EMOTION AND INHIBITORY CONTROL IN CHILD SOCIAL DEVELOPMENT:

A BEHAVIORAL SYSTEMS APPROACH

by

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(Under the Direction of Randy W. Kamphaus, Ph.D.)

ABSTRACT

This investigation used a behavioral systems framework to longitudinally predict elementary school social adaptation using measures of emotional and inhibitory control. A racially and ethnically diverse group of boys and girls in six urban schools were followed from the 1st to the 3rd grade. Results support the existence of and interaction among basic behavioral systems of reward-driven approach and harm-avoidant withdrawal. Interactive effects between the approach-driven dimension of impulsivity and the withdrawal-driven dimension of fearful inhibition were significant in the prediction of conduct problems for both genders and approached significance in the prediction of boys' aggression. Similarly, interactive effects between fearful inhibition and attentional control approached significance, suggesting a positive effect of fearful inhibition on later social skills for girls and boys with attentional deficits. Impulse control moderated the effect of negative emotionality on later aggression in girls and attentional control moderated the effect of negative emotionality on later conduct problems in boys. A curvilinear relationship between girls' negative emotionality and later aggression indicated that aggression increased at a faster rate at low levels of negative emotionality, peaked, tapered off, and slightly declined at high levels. Interactive effects between negative emotionality and impulsivity were also significant in the prediction of girls' conduct problems but again in the opposite direction. For highly impulsive girls, increases in negative emotionality predicted fewer conduct problems in 2nd grade but for girls with low levels of impulsivity, increases in negative emotionality predicted more conduct problems.

INDEX WORDS: Behavior ratings, emotionality, longitudinal, developmental psychopathology

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DEDICATION

This work is dedicated to my family. To my husband, Ken, for his love and support in this long, long endeavor. To my children, Hannah and Ryan, for showing me the true meaning of temperament. To my mom and dad who taught me to seek truth and beauty in others, to value differences, and to love knowledge. To my sister for her miracle and for giving me faith. To my brother for his humor and love. To my dad, my stepmom, Eileen, and my in-laws, Gary and Connie, who endured multiple reads and even acted like they enjoyed it. To Aunt Susan for her interest and empathy. To Anne for her patience. To all of you for your wonderful craziness without which, this work would lack its charm.

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CHAPTER 1

INTRODUCTION

Overview

Research in developmental psychopathology has increasingly focused on the interplay among child emotional and inhibitory characteristics in the onset of psychopathology (Keenan, 2000; Cicchetti, & Cannon, 1999) and in the fostering of positive social adjustment (Calkins, & Fox, 2002; Eisenberg, 2000; Eisenberg, Fabes, Guthrie, & Reiser, 2000; Rothbart, & Bates, 1998). Although this work has been generated by a diverse field of inquiry, a growing consensus exists that children's behavior cannot be characterized by a single symptom category in isolation but must instead be studied as a whole system (Caspi, 2000). Even though we currently know little about these dynamics, these systems of behavior are likely to interact in specific ways such that a clinician or researcher might predict other behaviors in that same child that might not be currently manifest (Calkins, & Fox, 2002).

This focus on basic building blocks of behavior is part of a broad-based movement towards a mechanistic understanding of the processes of developmental psychopathology and away from one that uses a categorical diagnostic system as the sole indicator of pathology (Cantwell, 1996; Cicchetti, & Cannon, 1999; Kamphaus, Reynolds, & Imparato-McCammon, 1999; Robins, John, & Caspi, 2000; Rutter, & Sroufe, 2000). Indeed, the common comorbidity of psychological diagnoses suggests that similar processes or malfunctions therein are involved in the development of a heterogeneous array of outward symptoms (Angold, Costello, & Erkanli,

1999). Yet few studies have explored how basic components or systems of behavior might combine to generate apparently diverse symptom sets or psychopathologies.

Temperament researchers, neurobiologists, and those interested in behaviors supporting social competency in early childhood (Eisenberg, et al., 2000, 1997; Eisenberg, 2000; Denham, Mason, Caverly, Schmidt, Hackney, Caswell, & DeMulder, 2002; Calkins, & Fox, 2002; Rothbart, & Bates, 1998) have begun to converge on the roles of some basic emotional and inhibitory control systems. Their findings, to be reported and presented in detail in the following review of the literature, suggest that emotional systems and inhibitory control systems are closely connected and may play complimentary and competing roles in development. Specifically, Rothbart and Posner (2000) have proposed that a child's ability to exert effortful control over his or her attention and impulses are key processes that make possible emotional modulation and effective social interactions (Rothbart & Bates, 1998; Eisenberg, et al., 1996, 1997, 2001; Eisenberg, 2000; Barkley, 1996; Kochanska, Murray, & Harlan, 2000; Calkins, & Fox, 2002). In addition, she and others (e.g. Kochanska, Coy, & Murray, 2001) have provided evidence to suggest that emotions such as fear and anxiety may also play a regulatory role in the development of certain socially desirable behaviors such as conscientiousness, empathy, and compliance.

The idea that emotions and inhibitory control might operate in tandem is also reflected in the theories of J.A. Gray (1987, 1991) and Patterson and Newman (1993) whose ideas provide a unifying framework from which to view behaviors traditionally studied in isolation, such as attention, impulse control, fearful inhibition and negative emotionality. In Gray's theory (1987, 1991) and its application in temperament work (e.g. Rothbart & Bates, 1998; Martin, 1999), impulse control, attentional focus, and emotional response are operating components of two main

systems, the Behavioral Activation System (BAS) and its counterpart, the Behavioral Inhibition System (BIS). The Behavioral Activation System is driven by appetite or reward cues in the environment. Children with an active BAS lack restraint when seeking reward, even in the presence of aversive contingencies. They are poor at passive avoidance -- the ability to inhibit responses when the possibility of punishment exists (Patterson, & Newman, 1993). When blocked from reward seeking, these children are likely to exhibit anger or frustration -- approach-driven responses that may prompt overt behavior, such as argument or aggression (Martin, 1999).

In contrast, the Behavioral Inhibition System is activated by conditioned punishment stimuli, is sensitive to cues of warning, and is responsible for enhancing attention to possible danger. After detecting such cues, this system is responsible for evaluating them, and implementing protective measures such as either active withdrawal, or the cessation of ongoing activity. Anxiety, worry, and fear are the most common emotions that fuel this system. It is the internal experience of these emotions, which cause children to slow or stop their activity, carefully assess their environment, and take any necessary precautions. Children with an overactive BIS are overly sensitive to possible non-reward and punishment in the environment, and are often described as shy and socially reticent (Gray, 1987; Martin, 1999; Avila, 2001). Children with an insensitive BIS are less likely to respond to cues of warning, reprimand or punishment and may require heightening of these cues.

In their theoretical definitions and operating assumptions, the Behavioral Activation System and the Behavioral Inhibition System have much in common with the fundamental systems of approach and withdrawal systems proposed by Davidson, Jackson, and Kalin (2000). Similar to the BAS, Davidson's approach system facilitates appetitive behavior, generates

positive affect, and may also generate approach-related anger. The withdrawal system facilitates withdrawal from aversive stimulation; organizes appropriate responses to cues of threat; and generates withdrawal-related negative emotions such as fear and anxiety (Davidson, et al., 2000). The BIS and BAS as well as these two basic approach and withdrawal mechanisms are believed to be orthogonal, yet mutually deterministic systems that generate characteristics and patterns of personality (Martin, 1999). In other words, children possess both systems in varying degrees of strength; personality lies in the balance. Patterson and Newman (1993) suggest that impulsivity or poorly modulated responding for reward evident in children with an overactive BAS is the "common diathesis" underlying traditionally distinct categories of psychopathology like, substance abuse, psychopathy, and hyperactivity.

Both systems have important functions and adaptive advantages. Within limits, impulsive or reward-sensitive behavior is important for psychosocial adjustment. A general tendency towards impulsivity or reward responsiveness has long been associated with extraversion or positive social activity (Eysenck, 1967; Patterson, & Newman, 1993) features of personality viewed as desirable. A certain level of impulsivity and reward seeking may help ward of the blues. A recent study found that inadequate impulsivity or an under active sensitivity to reward predicted the course and severity of depression in adults (Kasch, Rottenberg, Arnow, & Gotlib, 2002). These results suggest that, at least in patients with depression, a certain level of reward responsiveness is necessary for adequate psychosocial adjustment.

Although such hypotheses have not been directly tested in children, normal development might require a balanced sensitivity to both reward and punishment stimuli. It is only when people pay disproportionate attention to opportunities for reward or satiation of appetite or when they are unable to disengage from negative or punitive thoughts that such tendencies become

psychopathological. Patterson and Newman (1993) argue that impulsivity is maladaptive when its force is so strong that children cannot 1) suspend the reward driven dominant response, 2) shift attention from implementation to evaluation, and 3) accommodate and attend to relevant corrective feedback (Patterson, & Newman, 1993). Attention is highly relevant in this behavior regulatory process since it allows for a shift in focus to alternative behavior and the accommodation of new information. This formulation also suggests that attentional control might be in some ways a function of the power of the approach response.

Posner and Rothbart (2000) explicate an even more dominant role for voluntary overt control over attentional processes in children's emotional regulation and successful functioning. They argue that effortful control over attention is itself a generative system (Kochanska, et al., 2000, 2001; Posner, & Rothbart, 2000) that drives development and expression of other behavioral systems (e.g. approach and withdrawal). Inhibitory control (i.e. impulse and attention control) regulates and monitors internal and external cues to behavior in the service of specific skill development (social, academic, behavioral) necessary for the emergence of adaptive functioning. Deficiencies may incapacitate the child's ability to shift attention from immediate cues of fear or reward (Rothbart, Ahadi, & Hershey, 1994), suppress an inappropriate response, or control interference in pursuit of a goal (Taylor, 1999; Barkley, 1997). Likewise, the ability to shift attentional focus and suppress a dominant response is incorporated in most theoretical and operational definitions of emotional regulation (Eisenberg, 2000; Posner, & Rothbart, 2000; Thompson, 1994). These abilities which Rothbart calls "effortful control," and which in this paper will be referred to as inhibitory control enable the child to focus on non-arousing stimuli, to flexibly shift attention away from distressing situations, and to select behaviorally appropriate responses to the exclusion of impulsive, angry, withdrawing, or aggressive responses (Eisenberg

et al., 2000; Posner, & Rothbart, 2000). As a result, this aspect of behavior is believed to be necessary for the development of many basic competencies, social, emotional, and academic.

The ability to control the direction, duration, and content of one's attention has long been recognized in cognitive behavioral theories of depression. Because depression and anxiety are believed to result from a disproportionate attention to negative thoughts and environmental stimuli, a primary goal of cognitive behavioral therapy (CBT) has been to help clients to shift attention away from automatic negative thoughts and towards proactive, controllable thoughts (Beck, Rush, Shaw, & Emery, 1979). Social problem-solving training in children has also promoted attention to the beliefs and contingencies associated with negative emotion in order to generate rational solutions (Spivack, & Shure, 1974; D'Zurilla, & Nezu, 2001). The efficacy of these interventions attests to the veracity of the attention-emotion interface, yet we know little about how early imbalances in these systems, relative to other behavioral tendencies, impact development. Moreover, despite the high level of importance ascribed to its functions, the precise nature of the inhibitory control construct is still a matter of debate.

In Rothbart's theory, the inhibitory or effortful control system is often portrayed as a single entity with particular functions. However, a decade of factor analytic research has shown that attentional control, and impulsivity (Lahey, et al., 1988; Reynolds, & Kamphaus, 1992) are two distinct dimensions of behavior. They have been shown to be both psychometrically distinct and predictive of different outcomes in child adjustment (Frick, & Lahey, 1991; Warner-Rogers, et al., 2000). Attentional deficits are broadly associated with poor psychological adjustment and are specifically related to developmental and cognitive delay (Eisenberg, et al., 1993, 1999, 1997; Ladd, & Profilet, 1996; Harpur & Hare, 1990; Moffitt, 1993; Nigg, Quamma, Greenberg, & Kusch, 1999; Stanger, McConaughey, & Achenbach, 1992; Warner-Rogers, et al., 2000).

Impulsivity predicts externalizing problems, such as delinquency, substance abuse, and conduct disorders (Eisenberg, et al., 1996; Ellis, & Walsh, 1999; Farrington et al., 1990; Moffitt, 1993; Loeber, Green, Keenan, Kate, & Lahey, 1995; Lynam, et al., 2000; Patterson & Newman, 1993; Stice, Barrera, & Chassin, 1998). Interestingly, when attentional problems are not manifest, impulsivity alone does not predict cognitive delays (Warner-Rogers, et al., 2000). For these reasons and others to be fully elaborated in the following literature review, impulsivity and attention will be considered separately for their unique contribution to development rather than as a unit.

Emotions too appear to come in different kinds and to serve different functions. As noted, emotions appear to operate within approach and withdrawal systems by activating a certain set of associated behaviors. The experience of emotion is an important way in which children receive feedback on the effect their actions have on their environment and the effect their environment has on them. This is why emotional regulation is not just about suppressing excessive emotion but harnessing and interpreting subtle emotional responses in the service of appropriate behavior (Thompson, 1994).

At their essence, emotions are designed to prompt different kinds of behavior. Emotion theorists as well as temperament theorists have argued for action-specific roles for fear and sadness in precipitating withdrawal or avoidance. Positive emotions, such as happiness, and negative emotions, such as anger or frustration, are argued to precipitate approach behavior (Caplovitz-Barrett, 1998; Ackerman, Abe, & Izard, 1998).

In the field of neurobiology, researchers have demonstrated that emotions differ in their hemispheric laterality by type, and that these differences predict later temperament in children (Davidson, et al., 2000; Fox, 1991, 1994). For example, there is evidence of disproportionate

right frontal EEG activation in infants of depressed mothers (Dawson, Frey, Self, Panagiotides, Hessl, Yamada, & Rinaldi, 1999), and infants that have been presented with aversive contingencies such as sour or bitter tastes (Fox, 1991). Asymmetrical left frontal activation has been found in infants presented with sweet tastes and those who demonstrate positive affect (Fox, 1991). Depression in adults is also associated with asymmetrical right frontal activation (Davidson, et al., 2000). Thus, the right hemisphere appears to be more heavily involved in depressed affect, while the left hemisphere is associated with happy, positive feelings.

Angry affect does not show the same pattern of right activation as sadness and fear (Davidson, et al., 2000) suggesting that there is something different about the underlying neural circuitry. Similarly, early expressions of anger in children predict a different profile of behavior than early fear or sadness (Rothbart, et al., 2000; Calkins, & Fox, 2002). Frustration and anger have been implicated in the development of aggression, conduct problems, substance abuse, and poor psychological adjustment overall (Lahey, & Loeber, 1994; Nelson, Martin, Hodge, Havill, & Kamphaus, 1999), while fear and sadness are associated with later mood and anxiety disorders (Kagan, 1998). In addition, moderate levels of fear and anxiety have been associated with positive adaptation (Kochanska, et al., 2001; Kochanska, Murray, & Coy, 1997; Rothbart, Ahadi, & Evans, 2000; Rothbart & Bates, 1998).

Traditional learning theorists have demonstrated that anxiety increases the speed with which associations are made between behavior and consequences (Mowrer, 1960). For this reason, Rothbart suggests that fearful inhibition, like effortful control, may regulate behavior in a reactive rather than intentional, goal-based manner (Rothbart, & Ahadi, 1994; Kochanska, 1993). Evidence consistent with this view documents how fearful inhibition enhances the development of both behavioral control and empathy in young children (Kochanska, et al., 2001Rothbart, et

al., 2000; Eisenberg, 2000). In addition, fear has been shown to be a crucial deficit in some psychopaths (Harpur, & Hare, 1990) as well as a discriminative factor in a more positive prognosis for children with conduct problems (Walker, et al., 1991). While these findings certainly imply a functional role for fear in development, they do not tell what might be the optimal level of anxious or fearful inhibition, for whom or under what conditions such relationships are applicable. In other words, when is a healthy level of anxiety unhealthy? Is anxiety always good, or only good when paired with potentially harmful behaviors such as conduct problems or criminality?

The current investigation will explore the developmental role of fearful inhibition and anger when considered simultaneously and interactively with other major child behavioral adaptation systems, such as attention and impulse control. The expectation is that additive and interact effects of these four specific behavioral dimensions in children -- attentional control, impulsivity, negative emotionality or frustration, and fearful inhibition – will predict distinct social development outcomes. These "behavioral systems" are expected to conform to the theoretical roles presented here and to relate in lawful ways to social behaviors reflective of approach or withdrawal excesses. Social development is used as the outcome of interest because it is a stepping-stone for later adjustment and is likely to be one of the earliest and most obvious consequences of poor inhibition and emotional regulation (Calkins, & Fox, 2002; Denham, et al., 2002; Eisenberg, 2000). Children who cannot regulate emotions appropriately are prone to socially aversive, unpredictable behaviors, experience greater peer rejection (Ladd, 2000) and fail to develop social skills (Denham, et al., 2002; Eisenberg et al., 2000; Eisenberg, Fabes, Guthrie, Murphy, Maszk, Holmgren, & Suh, 1996; Calkins, Gill, Johnson, & Smith, 1999; Stifter, Spinrad, & Braungart-Rieker, 1999). Because the form of social adaptation and

maladjustment might differ across children however, four different outcome indicators -- aggression, conduct problems, withdrawal, and social skills – will be used to index the child's social status in 3rd grade.

Purpose of This Study

Several key gaps in the literature will be addressed. First, much of the research to date has been of a theoretical nature in that differing constructs are posited but defined in various ways by differing researchers. In fact, Elliot and Thrash (2002) in a recent paper exploring approach-avoidance motivation in personality note that one of the most pressing problems facing the field of psychology is "how to organize the various constructs that have been introduced over the years into a coherent framework. . The proliferation of these constructs has made their integration a critically important task for personality theorists (p.23)." The same could be said in work on child temperament. The veracity of the various constructs proposed can be checked psychometrically in order to ensure that the constructs proposed are actually being assessed. Study of the validity of constructs in this field can help clarify reasons for differing findings, and inform theory development by further refining the constructs that are most fruitful for further study. The first goal of this study is to confirm and validate a four-factor structure comprised of the two partially independent inhibitory dimensions of attention and impulsivity and the two emotional dimensions of fearful inhibition and negative emotionality. These constructs will be tested under the stringent requirements of confirmatory factor analysis (CFA) using teacher behavior ratings of a large sample of elementary school children.

The next question this study seeks to explore is the extent to which these behaviors represent interlocking components in behavioral development. Consistent with a developmental psychopathology perspective, this paper proposes that these primary systems of emotion and

inhibitory control will interrelate within individual children, creating multiple pathways to both adaptive and maladaptive outcomes (Cicchetti, & Rogosch, 1996). In keeping with this perspective, system components will be considered as mechanisms of effect in the development of positive behavioral strengths and negative outcomes, including withdrawal, aggression, and conduct problems. A systems approach to understanding child developmental phenomena has been used previously in work on early motor development in infants (Thelen, & Fisher, 1982) but rarely used to consider a complement of child behaviors simultaneously.

The review of the literature will proceed in the following fashion. First, a review of relevant research regarding inhibitory control (and its component parts, impulsivity and attention) will be presented, followed by similar coverage of the fearful inhibition construct and negative emotionality. Evidence for gender differences in each construct will be presented. Finally, research documenting interactions and interrelations between these constructs will be considered, and hypotheses will be offered.

CHAPTER 2

REVIEW OF THE LITERATURE

Inhibitory Control: Attention and Impulsivity

Current models of temperament and emotional regulation specify leading roles for the construct of inhibitory control in child social and emotional development. Inhibitory control has been described as a multidimensional "family" of processes (Kochanska, et al., 2000, 1997; Barkley, 1996; Nigg, 2000) reflecting the ability to inhibit a dominant or prepotent response (Posner, & Rothbart, 2000; Barkley, 1996; Taylor, 1999; Kochanska, et al., 2000), activate a subdominant response, stop an ongoing response, and control attention, and interference in the pursuit of a goal (Nigg, 2000; Barkley, 1996). Poor inhibitory control is often called impulsivity or hyperactive behavior when it relates to motor activity (e.g. high levels of poorly organized activity, loud playing, excessive talking, interrupting, and problems with waiting for a turn) (Martin, 1999; Barkley, 1996) and attentional problems when it relates to orienting, shifting of cognitive or visual focus, interference control, or the ability to sustain attention. The theoretical and operational definitions of the construct have varied according to realm of inquiry, purpose of the investigation, and theoretical perspective (Nigg, 2000). Table 1 presents some of the theoretical and operational definitions of inhibitory control used by researchers.

Despite these differences, most operational definitions of this construct include elements of attention and impulse control. Mary Rothbart and Nancy Eisenberg have theorized and demonstrated that attentional control allows children to regulate emotional arousal by re-focusing on non-distressing stimuli, disengaging from attractive, but prohibited objects or

situations, and redirecting thought content to appropriate or non-arousing topics (Posner, & Rothbart, 2000). Being able to control the direction of attention and suppress impulses, it is argued, allows a person to overcome the urge to satisfy cues of immediate gratification or to avoid potential sources of discomfort, and maintain effort in the pursuit of a long-term goal (Posner, & Rothbart, 2000). So defined, this system resembles a broad override mechanism. "Systems of effortful control . . . allow the approach of situations in the face of immediate cues for punishment and avoidance of situations in the face of immediate cues for reward (p. 434, Posner & Rothbart, 2000)."

Eisenberg (1996, 2000) has argued that emotional regulation consists of two central processes the first of which relates to the ability to modulate the internal experience of arousal and the second of which relates to the ability to regulate behaviors associated with that arousal. The former is operationalized using Rothbart's Attentional Focusing and Shifting scales while the latter (which she calls emotion-related behavior regulation) is operationalized using measurements of Block and Block's ego control. Ego control is a theoretical construct that refers to a child's characteristic ability to contain desires, urges, or impulses. Low levels reflect behavioral undercontrol and impulsivity while high levels suggest constriction or the inability to give in to desire or enjoyment.

According to Eisenberg, both components of regulation are involved in "the process of initiating, maintaining, modulating, or changing the occurrence, intensity, or duration of internal feeling states and emotion-related physiological processes often in the service of accomplishing one's goals (p. 2)." The ability to shift attention, she suggests, is centrally important to management of internal physiological arousal but may also facilitate behavioral regulation (Eisenberg, et al., 2000). The behavioral aspect of regulation overlaps in large part with the

impulse control construct to the extent that it involves suppression or activation of emotionally linked responses. However, in Eisenberg's model behavioral regulation also includes attempts to control arousal by changing context (e.g. approach or withdrawal). Both behavioral and emotional regulation allow children to monitor and regulate the intensity, duration, and appropriateness of emotional signals in determining general patterns of adaptive behavior.

From a neuropsychological perspective, the construct of inhibitory control is often called "executive functioning" and is widely considered to measure aspects of frontal lobe functioning (Korkman, Kemp, & Kirk, 2001; Friedes, 2000). However, most neuropsychological measurement approaches tend to confound attentional processes with motor control processes by using tasks that require a motor response (e.g. key pressing or verbal) to indicate attentional processes. Some examples include the Stroop, go-no-go, the stop-signal paradigm and continuous performance tasks (CPTs) in which children are required to suppress some aspects of a dominant pre-potent response, and to redirect ongoing behavior (Nigg, 2000). Kochanska and her colleagues (1996, 1997, 2000) developed a behavioral battery of inhibitory control tasks for use with toddlers and preschool age children. Tasks included slowing down motor activity; suppressing and initiating activity to signal; delaying and lowering voice (toddler and preschool); cognitive reflectivity (early school age only); and effortful attention (Stroop-like task modified for pre-literate children). The NEPSY a developmental neuropsychological assessment battery also includes developmentally normed measures of inhibitory control including attentional/executive functions and incorporates tasks of sustained attention, visual scanning, planning, and motor persistence (Korkman, et al., 2001).

Toddler scores on Kochanska's inhibitory control battery were predictive of adjustment status at school age. Toddlers who scored low on inhibitory control measures were less

compliant, able to refrain from appealing but prohibited activities, and had lower scores on measures of conscience at school age (Kochanska, et al., 1996; Kochanska et al., 2000). Children with higher inhibitory control scores were more likely to behave appropriately in a clean-up task with mother and child, and to complete an unsupervised cleanup chore. At school age, children with higher scores were less likely to violate rules and to propose selfish vs. prosocial responses to hypothetical moral dilemmas that pitted self-interest against the interest of others (e.g. ignore injured child to attend birthday party) (Kochanska, et al., 1997). In another longitudinal study of elementary school children, Nigg and his colleagues (1999) found that neuropsychological measures of attention and executive functioning predict behavior problems two years later even after controlling for baseline scores.

Although diagnostic criteria for ADHD reflect the fact that poor attention, impulsivity and high activity level often co-occur in individual children (American Psychiatric Association, 1994), factor analyses have generally documented two partially independent dimensions, 1) inattention/ disorganization, and 2) impulsivity/overactivity (Lahey, et al., 1988; Reynolds, & Kamphaus, 1992; Frick, & Lahey, 1991). In norming data from the BASC, the attention problems scale loaded more highly on a learning problems factor, while hyperactivity was related to conduct problems, aggression and other externalizing difficulties (Reynolds & Kamphaus, 1992). In addition, the developmental prognosis associated with impulsive behavior predicts more externalizing problems, such as aggression and conduct problems, while attentional problems are often predictive of learning or cognitive difficulties. For example, in a study examining "pure" groups of inattentive and hyperactive boys, the hyperactive, impulsive group had the highest rates of conduct problems while purely inattentive children had even lower rates than controls (Warner-Rogers, et al, 2000). In contrast, children with purely inattentive

behavior were more likely to have cognitive delays, lower full scale and verbal IQ, reading, language, and speech problems (Warner-Rogers, et al., 2000). Similarly, Frick and Lahey (1991) found that kids with ADHD hyperactive type had more conduct problems, peer rejection, and impulsivity while children without hyperactivity were cognitively sluggish, anxious and shy. Inattentive and hyperactive subtypes of Attention-Deficit/Hyperactivity Disorder derive from the body of research supporting the distinctiveness the two constructs (American Psychiatric Association, 1994).

Attentional control

Attentional control appears to be important for the development of a wide range of behaviors from social competence (Eisenberg, et al., 1993, 1999, 1997; Ladd, & Profilet, 1996) to academic success. Deficiencies are related to delinquency (Stanger, McConaughey, & Achenbach, 1994), conduct disorders (Moffitt, 1993), behavior problems in elementary school (Nigg, Quamma, Greenberg, & Kusch, 1999), and psychopathy (Harpur & Hare, 1990). However, in the absence of impulsivity, attentional deficits are less likely to relate to externalizing problems and more likely to indicate learning problems (Reynolds, & Kamphaus, 1992) or general cognitive delays (Warner-Rogers, et al., 2000).

In fact, attentional deficits are common to most childhood and adult psychopathologies, including autism, schizophrenia, mental retardation, depression, learning disabilities, anxiety, and nearly all other childhood psychological disorders (Cicchetti, & Cannon, 1999) and might be the first visible sign that a child is experiencing difficulties. One study found that attentional anomalies were the first noticeable irregularity in children who later developed schizophrenia (Cornblatt, Obuchowski, Roberts, Pollack, & Erlenmeyer, Kimling, 1999). The ubiquitous nature of attentional deficits in psychopathology, has lead some researchers to observe that

attentional failures are to psychological disorders what fevers are to disease: a general, non-specific indicator that something is wrong (Kamphaus, 2002, personal communication).

Impulsivity

Because it reflects the ability to resist gratification in situations of prohibition, impulsivity has become the focal point for many theoretical models of the origins of conduct disorder and criminality (Moffitt, 1993; Lynam, et al., 2000) and is believed by criminologists to be most important psychological risk factor in offending (Ellis, & Walsh, 1999). Consistent with Patterson and Newman's (1993) assertion that poorly modulated responding for reward represents a "common diathesis," underlying several forms of psychopathology, impulsive behavior is strongly predictive of externalizing behaviors such as aggression, conduct problems (Eisenberg, et al., 1996; Lynam, 1997), and substance abuse (Stice, Barrera, & Chassin, 1998). In a study of precursors to conduct disorder in clinic referred boys, children with ADHD had a five fold risk of developing conduct disorder before age 12; however, only symptoms of hyperactivity and impulsivity, but not inattention, distinguished early from late onset cases (Loeber, Green, Keenan, Kate, & Lahey, 1995). In their longitudinal study, Farrington and colleagues (1990) reported that hyperactivity symptoms were more powerful predictors of early convictions and repeat offending. However, unlike attentional deficits, impulsive, hyperactive behavior does not predict learning problems when attentional deficits are not present (Warner-Rogers, et al., 2000).

Some researchers have attempted to differentiate children with ADHD from other DSM-IV classifications using speed of response execution and inhibition in the stop-signal task (Oosterlaan, & Sergeant, 1996, 2000; Casey, et al., 1997). However, this effort has met with mixed results. Although across studies, children with ADHD have demonstrated slower and

more variable response execution times, speed of response inhibition has inconsistently differentiated ADHD groups from other groups. In one study, aggressive children were found to have similar problems with response execution and inhibition (Oosterlaan, & Sergeant, 1996) while in a follow-up, only children with co-morbid ADHD and ODD showed such problems and only with response execution times (Oosterlaan, & Sergeant, 2000).

Fearful Inhibition

Fearful inhibition represents a child's overall sensitivity to conditioned environmental cues of punishment (Rothbart, et al., 1994; Kochanska, et al., 1997; Dienstbier, 1984; Martin, 1999) and is often accompanied by withdrawal. Martin (1999) and Kagan (1998) use the word inhibition to reflect general tendencies towards behavioral wariness, heightened anxiety, and vigilance for cues to punishment. Kagan (1998) in his work on temperamentally inhibited children defines "inhibited" as "a category of child who is initially fearful and avoidant in response to unfamiliar events because of an inherited temperamental bias (p. 117)." Drawing from Gray's theory (1987, 1991), Martin (1999) defines inhibition as the individual's general sensitivity to cues of punishment and tendency to experience anxiety and fear. A strong inhibition system should lead to a general tendency towards less activity, spontaneity, and social interaction. Noting the role of fear in suppressing behavior in early learning models (e.g. Mowrer, 1960), Kochanska (2001) writes, "A deficient fear system accounts for poor passive avoidance learning and ineffectiveness of punishment in psychopaths and ultimately their inability to refrain from prohibited acts (p. 1092)."

In this convergence of associative learning theory with temperament theory, fear and anxiety play a featured but perhaps unseen role by enhancing conditioning to cues of punishment and slowing or stopping unwanted behavior in the presence of uncertainty or possible negative

consequences. Unpleasant feelings of fear and anxiety, triggered by reprimand or non-reward, are paired with the prohibited behavior causing more rapid internalization of social rules and norms. Thus, it is suggested that, reactivity of this system may affect the speed with which children learn social rules and the contingencies associated with compliance (Rothbart, et al., 1994; Dienstbier, 1984). Temperament theorists believe that, for reasons of biological makeup as well as some aspects of early learning history, this pairing takes place more rapidly in some children than in others (Kagan, 1998; Martin, 1999).

Martin (1999) and Rothbart (2000) have proposed that fearful inhibition operates to cue either withdrawal or activity cessation, akin to a braking mechanism in a car. Inhibitory control, on the other hand, "reads" and organizes the emotional cues with the action cues in coherent patterns of behavior. Thus, "While fear may provide reactive inhibition and strong negative affect for association with moral principles, effortful control provides the attentional flexibility needed to link negative affect, action, outcome, and moral principles (p. 435, Posner & Rothbart, 2000)." Kochanska et al., (1993, 1995, 2001) has shown that fearful inhibition hastens the development of conscience and has reported findings that suggest that more fearful children are responsive to lower maternal power approaches to achieving compliance while less fearful children are not.

Empirical studies have shown that fear in infants negative predicts activity level and externalizing problems such as impulsivity and aggression at age seven, but positively predicted sadness, low-intensity pleasure, and guilt (Rothbart, et al., 2000). Likewise, Kochanska and her colleagues (2001) found that both fearful inhibition and inhibitory control as observed in the laboratory and rated by mothers were associated with an increased likelihood of compliance with maternal prohibitions in four year olds (Kochanska, 2001). The more fearful and attentionally

controlled children were better able to suppress appealing but prohibited behavior (Kochanska, et al., 2001).

Fear or anxiety has also been associated with better prognosis for children with conduct disorder in that those children with conduct disorder and comorbid anxiety were found to be less impaired, respond better to treatment and have a better long-term prognosis (Walker, et al., 1991). In a three-year longitudinal study of four to sixteen year olds, withdrawn children were less likely to become aggressive over time (Stanger, et al., 1992). Bates, Pettit, and Dodge (1995) found that internalizing tendencies moderated the continuity of aggression. Authors used early teacher ratings of internalizing behaviors with the expectation that such anxiety might heighten the child's response to potential or real punishment. The high internalizing group did decline slightly on measures of aggression providing additional evidence for the suppressive role of fearful inhibition.

These results all suggest a place for "the fear factor" in the development of socially desirable behaviors across early and later child development. How this facet of temperament might relate with other child behaviors such as attention and impulsivity will be considered in a later section on interactive relationships.

Negative Emotionality

Negative emotionality is a construct that has been defined in a great many different ways, leaving considerable confusion as to what exactly it is and how it was measured. Even now there is disagreement as to whether negative emotions should be considered as a class, a view that is most common in adult personality research (Tellegen, & Walker, 1996; Costa, & McCrae, 1992) or as to type and function, a view increasingly advocated in child development research (Martin, 1999; Eisenberg et al., 2001; Rothbart, et al., 1994; Rothbart, Derryberry, & Hershey, 2000;

Calkins, & Fox, 2002). Yet, despite inconsistencies in definition, negative emotionality is a dimension of temperament that appears to be robustly related with important aspects of child social, academic, and moral development.

Early temperament and emotional regulation models tended to discuss emotional, intensity, duration and latency without respect to type. Thomas and Chess, (1977) referred to a non-specific "easy-difficult factor" characterized by negative mood, high emotional intensity, low biological rhythmicity, low approach and slow adaptation to environmental change. Adult personality researchers have repeatedly identified a larger order construct characterized by a general predisposition towards negative affectivity. For example, Costa and McCrae (1992) identify their Neuroticism factor as the "general tendency to experience negative affects such as fear, sadness, embarrassment, guilt, and disgust." More recently, Tellegen and Walker (1996) developed a personality model in which Negative Emotionality (NEM) represents a higher-order construct encompassing stress reaction, alienation and aggression. Like Neuroticism, this factor includes both the general tendency to experience fear and anxiety as well as frustration and anger. Other temperament researchers have also defined negative emotionality in terms of intensity, duration and frequency in a general negative emotionality construct without specifying type (Larsen, & Diener, 1987; Buss & Plomin, 1984).

Despite this tradition in some adult personality and temperament research, developmental researchers tend towards the consideration of emotion derived from its role in precipitating particular forms of behavior. Both functionalist and differential emotions theories (DET) (Caplovitz, 1998; Ackerman, Abe, & Izard, 1998) argue that the function of emotion is to precipitate specific forms of organism activity. For example, fear motivates the avoidance of harm; sadness generates a slowing or cessation of activity; shame, drives active withdrawal;

while joy and pride spark an increase in interpersonal interaction and outward movement (Caplovitz, 1998). Similarly, Rothbart and Martin define the construct according to its role as an approach-driven reaction to the interruption of ongoing behavior or frustration of desires (Martin; 1999; Rothbart, et al., 2000; Rothbart, et al., 1994; Presley, & Martin, 1994). Martin subsumes this tendency under his Impulsivity dimension, which reflects sensitivity to reward, whereas Rothbart combines her two lower order fear and frustration factors into a second order factor of Negative Affectivity. Although the underlying scales are structurally related, they evidence differential relationships to child outcomes, and suggest different developmental functions (Rothbart, et al., 2000). A frustrated child is actively approaching or anticipating something that is being blocked while a fearful child is trying to stop avoid or moderate something that is approaching him or her. "Frustration would need to be seen as having its roots in a strong accelerator (approach system) . . . related . . . to the blockage of approach tendencies (p. 43, Rothbart, et al., 2000)."

In contrast to the potential positive effects of early fear on socialization, early negative emotionality both as a general construct and as a specific frustrated, angry dimension of behavior is related to a wide range of later, primarily approach-related problems. Early, nonspecific, negative emotionality combining fear, anger and general distress predicts poor adjustment at home and school, behavior problems, psychiatric symptoms, conduct disorder, and criminal behavior. Infants high on Thomas and Chess' (1977) "easy-difficult" factor were more adjusted at home at ages 4 and 5 and at school at 5 years. Bates, Maslin, and Frankel (1985) found that difficult, unsociable, negatively affective infants had more behavior problems at age 3 relative to peers. Three year olds who were more task persistent and less negatively emotional (Thomas and Chess Questionnaire) were more likely to be better adjusted in 1st grade as reported by

teachers (Garrison, Earls, and Kindlon, 1984). Teerikangas, Arronen, Martin, and Huttunen (1998) found that a fussy/demanding temperament in infancy predicted adolescent psychiatric symptoms. In a meta-analysis, Lytton (1995) found child temperament to be the single most powerful predictor of later conduct disorder and criminal behavior, exceeding even quality of parenting. Children prone to generally intense emotions were at higher risk for aggression and conduct problems (Eisenberg, et al., 1996) both concurrently and longitudinally (Eisenberg, et al., 1995, 1997, 1999). Intensity and frequency of negative emotionality has also been found to predict substance abuse (Stice, Barrera, & Chassin, 1998). As early as preschool and thereafter, negative affect, moodiness, and episodes of anger are associated with poor social skills, peer rejection, and social status (Hubbard & Coie, 1994). Not surprisingly in light of these findings, interventions that make anger arousal control a target are more successful long-term with rejected and neglected kids than are interventions that do seek to build discrete social skills (Lochman, Curry, Dane, & Ellis, 2001).

Conversely, low levels of negative emotionality have also been found to operate as protective factors. Kyrios and Prior (1993) found that temperamental factors of manageability and reactivity were protective against family discord. Owens, Shaw, Giovanelli, Garci, and Yaggi (1999) found that low levels of negative emotionality protected low income boys against later behavior problems and in cumulative combination with other protective factors was more powerful that cumulative risk factors. These researchers measured infant negative emotionality using a maternal report measure that included fear, anger and general distress (Infant Characteristics Questionnaire (ICQ). Boys who were low on this dimension at 18 months had fewer difficulties as reported by teachers on the Achenbach Teacher Report Form (TRF) at 6

years of age. In this study, mother-rated infant sociability, which correlated significantly with negative emotionality, was also a strong precursor of later behavioral competence at school.

Other investigations that more narrowly defined negative emotionality as anger or distress to limitations have also found it to be the most salient predictor of a wide range of adjustment indices (Nelson, et al., 1998; Eisenberg, et al., 1999). Children high on negative emotionality were more likely to have impaired school performance, deficient positive social behavior, and higher levels of both externalizing and internalizing problems (Nelson, et al., 1999). In another investigation, anger reactions in four to six year olds predicted the quality of social functioning as many as four years later (Eisenberg, et al., 1999).

In a longitudinal investigation, Rothbart et al., (2000) reported that infants (10-month-olds) with elevated levels of anger and frustration in laboratory tasks were more likely to be rated as higher in aggression, activity, impulsivity, attentional problems, discomfort, and high intensity pleasure seeking at 7 years of age. Although these early measures of anger and frustration had no bearing on later fearful behavior, they also predicted later positive anticipation another approach-related dimension of behavior. The fact that fear and frustration were related in lawful ways to later approach and withdrawal dimensions of personality, but not to one another, accentuates the importance of distinguishing emotional type in developmental research.

Developmental Change

The observation that children become less impulsive, more attentive, less fearful and less intensely emotional over development is a generally accepted tenet of child development. Parents everywhere know that preschoolers throw fewer tantrums than toddlers and that elementary school age children can pay more attention and sit still longer than preschoolers.

While a patchwork of empirical evidence has also been presented to support this parent-lore, some measures appear to be less sensitive to such changes than others.

Developmental improvements in distractibility, persistence, and attentional control have been demonstrated in maternal ratings from infancy to toddlerhood, from toddlerhood to preschool (Guerin, & Gottfried, 1994; Kochanska, et al., 1997) and over the course of early elementary school (Eisenberg, et al., 2001). Significant change in neuropsychological measures of interference control, inhibition of dominant responses, sustained attention, and motor impulse control have also been demonstrated from toddlerhood to early school age (Kochanska, et al., 1997; 2000) and across middle childhood (Korkman, Kemp, & Kirk, 2001). Sharper increases took place over the early school years (e.g. 5-8 years of age) followed by a more gradual slope until about 12 years of age (Korkman, Kemp, & Kirk, 2001). Carver, Livesey, and Charles (2001) also reported significant age-related changes in speed of response execution, the ability to withhold response, and overall efficiency on the stop signal task in a cross sectional sample of children ages 5 to 9 years of age. These findings, on top of long-held qualitative observations, suggest rapid development across this age period. In fact, White (1965) dubbed this period the "5 to 7 year shift" because of quantitative and qualitative changes in capacities for self-control that occur over this age period.

Nonetheless, these changes have not always been evident in teacher ratings (Reynolds, & Kamphaus, 1992). In one study, teacher ratings of attention focusing on the Child Behavior Questionnaire actually deteriorated with increasing age (Eisenberg, et al., 2001). It may be that with increased demand for cognitive attention, differences in this domain become more salient as children progress in school. It is possible that the ability of teachers to interpret questionnaires in a normative framework (e.g. does this child do these things "often" relative to other children his

age?) may result in less evidence of developmental changes via this method of measurement. It is also possible that inattention and impulsivity develop at different rates. In partial support of the last possibility, one study of boys (7-12 years old) with ADHD showed that only impulsivity and hyperactivity declined with age while inattention remained more stable (Hart, Lahey, Loeber, Applegate, Green, Frick, 1996).

In general, the quantity of fear and anxiety symptoms declines over early childhood and into adolescence (Barris, & O'Dell, 1998). In addition, the topography of the reaction also appears to change with younger children evidencing more attachment anxiety and older children being more likely to somaticize (Barris, & O'Dell, 1998). Parents reported that their children became less negatively moody, intense and fearful as they develop from preschool across middle school (Guerin, & Gottfried, 1994). Asendorpf (1994) reported that socially competent, intelligent children decreased in behavioral inhibition towards strangers and peers relative to less competent children possibly suggesting an interaction between regulatory capacity and a declining developmental trend in fearful inhibition. Based on structural relationships among affect types and the factor structure found in most adult personality research, some people have speculated that the tendency to be negatively emotional in general might become more unidimensional over development (Rothbart, & Bates, 1998) although this proposal has not been directly tested.

Gender Differences

A substantial body of evidence exists to support the assertion that girls are less impulsive, negatively emotional, and more attentive than boys, particularly in toddlerhood and elementary school. Toddler-age and elementary school-age girls scored higher than boys on both laboratory measures and behavior ratings of attention; and lower than boys on laboratory and behavioral

ratings of impulsivity (Kochanska, et al., 1996; Kochanska, et al., 1997; Kochanska, et al., 2000; Kochanska, et al., 2001; Eisenberg, et al., 2000; Eisenberg, et al., 2001). Girls have been rated as more anxious and distressed by novelty than boys (Martin, 1997; Reynolds, & Kamphaus, 1992) and report more anxiety than boys across every age range (Barris, & O'Dell, 1998). In infancy, preschool and early school age, boys are rated by parents as less adaptable, more emotional, and temperamentally difficult than girls (Martin, 1997; Eisenberg, et al., 2001; Prior, Smart, Sanson, & Oberklaid, 1993).

In addition to these mean differences, these constructs have shown differential predictive value for boys and girls. For example, using a nonspecific measure of negative emotionality, Rende (1993) found that a high level of negative emotionality in infant males predicted later delinquency, attention problems, as well as anxiety, and depression at age 7. However, the same index of infant negative emotionality predicted only anxious and depressed symptoms in girls at age 7. In addition, attentional deficits in girls in adolescence were associated with more diverse problems in adulthood for girls than in boys (Achenbach, Howell, McConaughy, & Stanger, 1995). Therefore, the frequency of these behaviors as well as the way in which they predict later behaviors differ in boys and girls. To fully appreciate these differences and the behavioral profiles associated with them, boys and girls should be studied separately but under comparable ages and environmental conditions.

Interactive, Additive, and Indirect Relationships

Inhibitory Control and Negative Emotionality

While some researchers include affect regulation as a component of inhibitory control (Barkley, 1996, 1998), others have argued for developmentally dynamic, reciprocal relationships in which the inhibitory control system manages the reactivity of and overt expression of the

emotional systems (Posner, & Rothbart, 2000; Eisenberg, et al., 2000; Calkins, & Fox, 2002). Others (e.g. Martin, 1999; Davidson, et al., 2000) propose that approach-related and withdrawal-related systemic relationships are largely independent of one another, yet work in tandem to activate or suppress behavior. Although the precise nature of this interface has not as yet been determined, a burgeoning literature supports a close and likely interacting relationship.

First, these dimensions of behavior show high correlations. It has been widely documented that deficiency in inhibitory control is often accompanied by problems with emotional regulation (Ahadi, Rothbart, & Ye, 1993; Derryberry & Rothbart, 1988; Evans & Rothbart, 1999; Barkley, 1998). Heightened emotional lability is often present in children with ADHD and those recovering from neurological trauma (Barkley, 1998; Friedes, 2001) possibly because of inhibitory dyscontrol associated with both conditions. Toddlers with better inhibitory or effortful control scores on a neuropsychological battery were more moderate in their expression and intensity of both anger and joy (Kochanska et al., 2000). Three-year olds performance on inhibitory "Stroop-like" tasks were negatively related to anger and frustration and positively related to mother reports of inhibitory control (Gerardi, Rothbart, Posner, & Kepler, 1996). Warner-Rogers, et al, (2000) found that inattention was related to emotional problems regardless of the presence or absence of hyperactivity. In addition, the quantity and flexibility of regulatory strategies employed by preschoolers predicted lower levels of aggression and disruptive behavior at school entry (Gilliom, Shaw, Beck, Schonberg, & Lukon, 2002).

Second, some studies have found that attentional control precedes change in emotional status. Regulatory behaviors reflective of inhibitory control such as gaze aversion and distraction in infants and toddlers predicted decreases in distress following restraint and goal frustration (Buss, & Goldsmith, 1998; Calkins & Johnson, 1998). Similarly, Johnson, Posner

and Rothbart (1991) found that, in infants, increases in attentional control and the ability to disengage from distress demonstrated temporal precedence to a decline in vulnerability to negative emotions. In laboratory observations, preschoolers who were able to reorient from a distressing situation showed reductions in arousal and were later found to have fewer externalizing problems when they entered school (Gilliom, et al., 2002).

More complex and interactive effects between the emotion and regulatory systems have been reported in relationships to social skills and peer acceptance. Toddlers who displayed greater negative affect in response to a frustrating situation were more likely to engage in socially competent play with peers and less likely to withdraw or aggress (Calkins, Gill, & Smith, 1999). Using simulated laboratory situations and observational coding, Calkins et al. (1999) found interactions between frustration-type, emotional distress and regulatory behaviors such as distraction, orientation to mother, and focal object focus, in the prediction of peer conflict. Levels of emotional distress were positively predictive of peer conflict but only when they were not accompanied by efforts at distraction, or orientation to mother. Similarly, the effect of emotional distress on peer conflict was only significant when it was accompanied by venting (banging, hitting, kicking, etc.) or inflexible focus on the object of distress. Children who were able to reorient their attention were less likely to have conflict with playmates.

Rubin, Coplan, Fox, & Calkins (1995) found that, in a sample of 96 preschool children, the "costs" of social withdrawal differed according to the child's ability to regulate emotions. Dividing groups into extremes on the dimensions of social interaction and emotional dysregulation, they found that socially withdrawn, emotionally-dysregulated children had higher internalizing scores relative to a socially withdrawn, emotionally-regulated group and an average control group. Similarly, children who were highly interactive socially but emotionally

dysregulated were more likely than those with average to above average emotional regulatory capacity to have elevated externalizing problems. Withdrawn, dysregulated children were more likely to be wary bystanders while socially noninteractive children who were judged to be good regulators were more likely to engage in solitary, constructive play.

Similarly, in a study of 199 elementary school age children (grades k-3), Eisenberg, et al. (1996) found direct and interactive relationships between concurrent ratings of negative emotionality, poor attentional and ego control and frequency of behavioral problems. Attentional regulation was more important for those children with high levels of negative emotionality relative to those children with low levels. The slope of attentional control on problem behaviors was sharper at higher levels of negative emotionality, such that greater reductions in problem behavior were evident as regulatory functions improved. The slope was more gradual at low levels of negative emotionality. Behavior regulation (impulsivity or ego control) was equally important for children with high or low levels of negative emotionality. For boys but not girls, ego resiliency (optimal regulation) was related to problem behavior. In a follow-up study, this same research group used structural equation modeling multiple group approach to interaction testing and found that the paths from attention to problem behavior were moderated by negative emotionality. Results indicated that attentional regulation predicted externalizing behavior primarily for children prone to frequent and intense negative emotionality.

In a partial replication of these results, Belsky, Friedman, & Hsieh (2001) tested these predictions longitudinally from infancy (15 months) to preschool. Attentional persistence and shifting was coded in play situations and negative emotionality was measured as a child's response to the Strange Situation. The sample was divided into low and high levels of attentional control and a structural equation model, using negative emotionality as a predictor,

was tested on each half of the sample. Three episodes of the Strange situation were used as multiple indicators of the negative emotionality latent construct and maternal ratings of behavior problems and social competence and school readiness scores on the Bracken were used as outcome measures. Small but significant moderating effects emerged for attentional control in the prediction of social competence and academic readiness. In the former, the pathway from negative emotionality to social competence was only significant for children with low levels of attentional persistence (path value=-.14). Moderating effects were also found in the prediction of school readiness but not in the expected direction. In this case, the pathway from negative emotionality to school readiness was positive and only significant for children with high attentional control (path value=.31).

Similarly conflicting findings were reported by Stifter, Spinrad, and Braungart-Rieker (1999) in their longitudinal investigation of the relationship between emotional reactivity and regulation in infancy to the development of compliance in toddlerhood. They found interactive relationships in infants' emotional reactivity, regulatory strategies (distraction, escape, self-comforting, communicative efforts), and non-compliance in toddlerhood. Although they too found evidence for moderating effects of regulation, the nature of these effects differed diametrically at two age ranges. As emotional reactivity increased in 5-month-old infants, passive non-compliance and defiance increased when regulation was low and actually decreased when regulation was high. These results are consistent with predictions and those reported by Eisenberg et al., 1996. However, in 18-month-olds, emotional reactivity was positively predictive of passive non-compliance and test non-compliance only when regulation was high. When regulation was poor, reactivity had a negative impact on non-compliance.

In one study, Eisenberg and colleagues (1997) found that impulsivity or ego control interacted with negative emotionality, or was differentially predictive of social functioning for children high in negative emotionality than for those low in negative emotionality, but found only main effects interactions in a later study. Colder and colleagues found that adolescents with high levels of anger were more likely to use illegal substances and to be delinquent, only if they were high in impulsivity (Colder, & Stice, 1998). If they were not impulsive, anger was not as great a risk factor for these problem outcomes. However, another study by the same research group found interactions between positive affect and impulsivity (Colder, & Chassin, 1997), but not negative emotionality and impulsivity. Impulsive adolescents with low positive affect were more likely to use and be impaired by alcohol whereas level of affect did not change the probability of alcohol use in nonimpulsive adolescents.

These results illustrate the difficulty in capturing and replicating interaction effects across studies, a problem that has received ample comment in statistical literature. Not only were interaction effects inconsistent, but also in some cases the direction of moderation actually reversed. In some cases high levels of regulation predicted a negative slope across levels of emotionality whereas in others it predicted a positive or flat slope. In addition, it was unclear from the Eisenberg, et al., 1996 and Stifter, et al., 1999 investigations whether mean scores were higher or lower in groups with high emotion/low regulation or high emotion/high regulation. The correlated nature of these behaviors make it harder to detect pure "moderational" effects. For this reason, Baron and Kenny (1984) argue that moderators should have low correlations with predictor and outcome.

Interpretation is further complicated by the overlapping nature of the constructs and the many approaches that have been taken to measurement. For example, Eisenberg et al., (1996)

operationalized negative emotionality using a general emotional intensity measure, and inhibitory control using parent and teacher ratings on Rothbart's attentional shifting and focusing scales from the CBQ, and Block and Block's (1980) ego control and ego resiliency constructs. Kochanska developed and utilized a battery of inhibitory control tasks for use in toddlers and preschoolers. Calkins et al., (1999) used mild restraint procedure in the laboratory to induce primarily frustrated behaviors. She and other researchers used real-time observational coding of children's regulatory response to an actual emotionally distressing situation (Calkins, et al., 1999; Stifter, Spinrad, & Braungart-Rieker, 1999; Belsky, Friedman, & Hsieh, 2001). The current study will first confirm the structure of the measurement constructs to be used in order to avoid overlap in constructs.

Another possible reason for the inconsistent interaction findings is that the emotion-regulation interaction is dependent upon the type of emotion and this distinction has not been adequately captured in extant research. Buss and Goldsmith (1998) found that infants differed in type of regulatory strategy they employed depending on the type of emotion displayed. Using laboratory fear and anger-induction paradigms (e.g. gentle arm restraint and remote controlled spider), they found that infants high in fear intensity demonstrated less approach, more withdrawal, and were more likely to look to mothers. The infant's level of fear expression was related to the frequency of regulatory behaviors while the infant's level of anger was not. Fear decreased after withdrawal behavior while approach, interaction with stimulus and distraction appeared to be effective at keeping fear from increasing. Infants higher in anger interacted with stimulus more in toy barrier condition and used distraction less in the arm restraint episode.

Perhaps in response to somewhat erratic interaction results, in a subsequent study Eisenberg et al., (2001) divided children into control, externalizing, internalizing and control

groups and found mean differences in fearful inhibition and anger, attention, and impulsivity across the groups. They found that attentional deficits were common across externalizing and internalizing types, but emotional tendencies and impulse control differed across the groups. Children (4-7 yrs) who were high in anger, sadness, and impulsivity and low in attentional regulation were more likely to develop externalizing problems. Conversely, children high in fear and sadness but low in attentional regulation and impulsivity were more likely to develop internalizing problems.

The constellation of behaviors reported for the externalizing types and internalizing types are suggestive of the "undercontrolled" and "inhibited" types reported by Caspi, Henry, McGee, Moffit, and Silva (1995) in a group of three year olds who were studied over two decades. As three year olds, the majority male "undercontrolled" group was described as highly emotional, impulsive, and inattentive. They were found at age 15 to have a greater likelihood of being aggressive, and non-compliant and as adults to be more alienated, have more interpersonal conflict, be less harm avoidant, and to have higher levels of antisocial personality disorder (Caspi & Silva, 1995; Caspi, Moffitt, Newman, & Silva, 1996). In contrast, the "inhibited" types, the majority of whom were females, were fearful, socially reticent, upset by strangers, but not impulsive (Caspi, & Silva, 1995).

Other researchers have found similar but more fine-grained behavioral typologies in children. Kamphaus and his colleagues (1997) have identified seven patterns of behavioral adjustment in elementary school two of which are characterized by high levels of externalizing behavior as well as dysphoric mood (e.g. depression). Two clusters "Well Adapted," and "Average," seemed to typify a profile of behavioral characteristics associated with normal adaptation, while one cluster had similarities with the overcontrolled profiles found by Caspi.

The latter group was disproportionately female and more likely to display behaviors suggestive of heightened anxiety, somatic complaints, and worry. A mild disruptive group had lesser but still problematic elevations in externalizing behaviors but significantly less emotional disturbance. Finally, a Learning Problems cluster seemed to represent a unique profile of behavioral attributes particularly problematic for academic success.

Fearful Inhibition and Inhibitory Control

Interactions among impulse and attentional control and fearful inhibition have received less consideration. As noted, Rothbart has proposed that these two systems represent two systems of inhibitory control, one effortful, and one reactive. At one time, researchers believed that fear itself was the product of an overactive inhibitory system. However, Oosterlaan, and Sergeant (1996) found that inhibitory control as measured by the stop-signal paradigm was no stronger in highly anxious children than in control. These results suggest that, if inhibitory control is in fact tapped on the stop-signal task, anxious children do not lie at the high end of this inhibitory control paradigm (Oosterlaan, & Sergeant, 1996). These results support Martin's (1999) general proposition that these two behaviors are not opposite of one another.

Recently, using infant activity as an indicator of the BAS or reward-sensitive system and infant fear as a measure of the BIS, Colder, Mott, and Berman (2002) reported interactive effects in the prediction of growth trajectories in problem behavior in early childhood. This investigation used maternal temperament ratings of infant behaviors of fear and motor activity to predict patterns of externalizing and internalizing behavior in the same children from four to eight years of age. A large sample facilitated examination of separate effects for each gender: boys (N=235) and girls (N=202).

Externalizing symptoms were stable for males over the four to eight year old age range while they declined significantly for girls (Colder, et al., 2002). For both males and females, maternal reports of internalizing symptoms increased over this age range. For boys, low levels of fear and high levels of activity in infancy predicted increasing externalizing symptoms over early childhood. For girls, this pattern of high activity level and low fear did not portend for a similar escalation in externalizing symptoms. Boys with high levels of fear and low levels of activity in infancy demonstrated increases in depressive symptoms. Authors theorize that boys with this constellation of behaviors are less sensitive to environmental cues to reward and thus more susceptible to these symptoms. More difficult to explain was this study's finding that girls with high levels of fear and low levels of activity showed declines in anxiety and depression over early and middle childhood.

Summary and Hypotheses

The theory and empirical evidence reviewed above articulate several hypotheses, all of which support the premise that effects of these child-centered systems combine to predict adjustment, particularly in social realms. The systems to be considered in the current investigation include attention, impulsivity, negative emotionality, and fear. These basic dimensions of behavior, present arguably from birth, may be key substrates of more complex functioning. In order to succeed in social settings such as school or a playground, a child must be able to maintain a certain level of emotional and cognitive arousal, to focus and sustain attention, to control urges, and to adapt to changing circumstances with minimal upset. Unregulated emotionality may be a primary reason for why children fail to interact appropriately with peers and are rejected or neglected.

This investigation uses a dynamic, systems approach, that simultaneously considers reciprocal interdependent relationships in emotional and inhibitory control constructs (Calkins, & Fox, 2002) in the prediction of social development in early elementary school. No previous research has considered these four dimensions simultaneously and interactively. Furthermore, current research is limited by inexact measurement approaches and inconsistent construct definitions.

Figure 1 graphically depicts the model used to generate the hypotheses and indicates the expected interconnections and interactions among the systems defined for study. This model and the hypotheses embedded in it assume that elements of inhibitory control incorporate the two separate dimensions of attention and impulse control and that fear and negative emotionality will relate in lawful ways to behaviors characteristic of approach or withdrawal. As noted, in both empirical and theoretical literature, the nature of the synergies among these behavioral systems of attentional and impulse control and types of emotional reactions is still a matter of some debate. While conceptually, theorists are in at least partial agreement that a combination of poor regulation and heightened emotionality portends for poorer prognosis, there is less consensus on the exact nature of that relationship.

Based on the theory of Posner and Rothbart (2000) that a dominant system of effortful control, comprised at least in part of attentional and impulse control, controls the expression of other behavioral systems, it is expected that poor attentional control and impulse regulation will potentiate the relationship between the expression of negative emotions and impaired social adaptation. Thus far, tests of these interrelationships have either combined two types of emotions, fear and frustration, or combined two types of regulatory systems, attentional control and impulsivity. Using composite measures of these systems obscures the separate effects each

has on behavioral adjustment. In order to clarify these relationships, interactions among attention, impulsivity and fearful inhibition and negative emotionality will be examined separately towards the prediction of pathway specific outcomes. For example, poor attentional control, high impulsivity and negative emotionality are expected to lead to aggression and conduct problems while fearful inhibition is expected to lead to withdrawal. Attention and impulse control are expected to moderate the effect negative emotionality and fearful inhibition have on social adjustment.

Based on the theories of Gray (1987, 1991), Patterson, and Newman (1993), and Martin (1999), as well as the empirical evidence that low levels of fear predict more problem behavior when children are highly impulsive (Avila, 2002; Colder, Mott, & Berman, 2002; Kochanska, et al., 1997), it is expected that impulsivity will have a stronger relationship with conduct problems and aggression at low levels of fearful inhibition. It is also hypothesized that fearful inhibition will act as a suppressor of approach behavior, both in terms of prosocial behavior and in terms of aggression and conduct violations. Furthermore, it is expected that impulsivity and anger or frustration will show strong relationships as indicators of an active approach system. However, based on its past association with extraversion, it is expected that impulsivity may also relate positively with active social involvement. Because of its rather ubiquitous role across theories and past research findings, attentional control is expected to play a more general, positive role in predicting child adjustment.

Prior to testing these relationships, the measurement strategy employed for this investigation will be subjected to a rigorous test of reliability and validity using confirmatory factor analysis (CFA). CFA techniques provide a stringent test of a priori specified theoretical constructs by estimating and controlling error variance and by constraining all items to load on

only one factor. Such tests provide needed evidence for the unidimensionality and independence of constructs selected for study. As was apparent in the review of the current literature, a proliferation of psychological constructs all with different names and measurement properties has made it increasingly more difficult to interpret and compare research findings on similar topics. A qualitative comparison of items on scales used in temperament instruments measuring these dimensions shows substantial overlap among these constructs (see Appendix B). To avoid overlap and unreliability in construct measurement, a confirmatory factor analysis was conducted prior to testing the main hypotheses set forth here. Items reflective of the behavioral dimensions in question were selected from an established behavioral rating scale, the Behavioral Assessment System for Children – Teacher Rating Scales (Reynolds, & Kamphaus, 1992). The resulting scales were then subjected to a stringent test of differential construct validity using confirmatory factor analysis. Although teacher ratings have been demonstrated to be reliable and valid indices of the constructs in question (Ladd, & Profilet, 1996) little research has attempted to use items from a multidimensional behavior rating scale to capture interdependent system effects. It was expected based on the previous review that each construct would demonstrate at least partial independence as a latent trait. The results of these analyses are presented first in the following Method I, Results I, and Discussion I.

The next overall purpose of this study is to test whether current conceptualizations of these behavior dimensions can be extended to a diverse, cross-sectional/longitudinal sample of children from low-income neighborhoods and diverse cultural backgrounds. Until now, these constructs and interrelationships have been tested in predominantly white, middle class samples, limiting their application in other more racially and socio-economically diverse schools and communities.

A priori testing of interactive and dynamic relationships among these systems will proceed from the following hypotheses.

Hypothesis 1: Attentional control, impulsivity, negative emotionality, and fearful inhibition are distinct and partially independent constructs that can be reliably and validly measured using teacher ratings.

Hypothesis 2: These regulatory and emotional systems each contribute unique variance to later positive and negative adjustment (social skills, aggression, conduct problems, and academic achievement) in early elementary school age children.

a) Negative emotionality will predict negative social adaptation across outcomes, but show stronger relationships with aggression and conduct problems.

b) Impulsivity will demonstrate positive relationships with aggression and conduct problems and negative relationships with withdrawal.

c) Attentional control will relate generally with all outcomes.

d) Fearful inhibition will act as a positive predictor of withdrawal and a negative predictor of aggression and conduct problems.

Hypothesis 3: The ability to shift and control attention will moderate the predicted positive relationship between negative emotionality and later aggression and conduct problems. It will also moderate the predicted negative relationship between negative emotionality and social adaptation.

Hypothesis 4: Impulse control will moderate the predicted positive relationship between negative emotionality and later aggression and conduct problems. It will also moderate or lessen the expected relationship between negative emotionality and social adaptation.

Hypothesis 5: The ability to flexibly shift and control attention and the ability to manage behavioral impulses will moderate the relationship between fearful inhibition and the development of positive, prosocial skills and withdrawal.

Hypothesis 6: Fearful inhibition will be less predictive of withdrawal and social skill deficits in children with moderate or high levels of impulsivity.

Hypothesis 7: Impulsivity will be less predictive of aggression and conduct problems in children with moderate to high levels of fear and more strongly related to aggression in children with low levels of fear.

CHAPTER 3

METHOD I:

CONFIRMATORY FACTOR ANALYSIS

Participants

Data for this investigation were collected as part of a federally funded longitudinal investigation (Project ACT Early; grant #s R305T990330 and R306F60158 from U.S. Department of Education) into effective teaching strategies and environmental support for at-risk children. The first three-year phase of ACT Early focused on fostering skills for teachers working with high- risk children (e.g. solution-focused consultation, dimensional assessment), while the second evaluated the relative strength of school environmental factors associated with academic and behavioral adjustment in school. Teacher-level interventions in Phase I of the grant were designed to respond to specific, unique needs of participating classrooms and schools. As such, they were not expected to result in systematic effects on children included in this analysis.

The sample (n=1015) used for the confirmatory factor analysis included regular and special education mainstreamed children who were in 2nd grade and consented to participate in any of the 6 years of the project (1997, 1998, 1999, 2000, 2001 or 2002). The children came from six public schools in an urban school district. Students in self-contained classrooms for physical/orthopedic, intellectual, or emotional behavioral disorders were not included. Classrooms were selected based on teacher and school consent to participate, and if parental

written consent was given. The participation rate was high at over 70% of requested participants agreeing to participate. A Spanish language consent form was distributed to expand the number of minorities included. The racial and ethnic composition of the sample was 55% African American, 37% White/Caucasian, 3% Hispanic, 3% Asian/Pacific Islander, and 2% Multi-racial.

Children attending these schools were at greater risk for developing problems with psychological and academic adjustment. In the year 2000, more than one in four children in this area lived below the poverty level (Boatright & Bachtel, 1998) and more than two out of three children qualified for free or subsidized lunch. The school district has among the state's highest school dropout rates, unwed teen-age pregnancies, juvenile delinquency, and percentage of children living below the poverty level. In 1997 the rate of students dropping out from one year to the next topped 10% and nearly one half of students fail to graduate from high school.

Procedure

Teachers rated the children on all 148 items on the Behavioral Assessment System for Children--Teacher Rating Scale (BASC-TRS) in mid-fall of the academic year. Teachers received a stipend for participation, which included completing the Behavioral Assessment System for Children--Teacher Rating Scale (BASC-TRS) for each child with parental consent as well as other measures of child school adjustment. The average experience level for teachers was 19 years (in year 1) and 15 years (in year 3). Demographic information (e.g. age, gender, ethnicity) and school record data (e.g. days tardy, standardized achievement scores) were collected from cumulative student files and from teacher class roles.

Instruments

Measures of negative emotionality, fear, attention, and impulsivity were created using items from the Behavioral Assessment System for Children – Teacher Rating Scale -- Child

version (Reynolds, & Kamphaus, 1992). The BASC is a multidimensional rating scale, including 148 items rated by teachers on a 4-point Likert scale frequency basis (e.g. often, never) and scored from 0 to 3. Items were selected for each scale based on theoretical nature of the construct to be measured. All items pertaining to quality of social interactions in predictor scales were purged to eliminate overlapping item content with outcome measures. Item examples and a description of what each scale was intended to measure are presented in Table 2.

CHAPTER 4

RESULTS I

Statistical Analyses

The confirmatory factor analysis was performed at the item level using LISREL version 8.53 (Joreskog, & Sorbom, 2002). Table 3 includes a description of each item included in the analysis. The PRELIS program, version 2.53, was used to generate the item covariance matrix and asymptotic covariance matrix.

As can be seen in Table 4, several items had skewness and kurtosis substantially outside the acceptable range of $\pm$ 1.00. One item from the Negative Emotionality scale and several from the Fear scale had values of skewness and kurtosis outside this range. Violations of normality assumptions can result in standard errors that are too small and significance tests that are positive too often. For this reason, the Satorra-Bentler Scaled chi-square adjustments were used to control for the effect of non-normality in the chi-square statistic and parameter standard errors. The procedure provides parameter estimates and fit indices that are adjusted for the degree of kurtosis. Maximum likelihood estimation procedures provide more accurate path estimates that General Least Squares or Weighted Least Squares techniques when the model is misspecified and even when the data are non-normal (Olsson, Foss, Troye, & Howell, 2000). ML was used for this analysis for that reason.

Data screening identified several significant multivariate outliers. To consider the impact of these cases on the results, the analyses were performed with and without these cases. The

effect on the results was negligible and non-significant. As there was no theoretical rationale for excluding them, all cases with complete data were included in the final analyses (n=1015).

Fit Indices

Overall goodness of fit was evaluated using the indexes suggested by Hu and Bentler (1999) who advise using complimentary fit indices that assess different aspects of model fit as a way to avoid both Type 1 and Type II errors. They recommend using a combination of the standardized root mean square residual (SRMR), which is a standardized summary of the average difference between the sample covariance matrix and the model-implied matrix (Kline, 1998), and several incremental fit indices such as the Comparative Fit Index and the Non-normed Fit Index (NNFI) [also known as the Tucker-Lewis Index (TLI),] which measure the relative increase in model fit compared to a target or null model. They also recommend using the Root Mean Square Error of Approximation (RMSEA), which is another population-based index that is relatively insensitive to sample size, has a known distribution, confidence intervals, and can be tested for significance. Cutoff levels of .08 or less for the SRMR; .95 or more for the CFI and NNFI; and .06 for the RMSEA are suggested. However, Browne and Cudeck (1993) have suggested that values under .08 are also acceptable for the RMSEA.

Model Fit

In the initial model (Model 1), all items were forced to load only on their respective factor. This is a stringent test of the hypothetical four-factor model because it constrains all other relationships to zero. Table 5 presents these path values, t-values and R^2 values for each item. Path values represent linear relationships between the latent trait and its observed indicator. With the exception of items on the fear scale, most item R^2 values (1-error variance) indicate that the proportion of variance accounted for item-latent trait relationship was in excess

of that attributable to error. Only three items, two on the negative emotionality scale (Is easily upset and Throws tantrums), and one item on the Impulsivity scale (Makes loud noises when playing), had R^2 values of less than .50. However, most items on the fear scale, save one, had large proportions of variance accounted for by error relative to latent trait suggesting that these items are less reliable measures of this characteristic.

Overall fit for the initial model was adequate. All fit indices for Model 1, save the RMSEA, were within Hu and Bentler's (1999) recommended cutoffs (e.g. SRMR=.072; CFI=.96; NNFI=.96; RMSEA=.076). However, modification indexes and an examination of the residuals indicated that freeing several items to load on multiple factors would substantially improve overall model fit. Fit of these less constrained models was evaluated by using the initial model as a baseline and testing suggested pathways sequentially using the chi-square difference test.

Fit indices for the constrained initial Model 1 and each subsequent model are presented in Table 6. Because these models are nested, the models can be compared using the chi-square difference significance test. Note here that, for each child, all characteristics were rated by the same teacher using paper and pencil method. Given this fact, one might expect some error variance due to both method and rater effects. In fact, modification indices suggested that significant improvement in model fit would be obtained by letting the error variance of several items correlate. The more similar the item content, the greater this tendency (e.g. Listens attentively and Listens to directions.) Nonetheless, the purpose of the analysis was to determine the adequacy of a four-factor measurement model. Since error variances had no practical relationship to this enterprise, there was no reason, save fit improvement, to complicate the model further by allowing them.

Based on the remaining suggested modification indices as well as theoretical considerations, the following changes were made to the initial model. First, a pathway was added from the latent trait of Attention to the item "Acts without thinking" (Item v24). This change resulted in a statistically significant and substantial improvement in model fit from Model 1 to Model 2 ($x^{2\ difference}$=246.78; df=1) and a significant loading of .41 for this item on the Attention factor. The item continued to load at a higher level on the Impulsivity factor (.52) even after controlling for its relationship with Attention. This finding was somewhat unexpected since the tendency to act without thinking is often considered to be a hallmark of impulsivity. However, this empirical evidence adds to the theoretical view that the ability to control attention allows for more complete processing of information prior to the initiation of activity.

In Model 3, a path was added from the Negative Emotionality factor to the item "Has trouble shifting gears from one task to another" (Item 20). This change resulted in a statistically significant and substantial improvement in model fit from Model 2 to Model 3 ($x^{2\ difference}$=80.61; df=1) and a significant loading of .30 on the Negative Emotionality factor. This item still demonstrated a stronger relationship to the Attention factor (standardized path value=.54) suggesting that it is an appropriate indicator of this construct. The co-loading on the Negative Emotionality factor is also theoretically interesting because Rothbart's theory suggests that the ability to shift attention towards non-distressing stimuli or away from frustrating stimuli is a key ingredient in emotional regulation. These data suggests that this item reflects elements of both Attention and Negative Emotionality.

In Model 4, a path was added from Negative Emotionality factor to the Fear item "Worries about things that cannot be changed" (Item v9). Table 7 presents the path values, t-values and R^2 values for each item in Model 4. Adding this path resulted in a slight, but

statistically significant improvement in model fit ($x^{2\ difference}$=24.88; df=1). However, once this item was allowed to load on both factors, it accounted for relatively little variance in either (Negative Emotionality factor loading=.17; Fear factor loading=.20) suggesting that it is a fairly weak indicator of these qualities. As a result, it was excluded from the final model (Model 5).

Since an item was removed from this model, it cannot be compared using the chi-square statistic. However, the fit indices for this modified and final model reflect were similar to that of Model 4 which represented significantly improved fit over and above earlier models (Satorra-Bentler Scaled X^2(399)=2242.88, p=0.0; SRMR=.056; CFI=.97; NNFI=.97;RMSEA=.071). Table 8 presents path values, t-values and R^2 values for each item in the final Model. Note that the small value of the SRMR suggests that the correlations predicted by the model differ from the actual correlations on average by only .056 points compared to the value of .072 in the constrained model. All items, save one, were retained on their original scales with two items allowed to load on two scales s simultaneously. As would be expected, coefficient alphas for the final scales, reflected in Table 2, reflected good internal consistency of the attention, impulsivity, and negative emotionality final scales and adequate consistency of the fearful inhibition scale.

CHAPTER 5

DISCUSSION I

Several conclusions can be taken from the CFA results. First, child temperamental characteristics of negative emotionality and effortful control can be reliably measured with items from a common behavior rating scale, the BASC. With the exception of the fear scale, the items demonstrated strong empirical relationships with the latent factors suggesting that they are strong indicators of their respective constructs. All items loaded significantly on their hypothesized constructs and the vast majority had a preponderance of variance explained by these constructs. For this study, a consistent and reliable measure of negative emotionality (coefficient alpha=.91) was constructed using items from the BASC Depression, Aggression, Hyperactivity, and Adaptability scales. The commonality across these items is consistent with the hypothesis of Patterson and Newman (1993) that a common diathesis might underlie diverse psychopathology.

The overall model provided a good fit under most criteria and an adequate explanation of the sample covariance under all currently acceptable criteria of model fit. Good but imperfect fit is expected because of the practical reality of "independently" measuring overlapping, interrelated psychological constructs. The behaviors and characteristics in question are reflective of the same child and are theoretically, biologically, and psychometrically intertwined. Allowing multiple factor co-loadings would have resulted in slight improvements in model fit

but was not desirable as it increased the complexity of the model. Disentangling these facets of behavior completely is probably not possible using this -- or perhaps any -- measurement strategy. The current analytic approach attempts to strike a balance between theory development and ideal fit.

In addition, error covariances were not permitted in this model. A reasonable argument can be made to have allowed this covariance since method variance and rater variance are likely tied up in these residual correlations. However, aside from the surface improvement in model fit, no additional gains in understanding are provided by taking this step and computationally the model becomes infinitely more complex and difficult to cross-validate. Even the items that were freed to load on multiple factors continued to load primarily on their original factor. Furthermore an examination of the final parameter estimates illustrates the relatively strong construct validity displayed by these scales and items.

Another finding meriting consideration is the comparatively low reliability of items on the fear scale. Although this study used teacher ratings, the relatively lower reliability of fear and anxiety scales has been reported across rater types, with self-report, and maternal report measures demonstrating similar difficulties in internal consistency (Martin; Kamphaus, personal communication). On one of the most widely used measures of child anxiety the Revised Children's Manifest Anxiety Scale (RCMAS), item factor loadings were similarly low ranging from .28 to .42 on the Social concerns/Concentration subscale and from .33 to .61 for the Worry/Oversensitivity subscale (Reynolds, & Richmond, 2000). These loadings are comparable to these fear item loadings that were attenuated for measurement error. Similarly, corrected item total correlations on the Child Anxiety Scale ranged from a low .14 up to only .45 (Gillis, 1980). Why unreliability occurs in fear measurement is a matter for debate and discussion. It could be

because the topography or behavioral forms that fear takes differs widely across children or because fear tends to be a more unstable, situationally specific behavior (Barris, & O'Dell, 1998). These characteristics would impact consistency indexes by making some items relevant for only some children, only some of the time. Regardless of the cause, empirically fear and anxiety present as less uniform constructs, impacting strength of prediction, power of hypothesis testing, and the conclusions that may be derived from them.

In terms of the extent to which impulsivity and attention reflect the same latent construct, the results were fairly persuasive. Even after disattenuating for measurement error, the relationship between impulsivity and attention problems was not even the highest inter-scale correlation (r=.64) and was well below that reported for constructs such as Performance and Verbal IQ (Kamphaus, 2001) or Internalizing and Externalizing behaviors (Achenbach, 1991; McConaughy, & Skiba, 1993) that are widely accepted to be distinct dimensions. A three-factor model, with attention and impulsivity combined to form a single inhibitory control construct, provided a much poorer fit to the data. In fact, the highest disattentuated correlation (.80) was between the negative emotionality and impulsivity scales. The extent of the overlap between these two scales is of note, since they are typically discussed as distinct entities. Implications of such a high correspondence between these constructs will be examined further in the subsequent multiple regression analyses which will test the amount of unique variance each contributes to a child's social adaptation.

CHAPTER 6

METHOD II: LONGITUDINAL PREDICTION

Participants

The longitudinal sample included regular and mainstreamed students (n=249) who were in 1st grade at the first measurement (in any year of the project) and for whom two more consecutive years of data were available. Table 9 which presents the breakdown of the four multi-year cohorts were represented in the sample shows that the majority of the sample participated in the first year of ACT Early. Since the purpose of this investigation was cross-rater, longitudinal prediction, children were not included if they were retained a grade. The children were recruited from the same research project, and were enrolled in the same schools as those in Study I. Consent was obtained in the same manner. Inclusion and exclusion criteria were the same as Study I. For the longitudinal sample, subject attrition, which was minor (especially in light of the fact that Project ACT Early study was not originally a longitudinal design) occurred largely when children advanced to middle school, and when two elementary schools declined to participate in the second phase of the study.

Procedure

A 3-year longitudinal/cross sectional design was employed with three annual assessments of children in 1st, 2nd, and 3rd grade. First grade teachers (n=17) rated behaviors representative of negative emotionality, impulsivity, attentional control, and fearful inhibition on a frequency scale (never to always, 0-3). These ratings were summed and used to predict 2nd grade teacher ratings

on measures of prosocial behaviors, such as empathy, aggression, conduct problems, and withdrawal. A different teacher rated the child in each consecutive year of the study. In the last three years of the study, student ratings on a range of classroom life indicators were collected in the fall. These measures were administered to classes in groups. Each item was read aloud while students completed the self-report inventory to preclude problems for children with low level or pre-reading skills.

Instruments

Measures of negative emotionality, fear, attention, and impulsivity were created using items from the Behavioral Assessment System for Children – Teacher Rating Scale -- Child version (Reynolds, & Kamphaus, 1992). The Behavior Assessment System for Children (TRS-C) is a multidimensional rating scale that includes 148- behavior items that the teacher rates on a frequency based Likert scale (Never, Sometime, Often, Always) (BASC; Reynolds & Kamphaus, 1992). BASC norms were derived from a large normative sample, reflective of the general U.S. population with regard to sex, race/ethnicity, clinical or special education classification (Reynolds & Kamphaus, 1992). Independent reviewers of the BASC-TRS have presented evidence for adequate to good reliability and validity using a variety of indicators (Adams & Drabman, 1994; Flanagan, 1995; Hoza, 1994; Kline, 1994; Sandoval & Echandia, 1994; Jones & Witt, 1994) and the scales typically relate closely with other behavior rating instruments (Kamphaus, & Frick, 1992). The median internal consistency coefficient for all scales is .82 (Reynolds & Kamphaus, 1992).

BASC items are rated by teachers on a 4-point Likert scale frequency basis (e.g. often, never) and scored from 0 to 3. Items were selected for each scale based on theoretical nature of the construct to be measured. Table 2 presents a brief description of both predictor and criterion scales created for the purpose of this investigation, a description of the construct to be measured, and the coefficient alpha for the final scale. Scale items (0-3) were summed to form raw composite scores for each child in 1st, 2nd and 3rd grade.

Outcome measures included 2nd and 3rd grade measures of positive adjustment including socially skilled behavior, and 2nd and 3rd grade indicators of maladjustment including aggression, conduct problems, and withdrawal. Positive adjustment was measured via teacher reports of prosocial, empathic behaviors, and student self-report of feelings of acceptance in the classroom. Prosocial behaviors were those that reflected a positive social orientation, an interest in and support for the welfare of others (e.g. tries to bring out the best in others, compliments others, makes suggestions without offending, and has a sense of humor). The Student Support Scale (Classroom Life Inventory) was used as a self-report measure of child's perception of social acceptance in his/her classroom (e.g. it is easy to make friends in my class).

Negative adjustment indicators included teacher reports of conduct problems, aggression, or social withdrawal. Conduct problems included reports of cheating, truancy, suspensions, or detention. Aggression included teacher reports of verbal (name calling) and physical aggression (hitting), as well as threatening or bullying behaviors. Withdrawal was measured using items reflective of social reticence or isolation (e.g. plays alone, refuses to talk, participate in activities, shyness with adults).

Given inconsistent replication of interaction effects that were noted in the literature review and in statistical papers (Jaccard, Turrisi, & Wan, 1991), a liberal significance level of .05 was set a priori and small to moderate interaction effect sizes were predicted.

CHAPTER 7

RESULTS II

Preliminary Statistical Analyses and Descriptive Statistics

After the scale items were summed to formed composites, the scores for the children in the longitudinal sample were compared with the sample lost to graduation and attrition to examine whether there were meaningful differences in either mean level of predictor (regulation or emotionality) or in outcome (aggression, conduct problems, or social skills). No mean differences were found in either predictor or outcome variables. Next, an analysis of variance was conducted to determine whether significant effects were apparent by classroom and teacher. This analysis revealed significant mean differences in ratings of negative emotionality $F(16, 241)=2.155$, $p<.007$, attentional control, $F(16, 238)=2.426$, $p<.002$, fearful inhibition $F(16, 240)=6.115$, $p<.000$, and impulsivity $F(16, 241)=2.818$, $p<.000$ among the 17 1st grade classrooms and teachers represented in the longitudinal sample. For example, mean classroom raw scores on negative emotionality ranged from 2.1 to 8.4 while mean classroom raw scores on attentional control ranged from 9 to 18. These differences may reflect environmental effects of classroom, baseline differences in child temperament or behavior, or teacher response bias. However, the objective of the current investigation was to explore individual differences in child behavior, not classroom effects. When data are nested by classroom or school in the way that these data are, Bryk and Raudenbush (1992) recommend a centering approach in order to make child predictor score meaningful across years of the study. This approach was adopted by

subtracting the classroom mean from each child's score to produce deviation scores. Thus, the child's final score reflects his or her standing relative to peers in his or her classroom. Since z-scores were not used, the original variance of the classroom was preserved while mean classroom effects were removed. Since the same differences in ratings were also evident in the 2nd and 3rd grade teacher ratings, the same approach was used to adjust the outcome measures of social adaptation (social skills, aggression, conduct problems, withdrawal.) Descriptive statistics for all classroom-centered variables are presented separately for each gender in Table 10.

Next a series of one-way ANOVAs were conducted to explore whether boys and girls differed in their levels of negative emotionality, fear, impulsivity, and attentional control. As expected and consistent with the findings of other investigators, boys were substantially less attentive $F(1, 253)=8.841$, $p<.003$, and more impulsive $F(1,256)=10.57$, $p<.001$ than girls. Somewhat unexpectedly, there were no significant differences between the genders on measures of fearful inhibition or negative emotionality. In addition, 1st grade boys were rated as less socially skilled than girls $F(1,256)=14.42$, $p<.000$, but no significant differences were found for measures of aggression, withdrawal or conduct problems. Although these differences were not as pervasive as expected, based on these findings and previous results, all of the following statistical analyses were run separately for boys and girls. Pearson product moment correlations and descriptive statistics for these scales are presented separately for each gender in Tables 11 and 12.

Stability

To determine the degree of stability in these dimensions of behavior, zero-order correlations between 1st, and 2nd grade classroom mean-centered negative emotionality, fearful inhibition, attentional control, and impulsivity were computed. For boys, the correlations

between first and second grade scores indicated an impressive degree of stability in negative emotionality (r=.60, p<.000), attentional control (r=.63, p<.000), and impulsivity (r=.627). Ratings of fearful inhibition were substantially less stable from 1st to 2nd grade (r=.166, p<.068). For girls, scores for fearful inhibition were more stable (r=.34; p<.000) but still less so than for other dimensions of behavior. Stability of girls' attentional control (r=.552; p<.000), negative emotionality (r=.65, p<.000), and impulsivity (r=.544, p<.000) was similar to boys.

Main Effects

The first goal of this investigation was to examine simultaneously the unique effects that children's negative emotionality, fear, attention problems, and impulsivity would have on diverse indicators of social adaptation. In view of inconsistent findings regarding age-effects on these systems, all of the analyses included age as a control variable. None of the results for age were significant and are excluded from the relevant results tables.

It was hypothesized that types of emotionality (fear and frustration), and types of regulation (attention and impulsivity) would contribute uniquely to the prediction of four indicators of social adjustment. It was expected that attentional control would positively predict social skills but negatively predict aggression, conduct problems, and withdrawal. It was hypothesized that negative emotionality would positively predict aggression, and conduct problems but negatively predict social skills. Impulsivity was expected to reflect an approach-reward orientation and to positively predict aggression and conduct problems. Based on findings suggesting a compliance enhancing function and on its theoretical role in the Behavioral Inhibition System (BIS), it was also expected that fear would have a suppressive effect on aggression and conduct problems, but positively predict withdrawal. Conversely, it was

hypothesized that, as a reward-driven approach dimension, impulsive behavior would attenuate the negative effects of fearful inhibition on social skills and withdrawal.

Social Skills

The results of these regressions are presented in Table 13. Attentional control positively and significantly predicted social skills for both boys and girls in both 2nd and 3rd grade, suggesting that attentional control is robustly related to social adaptation. In addition, consistent with expectations, negative emotionality significantly and negatively predicted social skills for both genders in 2nd grade and for boys in 3rd grade. For boys, impulsivity was a positive predictor of social skills in 2nd grade after the effects of fear, negative emotionality, and attentional control were removed. The variance that impulsivity did predict for girls was also positive. The full model accounted for 29% and 22% of the variance in girls and boys 2nd grade social skills respectively. The model accounted for roughly a fifth of the variance in social skills in 3rd grade for both genders.

Withdrawal

The results of these regressions are presented in Table 13. Consistent with its theoretical role as an approach-driven dimension, impulsivity significantly and negatively predicted withdrawal for both genders in the 2nd grade. However, somewhat contrary to predictions, fear was not a positive predictor of withdrawn behavior in for either gender. For boys and girls, negative emotionality was a positive predictor of withdrawal in 2nd grade while impulsivity was a negative predictor of boys' 3rd grade withdrawal. Given the somewhat weaker reliability of this outcome measure (coefficient alpha=.71), the full model of 1st grade predictors accounted for an impressive 25% and 23% of the variance in 2nd grade withdrawal for boys and girls respectively.

For boys, negative emotionality and impulsivity were significant but opposing predictors of withdrawal in 3rd grade. None of the factors reached significance in the prediction of girl's 3rd grade withdrawal.

Aggression

The results of these regressions are presented in Table 14. Negative emotionality was a significant and robust predictor of aggression in both genders across 2nd and 3rd grade even after controlling for variance of other factors. Impulsivity was also a significant predictor of boy's aggressive behavior in 3rd grade. In addition, consistent with predictions, for girls in 2nd grade and for boys in 3rd grade, fearful inhibition was a significant and negative predictor of aggression. The model accounted for more than 35% of the variance in 2nd grade aggression in both boys and girls. The model accounted for 25% and 30% of the variance in 3rd grade aggression for girls and boys respectively.

Conduct Problems

For girls, attentional control was a strong and unique predictor of conduct problems in 2nd and 3rd grade. The full model including nonsignificant predictors accounted for 24% and 22% of the variance in 2nd and 3rd grade social skills. For boys, negative emotionality was a positive predictor of conduct problems in 2nd and 3rd grade while, consistent with expectations, fearful inhibition and attentional control were negatively predictors. That is after controlling for other factors, the more fearful boys were less likely to engage in conduct violations. Interestingly, impulsivity was not the strongest or even a significant predictor of conduct problems after accounting for these other factors.

Interactive Effects

To examine the interactive effects of emotion, attention, and impulsivity on social behavior, a series of hierarchical regressions were conducted separately for each type of emotion (fear and negative emotionality), regulatory function (attention and impulsivity) and social outcome (social skills, aggression, conduct problems, and withdrawal). Each analysis was conducted for the sample of boys and the sample of girls. Boys and girls scores were again centered prior to computing the interaction term and conducting the regression analyses in order to reduce collinearity among the main effects and product terms (Cronbach, 1987; Jaccard, Turrisi, & Wan, 1991). Both main effect and quadratic terms were entered at the first step of the equation, and the interaction term was entered on the second step. Significance t-tests and change in R^2 were used to test statistical significance of the interaction term. Table 15 and Table 16 present the results of these analyses separately for boys and girls.

Social Skills

Interaction of Attention and Negative Emotionality

It was hypothesized that the child's ability to focus, sustain, and shift attention or control impulses would moderate the negative effects of negative emotionality on social skills. To explore this question, two separate analyses were conducted using attention as the moderator and second using impulsivity as the moderator. Main and quadratic terms for attention and negative emotionality were entered on the first step of the equation and the interaction term was entered on the second step. As in the main effects model, negative emotionality and attentional control continued to significantly predict 2nd grade social skills. For boys and girls, the effect of the interaction between attention and negative emotionality in the prediction of 2nd and 3rd grade social skills was insignificant.

Interaction of Impulsivity and Negative Emotionality

In the prediction of 3rd grade social skills, the effect of the interaction between impulsivity and negative emotionality was not significant for either boys or girls (boys R^2 Δ =.025; β=.260, t(125)=1.89, p<.06, girls R^2 Δ =.021; β=.612, t(128)=1.73, p<.087). The direction of effect suggested that highly impulsive boys were less likely to decrease much in social skills as negative emotionality increased. However, negative emotionality had the expected detrimental effect on social standing for boys with average to good impulse control. Since this effect was contrary to expectations and since impulsivity and negative emotionality are highly related dimensions, the raw data was inspected for possible restrictions in range of social skills at high and low levels of impulsivity. Interactions may appear significant when they are not when groups exhibit there is a restriction of range or less variability in the moderator at different levels of the predictor (Jaccard, et al., 1991). Dividing the sample by thirds into high, medium, and low percentiles on impulsivity and negative emotionality, only one child fell into the category of having both low negative emotionality and high impulsivity, reflecting the significant correlation between the two variables. In addition, the variance of social skills in the lower and highest 33% of impulsivity were 19 and 13 respectively while the variance of social skills of the middle 33% of impulsive boys was 26 suggesting greater variance in the middle range of the distribution relative to the tails. Figure 2 displays mean social skill scores and shows that boys with high levels of impulsivity had low socials skills regardless of levels of negative emotionality, while those with moderate levels of impulsivity declined in social skills as negative emotionality increased.

Interaction of Fearful Inhibition and Attentional Control

It was hypothesized that attentional control might moderate the expected negative effects of fearful inhibition on the display of socially skilled behavior. The results of these regressions, displayed in Table, show that the interaction approached significance in the prediction of girls' and boys' 3rd grade social skills (girls $R^2 \Delta = .021$; $\beta = -.215$, $t(126) = -1.88$, $p < .063$; boys $R^2 \Delta = .022$; $\beta = -.213$, $t(123) = -1.755$, $p < .082$). The same effect was evident in the prediction of girls' but not boys' 2nd grade social skills (girls $R^2 \Delta = .018$; $\beta = -.204$, $t(126) = -1.74$, $p < .08$). Because the interaction approached significance for girls and was consistent across grades, it was plotted to explore the nature of the effect. As illustrated in Figure 3, girls' fearful inhibition positively predicted social skills for girls with attentional deficits, but negatively predicted social skills for girls with adequate to high attentional control. Although this effect was not predicted, it is consistent with the posited behavioral regulatory role for fearful inhibition and suggests that it might be more evident in those children with poor voluntary or attentional control.

Interaction of Impulsivity and Fearful Inhibition

After controlling for the main and quadratic effects of impulsivity and fear, the effect of the interaction between impulsivity and fearful inhibition in the prediction of 2nd and 3rd grade social skills was insignificant for both boys and girls.

Aggression

The next series of regressions examined whether impulse control or attentional control would moderate the effects of negative emotionality on aggression. While the main effects of 1st grade negative emotionality continued to significantly predict increases in aggression in 2nd grade for both boys and girls, the interaction between negative emotionality and attentional control were not significant predictors of aggression in 2nd or 3rd grade for either gender. For

boys, the effect of the interaction between impulsivity and negative emotionality was also not significant in the prediction 2nd and 3rd grade aggression, suggesting no moderating effects of impulse control on the strength of relationship between negative emotionality and aggression.

For girls however, in the model testing moderating effects of impulse control on negative emotionality, the interaction term approached significance in the prediction of girls' 3rd grade aggressive behavior (β=.643, t(129)=1.95, p<.054). The nature of this effect is illustrated in Figure 4. For girls with good impulse control, increases in negative emotionality resulted in no significant increases in aggression, whereas for highly impulsive girls, increases in negative emotionality predicted steeper increases in aggression. The effect of the quadratic term for negative emotionality was also significant (β=-.545, t(129)=2.272, p<.024) and indicated that aggression increased at faster rate at low levels of negative emotionality, peaked, tapered off, and slightly declined at high levels. Figure 5 presents the scatter plot of the raw data that illustrates the nature of this curvilinear relationship.

The full model incorporating measures of negative emotionality and impulsivity accounted for 35% of the variance in 2nd grade aggressive behavior for girls and boys suggesting that these two dimensions of behavior are powerful predictors of later aggression. Similarly, the model including main and quadratic effects of attention and main effects of negative emotionality predicted over 35% of the variance in 2nd grade social skills for both genders.

Interaction of Fear and Impulsivity

The next set of regressions tested the interaction between impulsivity and fearful inhibition in the prediction of aggression. It was hypothesized that fearful inhibition would moderate the effects of impulsivity on aggression by acting as a behavior "brake." For boys, the effect of the interaction between fear and impulsivity was in the expected direction in the

prediction of both 2nd and 3rd grade aggression and approached significance levels for 3rd grade aggression (3rd grade aggression R^2 Δ =.02; β=-.148, t(122)=-1.75, p<.08; 2nd grade aggression R^2 Δ =.01; β=-.101, t(123)=-1.22, p<.225). This effect, depicted in Figure 6, shows that impulsivity was less predictive of aggression at high levels of fear and but more highly predictive of aggression for boys with low levels of fear. The bar graph in Figure 7 presents mean 3rd grade aggression raw scores for boys with high, medium, and low fear. Fearful boys had lower mean levels of aggression and increased less than low and medium fear boys as impulsivity increased. Although the interaction terms were insignificant predictors in the girls' regressions, examination of mean aggression scores showed that girls with low levels of fear and high levels impulsivity had the highest rates of aggression in 3rd grade (see Figure 8).

Conduct Problems

Interaction of Fear and Impulsivity

As was the case with aggression, it was expected that fearful inhibition would act as a suppressor of conduct problems. In the prediction of boy's 2nd grade conduct problems, the interaction between fear and impulsivity was significant (R^2 Δ=.04, β=-.209, t(123)=-2.302, p<.023) and in the expected direction. That is for boys with little fear the relationship between impulsivity and conduct problems was strong whereas at high levels of fear, impulsivity was not predictive of conduct problems. The nature of the effect is graphically illustrated in Figure 9. The results were in the same direction in the prediction of 3rd grade conduct problems but did not reach statistical significance.

In the prediction of girls 3rd grade conduct problems, the interaction between fear and impulsivity was also significant but contrary to expectation (R^2 Δ=.039, β=.279, t(123)=2.503, p<.014). The nature of the effect is graphically illustrated in Figure 10 and shows that for girls'

with high levels of fear, impulsivity was more predictive of conduct problems, whereas for impulsivity was less strongly related to later conduct problems for girls with lower fear. The effect of the interaction was insignificant in the prediction of girl's 2nd grade conduct problems. The variance of conduct problems across levels of impulsivity was as follows: low impulsivity: .908, medium impulsivity: .552, high impulsivity: 1.48.

Interaction of Attention and Negative Emotionality

The hypothesis that attentional control would moderate the expected prediction of conduct problems for boys with higher levels of negative emotionality was supported for boys but not girls. Table shows that the effect of the interaction product term between attention and negative emotionality was significant and in the expected direction for boys in the prediction of 2nd grade conduct problems (R^2 Δ=.052, β=-.284, t(123)=-2.858, p<.005). Negative emotionality was less strongly predictive of conduct problems when attentional control was high but highly related to conduct problems for boys with poor attention. Figure 11 illustrates the nature of this effect. The quadratic term for negative emotionality was also significant (β=-.511, t=-3.23, p<.00) indicating a stronger positive prediction of conduct problems at low levels of negative emotionality and a flatter slope at higher levels. Figure 12 depicts this curvilinear relationship. The interaction between attentional control and negative emotionality was insignificant in the prediction of girls' conduct problems in either 2nd or 3rd grade.

Interaction of Impulsivity and Negative Emotionality

The effect of the interaction between impulsivity and negative emotionality was significant in the prediction of girls' from 2nd grade conduct problems (girls R^2 Δ =.029; β=-.655, t=-2.10, p<.037). Again, however, the effect was not in the expected direction. Plotting these effects at high, medium, and low levels of impulsivity (see Figure 13), revealed that negative

emotionality was positively predictive of conduct problems when impulsivity was low but negatively predictive when impulsivity was high. That is, for highly impulsive girls, increases in negative emotionality predicted fewer conduct problems in 2nd grade but for girls with low levels of impulsivity, increases in negative emotionality predicted more conduct problems. No significant interactive effect was present for boys.

Withdrawal

Interaction of Attention and Fearful Inhibition

In the prediction of 2nd grade withdrawal, after controlling for the main effects of fear and quadratic effects of both terms, attention was a significant negative predictor of withdrawn behavior in boys (boys β=-.276, $t(120)=-2.755$, $p<.007$), while only fearful inhibition approached significance in the prediction of withdrawal for girls (girls β=.241, $t(128)=1.827$, $p<.07$). For both genders, the effect of the interaction was insignificant.

In the prediction of 3rd grade withdrawal, the main effect for fear was positive and significant for both genders (girls β=.388, $t(128)=2.95$, $p<.004$; boys β=.272, $t(120)=1.96$, $p<.05$). After controlling for the main effects of fear and quadratic effects of both terms, the effect of attentional control was insignificant (girls β=.056, $t(128)=.499$, $p<.619$; boys β=.099, $t(120)=.951$, $p<.344$). The effect of the interaction was also insignificant for both boys and girls.

CHAPTER 8

DISCUSSION II

Summary

Children's behaviors appear to operate as a system, interacting with one another in theoretically lawful ways to promote or detract from normal social development. These findings were consistent with the theories of Gray (1987), Patterson, and Newman (1993), Davidson, et al., (2000), Posner and Rothbart (2000) and Martin (1999), who argue for the existence of at least two basic neurological systems, one responsible for reward-approach behavior and the other sensitive to possible harm and responsible for withdrawal behavior. This is the first study to use a multiple systems perspective to model longitudinal relationships in a diverse group of elementary school children. Over a two- and three-year period and across two independent and arguably "expert" raters of child behavior, indicators of approach and withdrawal operated in concert to predict later socially competent as well as social problem behavior.

The findings suggested that the right "mix" of behaviors was nearly as important as the levels of any individual variable. Some of the behavioral cocktails explored in this study were additive, compounding the positive or negative effects of the other, while some were interactive. For instance, adding high levels of frustration or anger to poor attentional control resulted in a more toxic mixture than either behavioral attribute alone. Others combinations produced different effects on behavior, contingent upon the level of the other behavioral ingredients. For example, impulsivity in a highly emotional or fearful child had a positive effect on behavior. On the other hand, children with higher levels of fear and problems with impulsivity or attentional

control, actually benefited from that heightened anxious sensitivity. The presence of anxiety effectively counteracted the potential negative impact of maladaptive developmental systems, much in the same way that wealth may lessen the impact of being physically unattractive to others in some societies. Thus, in the same way that we understand the nature of the effect when iron reacts with oxygen to form rust, these findings bring us one step closer to understanding how behavioral systems might interact or compound in the development of social behaviors.

Consistent with expectations, a child's ability to control, shift, and focus attention was broadly predictive of socially skilled behavior, frequency of conduct problems, levels of aggression, and social withdrawal. This general but powerful predictive role of attentional control in development is consistent with the theorizing of Posner and Rothbart (2000) who argue that attentional control is part of a hierarchically predominant voluntary inhibitory control system that regulates other behavioral systems. In the same manner that a fever is interpreted as a strong, yet non-specific symptom of illness, attentional deficits were strong, yet non-specific predictors of psychosocial adjustment problems. As expected, fear operated primarily as a behavior inhibitor or withdrawal mechanism while impulsivity was a consistent approach or behavior-activating dimension. While in general, the construct of negative emotionality conformed to expectations that it would reflect the reaction of a child with an overly active reward-approach system, it was also associated strongly with social withdrawal and operated in opposition to impulsivity in the prediction of both withdrawal and social skills. These findings suggest at least two possibilities. One, some aspects of this construct might also represent harm-avoidant or inhibiting arousal or two, negative emotionality as a construct might reflect the emotional dysregulation common to children with externalizing behaviors who also have been observed to be socially withdrawn (Rubin, LeMare, & Lollis, 1990). Some elements of both

hypotheses are likely but future research is needed to document the sequence of events leading to the withdrawn behavior.

Children whose 1st grade teachers found in them high levels of frustration, anger, and general emotional lability were more likely to be aggressive, have conduct problems, and be social withdrawn in 2nd and 3rd grade. Although poor attentional control was a general risk factor across outcomes for both genders, impulsivity "protected" against social withdrawal, contributed positive variance to boys' social adaptation after controlling for negative emotionality, attentional control, and fear, and moderated the effects of negative emotionality on social adaptation.

In the main effects model, children with better attentional control and fewer episodes of negative emotional expression in 1st grade were more likely to be rated as socially skilled and adapted and less likely to be rated as socially withdrawn by their 2nd grade teachers. The effects of these two facets of behavior were additive in that they both accounted for variance in these two indicators of social adaptation. These findings are consistent with those reported by Eisenberg and colleagues in a series of studies (1995, 1996, 1997) in which negative emotionality was measured as a more general construct of emotional intensity. The fact that the hypothesized approach-related dimension of anger and frustration (negative emotionality) was more highly predictive of withdrawal than fear was contrary to expectations, but consistent with the view that children are often socially withdrawn because of externalizing problems. It was also consistent with results showing that children with more dispositional negative emotionality spent more time playing alone (Fabes, Hamish, Martin, & Eisenberg, 2002).

Although it was expected that attentional control would moderate the effects of negative emotional expression on social adaptation, this hypothesis was only partially supported.

Attentional control did moderate the effect of negative emotionality on conduct problems in boys but only main effects were significant in the models predicting social skills, and aggression. For boys, the interaction was significant and in the expected direction in the prediction of conduct problems in 2nd grade, but insignificant and trivial in the prediction of 3rd grade conduct problems. Boys who were better able to pay attention were less likely to develop conduct problems as their negative emotionality increased, while for those with attentional deficits, negative emotionality predicted sharper increases in conduct problems. For girls and for the most part for boys, however, negative emotionality and attentional control did not "interact" at least in a statistical sense.

Despite its poor reliability and small zero-order correlations, fearful inhibition played a "sleeper" role in both the main effects and interactive models in moderating the effects of impulsivity and attentional deficits on behavior problems and social skills. In the main effects' model, fearful inhibition was a significant negative predictor of aggression for girls and boys as well as a negative predictor of conduct problems in boys. In interactive models, fearful inhibition predicted better social skills in girls with poor attentional control, and less aggression and conduct problems in boys with high impulsivity. This effect is consistent with prior adult research showing that individuals with high levels of impulsivity and low levels of anxiety are more prone to risky and disinhibited behavior, have more difficulty perceiving and learning from punishment, and when they do, can disengage or ignore these warnings faster than those with higher anxiety (Avila, 2000; Derryberry, & Reed, 1994; Corr, Pickering, & Gray, 1995).

For girls, the interaction between 1st grade ratings of impulse control and negative emotionality was also significant and consistent with predictions. For girls with good impulse control, increases in negative emotionality resulted in no significant increases in aggression,

whereas for highly impulsive girls, increases in negative emotionality predicted steeper increases in aggression. A significant curvilinear relationship between girls' negative emotionality and later aggression indicated that aggression increased at a faster rate at low levels of negative emotionality, peaked, tapered off, and slightly declined at high levels. Interactive effects between negative emotionality and impulsivity were significant in the prediction of conduct problems but again in the opposite direction. For highly impulsive girls, increases in negative emotionality predicted fewer conduct problems in 2nd grade but for girls with low levels of impulsivity, increases in negative emotionality predicted more conduct problems.

Of equal interest was the fact that these systems of behavior and their interactions were quickly and inexpensively assessed with widely available rating scales that are commonly used for clinical assessment purposes. The results of the confirmatory factor analysis of a large sample of 2nd graders (n=1015) provided empirical support for the construct validity of two conceptually distinct components of inhibitory control, attention and impulse control as well as two main components of emotional expression in children – fear and frustration or anger. Results from the longitudinal study supported the differential predictive validity of each of these four latent traits.

These findings contribute to current knowledge by applying a theoretically driven system's perspective to behavioral indicators and by complimenting a child-centered or typological approach described by Caspi (2000) as focusing on "the configuration of multiple variables within each child rather than relative standing across single variables." While the typological approach explores the patterning of these variables, the current investigation attempted to explore the system synergies and asynchronies underlying those patterns. Both perspectives support an approach to interpretation of behavioral rating scales in clinical practice

that moves away from the conventional symptom verification approach. Such a shift in approach is necessary because considering deviant behaviors in isolation provides no real understanding of how they developed and how they are maintained. A systems approach helps the clinician to conceptualize the child as an interlocking system of behavioral strengths and weaknesses, and facilitates identification of the primary imbalance. In addition, indicators of system integrity or complexes of particular scale elevations might foretell later adjustment problems even when they are not currently manifest. In the same way that auto mechanics check all relevant systems in preventive maintenance of car engines, it is proposed that prevention and diagnosis of psychological problems in children require a complete systems check.

Limitations

When interactions were present, effect sizes were similar to those ($R^2\Delta$=.01-.03) reported in Eisenberg, et al. (1996) and Calkin's et al. (1999) investigations cited earlier and consistent with expected levels of moderator effects typically reported in non-experimental studies (Champoux & Peters, 1987). Nonetheless, the analyses conducted in the current investigation provided information only on strength or slope of the relationship between predictor and outcome, but not differences in level or intercept. Analyses using intercepts as outcome variables are required to detect such patterns. To avoid misguided interpretations of such results, mean scores were examined when significant interactions were present. Another limitation of the study is the skewed distribution present in several of the outcome variables, particularly conduct problems. Such non-normal distributions can result in biased estimates and inaccurate hypothesis testing. Violations of distributional assumptions are a common problem in work in psychopathology but deserve attention as a caveat of the current results.

Another limitation of the current study – that of relying solely on teacher reports of behavior -- might also be viewed as a strong suit. In this study, stability of the dimensions of attention, impulsivity, and negative emotionality were demonstrated across teachers, across years of development. Although previous work has shown stability in such measurements of child behavior using maternal ratings, using such reports is in some ways problematic since stability might reflect continuities in aspects of maternal perception rather than actual child behavior (Caspi, 2000). Nonetheless, the low reliability of the fearful inhibition scale testifies to the need for multiple informants in measuring such ephemeral and difficult to assess constructs. Future research should gather information from multiple sources and types of measurement on these behaviors and perhaps use a structural equation modeling approach to capture common factors across raters. Using structural equation modeling has the added advantage of reducing error in measurement, an even greater barrier to accurate hypothesis testing using interaction terms (Jaccard & Wan, 1995).

Another limitation of the current study was an inability to observe a child's regulatory strategies in an emotionally distressing situation. It is possible that attentional control and attention shifting used to modulate emotional reactions are different facilities and as such were not adequately captured by the measurement approach used in this investigation. Finally, more research is needed to understand transformations that occur across development when system imbalances exist, to assess the ways in which learning histories of disciplinary techniques might engender or aggravate at-risk profiles, and to track the progression of such early behaviors towards later adjustment.

Conclusions

Overall, the strengths of the longitudinal/cross-sectional design, a large and diverse sample size, and reliability and validity of measurement scales, suggest that these findings are likely to replicate. The current results, as buttressed by the weight of similar findings from prior investigations (Colder, Mott, & Berman, 2002), support the premise that at least two primary behavioral adaptation systems of approach and withdrawal underlay child behavior. Fear, frustration, attention and impulsivity operated, not in isolation, but as a system with each component part reflecting tendencies to either actively approach or retreat from social interactions. These behavioral dimensions have much in common with neuroscience models, which include systems responsible for approach, harm-avoidance, irritability, and orienting or effortful control (Rothbart, & Bates, 1998). To borrow the metaphor used by both Rothbart et al. (2000) and Martin (1999) in their temperament work, impulsivity reflected the system accelerator while fear operated as the brakes. The construct of negative emotionality or anger and frustration were the lack of control a car experiences when the car is moving fast and the driver slams on the brakes. The child was not ready for the reduction in speed towards his or her goal and loses control. Applications of this metaphor in therapy might suggest tapping the brakes slowly for children who drive too fast as well as constant efforts to enforce a safe baseline rate of speed.

This analogy might also be extended to case exemplars of common childhood diagnoses. Take a case of a child who meets criteria for Attention-Deficit/Hyperactivity Disorder-Predominantly Hyperactive/Impulsive Type. Using a systems perspective means viewing that child as one who is overly reward-focused and approach-oriented. We might expect this child to respond with frustration or anger when blocked from that reward, and be less able to shift his or

her attention from a reward-focused goal implementation to feedback evaluation. Very low levels of fear in such a child might be a warning signal that unregulated behavior might be more likely to escalate. Important elements of therapy would have to include exercises that enforce a regular, structured level of activity, that accentuates cues to impending behavioral sanctions or non-reward, and if necessary, help that child to manage anger or arousal. Sociability in such an impulsive child might be likely, and an important strength that could be nurtured through approaches that teach careful monitoring and appropriate responses to social cues. In addition, it would be important to address the presence of angry or aggressive emotions in this child since such outbursts can be most damaging in interpersonal settings.

From a slightly different perspective, it could be argued that high levels of negative emotionality and anger represent the common behavioral features in a child diagnosed with comorbid Major Depression and Oppositional Defiant Disorder (ODD). An inability to control emotional arousal, short latency to distress, as well as low motivation to comply with his or her caregiver might underlie both diagnoses. In this case, treatment would proceed from this common diathesis rather than focusing on packages designed for either condition alone. Although not a necessary criteria for diagnoses of either disorder, that child's dispositional ability to control and focus attention would be an important consideration in predicting prognosis and course of illness.

Furthermore, the clinician would need to take into consideration both levels of reward and punishment sensitivity. Asymmetry in anxiety relative to impulsivity might suggest caution against strict behavioral management of the ODD symptoms since such steps might aggravate depressive symptoms. In that case, the clinician would want to use a therapeutic approach that enhanced sensitivity and opportunity to reward in that child's environment as a way to address

symptoms of both disorders. On the other hand, imbalances favoring overly impulsive responding and moderate to low anxiety might suggest that the Major Depression is secondary to the compliance problems. Most clinicians use their basic understanding of human behavior to inform these decisions to good effect. What these results are providing is an empirical guidepost to these intuitive approaches. These cases illustrate the importance of considering interactions among behavioral adaptation systems in children with multiple problems at the diagnostic and treatment level.

These results are also consistent with the qualitative and quantitative findings implicating a similar set of behavioral adaptational systems in the normal development of at-risk children. More than 30 years ago, Garmezy and Nuecherlein (1972), cited in Garmezy, 1991) described a particular constellation of skills reflective of good inhibitory and emotional control in children resilient to severe parental psychopathology. These children were described qualitatively as having a more cautious vs. impulsive response style, more goal-directed behavior, and being more friendly, and well-liked by other children. Other researchers have also documented the importance of adaptive behavioral and personality characteristics (is reflective, is persistent, attentive-able to concentrate, responds to reason, calm-relaxed, is dependable and planful) that taken together appear to provide substantial protection against seriously adverse conditions (Cicchetti, Rogosch, Lynch, & Holt, 1993). In this study, the same or similar attributes – attention, impulsivity, emotional stability -- measured easily, accurately, and inexpensively using teacher behavior ratings, were significant factors in the development of key components of socially skilled behavior.

Using a behavioral systems framework, this study found additive and interactive effects among basic elements of child temperament, fearful inhibition, attention, impulse, and emotional

control. These behaviors appear to be active ingredients in children's social development that fuel and regulate general approach and withdrawal systems. The interactions among these basic behavioral systems found in this study confirms the growing belief that child development research can no longer afford to consider individual variables in isolation. Instead, the term context must be expanded to include not only the environmental context but the child's own behavioral context.

Understanding the meaning of this context and the operation of basic underlying systems of behavior can be used to better understand the real reasons for comorbidity in diagnoses, and to refine intervention and assessment techniques. In shedding light on the relationships among these systems, these results bring us one step nearer to defining the behavioral building blocks upon which typical and atypical development are constructed.

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Table 1

Inhibitory Control: Construct Definitions

Hypothetical Construct	Definition	Study
Effortful control	Class of self-regulatory mechanisms that facilitate inhibition of dominant responses to perform subdominant responses; linked to anterior attention network.	Rothbart and Bates (1998)
Impulsivity	Active system sensitive to reward cues [similar to Gray's Behavioral Activation System (1987)]. Includes lower level factors of negative emotionality, attention, and motor activity	Martin (1999)
Active control	Effortful or willful impulse control Suppressing a prepotent response, initiating and maintaining a subdominant one	Kochanska, Murray & Harlan (2000)
Behavioral inhibition	Ability to inhibit prepotent response, stop an ongoing response, and control interference in the pursuit of a goal. Subsumes working memory, self-regulation of affect, motivation, and arousal	Barkley (1996)
Inhibitory control	Family of processes including attentional control, interference control (Stroop effect), suppression of a dominant pre-potent response (go-no-go), cessation of ongoing behavior and redirection in response to signal (stop signal paradigm), cognitive, behavioral and motor inhibition, negative priming, and the inhibition of oculomotor reflexes	Nigg (2000)
Selective attention Inhibition	Selection of relevant information in the presence of irrelevant stimuli; extent to which brain suppresses immediate reactions to events to allow more analysis and response	Taylor (1999)
Emotional and behavioral regulation	Processes of initiating, maintaining, modulating or changing the occurrence of emotion-related behavior and the occurrence, intensity and duration of internal feeling states and physiological processes; Attentional control and suppression of impulse are central capacities	Eisenberg (2000)

Hypothetical Construct	Definition	Study
Response execution and inhibition	Failure to delay responses derived from an over rapid gradient of reinforcement Stop signal task	Oosterlaan & Sergeant (1996; 2000)
Ego control Ego resiliency	Ego control: Threshold for the containment or expression of impulses, feelings or desires; motor tempo, ability to delay, suppress, or plan response Ego resiliency: Anticipating consequences, motor inhibition, cope with stress, optimal regulation	Block and Block (1980)

Table 2
Predictor and Criterion Scales

	Scale Description
Predictor Scales	
Negative Emotionality (Coefficient alpha=.91)	Frustration, anger, latency and lability of emotion, rigidity or inflexibility of emotional response (e.g. Is easily upset; Is a "sore loser"; stays disappointed a long time; throws tantrums)
Fearful Inhibition (Coefficient alpha=.78)	Feelings of fear, timidity, evaluative anxiety, or lack of self-confidence. (E.g. is nervous, fearful, expresses self-doubt)
Attention Problems (Coefficient alpha=.95)	Ability to sustain and focus attention, shift attention between tasks. (E.g. is easily distracted; has a short attention span; has trouble shifting gears)
Impulsivity (Coefficient alpha=.93)	The ability to control impulsive behavior and suppress reward-seeking behavior, particularly during non-stimulating activities. (E.g. calls out in class; interrupts; seeks attention while doing school work; acts without thinking; shows off)
Criterion Measures	
Prosocial/Empathic	A positive, engaged, social orientation; empathy and altruism.
Social Rejection	Ability to make friends and feel accepted by peer group.
Withdrawal	Tendency to withdraw from participation in social activities.
Conduct Problems	Violations of class, school, social rules leading to specific sanctions (e.g. suspension, detention).
Aggression	Overt physical and verbal aggression directed towards others.

Table 3
Scale Items

Negative Emotion	Fearful Inhibition	Attention Control	Impulsivity
Argues when denied way	Nervous	Easily distracted	Talks loud
Stays disappointed a long time	Fearful	Does not pay attention	Calls out
Stubborn	Afraid to make mistake	Trouble concentrating	Shows off
Changes moods quickly	Self-doubt about tests	Has a short attention span	Seeks attention
Throws tantrums	Says not good at this	Listens to directions	Interrupts
Sore loser	Worries about things that can't be change*	Has trouble shifting gears	Cannot wait to take turn
Good sport		Listens attentively	Acts without thinking
Is easily upset			Loud noises
			Acts silly

* Item excluded from final scale

Table 4

Descriptive Statistics for Item Scores

Scale	Item	Mean	SD	Skew	Kurtosis
Negative Emotionality	1	.745	.935	1.11	.23
	2	.567	.758	1.28	1.132
	3	.821	.957	.898	-.290
	4	.425	.692	1.66	2.353
	5	.553	.789	1.396	1.339
	6	.184	.517	3.235	11.21
	7	1.274	.937	.13	-.94
	8	.509	.787	1.546	1.738
Fear	9	.288	.570	2.177	5.089
	10	.416	.641	1.567	2.419
	11	.235	.524	2.378	5.768
	12	.300	.547	1.843	3.414
	13	.471	.670	1.418	1.922
	14	.397	.641	1.592	2.193
Attention	15	1.233	1.027	.397	-.971
	16	.991	.867	.589	-.323
	17	.937	.982	.777	-.455
	18	1.003	.975	.680	-.546
	19	1.397	.874	-.136	-.790
	20	.779	.852	.936	.206
	21	1.298	.862	-.068	-.864
Impulsivity	22	.670	.884	1.133	.290
	23	.798	.912	.933	-.057
	24	.804	.888	.851	-.181
	25	.812	.930	.913	-.160
	26	.757	.863	.878	-.140
	27	.684	.835	1.055	.336
	28	.914	.793	.558	-.195
	29	.549	.862	1.529	1.410
	30	.627	.848	1.262	.787

Table 5
Unstandardized Path Coefficients, t-values, and R^2 values for Constrained Model 1

Path from	to Item	Path	t-value	R^2
Negative Emotionality	1	.82	29.07	.67
	2	.76	22.33	.58
	3	.82	33.98	.67
	4	.76	20.25	.58
	5	.63	17.01	.40
	6	.67	12.02	.45
	7	.69	28.72	.47
	8	.83	24.04	.69
Fear	9	.51	10.85	.26
	10	.53	11.92	.28
	11	.67	12.60	.44
	12	.61	12.49	.37
	13	.67	18.15	.45
	14	.72	19.37	.51
Attention	15	.88	46.60	.77
	16	.84	33.52	.71
	17	.90	41.62	.82
	18	.88	39.50	.77
	19	.78	32.80	.61
	20	.73	25.83	.53
	21	.77	32.91	.59
Impulsivity	22	.80	27.14	.64
	23	.72	25.14	.51
	24	.78	29.93	.61
	25	.84	33.57	.70
	26	.86	34.09	.74
	27	.76	25.56	.57
	28	.67	23.45	.45
	29	.78	23.89	.61
	30	.83	27.38	.69

- Model fit (Satorra-Bentler Scaled $X^2(399)=2715.33$, p=0.0; SRMR=.072; CFI=.96; NNFI=.96;RMSEA=.076)

Table 6

Model Fit Indices

	Satorra-Bentler x^2	df	SRMSR	RMSEA	CFI	NNFI
Model 1	2715.33	399	.072	.076	.96	.96
Model 2*	2468.46	398	.068	.072	.97	.97
Model 3*	2387.85	397	.064	.070	.97	.97
Model 4*	2361.97	396	.057	.070	.97	.97
Model 5	2242.88	369	.056	.071	.97	.97

* Nested models

Table 7
Standardized Path Values and R^2 values for Model 4
(R^2 values are presented in italics)
Model fit (Satorra-Bentler Scaled $X^2(396)=2361.97$, p=0.0; SRMR=.057; CFI=.97; NNFI=.97;RMSEA=.070)

	Negative Emotionality		Fear		Attention		Impulsivity	
1	.82	*.67*						
2	.76	*.59*						
3	.82	*.67*						
4	.76	*.58*						
5	.63	*.40*						
6	.67	*.46*						
7	.69	*.47*						
8	.83	*.68*						
9	.30	*	.35	*.30**				
10			.53	*.28*				
11			.67	*.45*				
12			.61	*.38*				
13			.68	*.46*				
14			.72	*.52*				
15					.88	*.77*		
16					.84	*.71*		
17					.91	*.82*		
18					.88	*.78*		
19					.78	*.61*		
20	.30	*			.54	*.57**		
21					.76	*.65*		
22							.83	*.65*
23							.71	*.50*
24					.40	*	.53	*.69**
25							.85	*.71*
26							.86	*.74*
27							.76	*.58*
28							.67	*.45*
29							.78	*.60*
30							.83	*.69*

* R^2 value represents estimate of variance accounted for by item loadings on two factors

Table 8
Standardized Path Values and R^2 values for Final Model
(R^2 values are presented in italics)
Model fit (Satorra-Bentler Scaled $X^2(399)=2242.88$, p=0.0; SRMR=.056; CFI=.97; NNFI=.97;RMSEA=.071)

	Negative Emotionality		Fear		Attention		Impulsivity	
1	.82	*.67*						
2	.76	*.58*						
3	.82	*.67*						
4	.76	*.58*						
5	.63	*.40*						
6	.67	*.45*						
7	.69	*.47*						
8	.83	*.69*						
10			.50	*.25*				
11			.67	*.44*				
12			.59	*.35*				
13			.70	*.49*				
14			.74	*.55*				
15					.88	*.77*		
16					.84	*.71*		
17					.91	*.82*		
18					.88	*.78*		
19					.78	*.61*		
20	.30	*			.54	*.58**		
21					.76	*.65*		
22							.83	*.65*
23							.71	*.50*
24					.40	*	.53	*.69**
25							.85	*.71*
26							.86	*.74*
27							.76	*.58*
28							.67	*.45*
29							.78	*.60*
30							.83	*.69*

* R^2 value represents estimate of variance accounted for by item loadings on two factors

Table 9

Three-year Longitudinal Sample

	1st Grade	2nd Grade	3rd Grade	Longitudinal N
Cohort 1	1997	1998	1999	162
Cohort 2	1998	1999	2000	9
Cohort 3	1999	2000	2001	44
Cohort 4	2000	2001	2002	42
Total				257

Table 10

Descriptive Statistics

Males (n=126) Females (n=131)

1st Grade	Boys Mean	Boys SD	Boys Skew	Boys Kurt	Girls Mean	Girls SD	Girls Skew	Girls Kurt
Attention	-3.60	5.83	-.209	-.946	-1.552	5.28	-.503	-.634
NE	2.021	4.92	1.04	.572	1.144	4.29	1.46	2.01
Fear	.4145	2.15	1.44	1.89	.6712	2.44	1.17	1.05
Imp	3.20	6.63	.591	-.780	.847	5.09	.880	.496
2nd Grade								
Social Skills	-1.11	5.10	-.165	-.118	1.218	4.78	-.120	-.863
Aggression	.5123	4.69	1.39	1.44	-1.10	3.57	1.79	3.17
Conduct	.0311	1.24	2.48	9.64	-.2623	1.039	1.466	7.74
Withdrawal	-.135	1.85	1.19	1.68	-.1984	1.79	1.00	1.17
3rd Grade								
Social Skills	-.6153	4.49	.297	.246	1.21	4.995	-.406	.149
Aggression	-.149	3.248	1.2	2.5	-.506	3.51	1.52	2.46
Conduct	.0544	1.19	1.70	3.24	-.159	.879	1.51	4.44
Withdrawal	-.0151	1.55	1.62	4.15	-.0735	1.754	1.88	4.88

Table 11

Zero Order Correlations (Males)

1st Grade	1	2	3	4
Attention				
NE	-.438			
Fear	-.410	.309		
Impulsivity	-.649	.644	.233	
2nd Grade				
Social Skills	.348	-.292	-.080	-.118
Aggression	-.369	.584	.141	.451
Withdrawal	-.334	.259	.126	.051
Conduct	-.362	.317	.014	.254
3rd Grade				
Social Skills	.357	-.339	-.043	-.238
Aggression	-.340	.505	.035	.449
Withdrawal	-.031	.098	.140	-.086
Conduct	-.296	.332	-.035	.233

Table 12

Zero Order Correlations (Females)

1st Grade	1	2	3	4
Attention				
NE	-.579			
Fear	-.511	.476		
Impulsivity	-.652	.763	.395	
2nd Grade				
Social Skills	.463	-.460	-.271	-.336
Aggression	-.407	.560	.125	.517
Withdrawal	-.238	.204	.228	.143
Conduct	-.474	.315	.183	.383
3rd Grade				
Social Skills	.498	-.297	-.215	-.255
Aggression	-.361	.427	.148	.422
Withdrawal	-.133	.082	.232	-.005
Conduct	-.443	.386	.195	.389

Table 13
Regressions Predicting Social Adaptation and Problem Behavior Using Behavioral Systems of Negative Emotionality, Fear, Attention, and Impulsivity

	Social Skills 2nd Grade		Social Skills 3rd Grade		Withdrawal 2nd Grade		Withdrawal 3rd Grade	
1st Grade	β	T	β	T	β	T	β	T
Females								
Negative Emotion	-.426	-3.44	-.155	-1.26	.288	3.35	.124	.908
Attention	.386	3.53	.535	5.04	-.338	-4.07	-.090	-.769
Fear	.038	.409	.079	.902	.032	.471	.179	1.87
Impulsivity	.232	1.79	.182	1.42	-.354	-3.22	-.248	-1.75
Total R^2	.286		.235		.257		.054	
Males								
Negative Emotion	-.384	-3.49	-.313	-3.00	.398	2.33	.266	2.33
Attention	.505	4.37	.334	3.18	-.497	-4.45	-.096	-.857
Fear	.134	1.46	.148	1.72	-.063	-.694	.144	1.57
Impulsivity	.447	3.46	.109	.914	-.535	-4.26	-.323	-2.49
Total R^2	.220		.188		.231		.085	

Table 14
Regressions Predicting Social Adaptation and Problem Behavior Using Behavioral Systems of Negative Emotionality, Fear, Attention, and Impulsivity

	Aggression 2nd Grade		Aggression 3rd Grade		Conduct 2nd Grade		Conduct 3rd Grade	
1st Grade	β	T	β	T	β	T	β	T
Females								
Negative Emotion	.472	4.103	.332	2.75	.011	.087	.170	1.29
Attention	-.164	1.64	-.186	-1.79	-.427	-3.86	-.338	-3.02
Fear	-.248	-2.88	-.192	-2.24	-.093	-.981	-.078	-.816
Impulsivity	.151	1.263	.125	.998	.134	1.102	.069	.509
Total R^2	.378		.257		.240		.226	
Males								
Negative Emotion	.520	5.30	.352	3.65	.289	2.64	.329	3.098
Attention	-.124	-1.20	-.084	-.859	-.427	-3.69	-.305	-2.85
Fear	-.073	-.891	-.158	-1.99	-.220	-2.39	-.200	-2.29
Impulsivity	.046	.402	.235	2.12	-.168	-1.31	-.156	-1.29
Total R^2	.357		.310		.197		.157	

Table 15
Regressions Testing Interactions of Attention, Impulsivity, Negative Emotionality, and Fear in Predicting 2nd and 3rd Grade Social Adaptation
Females (n=126)

	Social Skills 2nd Grade		Social Skills 3rd Grade	
	β	T	β	T
Fear	-.115	-.958	.146	1.26
Fear^2	-.079	-.669	-.166	-1.45
Impulsivity	-.224	-2.10	.381	3.70
Impulsivity^2	-.122	-.981	-.110	-.912
FR x IMP	.055	.470	.173	1.52
R^2 Δ	NS		NS	
Total R^2	.145		.087	
Fear	.098	.810	.040	.333
Fear^2	-.230	-1.81	-.112	-.902
Attention	.458	4.397	.520	5.10
Attention^2	-.091	-.938	-.013	-.137
FR x ATT	-.204	-1.74	-.215	-1.88
R^2 Δ	.019		.021	
Total R^2	.244		.279	
Negative Emotion	-.326	-2.17	-.046	-.306
NE^2	.113	.579	.090	.462
Attention	.274	2.324	.512	4.29
Attention^2	-.027	-.250	.040	.372
NE x ATT	.106	.643	.010	.057
R^2 Δ	NS		NS	
Total R^2	.271		.258	
Negative Emotion	-.619	-3.66	-.485	-2.61
NE^2	-.019	-.083	-.070	-.275
Impulsivity	.166	1.164	.090	.558
Impulsivity^2	-.353	-1.73	-.420	-1.79
NE x IMP	.347	1.141	.612	1.73
R^2 Δ	NS		.021	
Total R^2	.237		.137	

Table 16
Regressions Testing Interactions of Attention, Impulsivity, Negative Emotionality, and Fear in Predicting 2nd and 3rd Grade Social Adaptation
Males (n=123)

	Social Skills 2nd Grade		Social Skills 3rd Grade	
	β	T	β	T
Fear	.024	.166	-.053	-.381
Fear^2	-.078	-.536	.118	.857
Impulsivity	-.209	-1.69	-.230	-1.93
Impulsivity^2	.166	1.374	.019	.166
FR x IMP	.073	.766	.021	.224
R^2 Δ	NS		NS	
Total R^2	.046		.076	
Fear	.163	1.20	.036	.782
Fear^2	-.149	-.993	-.025	.860
Attention	.392	3.89	.356	3.65
Attention^2	.163	1.660	-.014	-.147
FR x ATT	-.067	-.531	-.213	-1.76
R^2 Δ	NS		NS	
Total R^2	.156		.184	
Negative Emotion	-.161	-.924	-.257	-1.49
NE^2	-.023	-.137	.038	.228
Attention	.279	2.70	.252	2.50
Attention^2	.055	.539	.011	.107
NE x ATT	-.154	-1.46	-.037	-.352
R^2 Δ	.016		.001	
Total R^2	.179		.182	
Negative Emotion	-.440	-2.07	-.357	-1.70
NE^2	-.049	-.229	-.073	-.345
Impulsivity	.101	.671	.032	.221
Impulsivity^2	.016	.127	-.138	-1.09
NE x IMP	.258	1.84	.260	1.89
R^2 Δ	.026		.025	
Total R^2	.146		.150	

Table 17
Regressions Testing Interactions of Attention, Impulsivity, Negative Emotionality, and Fear in Predicting 2nd and 3rd Grade Aggression
Females (n=126)

	Aggression 2nd Grade		Aggression 3rd Grade	
	β	T	β	T
Fear	-.160	-1.49	-.027	-.233
Fear^2	.075	.702	-.004	-.037
Impulsivity	.493	5.16	.446	4.31
Impulsivity^2	.140	1.25	-.042	-.347
FR x IMP	-.028	-.262	.059	.521
R^2 Δ	NS		NS	
Total R^2	.308		.189	
Negative Emotion	.389	2.79	.354	2.34*
NE^2	.043	.237	-.102	-.518
Attention	-.195	-1.77	-.262	-2.18*
Attention^2	-.082	-.819	-.199	-1.84
NE x ATT	-.087	-.553	-.070	-.406
R^2 Δ	NS		NS	
Total R^2	.340		.237	
Negative Emotion	.309	2.02*	.392	2.27*
NE^2	.349	1.66	-.545	-2.29*
Impulsivity	.179	1.38	.239	1.60
Impulsivity^2	.364	1.97*	-.307	-1.40
NE x IMP	-.516	-1.87	.643	1.95*
R^2 Δ	NS		.024*	
Total R^2	.368		.244	

Table 18
Regressions Testing Interactions of Attention, Impulsivity, Negative Emotionality, and Fear in Predicting 2nd and 3rd Grade Aggression
Males (n=123)

	Aggression 2nd Grade		Aggression 3rd Grade	
	β	T	β	T
Fear	-.159	-1.27	-.177	-1.37
Fear^2	.205	1.65	.109	.861
Impulsivity	.500	4.66	.480	4.37
Impulsivity^2	-.038	-.369	.003	.024
FR x IMP	-.101	-1.22	-.148	-1.75
R^2 Δ	.010		.020	
Total R^2	.268		.235	
Negative Emotion	.488	3.21	.515	3.18
NE^2	-.014	-.096	-.084	-.543
Attention	-.173	-1.94	-.155	-1.64
Attention^2	-.063	-.708	-.111	-1.17
NE x ATT	-.113	-1.23	.017	.173
R^2 Δ	NS		NS	
Total R^2	.370		.293	
Negative Emotion	.352	1.94	.411	2.12
NE^2	.216	1.18	.026	.133
Impulsivity	.152	1.21	.160	1.20
Impulsivity^2	.057	.521	.081	.694
NE x IMP	-.190	-1.59	-.122	-.958
R^2 Δ	NS		NS	
Total R^2	.367		.289	

Table 19
Regressions Testing Interactions of Attention, Impulsivity, Negative Emotionality, and Fear in Predicting 2nd and 3rd Grade Conduct Problems
Females (n=126)

	Conduct 2nd Grade		Conduct 3rd Grade	
	β	T	β	T
Fear	.146	1.26	.060	.525
Fear^2	-.166	-1.45	-.111	-.988
Impulsivity	.381	3.69	.274	2.71
Impulsivity^2	-.110	-.912	.041	.347
FR x IMP	.173	1.52	.279*	2.50*
R^2 Δ	NS		.039*	
Total R^2	.183		.228	
Negative Emotion	.031	.208	-.033	-.221
NE^2	.058	.294	.184	.949
Attention	-.453	-3.84	-.384	-3.25
Attention^2	-.026	-.240	-.011	-.101
NE x ATT	-.012	-.069	-.111	-.658
R^2 Δ	NS		NS	
Total R^2	.237		.265	
Negative Emotion	.032	.186	.047	.269
NE^2	.409	1.73	-.029	-.120
Impulsivity	.319	2.18*	.241	1.58
Impulsivity^2	.336	1.61	-.052	-.233
NE x IMP	-.655	-2.11	.320	.947
R^2 Δ	.029*		NS	
Total R^2	.190		.212	

Table 20
Regressions Testing Interactions of Attention, Impulsivity, Negative Emotionality, and Fear in Predicting 2nd and 3rd Grade Conduct Problems
Males (n=123)

	Conduct Problems 2nd Grade		Conduct Problems 3rd Grade	
	β	T	β	T
Fear	-.115	-.834	-.026	-.186
Fear^2	.068	.501	-.072	-.524
Impulsivity	.243	2.06	.211	1.76
Impulsivity^2	.052	.456	.029	.253
FR x IMP	-.209	-2.30	-.137	-1.49
R^2 Δ	.040*		NS	
Total R^2	.115		.079	
Negative Emotion	.568	3.43	.405	2.326
NE^2	-.511	-3.23	-.101	-.606
Attention	-.260	-2.68	-.132	-1.29
Attention^2	-.114	-1.19	.064	.635
NE x ATT	-.284	-2.86*	.007	.063
R^2 Δ	.052*		NS	
Total R^2	.253		.168	
Negative Emotion	.651	3.166	.535	2.559
NE^2	-.302	-1.46	-.075	-.355
Impulsivity	-.097	-.680	-.104	-.724
Impulsivity^2	.198	1.594	.113	.899
NE x IMP	-.215	-1.598	-.140	-1.022
R^2 Δ	NS		NS	
Total R^2	.191		.157	

Table 21
Regressions Predicting Social Adaptation and Problem Behavior
Using Behavioral Systems of Fearful Inhibition and Attention

	Withdrawal 2nd Grade		Withdrawal 3rd Grade	
	β	T	β	T
Females (=126)				
Fear	.241	1.83	.388	2.95
Fear^2	-.157	-1.14	-.195	-1.43
Attention	-.116	-1.03	.056	.499
Attention^2	.075	.707	.114	1.09
FR x ATT	-.009	-.067	.066	.522
R^2 Δ	NS		NS	
Total R^2	.092		.121	
Males (n=123)				
Fear	-.020	-.149	.272	1.96
Fear^2	.149	1.00	-.040	-.256
Attention	-.276	-2.76	.099	.951
Attention^2	.048	.484	.168	1.65
FR x ATT	.211	1.67	.189	1.45
R^2 Δ	NS		NS	
Total R^2	.139		.084	

Figure 1.
Regulatory and emotional systems in social development: Multiple pathways to positive and negative outcomes

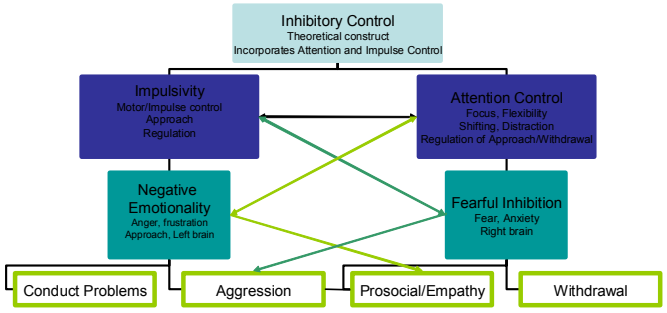


Figure 2.
Relationship of Boys' Negative Emotionality to 3rd Grade Social Skills by Level of Impulsivity (Raw Scores)

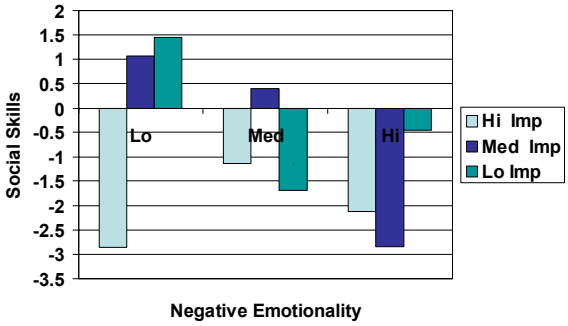


Figure 3.
Interaction of Fear and Attention in Prediction of Girls' Social Skills

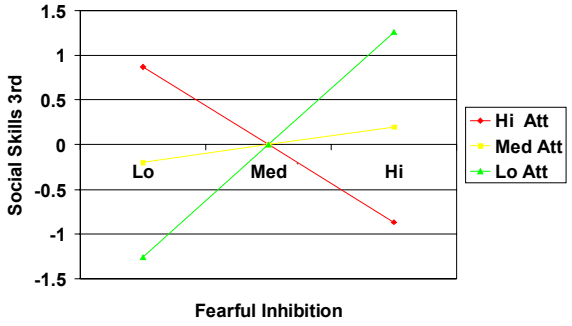


Figure 4.
Interaction of Negative Emotionality and Impulsivity in Prediction of Girls' Aggression

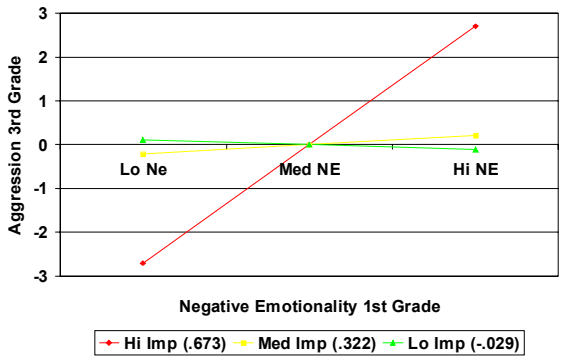


Figure 5.
Curvilinear Prediction of Girls' 3rd Grade Aggression by 1st Grade Negative Emotionality

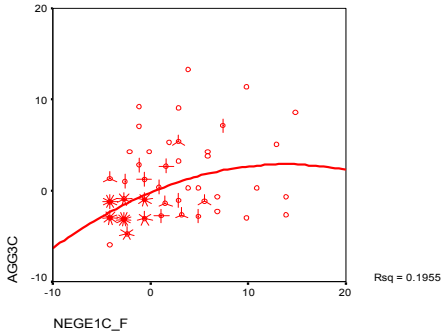


Figure 6.
Interaction of Fear and Impulsivity in Predicting Boys' Aggression

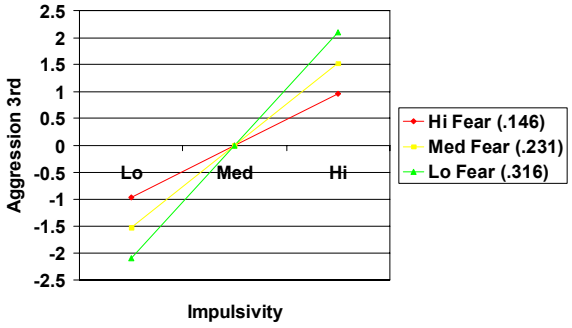


Figure 7.
Fear and Impulsivity in Predicting Boys' Aggression
(Mean Scores)

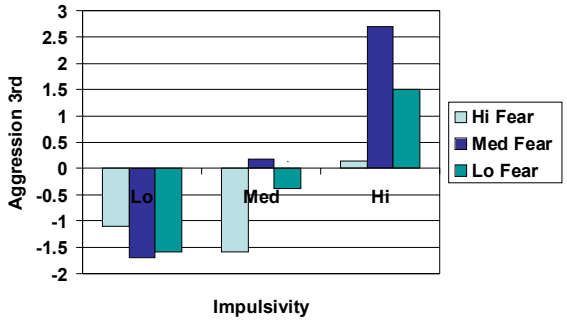


Figure 8.
Fear and Impulsivity in Predicting Girls' Aggression
(Mean Scores)

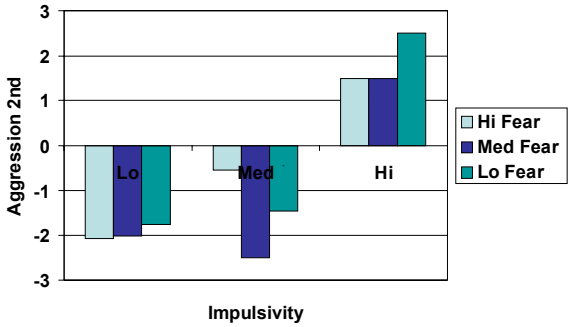


Figure 9.
Interaction of Fear and Impulsivity in Predicting Boys' Conduct Problems

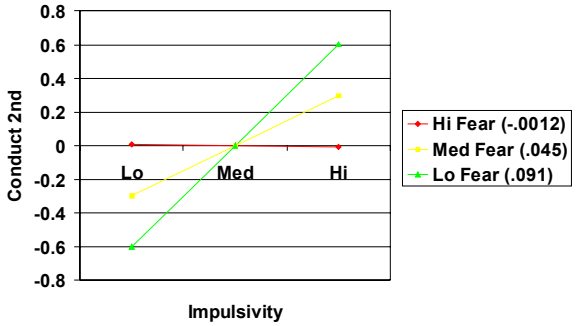


Figure 10.
Interaction of Fear and Impulsivity in Predicting Girls' Conduct Problems

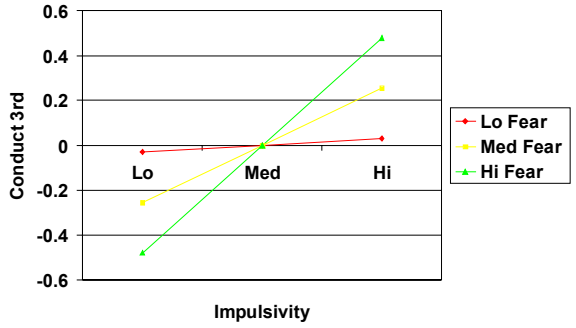


Figure 11.
Interaction of Attentional Control and Negative Emotionality in Predicting Boys' Conduct Problems

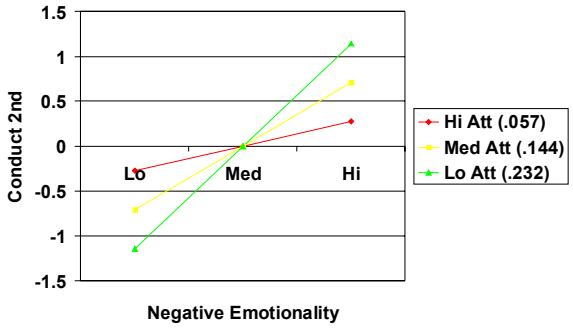


Figure 12.
Nonlinear relationship between boys' 1st grade negative emotionality and 3rd grade conduct problems

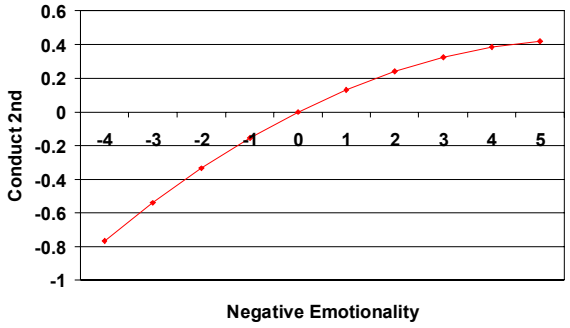
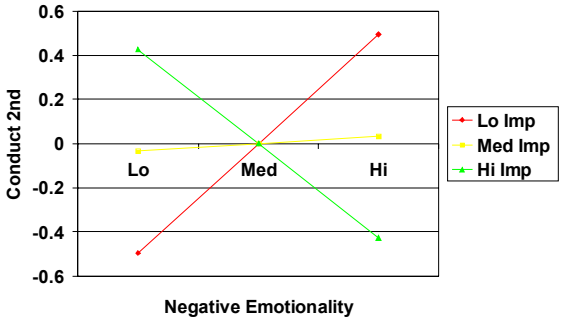


Figure 13.
Interaction of Negative Emotionality and Impulsivity in Predicting Girls' Conduct Problems



APPENDIX A

ITEMS INCLUDED IN OUTCOME MEASURES

Social Skills Scale
Coefficient alpha=.92

Encourages others to do their best	36
Has a sense of humor	48
Compliments others	62
Tries to bring out the best in other people	73
Congratulates others when good things	99
Makes suggestions without offending others	110
Offers to help other children	136
Shows interest in others ideas	147

Withdrawal
Coefficient alpha=.71

Refuses to talk	14
Plays alone	51
Avoids other children	65
Is shy with adults	125
Refuses to join group activities	139

Aggression Scale
Coefficient alpha=.93

Threatens to hurt others	16
Blames others	29
Bullies others	34
Orders others around	66
Calls other children names	76
Teases others	103
Hits other children	127

Conduct Problems Scale
Coefficient alpha=.71

Skips classes	20
Cheats in school	31
Has to stay after school for punishment	43
Steals at school	57
Complains about police . . .	68
Is truant	80
Has been suspended	117

APPENDIX B

NEGATIVE EMOTIONALITY: A QUALITATIVE COMPARISON

BASC-TRS (Reynolds, & Kamphaus, 1992)	TABC-R (Martin, 1988)	NEO-PPI Anger/Hostility (Costa, & McCrae, 1992)
Argues when denied own way	Argues loudly, yells,	I often get disgusted with people I have to deal with.
Stays disappointed for a long time	Stays moody after punishment	Even minor annoyances can be frustrating to me.
Is stubborn.	If angry, difficult to get in happy mood	I am usually known as a hot-blooded and quick-tempered
Changes mood quickly		
Is easily upset	Difficult to comfort when upset	It takes a lot to get me mad.
Throws tantrums.	Gets grumpy when tired	I often get angry at the way people treat me
Is a “sore loser”		
Is a “good sport”	Is easy going	I’m an even-tempered person.