subtle differences may emerge in terms of longitudinal outcomes of each trajectory. Children's behavioral adjustment in a range of relational and environmental contexts was assessed by including ratings of mothers, fathers, and teachers. It was expected that children's EC observed during a cognitively challenging, mother-child interaction task would predict concurrent and longitudinal individual differences in externalizing behavior problems across contexts.

4) Do these aforementioned relations differ by child gender? In general, the extant research points to gender differences in children's effortful control (e.g., Olson et al., 2005), parental socialization (e.g., Maccoby et al., 1984), and externalizing behavior problems (Card et al., 2008). However, questions remain as to when such differences begin to emerge in early childhood (Archer & Lloyd, 2002) and whether boys and girls differ in their moment to moment fluctuations of effortful control abilities. In the present study, these questions were addressed by testing the effects of child gender on micro-level EC profiles and examining concurrent and longitudinal outcomes of EC profiles on externalizing behavior problems separately for girls and boys. With regards to EC profiles, it was hypothesized that child gender would predict the initial level of EC and/or the change over time in EC in identified profiles in directions that favor better regulatory processes for girls. Similarly, gender-moderated patterns were expected in the associations between effortful control profiles assessed at 3 years and externalizing behavior problems at 3, 6, and 10 years of age.

## CHAPTER II

### METHOD

#### Participants

Participants were 235 children (113 girls) and their parents and teachers who were part of a longitudinal study of young children at risk for school-age conduct problems (Olson & Sameroff, 1997). Most families (95%) were recruited from newspaper announcements and fliers sent to day care centers and preschools; others were referred by preschool teachers and pediatricians. To recruit children with a range of behavioral adjustment levels, two different ads were periodically placed in local and regional newspapers and child care centers, one focusing on hard-to-manage toddlers, and the other on normally developing toddlers. Once a parent indicated interest, a screening questionnaire and brief follow-up telephone interview were used to determine the family's appropriateness for participation and willingness to engage in a longitudinal study. Children with serious chronic health problems, mental retardation, and/or pervasive developmental disorders, and those from families in the initial stage of divorce, and/or those experiencing severe economic hardship were not included in the study.

Children were screened by mother-report on the Child Behavior Checklist/2-3 (CBCL/2-3; Achenbach, 1992), with an oversampling of toddlers in the medium-high to high range of the Externalizing Problems scale. At recruitment, children represented the

full range of externalizing symptom severity on the CBCL/2-3: based on CBCL/2-3 scores, 39% of the sample were 1 SD above the mean ( $T$  scores  $>60$ ), 30% were up to 1 SD above the mean ( $50 < T < 60$ ), and 31% were below the mean ( $T < 50$ ). Teachers' [ $F(2, 184) = 3.70, p < .05$ ] ratings of externalizing behaviors for these three initial risk groups paralleled mothers' ratings in expected directions.

Children were assessed at three time points: first at approximately age 3 (T1;  $N=235$ , age range = 27 to 45 months,  $M = 37.7$ ,  $SD = 2.7$  months), then at age 5 ½ (T2;  $N = 227$ , age range = 52 to 71 months,  $M = 63.4$ ,  $SD = 2.7$  months), and again at 10 ½ (T3;  $N=197$ , age range = 8.5 to 11.8 years,  $M = 10.4$ ,  $SD = 0.6$  years). At T2, all children in the study had made the transition to kindergarten. At T3, all children were attending grade school: 46% of the sample were in 5<sup>th</sup> grade, 37% in 4<sup>th</sup> grade, 9% in 3<sup>rd</sup> grade, 6% in 6<sup>th</sup> grade, and 2% in 7<sup>th</sup> grade. The participants who had dropped out of the study across the three time points did not differ in makeup from the rest of the sample in terms of gender, socioeconomic status, cognitive ability, and child and parent variables from the block design task.

Families were representative of the local population. Most children were of European American heritage (86%); others were African American (5%) or biracial (9%). The majority of mothers indicated that they were married (89%), 3% indicated that they were living with a partner, 5% identified themselves as single (never married), and 3% as separated or divorced. Fifty-five percent of the mothers worked outside the home full-time. Eighteen percent of mothers and 22% of fathers had received high school educations with no further educational attainment; 43% of mothers and 32% of fathers had completed four years of college with no further training; 39% of mothers and 46% of

fathers had continued their education beyond college in graduate or professional training. The median annual family income was \$52,000, ranging from \$20,000 to over \$100,000. Families had mean scores of 7.58 (range = 2-9,  $SD = 1.59$ ) on Hollingshead's (1975) occupational scale, indicating that the majority of parents' occupations fell into the minor professional category.

### Procedure

Home assessment. Mothers, fathers, and children were administered questionnaires and assessments in their homes by a female social worker. In the first two hours of the home assessment, parents responded to a set of semi-structured interview questions adapted from that used by Dodge and colleagues in the Child Development Project (Dodge, Pettit, & Bates, 1994). Following the interview, the parent-child dyad participated in a series of different assessments, including the dyadic parent-child interaction task used in the present study. The dyad was videotaped by the experimenter. This parent-child session took about one hour, and included one session of free play in the middle of the hour. Mothers and fathers were interviewed and performed parent-child interaction tasks separately and on different days. Following the home assessment, parents were provided a packet of questionnaires about their child's temperament and adjustment to fill out in their own time and to return by mail or experimenter pick-up. Families were given \$100 for each of the first two waves of data collection (T1, T2) in which they participated. For T3 data collection, which only involved parents' self-report questionnaires, the participating families were provided with a \$25 gift certificate to a local store of their choice.

School assessment. Preschool, kindergarten, and grade school teachers

contributed ratings of children's behavioral adjustment. Those who agreed were mailed a packet of questionnaires which were asked to return by mail or experimenter pick-up. They were given \$20 gift certificates to a local bookstore for their participation in each of the first two waves (T1, T2). Teachers who participated in T3 data collection were provided with a \$10 gift certificate.

Lab assessment. At T1, children participated in a Saturday morning laboratory session scheduled at a local preschool. Following 20-30 minutes of rapport building, measures of effortful control and cognitive ability were individually administered. Children received small gifts for their participation.

### Measures

Mother-child interaction task: Videotaped Block Design. A videotaped block design task completed by mother-child dyad during the home assessment at T1 was used to measure momentary variations in children's effortful control. The block designs used were borrowed from the WISC-III (Wechsler, 1991), a standardized intelligence test for children between ages 6-16. The goal of the Block Design subtest is to copy small geometric designs with four or nine plastic cubes. In our study, three of the four-block designs were used. A block design task was a fitting task in which to assess children's effortful control for a number of reasons: a) it had a clear goal that the dyad had to work toward, and b) it was challenging for the child because the task was above the child's cognitive ability level and became increasingly more difficult. Moreover, since the task was administered at the child's home in an interpersonal context (i.e., mother-child dyad), it was expected to have high ecological significance. Thus, a block design task enabled an observation of the child's effortful control skills to meet immediate situational and

interpersonal goals.

Mothers and children were asked to work together to complete three block designs which increased in difficulty, and were provided in turn by the experimenter. The plastic cubes were introduced to the child and explained that they each consisted of six sides, with two sides of the same color (“red, white, and half red and half white”). The dyads were told that each design can be made with only four blocks. The experimenter completed the first block design as an example, which also became the first design that the dyads worked on. Mothers were allowed to help the child in any way they desired to complete the task. There was no set time limit for, or the required completion of, a particular design or the task as a whole. Mothers decided whether or not to move on to the next design or activity. Mother-child interactions were videotaped. Six mother-child dyads did not do the task due to child refusal to engage in the task at all or family’s non-participation in home assessment, and thus these cases were dropped from subsequent analyses. Among the remaining 229 dyads, 16 did not complete all three block designs due to child’s intense negative affect during task (e.g., temper tantrum). Of these 16 dyads, 5 only completed the first block design, and 11 completed the first and second block designs.

Children were coded for *persistence with the task* and *instances of verbal, object, and physical aggression* at 30-second intervals. Parents were rated on global scales of *behavioral responsiveness* and *emotional responsiveness* after the completion of the entire block task.

*Child persistence.* Child persistence with the task was defined as the child’s level of interest and orientation towards the task, as well as time spent on on-task as compared

to off-task behavior. Discussion about the task and physical work on the block designs were both counted as on-task behavior, whereas using the blocks in a manner that did not fit the goal of the task (e.g., building a tower) or clear diversions from the task (e.g., playing with other toys, running around) was considered off-task behavior. Persistence was coded as one of four levels for each segment of the task: none, mild, moderate, and high. None was coded when children never tried to do the task on their own and were off-task throughout the segment. Mild was defined as when children showed very little persistence and low task orientation. Children with mild persistence had several periods of intense off-task behavior (e.g., running around), remained on-task only through parents' continuous efforts to redirect them, or were off-task at least 50% of the time. Moderate was coded when children were task-oriented most of the time. Children with moderate persistence showed several subtle off-task episodes (e.g., briefly looking at other toys) or 1-2 intense off-task episodes, or were on-task at least 50% of the time. High was defined as when children displayed high level of persistence and motivation towards the task. These children showed almost no off-task behavior except for possibly one brief instance. Thirty-two children (15 girls) had persistence scores of high in every segment, and four (2 girls) had persistence scores of none in every segment of the task. Children in the latter group were able to get through all three designs despite their non-persistence because their mothers had completed each design for them. Average persistence for each of the three block designs was computed by averaging persistence scores across 30-second segments in which the child worked on each design, and was used in latent class growth analysis. In this study, the persistence variable is used as a behavioral index of child effortful control, as persistence on a challenging task requires a

set of effortful control abilities (attentional regulation and inhibitory control) is known to be a hallmark of successful self-regulation (Zhou et al., 2007).

*Child aggression.* Children's verbal, object, and physical aggression were coded for each 30-second interval. Verbal aggression was defined as the child's threats' swearing, name-calling, or shouting accompanied by negative affect (e.g., "Shut up!"). Simply yelling out a request (e.g., "I want to play Zelda" (in a negative, whiny tone) did not qualify as a verbal aggression. Object aggression was defined as the child throwing, hitting, or banging toys or other objects accompanied by negative affect. Physical aggression was defined as the child hitting, pushing, or throwing objects at the parent accompanied by negative affect. Instances of children's verbal, object, and physical aggression were tallied and combined into one overall aggression score for the whole of the task.

*Maternal responsiveness.* Parents' behavioral responsiveness and emotional responsiveness were rated after the coders watched the whole task (adapted from Matas, Arend, & Sroufe, 1978). Thus, these variables measured how parents responded to their child throughout the task in general. It should also be noted that these codes were parent codes, not relationship codes. *Behavioral responsiveness* was defined as the parent's ability to teach the child in a problem-solving task in terms of behavioral cues offered, timing, and appropriate feedback. Thus, it was a measure of how well the parent helped the child to learn to do a cognitively challenging task by providing concrete, behavioral assistance. Behavioral responsiveness was rated as one of the four levels: poor, fair, good, and excellent. Poor was assigned when parents failed to anticipate the child's need for help at all, followed their own agenda, and/or was very inflexible. Parents who showed

poor behavioral responsiveness were either a) generally behaviorally unresponsive to children, not helping them much at all, and very disengaged with respect to teaching children the task, or b) extremely over-intrusive, almost doing the entire task themselves, and providing cues that were all very demanding and controlling. Fair was coded when parents responded to children's needs but did not anticipate them, mostly followed their own agenda, and were fairly inflexible. Parents with fair behavioral responsiveness were either a) offering too little help or information, disconnected in terms of not monitoring the task, and distracted from the task, or b) offering too much information, telling children what to do, and completing significant amount of the task themselves. As described, parents falling into the poor and fair categories could fall into the over-involved or the under-involved end of the continuum, both of which interfere with the development of autonomy in the child. Good behavioral persistence was coded when parents were "good teachers" in general. They responded well to children's needs by providing well-timed (not always) hints and cues (e.g., modeling), were flexible, and adjusted their agenda when needed. Lastly, excellent was defined as when parents were highly responsive and very flexible. Parents in this category gave clear, well-timed, appropriate assistance that fostered the child's learning (e.g., breaking the task down into smaller steps based on the child's level of cognitive ability).

Parents also were rated for emotional responsiveness. *Emotional responsiveness* was defined as the parent's ability to respond to the child's emotional cues and needs during the frustration-eliciting task. Emotional responsiveness was rated on one of the four levels: poor, fair, good, and excellent. Poor was given when the parent was unresponsive to the child's emotional cues. Parents in this category were disinterested,

withdrawn, or highly critical. Fair was coded when the parent showed some responsiveness to child's feelings (e.g, frustration, boredom, anger). Parents with fair emotional responsiveness were involved in the task, but did not generate interest or enthusiasm in the child. They responded to, but did not anticipate the child's negative feelings or loss of interest. Good was defined as when the parent displayed moderate level of responsiveness to the child's feelings. Parents were physically involved and visually oriented towards the child most of the time. They anticipated the child's frustration or loss of interest by labeling feelings or responding sympathetically, and expressed some enthusiasm, praise, or encouragement to keep up the child's motivation. Finally, excellent was coded for parents who created highly positive emotionally context for task completion. Parents in this category were physically involved and oriented towards the child the whole time, anticipated or responded immediately to early signs of frustration or loss of interest with various strategies (e.g., by labeling feelings and proactively managing negative affect, consistently expressing enthusiasm for the task, encouragement, etc).

The aforementioned constructs were assessed by a team consisting of five members: three doctoral students in clinical and developmental psychology, one research assistant with a bachelors' degree in psychology, and one undergraduate research assistant working towards a bachelor's degree in psychology. All data were coded in equal amounts by the five team members. Inter-rater reliability was established on 40% of the sample and reliability subjects were distributed throughout the entire sample. Average weighted kappas for reliability were: .88 for child persistence, 1.00 for child aggression, .82 for parent behavioral responsiveness, and .95 for parent emotional

responsiveness. Disagreements were resolved by team consensus.

Lab assessment of effortful control. Individual differences in effortful control were assessed in the laboratory using six tasks from Kochanska and colleagues' toddler-age behavioral battery (Kochanska et al., 1996): Turtle and Rabbit, Tower Task, Snack Delay, Whisper Task, Tongue Task, and Lab Gift (listed in the order in which they were administered). Each behavioral task was designed to tap Rothbart's (1989) general construct of effortful control (suppressing a dominant response and initiating a subdominant response according to varying task demands). All tasks were introduced as "games," and children were reminded of the rules midway through each task. In order to provide a check on accuracy of recording, 15 test administrations were videotaped and independently scored. Reliability was excellent (mean kappa = .95, range = .92-.98). Individual tasks have been described in detail elsewhere (Kochanska et al., 1996; Olson et al., 2005). As recommended by Kochanska et al. (1996), a total effortful control score was computed by summing individual subtest scores (standardized alpha = .70).

Socioeconomic status. The Hollingshead four-factor index was used to assess family socioeconomic status (Hollingshead, 1975). Mothers' and fathers' occupational status and education was obtained by self-report. Occupational status was coded on a 9-point qualitative scale with the following categories: 1) farm laborers/menial service workers; 2) unskilled workers; 3) machine operators and semiskilled workers; 4) smaller business owners, skilled manual workers, craftsmen, and tenant farmers; 5) clerical and sales workers, small farm and business owners; 6) technicians, semiprofessionals, small business owners; 7) managers, minor professionals; 8) administrators, lesser professionals, proprietors of medium-sized businesses; and 9) higher executives,

proprietors of large businesses, and major professionals. Mothers' and fathers' education was coded on a 7-point qualitative scale with the following categories: 1) less than seventh grade; 2) junior high school; 3) partial high school; 4) high school graduate; 5) partial college; 6) college graduate; 7) graduate or professional training. Socioeconomic status (SES) was computed by summing the parent's occupation score multiplied by 5 with the parent's education score multiplied by 3. An individual SES score was obtained for each parent, and then these two values were averaged if both parents worked. If only one parent worked, then this parent's individual SES was used.

Child cognitive ability: Wechsler Preschool and Primary Scale of Intelligence-Revised (WPPSI-R, Wechsler, 1989). Children's level of cognitive ability was measured using the WPPSI-R, a standardized assessment of general intellectual functioning of children aged 3 to 7 years and 3 months, during a one-on-one testing session between child and experimenter in our laboratory. Two subtests of the WPPSI-R, Vocabulary and Block Design, were administered to evaluate the child's Verbal and Performance (non-verbal) Intelligence. The Vocabulary subtest consisted of two question types. In the first, the child is shown pictures and is asked to name the object in the picture (3 items). Each item is scored as correct (1 point) or incorrect (0 point). In the second, the child is orally presented with a word and is asked to provide its definition (22 items). Each item is scored on a scale reflecting strong understanding (2 points), moderate understanding (1 point), or no understanding (0 point). The test is concluded when the child worked through all 25 items or when they have defined five consecutive words with a score of 0. In Block Design, the child is asked to reproduce designs using three or four flat, two-colored tiles (14 designs). Two trials were allowed for each design. The test is timed and

children are given bonus points on some items for speed. The test is discontinued after the child's failure on both trials of three consecutive designs. The raw total scores on Vocabulary and Block Design were averaged to create a single index. The average IQ score correlated highly with the two subtests: .80 with Vocabulary and .81 with Block Design.

Children's externalizing behavior problems. The Child Behavior Checklist (T1: CBCL/2-3, T2 & T3: CBCL/6-18; Achenbach, 1992; Achenbach & Rescorla, 2001) and the Teacher Report Form (T1: CTRF/2-5, T2 & T3: CTRF/6-18; Achenbach, 1997; Achenbach & Rescorla, 2001), measures of behavioral and emotional problems in childhood, were used to assess parents' and teachers' ratings of children's externalizing behaviors. Ratings by multiple informants enabled the assessment of children's behavioral problems in multiple settings, following a growing consensus that discrepant reports of children's adjustment by informants reflect true differences across diverse contexts rather than measurement errors (Achenbach & Rescorla, 2001; Grietens et al., 2004; Hinshaw & Nigg, 1999; Kerr, Lunkenheimer, & Olson, 2007).

Mothers and fathers independently filled out the CBCL at three time points. Respondents rate the child on items (approximately 100 items for each version of the CBCL that describe the child's behavior currently or within the past 2 months (CBCL/2-3) or 6 months (CBCL/6-18). Each item is rated on a 3-point scale ("2"=very true or often true of the child; "1"=somewhat or sometimes true; "0"=not true of the child). There are two broadband, factor-analytically derived dimensions of child problem behavior, Internalizing and Externalizing. In this study, externalizing scores were included in the analysis. The Externalizing Problems scale was defined by Aggressive

Behavior and Destructive Behavior subscales in CBCL/2-3 and Aggressive Behavior and Rule-Breaking Behavior subscales in CBCL/6-18. The narrow- and broadband problem behavior scales were highly inter-correlated: the correlation between Externalizing and each of its subscales ranged from .76 to .98 (all  $ps < .001$ ) for mother- and father-report CBCLs. Achenbach (1992; Achenbach & Rescorla, 2001) has reported that the Externalizing Problems scale of the CBCL had high test-retest reliability (.84 at 7.7 day interval for CBCL/2-3; .92 at 7 day interval for CBCL/6-18).

Teachers completed age-appropriate CTRFs at all time points. The CTRF/2-5 and CTRF/6-18 have the same response format and share many of the same items with the CBCL/2-3 and CBCL/6-18. The content of some items and of the externalizing scale varies depending on the form to capture developmental changes and behaviors unique to or more typical of different settings. Achenbach (1997) derived broad Internalizing and Externalizing scales, with subscale components that differed somewhat from those of the CBCL/2-3 (e.g., the Externalizing Problems scale was defined by Aggressive Behavior and Attention Problems in CTRF/2-5). In CTRF/6-18, Externalizing consisted of Aggressive Behavior and Rule-Breaking Behavior subscales, identical to CBCL/6-18. Like CBCL, sums of items on the Externalizing scale were used to represent teachers' report of children's externalizing problem severity. As with the parent ratings, the broadband index of Externalizing Problems was highly correlated with its narrow-band subscales:  $r$ s ranged from .83 to .99 (all  $ps < .001$ ). The average test-retest reliability was .90 at 8.7 day interval for CTRF/2-5 and .95 at 7 day interval for CTRF/6-18 (Achenbach, 1997; Achenbach & Rescorla, 2001). In Achenbach's normative sample, level of agreement between teachers and parents was moderately high, at .64 for

### Externalizing Problems.

The participants who had both mother- and teacher-ratings of externalizing behaviors (T1, T2, & T3) did not differ in makeup from those whose teacher-ratings were missing in terms of child gender, socioeconomic status, cognitive ability, and child and parent variables from the block design task. However, children who had both parents' ratings of externalizing behavior differed from those who only had mother-ratings in terms of family SES. Children whose fathers had contributed ratings were from higher-SES families than those whose fathers did not participate in T1 and T2 (both  $ps < .001$ ), but not in T3.

## CHAPTER III

### RESULTS

#### Overview and Analysis Plan

The analytic plan of the present study was as follows. In preliminary analyses, the central tendency and variability of all study variables were obtained. Differences by child gender also were tested. In order to ensure the likelihood of the existence of heterogeneous subgroups of children based on their persistence trajectories in the Block Design dyadic task, the distribution of child persistence for each design was examined for non-normality. Next, the child's persistence on the block task was correlated with the laboratory measure of EC to check the validity of the persistence measure as a behavioral index of child EC. Then zero-order correlations were run for the dyadic task variables, child externalizing behaviors reported by multiple informants at 3, 6, and 10 years, as well as between all other study variables. Correlations between study variables were also observed by child gender.

The next step was to perform latent class growth analysis (LCGA) of children's persistence trajectories in Mplus Version 5.2 (Muthén & Muthén, 2007). This procedure identifies the best number of latent trajectory classes and tests potential predictors of class membership within the same analysis. It should also be noted that LCGA does not allow variance around the means. LCGA was conducted in multiple steps. First, a single-

class growth model was specified to examine the overall pattern of growth of child persistence across the three designs. Then unconditional models (i.e., models without predictors) with two, three, and four classes were run and compared for fit indices to select the optimal number of classes. Such comparison of solutions with different numbers of classes makes LCGA less subjective than cluster analysis (DiStefano & Kamphaus, 2006). Once the number of classes was determined, possible predictors (including child gender) were introduced in the model, hence, a conditional model. Then, for trajectories in each class, the effects of predictors on the initial status (i.e., intercept) and change over time (i.e., slope) were examined. The classes were compared in the multinomial logistic regression for predictors of class membership with the least dysfunctional class of children serving as a reference group.

Following LCGA, the identified classes were compared in ANOVA based on task time and child outcome measures which included the instances of children's verbal, object, and physical aggression during the dyadic task, and children's externalizing behavior problems reported by mothers, fathers, and teachers at 3, 6, and 10 years. This procedure was conducted separately by child gender to possible moderation effects. Post-hoc tests (Tukey HSD) were also run.

### Descriptive Analyses

Central tendency and variability. Means and standard deviations for all demographic variables and those derived from the mother-child interactive block design task are presented in Tables 1 and 2. Means and standard deviations for children's externalizing behaviors reported by mothers, fathers, and teachers at 3, 6, and 10 years are provided in Table 3.

Block design interaction task. As shown in Table 2, mother-child dyads took an average of 5.77 minutes to complete the block design task (range = 2 minutes to 16 minutes, 30 seconds). The average length of time spent on the 1<sup>st</sup>, 2<sup>nd</sup>, and 3<sup>rd</sup> design were 1.99 minutes (range = 30 seconds to 12 minutes), 2.10 minutes (range = 30 seconds to 9 minutes, 30 seconds), and 1.86 minutes (range = 30 seconds to 9 minutes), respectively. The average level of children's persistence on task decreased over time (mean=3.18 for design 1; 2.96 for design 2; 2.88 for design 3) which was expected given that the task difficulty increased across the three designs (Figure 1). Thirty-two children (15 girls) had persistence score of high in every segment, and four (2 girls) had persistence score of none in every segment of the task. On average, mothers' behavioral responsiveness (mean=2.71) and emotional responsiveness (mean=2.79) were closer to the "good" level, indicating that mothers in general responded well or little less to children's behavioral and emotional cues. Children's instances of verbal, object, and physical aggression was low (mean=0.35; range=0-10).

Differences by child gender. There were no gender differences in demographic and dyadic task variables (Tables 1 and 2). However, independent samples t-tests on children's externalizing behavior problems revealed that boys and girls received differential ratings by multiple informants (Table 3). Fathers' [ $t(155)=2.04$ ,  $p<.05$ ] and teachers' [ $t(186)=2.30$ ,  $p<.05$ ] ratings of boys' externalizing behavior problems were significantly higher than ratings of girls' externalizing at three years. At six years, only teachers' ratings were higher for boys than girls [ $t(188)=2.15$ ,  $p<.05$ ]. When children reached 10 years, both mothers [ $t(195)=2.01$ ,  $p<.05$ ] and teachers [ $t(192)=3.25$ ,  $p<.01$ ] reported that boys demonstrated higher levels of externalizing than girls. There were no

significant differences in externalizing reported by mothers at T1, mothers and fathers at T2, and fathers at T3.

Distribution of child persistent for each block design. The distribution of child persistence for each design was examined for non-normality which may reflect the presence of heterogeneous unobserved groups (Pearson, 1894). As shown in Figures 2, 3, and 4, the distribution of persistence for each design appears non-normal (2-peaks). This may suggest the possibility of qualitatively distinct subgroups of children with different means and standard deviations mixed together, thus, a latent class growth analysis was performed in a series of steps to identify children that belong to different classes.

Bivariate correlations. First, bivariate correlations between the child's persistence on the block task and the laboratory measure of EC were obtained. Next, bivariate correlations analyses were conducted within mother-child block design task variables (Table 4). Additionally, bivariate correlations among ratings of children's externalizing behavior problems by mothers, fathers, and teachers at T1, T2, and T3 are presented in Table 5. Bivariate correlations were also performed between all study variables, run separately by child gender (Table 6).

For boys, child persistence for block designs 1, 2 and 3 correlated positively with the laboratory measure of EC ( $M = -.13$ ,  $SD = .53$ , range = -2.34 – 1.20) indicating that it is a valid measure of child EC ( $r = .27$  to  $.35$ , all  $p < .01$ ). For girls, child persistence did not show significant correlations with the laboratory measure of EC ( $M = .15$ ,  $SD = .54$ , range = -1.41 – 1.50;  $r = .07$  to  $.13$ , n.s.). Child persistence for each of the three designs correlated positively with one another ( $r$  range =  $.52$ -. $.71$ ), suggesting that the rank order of child persistence remained stable over time. The time it took for mother-child dyads to

complete the interaction task was negatively correlated with the level of child persistence in each design ( $r$  range =  $-.43$  to  $.36$ ). With respect to maternal behaviors, behavioral and emotional responsiveness correlated at  $.58$ . Mother's behavioral responsiveness was positively correlated with the levels of child persistence in each design ( $r$  range =  $.18$ -. $56$ ). Interestingly, mothers' emotional responsiveness showed significant correlations with child persistence on designs 2 and 3, but not on the first design. Likewise, the instances of child aggression were correlated negatively with child persistence in designs 2 and 3, but not in the first design. The strengths of correlations between child persistence and aggression increased across the three block designs, suggesting that children were becoming more aggressive towards the end of the task. Mothers' behavioral and emotional responsiveness did not show significant correlations with the level of child aggression.

Agreement among parents' ratings of children's externalizing was moderately strong and was typical of studies on children's behavior problems (Stranger & Lewis, 1993). Surprisingly, mothers' and teachers' ratings in T1 were not significantly correlated, though other correlations ranged from  $.34$  to  $.44$  at T1,  $.42$  to  $.51$  at T2, and  $.48$ -. $77$  at T3 (Table 5). Mothers' and fathers' ratings correlation grew stronger over time ( $.44$  at T1;  $.49$  at T2;  $.77$  at T3). Within-rater stability from T1 to T2 ( $.50$  for mothers and  $.64$  for fathers), and again from T2 to T3 ( $.67$  for mothers and  $.62$  for fathers) was moderately strong. Agreement between teachers was notable given that children were rated by different teachers at the three time points ( $.43$  from T1 to T2;  $.62$  from T2 to T3).

Bivariate correlations among all study variables are provided for boys and girls separately in Table 6. Family SES and child IQ were included in correlational analyses to

explore potential relations with other variables of interest as prior research has demonstrated that family SES (Dearing, McCartney, & Taylor, 2006; Silver, Measelle, Armstrong, & Essex, 2005) and child IQ (Clark, Prior, & Kinsella, 2002) may be related to individual differences in children's externalizing problems. Correlations computed separately by child gender revealed a few noteworthy relationships. Family SES correlated positively with boys' externalizing behaviors reported by fathers at T2, and positively with girls' IQ and their mothers' behavioral and emotional responsiveness during mother-child interaction task. Child IQ showed modest correlations with children's persistence on the three designs ( $r$  range = .16-.24). Also, child IQ was negatively correlated with mother-report externalizing at T1 for boys, and positively correlated with mothers' behavioral and emotional responsiveness for girls.

The levels of child persistence on task showed significant correlations with teachers' ratings of children's externalizing behavior problems only for boys ( $r$  range = -.20-.22). It is also noteworthy that child persistence was modestly correlated with mothers' ratings of children's behavior problems at T3. In addition, gender-differentiated patterns were revealed in the informants' agreement on children's externalizing behaviors. Although within-rater stability across time points was moderately strong for both boys and girls, between-rater agreement was lower for girls, yielding a number of non-significant correlations, especially between parents and teachers and across time points (concurrent parent-teacher correlations were significant except for T1).

#### Latent Class Growth Analysis.

Univariate growth model. First, a single-class unconditional model was fitted to observe the overall growth pattern of child persistence across the three designs, and to

test whether there was significant individual variation in children's levels of persistence during the task. The results indicated that the variance of the random intercepts [est. mean = 3.16,  $p = .000$ ; est. variance = 0.71,  $p = .000$ ] and slopes [est. mean = -0.19,  $p = .000$ ; est. variance = 0.15,  $p < .01$ ] were significantly different from zero.

Extraction of latent classes. Subsequently, the data were examined using latent class growth analysis (LCGA). In this procedure, the optimal number of trajectory classes of child persistence was identified by comparing a set of fit indices between models with different number of classes (Nylund, Asparaouhov, & Muthén, 2007). At this stage, unconditional models (i.e., models without predictors for class membership) are tested. The predictors will be included once an optimal unconditional model is selected. The model fit statistics used to determine the number of classes were as follows: Akaike information criterion (AIC; Akaike 1983), Bayesian information criterion (BIC; Raftery, 1995), adjusted BIC (Sclove, 1987), entropy (Ramaswamy, DeSarbo, Reibstein, & Robinson, 1993), and Lo-Mendell-Rubin likelihood ratio test (LMR-LRT; Lo, Mendell, & Rubin, 2001). These cover a good range of the types of fit indices often used. Smaller values of AIC, BIC, and adjusted BIC indicate better model fit. Entropy indicates more accurate classification when the value is closer to 1. The models were also compared on the size of the smallest group to avoid solutions that included groups comprising less than 5% of the total sample. The LMR-LRT compares the models with  $k$  and  $k-1$  number of classes and a value less than .05 indicates significant improvement in fit for the model with  $k$  classes over the model with  $k-1$  classes.

The results for models with two, three, and four classes are presented in Table 7. A two-class model was fitted first, followed by a three-class model. The three-class

model showed significant improvement over the two-class model based on AIC, BIC, adjusted BIC, and LMR-LRT. Both models had entropy values of .92 which is reasonably good. The smallest class in each model included 38% and 12% of the sample, which exceeds the set criterion of 5%. The next step was to compare the three-class model to the four-class model. The four-class model had AIC, BIC, adjusted BIC values slightly smaller than the three-class model. The entropy for the four-class model was .91 indicating a reasonably clear classification, and the size of the smallest group was 11%. However, the  $p$ -value of the LMR-LRT for the four-class model is .421, indicating that it is not a better-fitting model than the three-class model. Taken together, these indices pointed to a three-class solution as the model with the optimal number of trajectory classes.

After specifying the three-class unconditional model, a set of predictors for class membership were introduced to test the conditional model. It is important to follow-up the unconditional model with the conditional model, because the unconditional model will lead to distorted results if the predictors have significant direct effects on the growth factors (i.e., intercept and slope) and on class (Muthén, 2004). The representation of the conditional model is presented in Figure 5. As seen in the figure, the model consists of the following components: a) a univariate latent growth model of observed variables measured at three time points (i.e., child persistence for designs 1, 2, and 3) with an intercept (I) and slope (S), b) a categorical variable for class (C), and c) a set of covariates or predictor variables which are tested for direct effects on I and S, and C. The predictor variables considered were: child gender, family SES, child IQ, mother's behavioral responsiveness, and mother's emotional responsiveness. It should be noted

that the direction of influence between mother's behavioral and emotional responsiveness and child persistence trajectories cannot be determined in the current study, as the relations between these variables were concurrent.

A comparison of the parameter estimates and model fit for the unconditional and conditional models is presented in Table 8. The two models were highly similar in terms of the growth factors (intercept and slope) and the proportion of the sample for each class, and the model fit (AIC, BIC, and LMR-LRT) and entropy. The results from the three-class conditional model were the bases for subsequent analyses.

Description of extracted latent classes. The characteristics of each class were as follows. Means and standard errors of the intercept and slope for each class are presented in Table 8, under the column labeled "conditional model." The largest group, comprising of 58% of the sample (59% for boys; 58% for girls), was characterized by a persistence trajectory that started with a high mean and a slope that was near zero, indicating that children in this group stayed highly persistent on task across all three designs (thus, named the "high-persistence" class). A second group, accounting for 14% of the sample (9% for boys; 14.5% for girls), showed a decreasing pattern in their persistence over time ("declining-persistence"). Children in this group appear to start the task with high persistence (i.e., high mean for the intercept), but then have a hard time maintaining their persistence over time (i.e., negative slope). The last group, comprised of 28% of the sample (32% for boys; 27.5% for girls), consistently displayed low persistence across over time ("low-persistence"). The average probabilities for most likely latent class membership ranged from .87 to .98 for the three classes, suggesting that children were clearly classified into their appropriate classes. The trajectories of child persistence based

on actual and predicted means for each class are presented in Figure 6.

Predicting class membership. The effects of predictors on children's persistence trajectories were examined in two ways. First, direct effects of predictor variables on the intercept (i.e., initial status) and slope (i.e. change over time) of children's persistence trajectories were tested, separately for each class (represented by the arrows from the predictors to I and S in Figure 5). Then, the effects of predictors on the categorical latent class variable were observed in multinomial logistic regression (represented by the arrow from predictors to C).

The effects of predictors on the growth factors (i.e., intercept and slope) of child persistence trajectories for the high-, declining-, and low-persistence groups are presented in Tables 9, 10, and 11, respectively. In the high-persistence group (Table 9), the initial level of child was marginally significantly predicted by child gender ( $\beta = -0.47, p = .07$ ) and child IQ ( $\beta = 0.56, p = .09$ ). Contrary to expectation, being female predicted lower level of initial persistence during the task. Higher IQ predicted higher level of initial persistence in children as expected. Family SES, mother's behavioral responsiveness, and mother's emotional responsiveness did not have significant effects on the initial level of child persistence. The change of persistence over time was strongly predicted by mother's behavioral responsiveness ( $\beta = 1.13, p = .000$ ). As expected, mothers who showed higher behavioral responsiveness had children who were able to maintain their high level of persistence over time. No other predictors had significant effect on the slope.

In the declining-persistence group (Table 10), only child IQ marginally predicted the initial level of child persistence ( $\beta = 0.58, p = .08$ ). This was in the expected direction with higher child IQ predicting higher intercept in the trajectory. As for the change over

time, higher mother's behavioral responsiveness was marginally significantly associated with lower decline in child persistence ( $\beta = 1.19, p = .09$ ). No other variables had significant effect on either the intercept or slope.

Finally, in the low-persistence group (Table 11), the initial level of child persistence was marginally predicted by child gender ( $\beta = -0.52, p = .09$ ), child IQ ( $\beta = 0.58, p = .08$ ), and mother's emotional responsiveness ( $\beta = 0.60, p = .08$ ). As in the high-persistence group, being female predicted lower levels of initial persistence during the task contrary to expectation. In addition, higher child IQ predicted higher initial child persistence. Interestingly, mother's emotional responsiveness was significantly associated with the initial level of child persistence in the expected direction. Mothers with high emotional responsiveness had children who started the task with higher levels of persistence. Like the other two groups, the change over time in child persistence was predicted only by mother's behavioral responsiveness ( $\beta = 1.07, p < .05$ ). Mothers with higher behavioral responsiveness had children who were able to maintain their persistence on task better than other children in the group.

The next step was to test the effects of predictors on the categorical latent class variable in multinomial logistic regression. In a multinomial logistic regression, one of the latent classes serves as a reference category to which other groups are compared. In the current study, the high-persistence group was first used as a reference class, because it was the most prevalent group and also the least dysfunctional in terms of their performance on the task. The results are presented in Table 12. The mean scores and odds ratios for each comparison and each predictor variable are presented in Table 12. The odds ratio (OR) is a way of comparing whether the likelihood of a certain event is the

same for two groups. An OR of 1 implies that the event is equally likely to occur in both groups. An OR greater than 1 indicates that the event is more likely in the current group compared to the reference group. An OR smaller than 1 implies that the event is less likely in the current group than in the reference group. As shown in Table 12, child IQ and mother's behavioral responsiveness had significant effects on the class membership. As the child's IQ increased by one unit, the likelihood of being classified to the low-persistence group decreased by 12% compared to the high-persistence group. Moreover, with a one-unit increase in mother's behavioral responsiveness, the likelihood of belonging to the low-persistence group decreased almost by half (41%), again compared to the high-persistence category. The odds of being in the declining-persistence group were not predicted by any covariates that were included in the model. As an additional step, the effects of predictors on class membership were examined with low-persistence class as the reference category. The purpose of this analysis was to see whether there were any predictors that differentiated the probabilities of belonging in the declining-persistence group compared to the low-persistence group. The results are presented in Table 13. The likelihood of being classified to the declining-persistence group with reference to the low-persistence group was not significantly predicted by any of the variables that were included in the model.

Comparison of classes on task time. As there was no set time limit for a particular block design or the task as a whole, there was large variability in task time among the mother-child dyads (Table 2). Children in the three classes derived from the latent class growth analysis were compared on task time separately for boys and girls using one-way ANOVAs and the Tukey HSD (Honestly significant differences) post hoc

tests. The differences in the time spent on the block task among the three classes are presented in Table 14. For both boys and girls, there were significant differences among the three latent groups in the total lengths of time on the task as well as time on each of the three block designs. Specifically, boys in the high-persistence group spent shorter time on the task as a whole than those in the low-persistence group [ $F(2, 112)=10.98, p<.001$ ]. Girls' total time on task was significantly shorter for the high-persistence group than both the declining- and low-persistence groups [ $F(2, 98)=13.08, p<.001$ ]. As for the time spent on the first block design, the low-persistence group spent longer time to complete this design than the other two groups for both girls [ $F(2, 98)=11.73, p<.001$ ] and boys [ $F(2, 112)=13.76, p<.001$ ]. The task time on the second design also differed across the three groups with slightly different patterns for boys and girls. Boys in the low-persistence group spent longer time on the second design than the other two groups [ $F(2, 109)=8.95, p<.001$ ], whereas girls in the high-persistence group spent shorter time on this design than the other two groups [ $F(2, 96)=12.10, p<.001$ ]. In the third design, the declining-persistence group spent longer time on the task than the high-persistence group for both girls [ $F(2, 93)=6.18, p<.01$ ] and boys [ $F(2, 101)=4.45, p<.05$ ]. The low-persistence class did not differ from the other two classes in their task time on the third design for both boys and girls.

Comparison of classes on child externalizing behaviors. Children in the three latent classes were compared on their severity of behavior problems. First, children were assigned to the group to which they had the highest probability of belonging based on their persistence trajectories. Then, one-way ANOVAs, followed up with the Tukey HSD post hoc tests, were run to observe group differences. These analyses were conducted

separately by child gender to observe potential gender-moderation in the pattern of prediction. Child outcome measures tested for group difference included the instances of child aggression during the mother-child interaction task, and mother-, father-, and teacher-report of children's externalizing behaviors when children were 3, 6, and 10 years.

The differences in child aggression during the block design task among the three latent classes are presented in Table 15 and Figure 7. For boys, the results from the ANOVA indicated that there was a significant difference among the three groups in child aggression during the task [ $F(2, 112)=3.33, p<.05$ ]. The Tukey HSD post-hoc tests revealed that children in the declining-persistence class displayed significantly more instances of aggression than those in the high-persistence group ( $p<.05$ ). The low-persistence group did not differ from the other two groups in terms of within-task child aggression. The ANOVA was also significant for girls [ $F(2, 98)=6.75, p<.05$ ]. The post-hoc tests showed that the high-persistence group significantly differed from both the declining-persistence group ( $p <.05$ ) and the low-persistence group ( $p<.05$ ). Girls in the high-persistence group displayed significantly less instances of aggression than the declining- and the low- group. There was no significant difference between the low- and the declining-groups of girls.

The next step was to test whether there were differences among the three classes in children's externalizing behaviors rated by mothers, fathers, and teachers. The analyses were run separately by child gender. The results are presented in Tables 16 and 17 for boys and girls, respectively. Boys in the three latent classes did not differ in their levels of externalizing behavior problems at 3 years according to mothers, fathers, and teachers. However, the three groups exhibited differences in externalizing behaviors three years

later. The ANOVAs were marginally significant for mother-report [ $F(2, 103)=2.38$ ,  $p<.10$ ] and significant for teacher-report [ $F(2, 91)=4.28$ ,  $p<.05$ ] of child externalizing at 6 years. The post-hoc tests revealed that, according to mothers, boys in the low-persistence group displayed higher levels of externalizing behaviors than those in the high-persistence group. The declining-persistence group did not differ significantly from the other two groups. The pattern of group difference was similar for teacher-reported children's externalizing behaviors. Thus, boys in the low-persistence group had higher externalizing scores than those in the high-persistence group, and the declining-persistence group did not differ from the rest. The three groups did not differ in externalizing behaviors on father-reports at age 6. When children reached 10 years, only teacher-reported child externalizing behaviors were significantly different among the three groups [ $F(2, 95)=3.50$ ,  $p<.05$ ]. Children in the low-persistence group displayed higher externalizing problems than those in the high-persistence group. The declining-persistence group, again, was not significantly different from the other two groups. The three groups of children at 10 years did not differ in their externalizing behaviors reported by mothers and fathers.

For girls, the three groups differed in the levels of externalizing behavior problems at 3 years according to father-reports [ $F(2, 66)=3.35$ ,  $p<.05$ ]. Girls in the low-persistence group exhibited more externalizing behaviors than those in the high-persistence group. The declining-persistence group was not significantly different from the other two groups. At 6 years and 10 years of age, girls in the three groups did not differ in their levels of externalizing behaviors reported by mothers, fathers, or teachers.

## CHAPTER IV

### CONCLUSION

The present study was designed to examine children's effortful control processes in early childhood and their concurrent and longitudinal relations to externalizing behavior problems. Microanalytic studies of children's effortful control skills are uncommon and have not utilized a person-centered approach which is useful in capturing both intra-individual changes over time and inter-individual differences in these patterns (Nagin, 1999). Accordingly, in our first research question we sought evidence for the existence of systematic, moment-to-moment patterns of EC in a challenging interaction. The results of the present study suggested that such profiles can be identified based on which children could be reliably classified into heterogeneous groups. This information offers a few theoretical and methodological implications for future research.

First, the present findings provide empirical support for the construct of effortful control as a *process* by modeling its variations over a relatively short span of time (the average time mother-child dyads spent on task was 5.77 minutes). This makes sense given that EC, by definition, is comprised of multiple regulatory processes (e.g., attention regulation and inhibitory control) that are interrelated and organized momentarily to fulfill immediate and long-term goals by suppressing dominant responses and initiating subdominant responses (Rothbart & Bates, 2006). To date, however, studies on EC have

mostly focused on its trait-like quality as a stable characteristic of a child rather than its process of change over time. One exception is a study by Zhou and colleagues (2007) which examined developmental trajectories of attention focusing and behavioral persistence, but they were mainly interested in modeling differential stabilization of the subcomponents of EC over the years of time in a group of school-aged children (5-10 years). While macro- and variable-centered analyses have greatly advanced our understanding of EC as a temperament factor and its relations to other variables of interest, micro- and person-centered analyses may offer additional, more refined insights about how EC plays out in children's daily interactions. Researchers have also noted the importance of integrating different levels of analyses (Dumas et al., 2001) and the value of analyzing time-sequential data (Howe et al., 2005). In the present study, we attempted to address a gap in the literature by examining heterogeneity in effortful control profiles in early childhood, a period in which a child's regulatory abilities develop rapidly based on neurological maturation and experiences in the environment (Carlson, 2005). In particular, it has been proposed that individual differences in EC emerge around the preschool years and become stabilized in the following years (Kochanska et al., 1996). Thus, examining moment-to-moment variations in preschoolers' effortful control may offer us clues about how dysfunctional regulatory patterns begin to develop in early childhood and set a foundation for later adjustment.

Overall, children's effortful control, measured by the child's level of persistence on the block design task, showed a decreasing pattern across the three block designs probably due to the increase in task difficulty. However, latent class growth analyses revealed that this overall pattern was masking individual differences in children's

persistence trajectories. In fact, three distinct EC profiles were identified: high-persistence, declining-persistence, and low-persistence. Based on these trajectories, children could be classified into three heterogeneous groups with high accuracy. Over half of the children were well-regulated, showing stably high levels of persistence throughout the entire task (high-persistence). About one third of children struggled with the task both in terms of getting started and maintaining their focus until the end (low-persistence). The remaining children displayed a decreasing pattern of EC (declining-persistence).

Among the three EC profiles identified, the low-persistence and the declining-persistence were potentially dysfunctional. We were particularly interested in explaining what contributed to the drop in persistence for children in the declining-persistence group, when many other children managed to keep their persistence high throughout the task. Do children whose persistence decreases have lower IQs so that they have a harder time regulating their attention and behavior as the task gets more challenging? Is it about how the mother and the child interact during the task? There also was a group of children who were dysregulated both initially and throughout the task. Again, why were these children manifesting poor effortful attention from the beginning? Are there differences between the two dysregulated groups (i.e., declining- and low-persistence) in terms of their predictors and correlates? These inquiries led to the formulation of our next research question: What predicts class membership and inter-class individual differences?

### Predictors of Effortful Control Profiles

In our second research question we sought to identify predictors of inter-class and intra-class individual differences. Specifically, we asked whether the three identified

trajectories of effortful control can be distinguished from one another by a set of theoretically relevant predictors. Also of interest were individual variations within a group in terms of their initial level of persistence and its maintenance throughout the task. Based on prior research, both proximal and distal factors that may have effects on effortful control profiles were included in the present study: child gender, socioeconomic status, child IQ, maternal behavioral responsiveness, and maternal emotional responsiveness (e.g., Calkins & Fox, 2002). It was anticipated that a different set of variables may have effects on different aspects of an EC trajectory (i.e., initial status, change over time) and in distinguishing different pairs of trajectories. Generally, however, it was hypothesized that boys (Else-Quest et al., 2006), children of lower socioeconomic status families (Noble et al., 2005), children lower in cognitive ability (Calkins & Fox, 2002), and children of parents who display lower behavioral and emotional responsiveness during the task (Wakschlag & Keenan, 2001) would manifest more dysfunctional patterns of effortful control. As expected, different predictors differentiated class membership and predicted individual differences within each class. Although there were subtle variations across the three EC groups, a general pattern was that child characteristics such as child gender and IQ affected how well-regulated the child is initially, but whether the child would persist throughout the entire task was associated with maternal behavioral responsiveness.

Child characteristics. Child IQ significantly determined the likelihood of a child belonging to the high-persistence group versus the low-persistence group. Specifically, as the child's IQ increased by 1 point on the WPPSI-R, the probability of being classified into the low-persistence group decreased by 12% compared to the high-persistence group.

It makes intuitive sense that children with higher cognitive ability would find the block task easier and show stably high levels of persistence throughout the entire task despite the increase in difficulty. Child IQ was a significant predictor of intra-class individual differences as well. Interestingly, child IQ only had marginally significant effects on the initial level of child persistence, but not on its change over time in all three groups with heterogeneous EC profiles. In each class, the association between child IQ and the initial status of EC was in the expected direction in that higher IQ predicted higher persistence in the beginning of the task. It may be possible that children with higher cognitive ability do not find the task very challenging in the beginning and thus, are not as burdened with regulatory demands as those with lower cognitive ability. The child's IQ did not have effects on the slope of each EC trajectory, suggesting that the degree to which a child is able to maintain a level of persistence throughout the task is determined by other factors.

Another child characteristic examined in the present study was child gender. Prior studies have found that girls show more sophisticated effortful control abilities than boys (Else-Quest et al., 2006). For example, Kochanska and colleagues (2000) have found gender differences in EC measured by a behavioral battery in 33-month-old children in the expected direction. In the present study, however, child gender did not differentiate the three EC trajectories from one another. Interestingly, boys in our sample have been found to show lower EC skills than girls on the aforementioned Kochanska's battery in another study (Olson et al., 2005). In the present study, the average scores of child persistence in each block design did not differ by gender. It was speculated that the inconsistent findings of the present study may be due to how we operationalized effortful control. The six tasks in Kochanska's behavioral battery were relatively pure,

independent measures of the subcomponents of EC, administered by a lab examiner (for a detailed description of the factor structure of her battery, see Murray & Kochanska, 2002). We measured children's persistence on a mother-child interactive problem solving task as a behavioral index of EC. Although a child's ability to persist on a challenging task has shown to be a hallmark of successful self-regulation, it has also been reported that persistence on a task is a more complex index of EC in that it relies on multiple subcomponents of EC which may develop at differing ages (Zhou et al., 2007). In fact, a child's persistence on a challenging task has been shown to continue to develop in school-aged children (Zhou et al., 2007). Additionally, a child's persistence on the block task in our study may have been affected by other factors that were not controlled (e.g., family environment) because the assessment was administered at the child's homes. As a result, gender differences evident in Kochanska's battery may not have translated to the child's persistence on the block task. In future research it would be useful to study how effortful control assessed by different methods converge and diverge, and its theoretical and methodological implications.

Another finding regarding child gender was that it had marginally significant effects on the child's initial level of persistence in the high-persistence and the low-persistence groups. Contrary to expectation, girls in both groups showed lower persistence in the beginning of the task than boys in the same group. As we did not examine whether intra-class individual differences provided any further insights for understanding children's effortful control and adjustment, it remains unclear what such gender differences in the reversed direction might imply.

Maternal responsiveness. The literature has offered theories and empirical

support for the effects of early parenting behaviors on children's development of self-regulation (e.g., Karreman et al., 2008; Kopp, 1989). In the present study, mothers' responses toward children during the block task were observed and analyzed for their effects on fluctuations in children's effortful behaviors. Therefore, no causal inferences could be made. Our analyses, however, enabled a closer look at mothers' behaviors that were associated with time sequential changes in children's regulatory processes. Mothers were observed for behavioral responsiveness and emotional responsiveness, a conceptualization that has been found useful for analyzing parent behavior during a problem solving task (Matas et al., 1978; Wakschlag & Keenan, 2001). The results of the present study suggested that the two kinds of maternal responsiveness have different effects on children's effortful control profiles.

The results revealed that maternal behavioral responsiveness (along with child IQ aforementioned) significantly differentiated the low- and the high-persistence groups. With a one-unit increase in the mothers' behavioral responsiveness, the likelihood of her child belonging to the low-persistence group decreased almost by half compared to the high-persistence group. More generally, mothers who were good "teachers" during the task (e.g., offering well-timed, appropriate assistance to the child without hindering autonomy) were more likely to have children who stayed persistent throughout the task than mothers who did not respond as well. The declining-persistence trajectory could not be differentiated from the other two trajectories by maternal behavioral responsiveness. In terms of intra-class individual differences, maternal behavioral responsiveness had significant effects on the slope of the EC trajectory in all three groups: high-persistence, declining-persistence, and low-persistence. Maternal behavioral responsiveness was not

associated with the initial level of persistence in any class. Additionally, no factor other than behavioral responsiveness showed significant relations with the change of persistence over time in any group. Together, these findings suggested that while how well a mother responds to her child's behavioral cues and needs is not related to the child's initial level of regulation, it is the only factor (among the ones observed in the present study) that was associated with how well the child would be able to maintain persistence throughout the task. Maternal behavioral responsiveness may have been particularly important for a child's persistence in the present study because mother-child dyads were observed in a challenging, problem solving task. Thus, the degree to which a mother assisted her child appropriately to complete the three designs was likely to be an important factor regarding whether a child continued to work on the task.

Contrary to expectation, maternal emotional responsiveness did not have much effect on children's EC profiles. It did not significantly differentiate any trajectory from another. It did not have relations with either the initial level or change over time in child persistence in the high- and declining-persistence groups. The only finding regarding maternal emotional responsiveness was that it showed marginally significant associations with the initial level of persistence in the low persistence group. Specifically, mothers who responded sensitively to their children's emotional cues with appropriate strategies (e.g., acknowledging the child's frustration by labeling feelings) tended to have children whose EC in the beginning of the task was higher than others in the low persistence group. Although this makes intuitive sense, it was unclear why emotional responsiveness was not a significant predictor of EC profiles in the other groups. One possibility is that whether mothers are emotionally responsive or not matters more to children with lower

effortful control abilities, which is consistent with prior research that has shown that children with difficult temperaments are more susceptible to parental discipline than those with relatively easy temperaments (e.g., Van Zeijl et al., 2007). It is also possible that the teaching demands of the block task may not have elicited much emotion from mother-child dyads. However, the fact that maternal behavioral responsiveness and emotional responsiveness showed associations with different aspects of the EC trajectory (the former with the slope, the latter with the intercept) was intriguing. Since emotional responsiveness included the mother's ability to create an emotionally positive context to engage the child in the task, it may have had effects on the child's initial level of interest and persistence. However, a question remains as to why maternal emotional responsiveness was not a significant predictor of class membership, which is inconsistent with the existing evidence that parental warmth and sensitivity are positively associated with children's effortful control (e.g., Eiden et al., 2007; Eisenberg, Losoya, et al., 2001).

In sum, children in the high- and the low-persistence groups were differentiated by child IQ and maternal behavioral responsiveness. By examining the EC trajectory of each group separately, we found that child IQ was a marginally significant predictor for the initial level of persistence for a child whereas maternal behavioral responsiveness was associated with the degree to which the child was able to maintain persistence throughout the task. With additional studies to confirm causality between mothers' behaviors and children's regulatory processes, the findings of the present study would have important implications for effective prevention and treatment efforts of children's regulatory problems. In research and practice, improving parenting has been a central focus of intervention for young children's problematic behaviors. Studies have also stressed the

importance of parenting as a mediator of the effects of more distal risk factors (e.g., poverty, marital conflict) and child outcomes (Patterson, Reid, & Dishion, 1992; Schoppe-Sullivan, Schermerhorn, Cummings, 2007). Many times over, it has been demonstrated that parenting is modifiable (Gardner, Hutchings, & Lane, 2004) which results in changes in children's behavioral adjustment (Gardner, Sonuga-Barke, & Sayal, 1999). Researchers have also proposed that parents may be more receptive to intervention at developmental transitions as they face and learn to manage new challenges elicited by children (Gardner, Shaw, Dishion, Burton, & Supple, 2007). The findings of the present study suggested that improving maternal behavioral responsiveness may lead to higher regulatory competence in children especially in learning situations. For mothers of children who have difficulty from the beginning of a task (i.e., the low-persistence group in our study), an intervention focused on helping mothers to be more emotionally responsive may also be beneficial. Gardner and colleagues (2007) have found that even a brief intervention could help parents improve their proactive and positive parenting (e.g., warm, clear limit-setting, preemptive use of positive discipline strategies) which had effects on children's dysregulation of behavior. In future research, it would be useful to study potential strategies of training parents to be more behaviorally and emotionally responsive and its effects on child outcomes.

Remaining questions. Two questions still remained with regard to our second research question in which we sought to identify predictors of inter-class and intra-class individual differences in children's effortful control in a problem solving task. First, the family's socioeconomic status did not have significant effects on the child's persistence either between or within group, which is contrary to prior studies that have found that

economic hardship is a risk factor for children's regulatory competence (Evans & English, 2002). The absence of findings regarding socioeconomic status in the present study may be due to our largely middle-class sample without any family experiencing severe economic strains. A discussion of our findings in relation to the extant literature on socioeconomic status is also presented separately later in this dissertation.

The other remaining concern was that the declining-persistence group could not be distinguished from the high- or the low-persistence groups by the factors included in the present study. Only the low- and the high-persistence EC trajectories could be differentiated from each other with child IQ and maternal behavioral responsiveness. The lack of findings regarding the declining-persistence group was disappointing because this information would have offered more refined insights about what determines children's maintenance and drop in their levels of persistence in a challenging task. It may be the case that factors not examined in the present study have effects on the declining-persistence trajectory (e.g., children's reactivity). Yet, another possibility is that by deriving a single score of child persistence for each of the three block designs, some meaningful patterns were masked. Such simplification was necessary because of the large variability in the length of time the dyads spent on the task (range = 2-16.5 minutes). One limitation of having three time points of data (each corresponding to the three designs in our study) is that only linear functional forms can be modeled. If there was a more complex systematic pattern of effortful control in the task, it could not be detected in the present study – a possibility that awaits future exploration. In the mean time, another way of testing the validity and usefulness of our classification of EC profiles was to examine their relations to child outcomes.

### Effortful Control Profiles as Predictors of Externalizing Behavior Problems

In our third research question, we asked whether fluctuations in effortful control during a challenging task predicted children's externalizing behavior problems across the preschool and school-age years. It has been well-documented that deficits in EC abilities are associated with higher levels of externalizing problems (e.g., Hill et al., 2006; Olson et al., 2005). However, in most studies, EC was observed as a trait rather than process that may fluctuate over time. We anticipated that a process-oriented microanalysis of EC in a challenging task may offer additional, more refined insights about the relations between EC and externalizing problems. To capture the variability in children's behavioral adjustment across time and in a wide range of relational and environmental contexts (Kerr et al., 2007), mother-, father-, and teacher-ratings of externalizing behavior problems at the ages of 3, 6, and 10 years were included in the analysis as well as the instances of child aggression during the block design task for an examination of more immediate effects of EC profiles. Additionally, the analysis was conducted separately by child gender to detect potential gender-differentiated relations between EC and externalizing behaviors. Consistent with the literature, it was expected that dysfunctional patterns of EC would predict higher levels of externalizing problems in children. Also in accord with prior research, we believed that there would be gender moderation in these patterns (Keenan & Shaw, 1997). More specific hypotheses as to how each EC profile might predict externalizing problems differently were not formulated due to a paucity of research that has directly addressed this question.

Child aggression during task. Child aggression in the task included the instances of verbal, object, and physical aggression. Generally, children exhibited few aggressive

behaviors (mean = .35), but there was large variability among individuals (range = 0-10). The findings of the present study showed that, as hypothesized, children with different EC profiles showed different levels of aggression during the task. Also consistent with our expectation, these patterns were moderated by child gender. For boys, the declining-persistence group showed significantly more instances of aggressive behavior than the high-persistence group. Boys in the low-persistence group did not differ from the others in terms of their aggression in the task. For girls, the high-persistence group displayed less aggressive behavior than the other two groups. The declining- and low-persistence groups did not differ from each other in girls.

The fact that both girls and boys in the declining-persistence group showed the most instances of aggression was intriguing, although its difference with the low-persistence group did not reach significance. The results suggested that children who struggle to keep up their initial levels of persistence across the task are more likely to become aggressive probably in the context of children resisting their mothers' attempts to reengage them in the task. Bivariate correlations between children's persistence on each design and their total number of aggression provided further support for the findings. Specifically, the child's persistence on the second and the third design each correlated significantly with the child's level of aggression in the task. The child's persistence on the first block design, however, was not correlated with child aggression, suggesting that whether the child is able to persist in the later designs is important for the child's non-aggressive completion of the task. The absence of differences in child aggression between the declining- and low-persistence groups raised a concern about the usefulness of this distinction for predicting behavioral problems – a question that was explored further with

regard to children's externalizing problems in other contexts reported by multiple informants.

Another interesting pattern was that the low-persistence group had significantly higher aggression than the high-persistence group in girls only. One possible explanation for this finding could be drawn from studies that have shown faster development of girls than boys in diverse domains of functioning in early childhood (Eme, 1992). Accordingly, parental and societal expectation for self-regulation may be higher for girls (Keenan & Shaw, 1997). Therefore, girls whose development of adaptive skills (including effortful control) is slower may be at a greater risk for behavior problems than boys with similar delays (Keenan & Shaw, 1997). Indeed, empirical studies have found that girls' externalizing problems are likely to be reflective of a larger pattern of developmental immaturity (Olson & Hoza, 1993; Szatmari, Boyle, & Offord, 1989). Thus, it may be possible that girls in the low-persistence group in the present study were experiencing a broader range of developmental delays that had resulted in their showing more aggressive behavior than boys in the same group.

Externalizing behavior problems. In order to examine whether the relations between the children's effortful control and aggressive behavior during the block task generalized to other contexts and across time, the EC profiles in task was related to behavioral ratings of children by mothers, fathers, and teachers at the ages of 3, 6, and 10 years. Again, these patterns were examined separately by child gender. Our hypothesis that momentary variations of EC would predict externalizing behaviors was partially supported. Additionally, the results were moderated by child gender.

Unexpectedly, we found very few associations between children's EC profiles

and externalizing problems across time and settings. The significant findings were as follows: Boys in the low-persistence group showed higher levels of externalizing problems than those in the high-persistence group according to teacher-ratings at 6 years and 10 years. Boys in these two groups also showed a marginally significant difference in their behavior problems reported by their mothers at 6 years in the expected direction. The three identified EC profiles did not predict difference in boys' externalizing problems in any other contexts. In all ratings for boys, the declining-persistence group did not differ in their problematic behavior from the other groups. For girls, the only significant finding was that those in the low-persistence group showed higher levels of externalizing behavior problems than those in the high-persistence group based on father-ratings at 3 years.

The findings of the present study were interesting in the light of prior research on interrater agreement on behavioral ratings. It has been documented that different informants within and across settings modestly to moderately agree on their ratings of children's behavior (e.g., Grietens et al., 2004; Kerr et al., 2007). In accord with the literature, mothers, fathers, and teachers in our sample agreed with one another in modest to moderate degrees except for between mothers and teachers at 3 years. Researchers have also reported that inconsistencies among the informants are likely to mirror true variability in children's behaviors in diverse environments with unique demands (Kerr et al., 2007). An interesting pattern in the present findings was that EC profiles identified in the block task at the age 3 predicted externalizing problems in schools (i.e., teacher-ratings) at 6 and 10 years for boys. These results made sense given the resemblance between the block task and the classroom setting in schools. They are both structured

environments with clear goals and rules in which children are expected to learn new material. It is likely that the block task used in our study offered a snapshot of children's future performance in classrooms. Such information was particularly valuable because a problem solving task is not typical of a 3-year-old's daily encounters at home or preschool. This may also explain why we didn't find significant relations between children's EC profiles in task and their levels of externalizing problems at homes. Additionally, the absence of concurrent relations between children's EC profiles and externalizing problems rated by preschool teachers was not surprising because a preschool environment is less structured around learning new, challenging material. In sum, our results suggested that observing children's regulatory competence during a problem solving task in early childhood may offer clues about their future externalizing behaviors. It is particularly impressive that these associations were examined across informants, settings, and time. Specifically, preschoolers' effortful control patterns assessed at homes during a mother-child challenging interaction showed relations to children's behavioral adjustment in school three and even seven years later.

Remaining questions. Some questions remained about our findings between effortful control profiles and behavior problems in children. First, given that the block task did not represent a typical parent-child interaction, it was unusual that children in the high- and the low-persistence group showed significant differences in some measures of externalizing problems. For girls, such a difference was present in father-ratings at 3 years; for boys, a marginal difference was found in mother-ratings at 6 years. It might be possible that the fathers of 3-year-old girls and the mothers of 6-year-olds engage their children in learning activities similar to the block task. Thus, for a better understanding of

these findings, it would be useful to know more about the nature of parent-child interactions by child and parent gender.

Irrespective of these unusual findings, the question also still remains why we did not find more evidence for the expected relationship between effortful control patterns in task and behavior problems in girls. Unlike boys, girls with different EC profiles did not differ in their externalizing problems even in grade schools. One possibility is that because the levels of and variability in girls' externalizing behavior was significantly lower and smaller than boys', there was not much variance in girls' behavior to predict from the EC profiles. Yet, another explanation can be found in prior studies that have revealed that externalizing problems may be associated with different predictors for boys and girls (Hill et al., 2006; Shaw et al., 1994). Generally, studies have failed to find predictors of girls' externalizing problems (NICHD Early Child Care Research Network, 1994) with few exceptions (e.g., Hill et al., 2006). Research has shown that the development of children's externalizing behavior problems involves complex interactions among individual child characteristics and environmental risk in the family and parenting, as well as in larger societal and cultural contexts (e.g., Colder, Mott, & Berman, 2002; Leve, Kim, & Pears, 2005). Because the focus of the present study was to examine whether within-task effortful control profiles existed in early childhood and whether these patterns had significant implications for children's externalizing problems, other potential predictors of externalizing problems were not included in our analyses. The general lack of relations between momentary fluctuations in effortful behavior and girls' externalizing problems may imply that other factors have more significance for understanding behavior problems in girls. It may also be possible that the EC profiles identified in our study

interact with other variables to affect girls' problematic behavior.

Additionally, dysfunctional patterns of effortful control in early childhood may lead to different consequences for girls and boys. Also of relevance is the finding that the continuity of externalizing behavior from childhood and adolescence only existed in boys but not in girls (Broidy et al., 2003). It may be possible that girls' dysregulation in the early years leads to difficulties other than externalizing problems. In fact, studies have demonstrated that individual differences in effortful control are associated with a wide range of adaptive functioning and psychopathology including externalizing and internalizing problems, academic performance, and peer relations (e.g., Buckner et al., 2009). Therefore, the literature will benefit from research on the effects of micro-level effortful control profiles on multiple kinds of child adjustment. Because the block task in our study simulates a challenging, structured learning experience, its implications for children's academic performance may be of particular importance. All these possibilities await future exploration.

Our final remaining concern was the discrepancy between our findings regarding children's aggressive behavior in the block task and those regarding their externalizing problems in broader environmental and developmental contexts. We were mostly interested in comparing within-task child aggression and teacher-ratings of externalizing problems because the block task provided a classroom-like setting and learning experience. The within-task EC profiles had significant relations to both child aggression in task and teacher-reported externalizing problems in boys. However, the significant difference in problem behavior was found between the high- and the declining-persistence groups in the block task, whereas it was between the high- and the low-

persistence groups in grade schools. One possibility is that because mother-child dyads in the block task were allowed to discontinue and move on to the next design or activity, children who did not engage with the task from the beginning (i.e., low-persistence group) may have given up before they became aggressive. Conversely, a mother of a child whose persistence dropped over time (i.e., declining-persistence group) may have been more reluctant to give up and demand the child to refocus on the task, which may have resulted in negative interactions between the dyad and the child's display aggressive behavior. This sort of variability in the use of time and intense interaction are not present in a classroom environment, which may lead to children who had stably low effortful control profiles to become frustrated and elevate in their externalizing behavior.

For girls, effortful control profiles did show significant associations with within-task aggression, but not with externalizing problems rated by teachers. It is unclear why girls' EC patterns may relate only to immediate variations in their aggression but not to their behaviors in other settings or time periods. A clue to this mystery, however, may be found in research on gender-sensitive conceptualizations of aggression. A construct of relational aggression has been proposed (Crick & Grotpeter, 1995) to capture covert, indirect form of aggression (e.g., spreading rumors, excluding from social activities) commonly found in girls to obstruct relational goals of the victim (Owen, 1996). It has also been documented that when relational aggression is taken into account, gender differences in aggression disappear (Crick & Rose, 2000). Based on these findings, it is speculated that the absence of associations between momentary fluctuations in effortful control and externalizing problems in girls may be due to our not capturing girls' unique forms of behavior problems appropriately. Although the CBCL has been shown to be a

reliable and valid measure of children's problem behaviors, it does not include many items that assess relational aggression that may be predominant in girls. It will be important to include such measures in future research to reveal potential implications of within-task EC profiles for girls' behavioral adjustment.

### Child Gender

In our final research question, we asked whether associations between children's effortful control, maternal behavior, and adaptive outcomes would be moderated by child gender. Research has found evidence for gender differences in effortful control (e.g., Olson et al., 2005), parental socialization (e.g., Van Zeijl et al., 2007), and externalizing behavior problems (e.g., Keenan & Shaw, 1997). However, inconsistencies have also been reported especially in toddlers and preschoolers (Archer & Lloyd, 2002). In addition, studies have shown that relations among these variables may differ by child gender (e.g., Hill et al., 2006). Furthermore, it was yet to be determined whether gender differences existed in within-task effortful control patterns in early childhood. Thus, in the present study, we tested for possible gender-moderation considering child gender in our preliminary analyses, by including child gender as a predictor of effortful control profiles identified in the block task, and by analyzing the relations between EC profiles and externalizing problems separately for boys and girls. It was expected that there would be gender differences in individual constructs as well as in relations among them. Since gender-moderated results of the present study were already discussed in a number of sections above, here we focused more on integrating those findings.

Child gender and effortful control profiles. Based on prior findings of gender differences in effortful control in children (e.g., Olson et al., 2005), we examined whether

child gender was a predictor of the initial level of or change over time in effortful control in the block task, and whether the likelihood of belong to the three EC profiles differed by child gender. Unexpectedly, child gender was not significantly associated with either intra-class or inter-class individual differences of effortful control as measured by the child's level of persistence in task. In fact, our preliminary analyses revealed that boys and girls did not differ in child IQ, socioeconomic status, persistence, and maternal emotional and behavioral responsiveness. Our findings are consistent with studies that have found no gender difference in temperament problems (including regulatory abilities) in the first few years of life (Prior, Sanson, & Oberklaid, 1989). Alternatively, the lack of gender difference in momentary fluctuations in child persistence may reflect methodological differences in measuring effortful control in our study. As aforementioned, a child's ability to persist on a challenging task is a more complex index of EC which has shown to stabilize more slowly than other more basic regulatory processes (Zhou et al., 2007). Thus, girls and boys, at the age of 3 years, may not have started to diverge in their abilities to keep focused on a problem solving task.

The lack of gender differences in maternal responsiveness to children was inconsistent with previous studies that have found that parents respond to sons and daughters differently (e.g., Maccoby et al., 1984). One explanation is that mothers do not interact with their preschoolers differently in a challenging task where both girls and boys show similar performance. Also, it is possible that a mother's behavior in a problem solving task may not be as affected by her expectation about gender roles as in a free play setting (e.g., girls playing with dolls), which may have resulted in no gender difference in maternal responsiveness in the present study. In future research, it might be useful to

examine whether gender-moderated patterns of parental socialization vary across situations (e.g., problem solving, unstructured play).

Child gender and externalizing behavior problems. A large body of research supports gender differences in externalizing behavior problems (Keenan & Shaw, 1997). Boys have shown to exhibit more chronically high levels of externalizing problems than girls (Schaeffer et al., 2006), and be more likely to present for mental health services for such problems (Green et al., 1996). Gender differences in externalizing problems have shown to emerge around 3- and 4-years of age (Keenan & Shaw, 1997), but earlier differences have also been documented (Archer, 2004). Correspondingly, we hypothesized that there would be gender differences in children's externalizing behavior problems, favoring girls. Surprisingly, girls and boys did not differ in their aggression during the block task. They did, however, differ in mother-, father-, and teacher-ratings of externalizing problems at 3, 6, and 10 years in the expected direction, except for in mother-report at T1 and T2, and father-report at T3. It is speculated that the discrepancy of findings between children's observed aggression in the block task and informants' ratings was due to the nature of the task used in the present study. Because the block task was cognitively challenging (i.e., children were presented with block designs above their cognitive level), children who had lower effortful control abilities may have struggled to regulate their behavior, irrespective of their gender.

Research has also shown that boys and girls may differ in the antecedents, pathways, and mechanisms related to externalizing problems (see Zahn-Waxler, Crick, Shirtcliff, & Woods, 2006 for a review). Correspondingly, the relations between EC profiles in the block task and children's externalizing behavior in our study were

moderated by child gender. The details of these patterns and their implications were already discussed above, focusing on different predictors of externalizing problems and different outcomes of temperamental dysregulation in boys and girls.

### Generalizability and Socioeconomic Status

Although our sample was representative of the local population, it was not ethnically or socioeconomically diverse. The majority of children in our study were of European American heritage and of middle-class families. Thus, we should be cautious in generalizing our findings to other populations. Research has shown that socioeconomic status (McLoyd, 1998), family income (Dearing, McCartney, & Taylor, 2006; Evans, 2004), and race/ethnicity (Deater-Deckard & Dodge, 1997) affect children's development of regulatory skills and externalizing behavior problems. For example, it has been documented that poverty adversely impacts children's adjustment via its effects on their regulatory skills (Aber, Jones, & Cohen, 2000; Evans & English, 2002; Friedman & Chase-Lansdale, 2002; Raver, 2004). Additionally, research has found that children of families in lower socioeconomic status tend to receive more inconsistent, harsh parenting than their peers of more affluent families (McLoyd, 1998). Contrary to expectation, we found few effects of socioeconomic status overall. In preliminary analyses, a family's socioeconomic status showed positive correlations with child IQ, maternal behavioral responsiveness, and maternal emotional responsiveness in the expected direction, which were consistent with the literature. However, socioeconomic status did not have significant effects on children's regulatory competence in the block task. The absence of our findings regarding socioeconomic status is likely to be due to the skewness in our sample favoring higher levels of socioeconomic status. Additional research efforts on

regulatory processes in ethnic minority groups and children of more diverse levels of socioeconomic status would be useful in informing whether the present findings can be generalized across various ecological contexts. A final caveat about our study is that although we oversampled children who showed medium-high to high range of the Externalizing Problems in CBCL, few children actually had Externalizing scores in the clinical range. Thus it is yet to be determined whether our findings are applicable to clinically referred populations as well.

#### Methodology and Statistical Analyses

Because of the large variability in the time each mother-child dyad spent on the block task, it was necessary to reduce and simplify our observations for the purpose of study. Therefore, although our observations for a child's persistence were made in continuous 30-second intervals, and an average score of persistence for each of the three designs was computed and included in our analysis. Children's regulatory processes are complicated and micro-momentary. Yet, such moment-to-moment fluctuations in child EC were not captured in our assessment. Furthermore, we had to assume linearity in the functional forms of EC profiles due to having only three data points for each child (i.e., the child's persistence on block design 1, 2, and 3). It is possible that the patterns of change in child persistence were more complex and non-linear. Our study was among the first attempts to model effortful control processes during a challenging interaction. In future research, it will be valuable to ask whether additional, more refined insights can be obtained by examining EC patterns across several time points, which will allow more advanced modeling of effortful control processes in children. Additionally, controlling for the length of time spent on the task and the age of the child, both of which have shown

large variability in the present study, will strengthen our findings in the future.

Another limitation of our analyses was the use of ANOVA to test whether the three effortful control profiles showed significant relations to externalizing behavior problems. This research question was exploratory due to the paucity of research on effortful control from a process-oriented, person-centered approach. We could not hypothesize whether the effects of EC profiles on children's externalizing problems would differ in different settings at various developmental periods. Thus one of our goals was to explore possible associations between EC profiles and externalizing problems across time and place using a relatively simple methodological and statistical procedure. However, we know from the extant literature that multiple risk factors independently and conjointly influence the development of externalizing problems in children (e.g., Colder, Mott, & Berman, 2002). Researchers have also shown that taking a person-centered approach is useful in detecting intra-individual changes in externalizing behavior problems (Nagin & Tremblay, 1999). Therefore, a more complex model for the development of externalizing problems incorporating multiple variables including micro-level effortful control profiles should be tested to affirm and expand our findings in future research.

Finally, with the methodological and statistical approach in the present study, we were not able to make causal inferences. For example, although maternal behavioral responsiveness in the block task significantly differentiated the effortful control profiles in the block task and predicted the change over time in effortful control, it could not be determined whether one was the cause of the other. In the transactional model of causality, it has been proposed that the mother and the child engage in repeated, reciprocal

interchanges and continue to influence each other over time (Sameroff, 1975; 2009). A formal test of the causality between the pattern of changes in the child's effortful control and the mother's behavioral responsiveness awaits future research. For example, it would be valuable to examine time-sequential changes in mothers' behaviors across the three block designs as well as momentary changes in children's effortful control, which will allow us to better understand transactional processes between the mother and the child.

### Conclusion

Researchers have emphasized the advantages of utilizing both macro- and micro-levels of analysis and integrating different insights from each approach (Dumas et al., 2001). Yet, the majority of research has focused on the development of effortful control over years of time, often from a variable-centered approach which does not allow an examination of growth over time and heterogeneity in the population. The present study represented among the first efforts toward a more balanced understanding of children's self-regulation by examining temporal variations in effortful control during a challenging interaction in early childhood. Additionally, with a latent growth analysis, we were able to model within-task effortful control processes as well as capture individual differences in these patterns.

Atypical regulatory processes may result in later, more serious outcomes such as the stabilization of externalizing behavior problems. It has been shown that intervention before school-age has higher rates of success (Dishion & Patterson, 1992), underscoring the value of identifying early risk factors and venues for prevention. In the present study, we illustrated the usefulness of observing children's regulatory competence during a problem solving task to obtain clues about their concurrent and future behavioral

problems. Moreover, with some follow-up studies to confirm causality between mothers' behavior and children's regulatory processes, our findings would suggest that maternal behavioral responsiveness in a learning situation is a promising target of intervention, especially with regard to boys' successful behavioral adjustment in grade school. We have more to learn about girls' development of dysregulation and externalizing problems. How momentary changes in effortful control relate to more macro patterns across the childhood years awaits future exploration. Continued research efforts on early regulatory processes are essential for a more integrative understanding of what delineates abnormal from normative development in childhood.

## TABLES

Table 1. Means and Standard Deviations: Demographic Variables

Variable	<u>M</u>		<u>SD</u>		<u>Range</u>		<i>p</i>
	Boys	Girls	Boys	Girls	Boys	Girls	
Child age at T1 (months) (boys n=122, girls n=113)	37.84	37.46	2.59	2.85	32.53-44.83	26.60-43.77	n.s.
Child age at T2 (months) (boys n=100, girls n=84)	63.77	63.00	2.34	3.05	58.40-69.73	52.43-70.80	n.s.
Child age at T3 (years) (boys n=99, girls n=88)	10.50	10.33	.56	.69	8.52-11.78	8.72-11.65	n.s.
Family SES (boys n=121, girls n=112)	55.05	53.79	10.59	11.10	22-66	22-66	n.s.
Child IQ* (boys n=120, girls n=106)	10.04	10.42	4.32	4.59	2-22.5	2.5-22.5	n.s.

\*Note: Child IQ represents the average score of Vocabulary and Block Design subtests on the WPPSI-R.

Table 2. Means and Standard Deviations: Mother-Child Interactive Block Task Variables

Variable	<i>M</i>		<i>SD</i>		<u>Range</u>		<i>p</i>
	Boys	Girls	Boys	Girls	Boys	Girls	
Task time total in minutes (boys n=120, girls n=110)	5.62	5.94	2.49	3.14	2.5-14.5	2-16.5	n.s.
Design 1: task time (boys n=120, girls n=109)	1.98	2.00	1.58	1.66	.5-12	.5-11	n.s.
Design 2: task time (boys n=117, girls n=107)	2.01	2.21	1.16	1.52	.5-6.5	.5-9.5	n.s.
Design 3: task time (boys n=109, girls n=104)	1.85	1.88	1.14	1.31	.5-8	.5-9	n.s.
Design 1: child persistence (boys n=120, girls n=109)	3.15	3.20	1.03	.94	1-4	1-4	n.s.
Design 2: child persistence (boys n=117, girls n=107)	3.05	2.87	1.05	1.05	1-4	1-4	n.s.
Design 3: child persistence (boys n=109, girls n=104)	2.93	2.83	1.09	1.08	1-4	1-4	n.s.
Mother's behavioral responsiveness (boys n=118, girls n=111)	2.71	2.70	.86	.84	1-4	1-4	n.s.
Mother's emotional responsiveness (boys n=118, girls n=111)	2.79	2.80	.75	.77	1-4	1-4	n.s.
Child aggression* (boys n=119, girls n=111)	.47	.23	1.44	.73	0-10	0-5	n.s.

\*Note: Child instances of aggression represent the total number of instances of verbal, object, and physical aggression during the task.

Table 3. Means and Standard Deviations: Child Externalizing Reported by Mothers, Fathers, and Teachers

Variable	<u>M</u>		<u>SD</u>		<u>Range</u>		<i>p</i>
	Boys	Girls	Boys	Girls	Boys	Girls	
<u>3-year Externalizing</u>							
Mother (boys n=122, girls n=113)	11.84	11.17	7.37	7.27	0-38	0-39	n.s.
Father (boys n=80, girls n=77)	11.73	9.57	7.08	6.06	0-28	0-26	<.05
Teacher (boys n=97, girls n=91)	12.01	7.88	13.80	10.41	0-57	0-41	<.05
<u>6-year Externalizing</u>							
Mother (boys n=113, girls n=102)	7.25	5.98	6.59	5.10	0-35	0-31	n.s.
Father (boys n=83, girls n=72)	6.59	5.06	5.68	4.85	0-28	0-18	<.10
Teacher (boys n=99, girls n=91)	5.59	3.09	9.10	6.65	0-49	0-40	<.05
<u>10-year Externalizing</u>							
Mother (boys n=105, girls n=92)	6.47	4.65	7.18	5.19	0-29	0-24	<.05
Father (boys n=55, girls n=39)	6.09	4.95	6.37	4.66	0-28	0-16	n.s.
Teacher (boys n=101, girls n=93)	4.72	1.94	7.40	3.87	0-30	0-22	<.01

Table 4. Bivariate Correlations among Mother-Child Block Task Variables

Variable	2	3	4	5	6	7
1. Task Time	-.357**	-.430**	-.406**	.025	.020	.151*
2. Design 1 Child Persistence	---	.623**	.519**	.177**	.110	-.129
3. Design 2 Child Persistence		---	.707**	.259**	.192**	-.193**
4. Design 3 child Persistence			---	.239**	.151*	-.251**
5. Mother behavioral responsiveness				---	.575**	-.104
6. Mother emotional responsiveness					---	-.072
7. Child aggression						---

\* $p < .05$ , \*\* $p < .01$

Table 5. Bivariate Correlations among Rates of Children's Externalizing Behavior Problems

Variable	2	3	4	5	6	7	8	9
1. T1 (M)	.441**	.128	.499**	.298**	.251**	.431**	.430**	.351**
2. T1 (F)	---	.344**	.399**	.642**	.329**	.374**	.549**	.340**
3. T1 (T)		---	.249**	.231*	.434**	.338**	.234*	.425**
4. T2 (M)			---	.490**	.510**	.665**	.637**	.466**
5. T2 (F)				---	.422**	.538**	.619**	.392**
6. T2 (T)					---	.438**	.273*	.616**
7. T3 (M)						---	.773**	.598**
8. T3 (F)							---	.483**
9. T3 (T)								---

Note: T1 = 3-year Externalizing; T2 = 6-year Externalizing; T3 = 10-year Externalizing,

M = Mother-report; F = Father-report; T = Teacher-report

\* $p < .05$ , \*\* $p < .01$

Table 6. Bivariate Correlations: All Study Variables (Top half for girls, bottom half for boys)

Variable	1	2	3	4	5	6	7	8	9
1. SES	---	.206*	.083	-.100	-.124	-.033	.198*	.188*	.104
2. Child IQ	.160	---	.119	.233*	.234*	.229*	.166	.118	-.191
3. Task Time	.030	.125	---	-.316**	-.468**	-.438**	.054	.044	.121
4. Persist1	-.042	.203*	-.415**	---	.550**	.515**	.120	.037	-.136
5. Persist2	.058	.161	-.386**	.693**	---	.733**	.126	.025	-.350**
6. Persist3	-.059	.244*	-.371**	.523**	.682**	---	.174	.058	-.325**
7. Beh.resp	.104	.173	-.008	.224*	.383**	.302**	---	.582**	-.097
8. Emo. resp	.100	.236*	-.010	.173	.358**	.248*	.569**	---	-.017
9. Child agg.	-.015	-.158	.204*	-.129	-.148	-.250**	-.116	-.104	---
10. T1 Ext. M	-.159	-.262**	.151	-.138	-.185*	-.123	-.074	-.132	.062
11. T1 Ext. F	.065	-.134	-.076	-.182	-.052	-.146	.047	.000	.095
12. T1 Ext. T	-.196	-.106	.129	-.207*	-.214*	-.150	-.092	-.004	.167
13. T2 Ext. M	-.020	-.015	.189*	-.180	-.137	-.067	-.030	-.075	.042
14. T2 Ext. F	.221*	-.054	-.021	-.103	-.071	-.088	.099	.123	.168
15. T2 Ext. T	-.035	-.022	.139	-.209*	-.195	-.206	-.221*	-.208*	.162
16. T3 Ext. M	.027	-.011	.203*	-.196*	-.224*	-.184	-.139	-.095	.101
17. T3 Ext. F	.134	-.181	-.083	-.011	.171	-.056	.143	.118	.204
18. T3 Ext. T	-.105	.000	.219*	-.198*	-.118	-.159	-.132	-.034	.149
19. Lab EC	.238**	.300**	.016	.345**	.321**	.270**	.129	.169	-.043

Note: Persist1 = Child persistence for block design 1; Persist2 = Child persistence for block design 2;

Persist3 = Child persistence for block design 3; Beh.resp. = Mother's behavioral responsiveness; Emo.resp.

= Mother's emotional responsiveness; Ext. = Externalizing; M = Mother-report; F = Father-report; T =

Teacher-report; Lab EC = Lab measure of child effortful control

\* $p < .05$ , \*\* $p < .01$

Table 6 (Continued)

Var	10	11	12	13	14	15	16	17	18	19
1.	-.075	-.107	-.110	.073	-.089	-.129	-.085	-.093	-.120	.128
2.	.022	-.238*	-.212	.069	.037	.024	.016	-.056	.197	.429**
3.	-.176	-.006	-.248*	-.013	-.042	-.096	.125	.019	-.110	.073
4.	.104	-.100	.018	.094	-.100	.070	-.097	.045	.066	.134
5.	.074	-.172	.081	.017	-.079	.172	.113	-.123	.238*	.130
6.	.202*	-.121	.155	-.002	-.076	.031	.060	-.142	.153	.068
7.	.000	-.103	-.183	-.030	-.125	-.107	-.048	-.115	-.167	.137
8.	-.005	-.112	-.246*	-.076	-.156	-.144	-.033	-.244	-.227*	.097
9.	-.026	-.044	.028	-.015	.057	-.055	-.140	-.314	-.086	-.131
10.	---	.507**	.071	.424**	.302**	.125	.283**	.362*	.139	-.127
11.	.384**	---	.145	.375**	.595**	.246	.181	.488**	.138	-.357**
12.	.151	.416**	---	.252*	.110	.301**	.213	.155	.297**	-.215*
13.	.547**	.396**	.242*	---	.441**	.523**	.669**	.608**	.332**	.034
14.	.304**	.660**	.291*	.516**	---	.319*	.361**	.549**	.314*	-.156
15.	.330**	.351**	.517**	.490**	.451**	---	.410**	.046	.434**	-.146
16.	.518**	.453**	.384**	.653**	.605**	.435**	---	.579**	.538**	.030
17.	.477**	.601**	.256	.642**	.675**	.362**	.821**	---	.425**	-.006
18.	.471**	.415**	.442**	.520**	.437**	.689**	.616**	.488**	---	-.024
19.	-.222*	-.242*	-.263**	-.138	-.061	-.189	-.068	.025	-.211*	---

\* $p < .05$ , \*\* $p < .01$

Table 7. Model Fit Statistics Used to Select Optimal Number of Persistence Trajectory Groups

	2 latent classes	3 latent classes	4 latent classes
-2*log likelihood	1605.630	1534.604	1475.364
AIC	1621.630	1556.604	1503.364
BIC	1649.100	1594.375	1551.436
Adjusted BIC	1623.745	1559.512	1507.065
Entropy	.92	.92	.91
Smallest class %	38	12	11
LMR-LRT p-value	.000	.000	.421

Note: AIC = Akaike information criterion; BIC = Bayesian information criterion; LMR-LRT = Lo-Mendell-Rubin likelihood ratio test

Table 8. Parameter Estimates and Model Fit for the Unconditional and Conditional Models

Parameter	Unconditional model	Conditional model *
<u>Class 1: High-Persistence</u>		
Proportion of Sample	59	58
Intercept $M$ ( $SE$ )	3.73 (0.04)	3.38 (0.23)
Slope $M$ ( $SE$ )	-0.08 (0.04)	-0.15 (0.19)
<u>Class 2: Declining-Persistence</u>		
Proportion of Sample	11	14
Intercept $M$ ( $SE$ )	3.61 (0.12)	3.43 (0.21)
Slope $M$ ( $SE$ )	-1.02 (0.11)	-1.12 (0.17)
<u>Class 3: Low-Persistence</u>		
Proportion of Sample	30	28
Intercept $M$ ( $SE$ )	1.83 (0.08)	1.56 (0.20)
Slope $M$ ( $SE$ )	-0.02 (0.06)	-0.09 (0.19)
<u>Model fit and entropy†</u>		
AIC	1556.604	1462.550
BIC	1594.375	1533.431
Entropy	.92	.92
LMR-LRT p-value	.000	.001

\*Note: Conditional model estimates included child gender, family SES, child IQ, mother behavioral responsiveness, and mother emotional responsiveness as covariates. Associations of these variables with class membership are shown in Table 8.

†Note: AIC = Akaike information criterion; BIC = Bayesian information criterion; LMR-LRT = Lo-Mendell-Rubin likelihood ratio test.

Table 9. The Effects of Predictors on Children's Persistence Trajectory for the High-Persistence Group

Initial Status			
Predictor	<u>B</u>	<u>SE</u>	<u>p</u>
Child gender†	-0.47	0.26	<.10
Family SES	-0.16	0.33	n.s.
Child IQ	0.56	0.33	<.10
Behavioral Resp.	0.15	0.38	n.s.
Emotional Resp.	0.52	0.33	n.s.
Change over Time			
	<u>B</u>	<u>SE</u>	<u>p</u>
Child gender†	0.24	0.76	n.s.
Family SES	-0.00	0.75	n.s.
Child IQ	-0.05	0.72	n.s.
Behavioral Resp.	1.13	0.31	<.001
Emotional Resp.	-0.34	0.79	n.s.

†Note: Child gender was a binary variable (boys=0; girls=1)

Note: *B* = Standardized regression coefficient; *SE* = Standardized error

Table 10. The Effects of Predictors on Children’s Persistence Trajectory for the Declining-Persistence

<u>Group</u>			
Initial Status			
Predictor	<u>B</u>	<u>SE</u>	<u>p</u>
Child gender†	-0.51	0.31	n.s.
Family SES	-0.17	0.35	n.s.
Child IQ	0.58	0.33	<.10
Behavioral Resp.	0.16	0.39	n.s.
Emotional Resp.	0.64	0.41	n.s.
Change over Time			
	<u>B</u>	<u>SE</u>	<u>p</u>
Child gender†	0.27	0.81	n.s.
Family SES	-0.00	0.79	n.s.
Child IQ	-0.05	0.78	n.s.
Behavioral Resp.	1.19	0.72	<.10
Emotional Resp.	-0.42	1.11	n.s.

†Note: Child gender was a binary variable (boys=0; girls=1)

Note: *B* = Standardized regression coefficient; *SE* = Standardized error

Table 11. The Effects of Predictors on Children’s Persistence Trajectory for the Low-Persistence Group

Initial Status			
Predictor	<i>B</i>	<i>SE</i>	<i>p</i>
Child gender†	-0.52	0.30	<.10
Family SES	-0.17	0.33	n.s.
Child IQ	0.58	0.33	<.10
Behavioral Resp.	0.15	0.37	n.s.
Emotional Resp.	0.60	0.34	<.10
Change over Time			
	<i>B</i>	<i>SE</i>	<i>p</i>
Child gender†	0.27	0.80	n.s.
Family SES	-0.00	0.77	n.s.
Child IQ	-0.05	0.75	n.s.
Behavioral Resp.	1.07	0.43	<.05
Emotional Resp.	-0.39	0.92	n.s.

†Note: Child gender was a binary variable (boys=0; girls=1)

Note: *B* = Standardized regression coefficient; *SE* = Standardized error

Table 12. Multinomial Logistic Regression for Predictors of Class Membership with High-Persistence

Class as the Reference Class

<u>Predictors</u>	<u>Low-Persist.</u>		<u>Declining-Persist.</u>		<u>High-Persist.</u>
	<u>M</u>	<u>OR</u>	<u>M</u>	<u>OR</u>	<u>M</u>
Child gender†	.44 (.50)	1.03	.59 (.50)	2.36	.47 (.50)
Family SES	55.82 (9.88)	1.03	54.04 (11.14)	1.02	53.96 (11.26)
Child IQ	8.98 (4.09)	0.88**	9.17 (4.24)	0.90	11.14 (4.49)
Behavioral Resp.	2.49 (.79)	0.59*	2.48 (.75)	0.71	2.87 (.87)
Emotional Resp.	2.70 (.78)	0.93	2.52 (.80)	0.60	2.91 (.72)

†Note: Child gender was a binary variable (boys=0; girls=1)

Note: OR = odds ratio; the odds of being in the class is OR times as likely with a one-unit increase of the predictor variable.

\* $p < .05$ , \*\* $p < .01$

Table 13. Multinomial Logistic Regression for Predictors of Class Membership with Low-Persistence Class as the Reference Class

<u>Predictors</u>	<u>High-Persist.</u>	<u>Declining-Persist.</u>
	<u>OR</u>	<u>OR</u>
Child gender†	0.97	2.30
Family SES	0.97	0.99
Child IQ	1.13**	1.02
Behavioral Resp.	1.69*	1.19
Emotional Resp.	1.07	0.65

†Note: Child gender was a binary variable (boys=0; girls=1)

Note: OR = odds ratio; the odds of being in the class is OR times as likely with a one-unit increase of the predictor variable.

Note: The means and standard deviations of predictor variables for each class are presented in Table 11.

\* $p < .05$ , \*\* $p < .01$

Table 14. Differences in Task Time among the Three Latent Classes

			<u>High-Persist.</u>	<u>Declining-Persist.</u>	<u>Low-Persist.</u>	<i>F</i>
Task time total	Boys	<i>M (SD)</i>	4.81 (1.88) <sub>a</sub>	5.45 (1.27) <sub>ab</sub>	6.92 (2.83) <sub>b</sub>	10.98***
	Girls	<i>M (SD)</i>	4.68 (2.27) <sub>a</sub>	7.21 (3.12) <sub>b</sub>	7.52 (3.02) <sub>b</sub>	13.08***
Task time for design 1	Boys	<i>M (SD)</i>	1.47 (.77) <sub>a</sub>	1.41 (.58) <sub>a</sub>	2.92 (2.21) <sub>b</sub>	13.76***
	Girls	<i>M (SD)</i>	1.48 (1.06) <sub>a</sub>	1.76 (.87) <sub>a</sub>	3.13 (2.25) <sub>b</sub>	11.73***
Task time for design 2	Boys	<i>M (SD)</i>	1.71 (.96) <sub>a</sub>	1.73 (.52) <sub>a</sub>	2.65 (1.39) <sub>b</sub>	8.95***
	Girls	<i>M (SD)</i>	1.63 (.84) <sub>a</sub>	2.84 (1.50) <sub>b</sub>	2.89 (1.77) <sub>b</sub>	12.10***
Task time for design 3	Boys	<i>M (SD)</i>	1.63 (.90) <sub>a</sub>	2.55 (.98) <sub>b</sub>	2.17 (1.54) <sub>ab</sub>	4.45*
	Girls	<i>M (SD)</i>	1.57 (1.23) <sub>a</sub>	2.75 (1.50) <sub>b</sub>	2.10 (1.20) <sub>ab</sub>	6.18**

Note: For each row, cell values that do not share subscripts are significantly different according to Tukey HSD post hoc tests.

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

Table 15. Differences in Child Aggression during Mother-Child Task among the Three Latent Classes

		<u>High-Persist.</u>	<u>Declining-Persist.</u>	<u>Low-Persist.</u>	<i>F</i>
Boys	<i>M (SD)</i>	.20 (.84) <sub>a</sub>	1.09 (2.98) <sub>b</sub>	.79 (1.58) <sub>a,b</sub>	3.33*
	N	71	11	38	
Girls	<i>M (SD)</i>	.03 (.18) <sub>a</sub>	.69 (1.01) <sub>b</sub>	.40 (1.10) <sub>b</sub>	6.75*
	N	63	16	30	

Note: Child aggression represents the total number of instances of verbal, object, and physical aggression during the task.

Note: For each row, cell values that do not share subscripts are significantly different according to Tukey HSD post hoc tests.

\* $p < .05$

Table 16. Differences in Externalizing among the Three Latent Classes for Boys

		<u>High-Persist.</u> (n=71)	<u>Declining-Persist.</u> (n=11)	<u>Low-Persist.</u> (n=38)	
Externalizing		<i>M (SD)</i>	<i>M (SD)</i>	<i>M (SD)</i>	<i>F</i>
T1	Mother	11.01 (6.45)	12.73 (6.94)	13.17 (9.14)	1.07
	Father	10.72 (7.34)	14.00 (9.04)	13.17 (5.59)	1.39
	Teacher	9.64 (12.34)	12.35 (12.83)	14.74 (13.72)	1.42
T2	Mother	6.25 (5.50) <sub>a</sub>	7.80 (6.20) <sub>a,b</sub>	9.30 (8.28) <sub>b</sub>	2.38†
	Father	6.24 (5.77)	7.50 (5.72)	7.75 (5.60)	.615
	Teacher	3.12 (5.04) <sub>a</sub>	8.50 (9.13) <sub>a,b</sub>	8.53 (12.72) <sub>b</sub>	4.28*
T3	Mother	5.26 (5.38)	7.20 (6.53)	7.98 (9.15)	1.73
	Father	5.47 (5.52)	6.25 (4.27)	6.76 (8.07)	.23
	Teacher	3.09 (5.03) <sub>a</sub>	6.00 (8.38) <sub>a,b</sub>	7.29 (10.02) <sub>b</sub>	3.50*

Note: For each row, cell values that do not share subscripts are significantly different according to Tukey

HSD post hoc tests.

†  $p < .10$ , \* $p < .05$

Table 17. Differences in Externalizing among the Three Latent Classes for Girls

		<u>High-Persist.</u> (n=63)	<u>Declining-Persist.</u> (n=16)	<u>Low-Persist.</u> (n=30)	
Externalizing		<i>M (SD)</i>	<i>M (SD)</i>	<i>M (SD)</i>	<i>F</i>
T1	Mother	11.84 (8.13)	10.58 (6.18)	10.38 (7.19)	.412
	Father	7.94 (5.53) <sub>a</sub>	10.25 (6.58) <sub>a,b</sub>	12.33 (6.19) <sub>b</sub>	3.35*
	Teacher	8.32 (11.45)	4.87 (5.76)	8.18 (9.77)	.68
T2	Mother	6.15 (5.57)	5.59 (4.30)	6.38 (5.70)	.11
	Father	4.68 (5.17)	4.25 (4.37)	7.00 (5.20)	1.36
	Teacher	3.80 (8.32)	1.47 (1.92)	3.05 (5.20)	.65
T3	Mother	4.78 (5.56)	3.24 (2.14)	5.90 (6.62)	1.16
	Father	4.56 (5.15)	5.29 (4.77)	5.46 (4.56)	.13
	Teacher	2.20 (3.97)	0.27 (0.70)	1.65 (2.58)	1.97

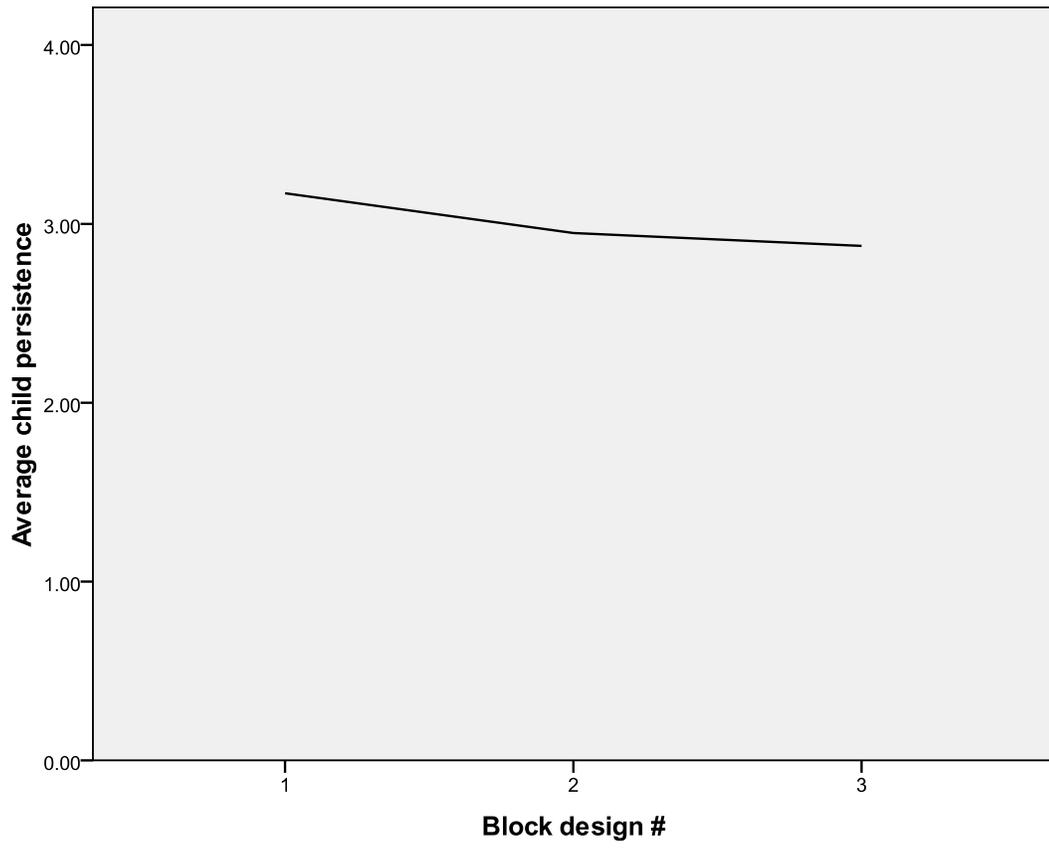
Note: For each row, cell values that do not share subscripts are significantly different according to Tukey

HSD post hoc tests.

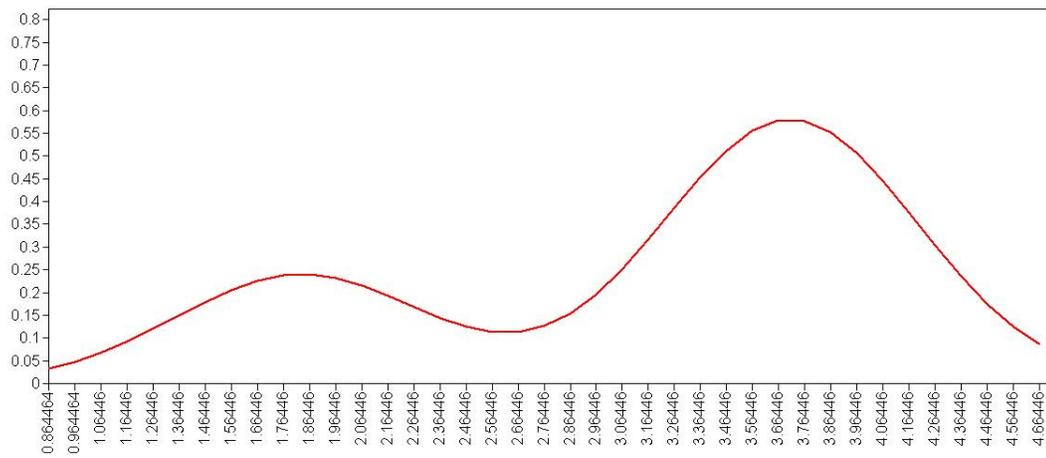
\* $p < .05$

## FIGURES

Figure 1. Mean Change of Child Persistence during the Block Design Task

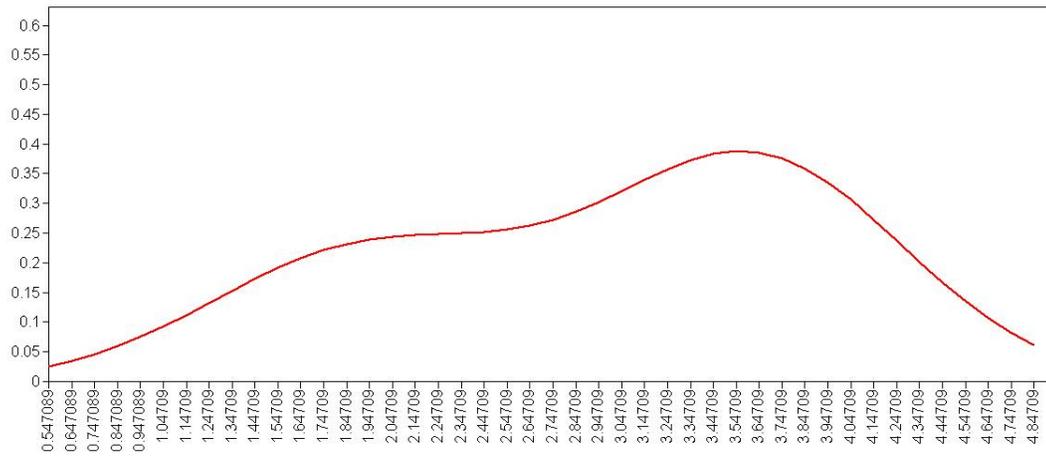


**Figure 2. Estimated Mixture Distributions of Child Persistence for Block Design #1 (n=229)**



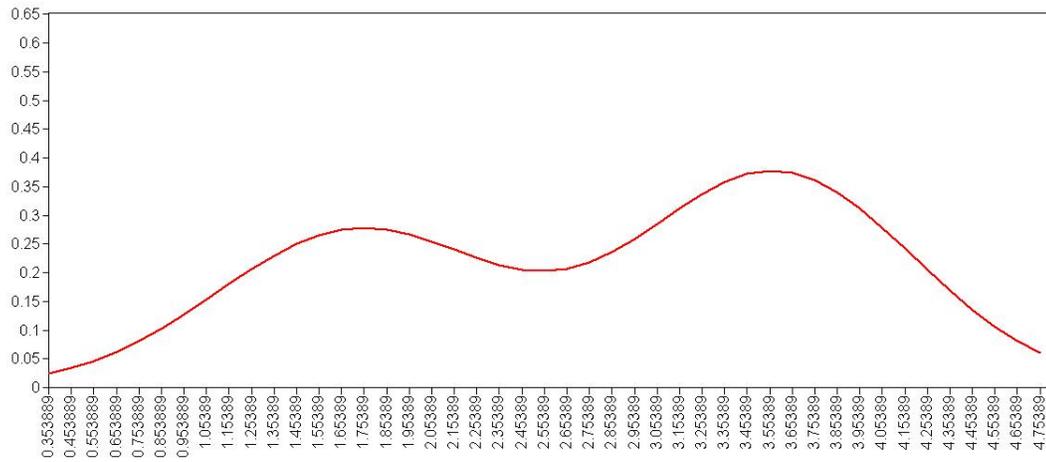
Note:  $M = 3.18$ ,  $SD = .98$

**Figure 3. Estimated Mixture Distributions of Child Persistence for Block Design #2 (n=224)**



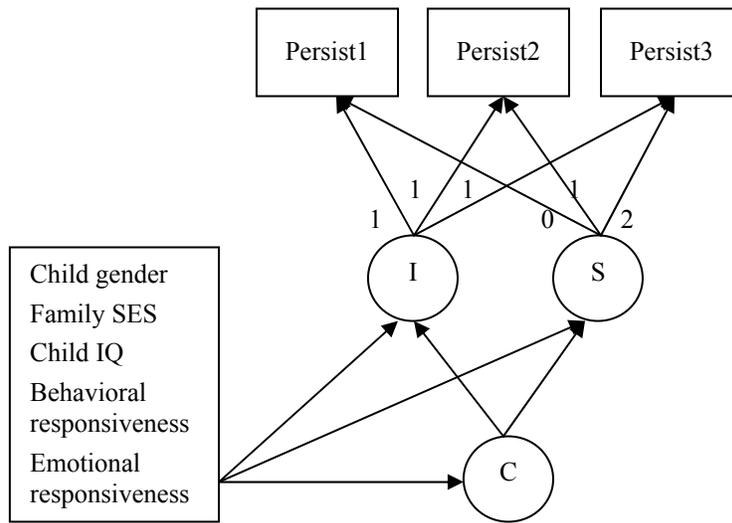
Note:  $M = 2.96$ ,  $SD = 1.05$

**Figure 4. Estimated Mixture Distributions of Child Persistence for Block Design #3 (n=213)**



Note:  $M = 2.88$ ,  $SD = 1.08$

Figure 5. Representation of the Latent Class Growth Model with Predictors



Note. I = Intercept; S = Slope; C = Latent Class; Persist1, Persist2, and Persist3 represent average child persistence on Block Design 1, 2, and 3, respectively

Figure 6. Trajectories of Child Persistence during the Block Design Task

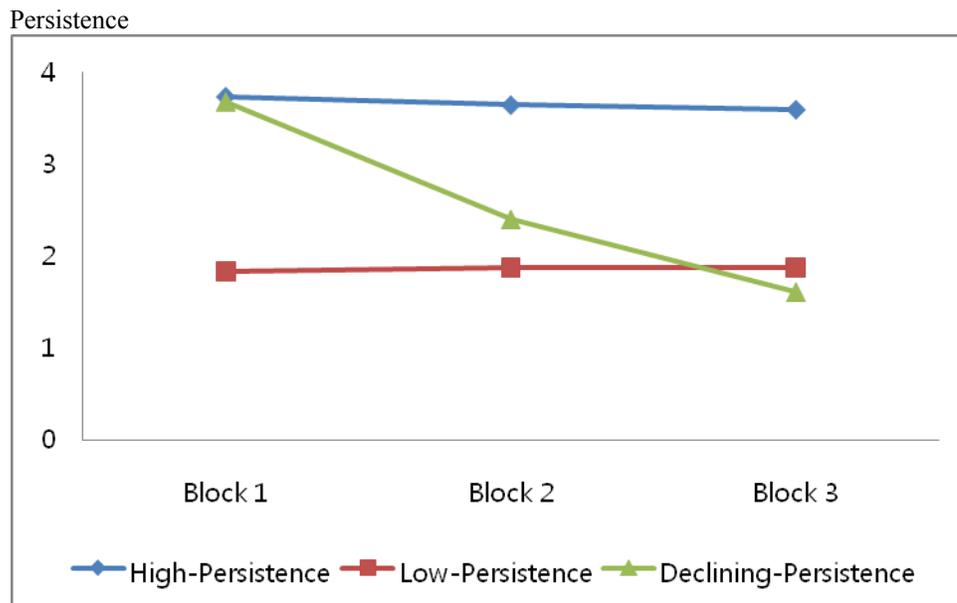
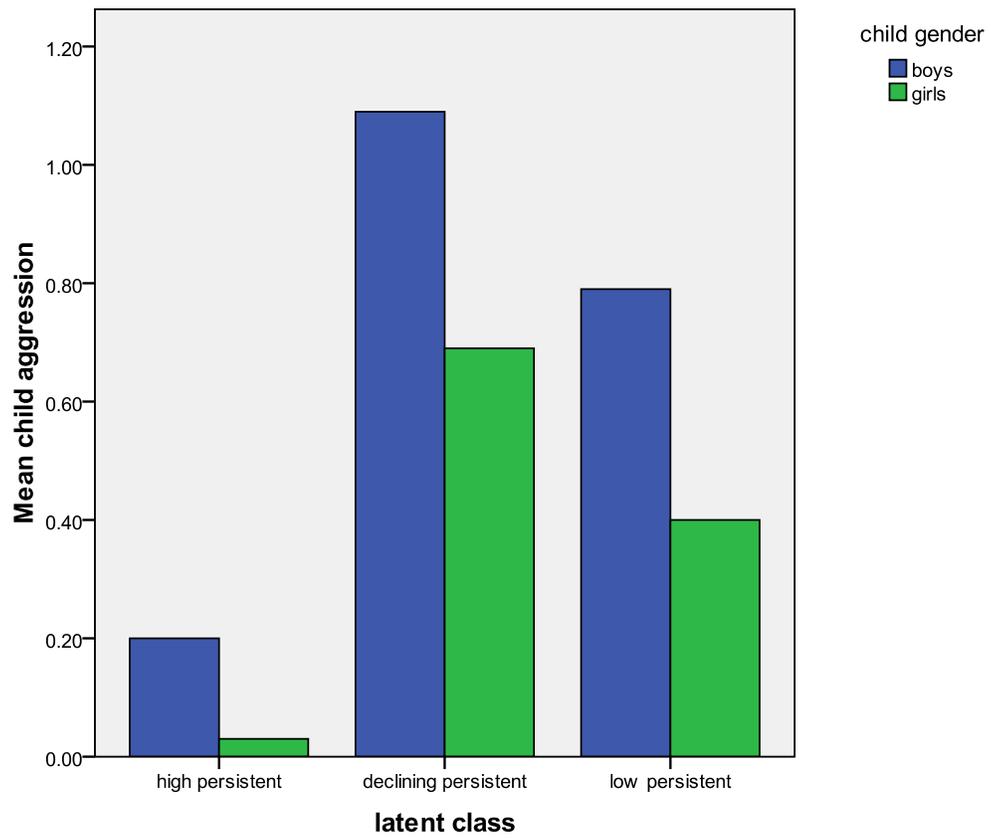


Figure 7. Differences among the Latent Classes in Children's Aggression during Task by Child Gender



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