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Executive Function and Social Problem-Solving in Maltreated and Non-maltreated Preschool Children

by

Julie Perkins Quamma

A dissertation submitted in partial fulfillment of the requirements for the degree of

Doctor of Philosophy

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Approved by _____
Chairperson of Supervisory Committee

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Program Authorized to Offer Degree Psychology Department

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University of Washington

Abstract

Executive Function and Social Problem-Solving in
Maltreated and Non-maltreated Preschool Children

by Julie Perkins Quamma

Chairperson of the Supervisory Committee
Professor Mark T. Greenberg
Department of Psychology

This study examined the early relationship between executive functioning (EF) and social problem-solving (SPS) skills and their influence on behavioral adjustment by comparing the performance of maltreated and non-maltreated preschool-aged children on measures designed to assess these three areas of functioning. Individual interviews were conducted with 30 maltreated and 28 non-maltreated children ages 4-5, and classroom teachers/daycare providers rated the behavior of each child. Groups were balanced on age, ethnicity, gender, and verbal ability, but not on maternal education level and socioeconomic status, which were both higher in the non-maltreated group. Important findings from this research included the identification of a coherent factor structure for EF in preschool-aged children supported by Confirmatory Factor Analysis. Four factors were generated (i.e., Sustained Attention, Selective Attention/Organized Search, Inhibitory Control, and Planning) and the model showed a good fit to the data. Maltreated children were found to have particular deficits in Sustained Attention when compared with non-maltreated children. Relationships between EF and SPS, as defined through the social information-processing model initially developed by Dodge (1986) and recently reformulated (Crick & Dodge, 1994), were directly examined for the first time in this research. Results indicated that Sustained Attention and Inhibitory Control were strongly associated with encoding skills, while Planning was strongly associated with response generation. Both SPS and EF showed significant relationships with aspects of behavioral adjustment, particularly Attention Problems and Social Skills. Path analyses in regression were conducted to further elucidate the relationships between components of EF, particular SPS skills, and aspects of behavioral adjustment and provided initial support for the hypothesis that components of EF can indirectly affect behavioral adjustment through SPS skills.

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DEDICATION

The author wishes to dedicate this dissertation to my husband, Michael Quamma, and my beautiful daughters, Samantha and Kate, who kept me going and never let me lose perspective.

CHAPTER 1: INTRODUCTION

Kevin is a five year-old boy who is described as being angry and reactive to others. He has difficulty calming down when upset and rarely takes others' points of view. On social-cognitive tasks, he frequently provides solutions that are aggressive or otherwise incompetent. Sean, also five years old, is described as highly distractible, impatient, and impulsive. He rarely considers the feelings of others, often misses important social cues, and feels that others are always being mean to him. He has difficulty generating and carrying out an effective plan of action. Emily, who is four and a half, is described as friendly, sensitive to the needs of her peers, and able to successfully follow classroom rules. She accurately judges the intentions of peers when involved in social conflict situations and frequently generates prosocial solutions to these problems.

These three profiles illustrate common differences among children in the late preschool years and suggest links between social-cognition and social adaptation. Patterns one and two have been associated with a number of family risk characteristics including poor parenting, maltreatment, and exposure to violence. Pattern three is more commonly found in children who have not encountered these particular risk factors. Recently, parallels have been drawn between component skills of executive functioning (EF) (e.g., attention, response control, planning) (Lyon & Krasnegor, 1996; Segalowitz & Rose-Krasnor, 1992) and aspects of social competence and behavioral adjustment. More specifically, recent models of the development of EF (Case, 1992; Dennis, 1991; Stuss, 1992) appear to have much in common with models of social problem-solving (SPS) (Crick & Dodge, 1994; Dodge, 1986; Rubin & Krasnor, 1986).

Among the most important skills children develop early in life are those contributing to successful social interactions. It has been consistently demonstrated that good SPS is related to positive social adjustment (Dodge, 1986; Parker & Asher, 1987). The present study focuses on the inter-relationships between EF, SPS, and behavioral adjustment in four and five year old children. In addition, it will compare these constructs and their inter-relationships between a normally parented and a maltreated sample. This introduction will review the following three areas: EF, SPS skills, and the effects of child maltreatment.

Executive Functioning (EF)

The Frontal Lobes and EF

Anatomically the frontal lobes are a large and heterogeneous structure making up the anterior one-third of the cerebral cortex (Stuss, 1992). The importance of the frontal lobes derives from the presence of rich connections with almost all other parts of the central nervous system (Stuss & Benson, 1984). Luria (1973) assigned to the frontal lobes important roles in the regulation of vigilance and control of goal-oriented behavior. Information about the influence of the frontal lobes on behavior has been obtained primarily through studies of adult patients with focal lesions in the frontal lobes. Striking impairment in planning, decision-making, directed goal selection, and monitoring of on-going behavior is characteristic of these patients (Stuss, 1992), as are deficits in social behavior and awareness. These skills and abilities are often referred to collectively as executive functioning (EF), a term which emphasizes the capacity to translate thought into action (Benton, 1991).

Frontal Lobe Functional Development

The myelination of the frontal lobes takes place gradually during development and is not completed until adulthood (Dennis, 1992). It has been assumed by many theorists that the frontal lobes do not become functional in any meaningful way until late childhood or adolescence. Luria (1973), however, believed that the prefrontal areas begin their development much earlier, perhaps between the ages of four and seven. More recent research has demonstrated that even infants show evidence of frontal lobe functioning (Bell & Fox, 1992; Chugani & Phelps, 1986; Davidson, 1994; Dawson, 1994; Thatcher, 1992).

Segalowitz and Rose-Krasnor (1992) discuss recent attempts to connect brain maturation with various aspects of children's cognitive and social development. They point out that early theorists such as Piaget and Freud were biologically oriented but understood the difficulties inherent in mapping brain development onto psychological development. Currently, there is renewed interest in connecting brain development with cognitive and social development. In addition to improved methodologies and technology, recent recognition that theories of child development need to consider metacognitive constructs (e.g., the development and evaluation of strategies, the ability to self-monitor) has opened up this area of research. The frontal lobes have become the center piece of this area of research because of its association with these metacognitive skills.

Similarities between the components of the social information processing model developed by Dodge and his colleagues (Crick & Dodge, 1994; Dodge, 1986) and skills

associated with frontal lobe functioning have also led to hypotheses that specific neuro-cognitive skills may be developmentally related to behavioral adjustment and risk for disruptive behavior problems (Cole, Usher, & Cargo, 1993; Kusche, Cook, & Greenberg, 1993). Specifically, attentional and inhibitory control processes, as well as planning skills are key elements of EF which might underly SPS. Because skills integral to good SPS skills are also used in definitions of EF, the frontal lobes have become the focus of research attempting to connect brain development with positive social competence.

A hypothesized developmental hierarchy of skills associated with EF is presented in Figure 1. Despite evidence that the frontal lobes most likely have a functional role early in development, young children do not exhibit EF in the same manner as adolescents or adults. Documentation of frontal lobe activity beginning very early in development suggests that there may be a continuum or hierarchy of frontally-mediated skills that begins with basic emotion regulation capacities in infancy (Davidson, 1994; Dawson, 1994). As childhood progresses, self-regulatory skills, such as attention and inhibitory control, and planning begin to develop and affect functioning (Becker, Isaac, & Hynd, 1987; Case, 1992; Passler, Isaac, & Hynd, 1985; Welsh, Pennington, & Groisser, 1991). During adolescence, further development results in skills allowing for abstract synthesis of information and self-analysis that continue to develop into adulthood (Stuss, 1992). This model raises questions about the nature of deficits caused by frontal lobe dysfunction at different ages. As Dennis (1992) suggests, instead of attempting to discover when adult-like frontal lobe functioning will appear, it is important to try to understand functions mediated by the frontal lobes at different developmental junctures. A hierarchy of SPS skills, based on Dodge's (1986) model, is also presented in this model in an attempt to illustrate ways in which EF and SPS may be related and influence children's behavior at different stages of development.

Performance of children from different age groups on neuropsychological tests thought to measure frontal lobe functioning have provided evidence which supports this hypothesis of a hierarchical, dynamic, multistage process (Becker et al., 1987; Levin et al., 1991; Passler et al., 1985; Welsh et al., 1991). Gnys and Willis (1991) found mixed support for the use of two measures of EF (Verbal Fluency and the Tower of Hanoi) in preschool-aged children. They examined construct validity by conceptualizing verbal and nonverbal aspects of EF, and used Sentence Memory and Bead Memory from the Stanford-Binet Intelligence Scale to assess discriminant validity. Their findings showed that the two EF measures could not be differentiated as representing verbal versus nonverbal constructs and that the memory tasks were highly

associated with the EF tasks. They concluded not that the EF tasks were inappropriate, but that the Tower of Hanoi is not necessary nonverbal, and that the memory tasks may have tapped working memory, a skill often associated with EF. Their study emphasizes the care with which measures must be chosen to assess EF in young children.

Additional data indicate that children between the ages of 6 and 10 show considerable variation in their mastery of skills associated with frontal lobe functioning. Nigg, Quamma, and Greenberg (submitted) found that the Stroop test was valid when used with normal but not with delayed first and second graders. Frontally mediated skills initially seem to involve control over attention and motor responding and then progress to more abstract metacognitive abilities (Case, 1992; Stuss, 1992; Welsh et al., 1991). This makes intuitive sense, as it would be difficult to complete complex hypothesis testing without the ability to focus attention on the appropriate material and inhibit motor responding while considering encoded information. Case (1992) suggests that gradual increases in working memory capacity allows for the acquisition and use of increasingly advanced executive strategies.

Factor analyses conducted in several studies suggest that there are component skills associated with EF (Levin et al., 1991; Shute & Huertas, 1990; Welsh et al., 1991). As these studies included different measures and children from somewhat different age groups, it is difficult to compare their factor structures. However, each seems to indicate factors related to attention, response control, and inhibition, as well as groups of more abstract skills such as working memory and planning. The most important skill area that has shown little relationship to EF is general intelligence (Stuss & Benson, 1984; Welsh et al., 1991).

Social Adjustment in Children with Frontal Lobe Dysfunction

Recent research conducted with children who have sustained frontal lobe damage indicates that significant social impairment occurs. Benton (1991) presented the well-known case of patient J.P., who suffered from a bilateral prefrontal lobe atrophy and began to show deviant behavior at the age of three. Cognitive assessments showed average intelligence but deficits in skills requiring self-regulation, planning, abstraction, flexibility, and goal-directed behavior. J.P. had difficulty maintaining friendships and showed poor social adaptation. The case of P.L. who suffered a focal prefrontal injury at age three is discussed by Marlowe (1992). Initial behavioral changes included emotional lability, impulsiveness, agitation, aggressiveness, and difficulty sleeping. Assessment at ages five and six showed no decrease in his IQ scores, but many skill deficits (i.e., self-regulation, learning from experience, maintaining set, carrying out a strategy). Mateer and Williams (1992) discuss four children who suffered nonfocal frontal lobe injuries in

early childhood. They found that each child showed evidence of maladaptive social behaviors such as poor attention, irritability, mood swings, and impulsivity. Some changes and problems manifested themselves immediately, while others appeared only after several weeks or months had passed. The authors grouped these behaviors into three main areas: the allocation of attentional resources, self-regulation, and the ability to act on knowledge. They noted that despite lack of intellectual, linguistic, and perceptual impairment, these children had significant academic and social difficulties.

It is clear from these studies that important EF skills exist in early childhood, and, although there is currently no standardized method of measuring these skills, even preliminary efforts at assessment have yielded important information about how they might change throughout development and affect social functioning. Studies involving children with documented frontal lobe lesions strongly suggest links between cognitive and social skills deficits in their effects on behavioral adjustment.

Social Problem-Solving (SPS)

Social Cognition and Social Information-Processing

Mental processes that occur in response to the social environment (e.g., social cognition), have been established as one important influence on social behavior (Bandura, 1962). Several constructs have been generated to describe the relationship between social cognition and social behavior. Social competence and SPS are among those most frequently used in the literature. Social competence has been used as both a global description of affective, cognitive, and behavioral components of social functioning (Greenberg & Kusche, 1993) and an evaluative judgment of outcome or social performance (Gresham, 1986; McFall, 1982). It is a term often used to refer to positive behavioral adjustment. SPS is a term that often refers to specific cognitions children utilize in social situations (Dodge, 1986; Rubin & Krasnor, 1986; Spivak, Platt, & Shure, 1976; Weissberg, Gesten, Rapkin, Cowen, Davidson, Flores de Apodaca, & McKim, 1981). It is a subset of social competence that refers to the specific mental processes which may translate social cognitions into socially competent behavior.

The social information-processing model originally developed by Dodge (1986) and reformulated by Crick and Dodge (1994) provided the supporting structure for the current study as its attempt to describe the microstructures involved in social information-processing makes it most useful for comparing SPS and EF. Dodge, Pettit, McClaskey, and Brown (1986) posit that "the social information-processing model is a beginning step toward a model that does describe

actual cognitive activity in the brain and one that will map onto basic cognitive and neuroscientific processes" (p. 57-58, emphasis in original). Crick and Dodge (1994) describe the reformulated model as a theory of "on-line" brain performance, but warn that "the translation to brain processes and neural functioning is impossibly loose" (p. 77) at this point in time. According to the reformulated model, a child's behavioral response occurs as a function of a series of six hierarchical processing steps which are influenced by his or her biological characteristics, memories of previous experiences, and perceptions about the social task at hand (see Figure 2). While the original model proposed by Dodge (1986) was linear, the reformulated model is regarded as cyclical, with feedback between particular steps. The various steps are still regarded as having temporal relations such that, for a single stimulus situation, earlier processing steps occur before later ones. The first processing step involves encoding cues in the environment, as well as internal cues such as level of arousal and affect. This includes both recognition of and attention to these cues. The second step involves the mental representation and interpretation of the encoded cues. Included here are causal and intent attributions, as well as evaluations of goal attainment, past performance, and self-evaluation. There is an important feedback process between these two steps such that interpretations often influence which cues are most readily encoded. The third step involves selecting a goal or desired outcome for the situation. This step was not explicitly included in the original model. At the fourth step, a search for possible responses is conducted, and the process of deciding upon a strategy occurs during the fifth step. Again, there is feedback between these two steps, allowing criteria used in evaluating strategies to influence the breadth of the response search. Finally, enactment of a behavioral response occurs during the sixth step. Crick and Dodge (1994) emphasize that these processes occur in real time and probably involves simultaneous processing of multiple social situations. This processing is thought to occur mostly on an unconscious level, except in circumstances involving a novel or particularly challenging task, and is thought to be the same whether it occurs consciously or unconsciously.

SPS and Behavioral Adjustment

In this section, the social information-processing model described above (Crick & Dodge, 1994; Dodge, 1986) will be used to organize a review of the literature on children's SPS. Specifically, encoding and representation, along with response generation and evaluation, have been subjected to the most empirical scrutiny and form the main focus for the current review. Support for the ability of this model to predict behavioral adjustment has been provided through research by Dodge and his colleagues (see Dodge, 1986; Dodge et al., 1986) who conducted two

studies to test hypotheses that skillful processing at each step of the model would increase the overall likelihood of competent responding by children when faced with a social conflict situation. The first study involved kindergarten through second grade children rated by peers and teachers as socially competent or incompetent. Children were presented first with videotapes of children in a group entry situation and then were asked, in a separate session, to participate in an actual group entry task. In each situation, questions designed to tap each step of the model were asked after the stimulus was presented. Four out of the five processing steps described in the model made independent significant contributions to the prediction of competent peer entry for this group of younger school-aged children. These findings were replicated in the second study, which involved second through fourth graders, and extended to a different social domain involving peer provocation. In the second study, all five processing steps contributed significantly to predictions of behavior. Interestingly, group entry processing variables did not predict responses to peer provocation and peer provocation variables did not predict responses to group entry situations, suggesting that the relationship between social information-processing patterns and social behavior is domain-specific (Dodge et al., 1986). More recent research has only partially replicated this finding, showing domain-specificity only in certain peer situations and in authority oriented situations (Dodge & Price, 1994). When deficits in social information-processing was aggregated across these two domains (i.e., peer provocation and group entry) in a reanalysis of the original data (Dodge et al., 1986), 63% of aggressive boys showed deficits in three or more levels of processing relative to 21% of boys who were not aggressive (Dodge, 1985).

Studies have also examined how children perform at particular levels of processing within the social information-processing model (Crick & Dodge, 1994; Dodge, 1986). This research has focused largely on school-aged children. Data about specific social information-processing steps is informative in that it suggests how and where certain children encounter problems in negotiating particular social conflict situations. Because of the dynamic relationship between encoding and representation, findings related to steps one and two of the model will be considered together. For the same reason, data regarding response generation and response evaluation (steps three and four) will also be considered together. After findings obtained from research with school-aged children are presented, research focusing on SPS in preschoolers will be reviewed.

Encoding and Representation

Dodge and his colleagues have conducted a number of studies examining the influence of attention to cues (encoding) and attributional biases (representation) on behavioral outcomes. Dodge and Newman (1981) explored two aspects of information processing thought to have a relationship with attributional biases: speed of decision-making and selective attention to and recall of hostile cues. They found that the non-aggressive boys (kindergarten through grade 5) in their sample searched for 40% more cues than aggressive boys during a detective game. In contrast, aggressive boys responded more quickly, gave less attention to cues, and over-attributed hostility to peers when they responded quickly. Dodge and Tomlin (1983) found that expectancies held by aggressive children (aged 11-14) about social conflict situations were associated with a failure to attend to cues. Other studies have indicated difficulties aggressive children have with regard to attentional processes, including shifting their attention away from hostile cues (Gouze, 1987), and attending to irrelevant cues (Dodge et al., 1986). These findings suggest that children who are aggressive may respond more quickly and impulsively in social conflict situations than their non-aggressive peers and lag behind in the development of flexible and accurate encoding skills. Failure to attend to appropriate cues in social conflict situations is likely to interfere with a child's ability to proceed through subsequent processing steps and may lead to maladaptive behavior.

Dodge and Frame (1982) examined selective attention and biased attributions in boys (kindergarten through grade five) asked to respond to hypothetical vignettes which varied in terms of the status of the peer (aggressive or non-aggressive), the story outcome (negative or ambiguous), and the target of the outcome (the subject or another peer). Findings showed that aggressive boys overattributed hostility to peers only when they themselves were outcome targets and not when the target was another peer. A subsequent study of 8-10 year old children by Dodge and Somberg (1987) confirmed that attributional biases are exaggerated in conditions where subjects perceive threats to themselves. Dodge and Frame (1982) also examined the role of selective attention in biased attributions made in response to videotaped interviews of boys making predominantly benevolent, hostile, or neutral statements about things they do with peers. Analyses revealed that selective recall of hostile statements was a significant predictor of attributions that a peer would act in a hostile way. In addition, aggressive boys were more likely to endorse statements that had not actually been made in the interview during both free recall and recognition tasks. These studies clearly demonstrate that aggressive boys of a fairly wide

age range show deficits in social information-processing, particularly in encoding and representing cues, that may result in frequent involvement in aggressive interactions with peers.

Dodge, Murphy, and Buschbaum (1984) examined the ability of children (kindergarten, through grade 4) to accurately discriminate intention cues. Sociometric interviews were used to assign children into one of four groups (i.e., popular, socially rejected, socially neglected, and average). Children viewed videotaped scenerios where one child destroyed the play object of the other. Five types of intentions were portrayed in the videotapes: hostile, prosocial, accidental, ambiguous, and merely present (but not involved). Both socially rejected and socially neglected children overattributed hostility when presented with prosocial and ambiguous intention cues. Younger children tended to have the same difficulty, which suggests that socially deviant children may experience a developmental lag in skills related to intention-cue detection. All children, regardless of social status or age, were able to accurately detect hostile intention-cues. Additional studies have demonstrated that aggressive children make hostile attributions in conflict situations where the intent of the other child is ambiguous (Dodge, 1980; Steinberg & Dodge, 1983). These mistaken attributions are very important because it is clear that children respond based upon their interpretation of a situation and not what may actually be happening (Dodge et al., 1984).

While there is some controversy about the extent to which social and non-social cognition parallel one another, studies on non-social problem-solving skills contribute additional evidence that deficient encoding skills severely compromise children's ability to successfully gather information to aid in negotiating a task (Piaget, 1968). For example, Siegler (1976) used the balance beam task to compare the problem-solving skills of five and eight year old children. He found that five year olds were less able to acquire new information because of immature encoding skills. The younger children tended to ignore important cues and could encode on only one dimension (i.e., weight but not height). In addition, the younger children were less flexible in their use of hypotheses to solve the problem.

Response Generation and Evaluation

The importance of generating alternative solutions to social conflict situations was first emphasized in early research on SPS skills by Spivak, Shure, and their colleagues (cf. Spivak et al., 1976). Their research demonstrated that the ability to generate many and varied solutions to hypothetical social conflict situations is related to behavioral adjustment (as rated by classroom teachers) in children as young as four years old.

Richard and Dodge (1982) presented hypothetical vignettes to second through fifth grade boys identified by peer nominations as either aggressive, cooperative, or isolated. The aggressive and isolated boys were able to come up with an initial solution that was rated as effective but were unable to come up with additional effective solutions in contrast to popular boys, who continued to offer effective solutions. This data replicated findings presented by Spivak et al., (1976) that maladjusted children are deficient in the cognitive skill of generating *alternative* solutions.

As a result of the findings of Spivak et al. (1976) with regard to the influence of general intelligence, Richard and Dodge (1982) assumed that their findings were not mediated by IQ. Evans and Short (1991) reported that non-aggressive/non-withdrawn children generated significantly more effective second alternative solutions and that the number of effective second responses predicted behavioral adjustment in 8-11 year olds, even after controlling for verbal ability. While verbal ability is related to the ability to generate alternative solutions, it does not fully explain its contribution toward predicting behavioral adjustment.

With regard to response evaluation, Dodge and his colleagues (1984) showed that children's responses varied depending on their interpretations of social conflict situations. This may be one illustration of how processing deficits at earlier steps can negatively influence subsequent processing. Kendall and Wilcox (1979) have suggested that because aggressive children often act impulsively, they are unable to encode and interpret cues successfully and enact the first response generated without engaging in any evaluation process. Although this hypotheses has not been validated empirically, it has been demonstrated that aggressive children correctly evaluate various solutions to social conflict situations presented in response to hypothetical vignettes (i.e., state that a competent response is good and inept and aggressive responses are bad) but do not act on these judgments in actual conflict situations (Richard & Dodge, 1982). It seems possible that aggressive children have some sort of performance deficit which prevents them from utilizing their ability to correctly judge the effectiveness of solutions. Weissberg and his colleagues (1981) reported that SPS skills training resulted in gains in alternative-solution thinking and the generation of more effective solutions in third graders. In addition, trained children were better able to anticipate alternative consequences to solutions. The ability to use information about consequences seems to contribute to competent SPS.

While all of the steps in the social information-processing model are important in generating a competent behavioral outcome, each step is believed to have a unique influence which may be measured separately from the others. As described above, research by Dodge et

al., (1986) has demonstrated that a comprehensive assessment of the skills and sequential patterns involved in a child's social information-processing results in strong predictions about that child's social behavior and adjustment. Other investigations by Dodge and his colleagues have found relationships between processing skills associated with particular steps in the model and behavioral adjustment (Dodge & Frame, 1982; Dodge et al., 1984; Richard & Dodge, 1982). While Dodge (1991; Dodge et al., 1986) has cautioned that important factors which influence social information-processing, such as affect and developmental level, are not fully addressed, this model has provided an empirically valid structure for studying children's SPS skills.

SPS in Preschool Children

Piaget (1932) wrote that negotiating interpersonal conflict is a necessary part of children's cognitive development. It is during the preschool years that skills necessary for successful SPS, such as self-regulation and planning, are first established through improvements in skills such as perspective-taking and verbal mediation (Eisenberg & Harris, 1984; Flavell, 1977). Self-regulation implies flexible use of internalized social rules and motor inhibition in response to changing situations (Kopp, 1982). Tinsley and Waters (1982) demonstrated that motor inhibition is aided by overt speech in children under five years of age. By age five, however, children become increasingly able to use covert (i.e., internal) speech to help guide behavior. This research supports Luria's findings about the development of verbal self-regulation and suggests that children begin to have the capacity for metacognition at this age.

Encoding and Representation

The achievement of self-regulation in preschool-aged children permits increasingly successful encoding and representation of problem situations. Indications from research with school-aged children are that younger children attend to fewer cues (Dodge & Newman, 1981), but no research specifically examining encoding and representation skills in preschoolers is currently available. However, Fabes, Eisenberg, McCormick, and Wilson (1988) found that normal preschoolers are able to use contextual information to make accurate attributions about others' emotional responses, so it appears that these skills are operating at some level in children at this age.

Response Generation and Evaluation

As stated above, the work of Spivak and Shure and their colleagues demonstrated that preschool-aged children can generate alternative solutions to social conflict situations (Spivak et al., 1976). Further, well-adjusted preschoolers were better able to conceptualize alternative

solutions and the consequences of actions than their maladjusted peers. Each of these skills implies the use of mental processes in planning a behavioral response to an interpersonal conflict situation. Data suggesting that the quality of initial responses may be more important in determining whether or not a child responds competently than the total quantity of responses has also been reported. Krasnor and Rubin (1983) observed preschoolers involved in free play and examined the success of initial and subsequent problem-solving attempts. Findings from this study suggest that flexible response generation after failed attempts is a developing skill in preschool-aged children. Other research by Rubin and Krasnor (1983) has demonstrated that flexible use of strategies greatly increases between preschool and kindergarten.

There is substantial evidence supporting the important contributions made by each of the processing steps presented in Dodge's (1986) model for children from a variety of age groups, but no direct data on the performance of preschool-aged children on encoding and representation. This is an important short-coming in the literature. The fact that self-regulatory abilities are still developing in preschool children suggests that the roles of encoding and representation might be especially important during this period.

While existing data provides explanations for many of the processes involved in SPS, it also raises questions about causes of deficient processing. Explanations for deficits in SPS skills may be conceptualized as resulting from problems in any of the following three areas: (1) biological development, (2) experiential data base, and (3) perceptions of the current social task (Dodge, 1986). As these three areas are involved in constant dynamic exchange, problems in any one area may cause difficulties in another area which may then exert additional maladaptive influence on the first problem area, and so on. Children may either fail to develop a particular skill (skill deficit) or be unable to perform an acquired skill (performance deficit) (Gresham, 1986). For example, inability to inhibit a behavioral response might result in inaccurate encoding of cues in a social situation, biased interpretations, and failure to consider alternative solutions, all of which interfere with the production of a competent response. Dodge and his colleagues (1986) conclude their monograph by suggesting that future research should focus on closer examination of the mechanisms involved in each processing step and how they may be related to functional brain development.

Relating SPS and EF

There are three possible ways in which SPS and EF could be related. First, all of the SPS skills included in the social information-processing model (Crick & Dodge, 1994; Dodge, 1986) may actually assess aspects of EF. Second, only particular SPS skills, such as encoding

cues and generating alternative responses, may assess aspects of EF. The third possibility is that, despite apparent similarities, SPS and EF are not related at all. The second scenario seems most likely, given the wide range of skills and abilities included in both areas. It appears that many of the cognitive abilities included in Dodge's social information-processing model are quite similar to those involved in EF (e.g., attention to cues, planning). In addition, there seems to be consensus that skills involved in EF are substantially related to aspects of interpersonal behavior such as social self-regulation, empathy, and self-awareness (Eslinger, 1996). As both transactional and main effects explanations for the effects of frontal lobe dysfunction on the development of behavioral maladjustment have been suggested (Moffitt, 1993; Pennington & Bennetto, 1993), it seems possible that deficient EF may negatively influence behavioral adjustment directly as well as indirectly, through compromised SPS skills.

Since the literature reviewed on deficient SPS has focused on children with disruptive behavior problems, research on neuropsychological impairment in these children may elucidate connections between SPS skills and EF. There are no studies currently available in the literature that directly assess the relationship between SPS and EF, so it is necessary to draw from other areas of research to generate hypotheses about how these constructs might be related.

In his theoretical paper, Mattes (1980) showed striking parallels in the symptoms of distractibility, impulsivity, poor planning, and hyperactivity between children with hypekinesis and adults with frontal lobe syndrome. Gorenstein, Mammoto, and Sandy (1989) reported that children whose teachers rated them high on inattention/overactivity (I/O) made significantly more errors on EF measures, but were not different on verbal abilities. Shue and Douglas (1992) also reported that children with ADHD showed deficits relative to controls only on EF measures. Finally, a recent review of neuropsychological studies of frontal lobe functioning in children with ADHD (with and without hyperactivity) indicated that measures of behavioral inhibition (i.e., the Continuous Performance Test, the Stroop, Hand Movements from the Kaufman Assessment Battery for Children, Go-No-Go) most consistently distinguished between children diagnosed as ADHD with hyperactivity and normal controls (Barkley, Grodzinskey, & DuPaul, 1992). In fact, Barkley (1997) advocates conceptualizing ADHD as a deficit in behavioral inhibition. In a New Zealand birth cohort, Moffitt and Henry (1989) found that delinquent adolescents who had been comorbid for antisocial behavior and attention deficit disorder in early childhood scored poorly on neuropsychological tests of EF. The authors suggest that neuropsychological difficulties that are manifested as problems with self-control are linked with the early onset and persistence of conduct disorder.

Kusche, Cook, and Greenberg (1993) compared groups of elementary-aged children with different types of symptomatology (i.e., internalizing, externalizing, and comorbid) with normal controls on various neuropsychological measures. They found that children in all three pathology groups showed impaired performance on measures of EF (i.e., Trails B, the Stroop), which suggests that frontal lobe dysfunction may be related to psychopathology in general and not necessarily to specific types of symptomatology. Cole, Usher, and Cargo (1993) assessed various cognitive skills, including verbal skills, and EF in preschool children. EF was assessed through use of the following instruments: the Tapping Test, the Rapid-Alternating-Stimulus-Naming Test, Hand Movements, a block sorting test, and a visual search task. They reported that all of these measures grouped into a single factor. Scores on all of the cognitive measures, including EF, were related to scores of behavioral control (as measured by a delay of gratification task). Problematic verbal skills were associated with higher levels of teacher rated behavior problems and EF was predictive of scores on the behavioral control task.

It has been suggested that the cognitive and linguistic deficits and impulsive behavior often found in children with disruptive behavior problems (Kusche et al., 1993) may be related to dysfunction in the left frontal lobe and its connections with the limbic system (Gorenstein et al., 1989). Children with this type of processing deficit seem to have difficulty sustaining cognitive activity when faced with competing stimuli. In other words, they are expected to show impairment in their ability to attend to relevant cues in a social situation. They also seem to lack skills important to competent social discourse, including empathy, perspective-taking, planning, and the ability to use representations to guide behavior. Moffitt (1993) suggests that executive dysfunction may be a causal factor for conduct disorder early in development and suggests a scenario through which early neuropsychological risk could interact with environmental variables and lead to the development of disruptive behavior problems.

Child Maltreatment

Maltreated children are a frequently studied high risk group who consistently show significant problems with behavioral adjustment. In addition, maltreated children may be more likely to suffer from neuropsychological dysfunction due to a variety of risk factors associated with both physiology and environment (e.g., prenatal drug exposure, genetic factors, physical trauma, chaotic home environment, poor parent-child relationship) (Lewis, 1993; Moffitt, 1993). Maltreatment is a general term referring to any type of abusive treatment of a child (i.e., physical abuse, sexual abuse, neglect).

It has been accepted that the study of high risk groups can help to increase understanding of normal development (Sroufe & Rutter, 1984). Maltreated children have been shown to be more likely to exhibit deficient SPS skill than non-maltreated children (Barahal, Waterman, & Martin, 1981; Dodge, Petit, & Bates, 1994; Farber & Egeland, 1987; Hasket & Kistner, 1991; Salzinger, Feldman, Hammer, & Rosario, 1993). As such, maltreated children represent a particularly appropriate group to involve in research examining possible relationships between EF and SPS and their effects on behavioral adjustment.

Social Cognition and Behavioral Adjustment in Maltreated Children

There is substantial evidence that maltreated children show more problem behaviors and lower social competence than their non-maltreated peers (see Widom, 1989 for a review). Observational data indicates that maltreated preschoolers show lower social competence than their non-maltreated peers as evidenced by frequent play transitions, fewer initiations of positive peer contact along with higher levels of aggressive behavior, less frequent response to friendly peer overtures, fewer expressions of positive affect, and low levels of peer conversation (Alessandri, 1991; George & Main, 1979; Haskett & Kistner, 1991; Herenkohl & Herrenkohl, 1981; Hoffman-Plotkin & Twentyman, 1984; Howes and Espinosa, 1985). Teachers and parents consistently rate maltreated preschoolers as more aggressive and less socially competent than their non-maltreated peers (Alessandri, 1991; Haskett & Kistner, 1991; Hoffman-Plotkin & Twentyman, 1984).

Several studies have demonstrated specific social cognitive deficits shown by maltreated children as they attempt to negotiate social conflict situations (Barahal et al., 1981; Haskett, 1990; Smetana, Kelly, & Twentyman, 1984; Weiss, Dodge, Bates, & Pettit, 1991). Barahal and colleagues (1981) compared social cognitive skills of physically abused children aged 6-8 to a matched group who were not abused. Assessment of IQ, locus of control, social sensitivity (as measured by accurate labeling of others' emotions), perspective-taking, and concepts of social roles showed that physically maltreated children scored lower than their non-maltreated peers in all areas. When IQ was controlled, some of the findings were attenuated but findings related to locus of control remained strong with maltreated children showing a strong external locus of control, particularly in negative situations. Haskett (1990) assessed SPS skills in maltreated and non-maltreated preschoolers and found that those who were maltreated generated fewer alternative solutions and showed a restricted and rigid understanding of approaches to solving common social conflict situations. When encouraged to generate alternative solutions, they relied on aggressive tactics. Deficient social information-processing

among children who have experienced harsh discipline was found in a longitudinal study conducted by Weiss et al. (1991). Specifically, children experiencing harsh discipline showed decreased attention to relevant cues, an increased hostile attributional bias, and an increased tendency to generate aggressive responses to hypothetical situations.

Early Risk Factors Associated with Maltreatment

Explanations for poor behavioral adjustment often shown by maltreated children most often consider interactions between child biologic factors and aspects of the early parent-child relationship. Greenberg, Speltz, and DeKlyen (1993) suggest that these factors operate in a transactional manner, significantly and necessarily affecting one another.

Child biologic influences on the development of children's social competence include disruptions of neural development before or after birth, genetic influences, atypical hormonal or neurochemical levels, and temperament (Greenberg et al., 1993; Lewis, 1993; Moffitt, 1993; Sussman, 1993). There is some evidence that children with biologic vulnerabilities are often born into unsupportive environments. Parents of children who are at risk for social adjustment problems are often vulnerable themselves and likely to provide toxic environments for their children (Moffitt, 1993). In addition, environmental factors (i.e., poor stimulation, insecure attachment relationships, learned hostile orientation) related to early maltreatment may potentiate existing psychobiological vulnerabilities (Lewis, 1993) and result in neuropsychological dysfunction. There is evidence for both behavioral and physiological consequences of experience (Lewis, 1993; Sussman, 1993). Pennington and Bennetto (1993) hypothesize that plasticity in frontal lobe functioning is greater for environmental versus genetic insults. Evidence that the effects of frontal lobe injury depend upon the developmental stage at which the damage occurred suggests that the degree of plasticity may be affected by the timing of exposure to toxic environments as well (Kolb, 1989). It is often suggested that biologic factors may also have an indirect effect on children's maladjustment by making problems in the parent-child relationship more likely.

Substantial attention has been devoted to studying the effects of the attachment relationship on the social adjustment of maltreated children. Research has consistently shown that a larger number of maltreated children than non-maltreated children demonstrate insecure attachment and their attachment classification is less stable (Farber & Egeland (1987). Greenberg and his colleagues (1993) hypothesized that one way that insecure attachment relationships may lead to the development of disruptive behavior problems is through affective-cognitive structures (e.g., working models of relationships) in which the child is represented as

unworthy and others are represented as hostile and unreliable. They suggest that this model fits well with Dodge's research on attributional biases in aggressive children (cf. Dodge et al., 1984). Maltreated children often acquire patterns of processing social cues that are biased and deviant. For example, they seem to selectively attend to hostile cues and rely upon violent strategies for solving interpersonal conflict (Dodge et al., 1990). Those who study social competence and peer relations among maltreated children have often hypothesized that early maltreatment disrupts the attachment relationship, leading indirectly to impairment in the child's social adjustment (Dodge et al., 1994; Meuller & Silverman, 1989; Vondra, Barnett, & Cicchetti, 1989).

It seems that there are many influences that may start maltreated children on developmental pathways which result in social maladjustment. The influence of both child biologic (in this case neuropsychological) and environmental factors must be considered together to understand why maltreated children often, but not always, have difficulties developing social competence. When specifically considering social information-processing deficits among maltreated children, the possibility of the involvement of neuropsychological deficits, particularly in the area of EF, is compelling given the increased likelihood of disruptions in normal brain development in combination with toxic environmental factors among this group of children.

Brief Description of the Current Study and Hypotheses

The proposed study will examine both EF and SPS skills in maltreated and non-maltreated preschoolers. Individual children will participate in tasks designed to assess each of these areas. Children in both groups will be enrolled in daycare/preschool settings and behavior ratings will be obtained from teachers to provide an assessment of each child's social competence and behavioral adjustment. This study has the following unique features. First, it is the first study to directly examine the relationship between EF and SPS. Second, EF will be examined in a preschool-aged sample which includes maltreated children; two group characteristics that have not frequently been studied in relation to EF. Third, the relationship between EF and behavioral adjustment, an area of much recent interest, will be examined. The following hypotheses will be tested:

1.) EF variables will be positively correlated and form at least two distinct factors, one related to attentional skills and inhibitory control and another related to planning ability.

2.) Maltreated children will perform more poorly than non-maltreated children to on EF tasks, particularly in the area of attention skills and inhibitory control.

3.) Maltreated children will perform more poorly than non-maltreated children at all steps of the social information-processing model (Crick & Dodge, 1994; Dodge, 1986).

4.) EF will be positively related to SPS skills for both maltreated and non-maltreated children. Specifically, attention skills and inhibitory control will be most strongly associated with encoding and representation. Planning ability will be most strongly associated with response generation/evaluation.

5.) Both EF and SPS will be associated with behavioral adjustment for both groups. Deficits in these areas, with respect to expected levels of performance for children at this age, will be related to higher levels of disruptive behavior problems (i.e., attention problems and aggression). Strong performance on EF and SPS tasks will be associated with lower levels of disruptive behavior problems and higher levels of competence for both groups.

Developmental Level[1]	(--Infancy ----------	Early Childhood ----------	Middle Childhood ----------	Adolescence/Adulthood ----------)
Luria's (1973) 3 Functional Units[2]	(--regulation of cortical tone ----------	sensation, information processing, and memory ----------	programming, regulating, & verifying mental activity ----------)	
Executive Function Skills[3]	(--basic emotion regulation ----------	self-regulation & the allocation of attentional resources ----------	planning & the ability to act on knowledge ----------	complex monitoring, metacognition, & self-analysis ----------)
Corresponding Social Problem-Solving Skills[4]	(--biological characteristics & early experience ----------	encoding & representation ----------	response generation ----------	response evaluation ----------)

Figure 1. Representation of a Hierarchical, Dynamic Continuum of the Development of Executive Functioning

[1] Developmental Level refers to the approximate age/stage at which certain skills become available and/or are emphasized.

[2] This presentation of Luria's 3 Functional Units is not meant to imply that each unit functions only at certain developmental levels. It is a matter of the functional unit emphasized by the skills that are salient at that time.

[3] Executive Function Skills refer to the area of functioning emphasized at each developmental level. This is influenced by successful processing at previous levels, and, as it is a dynamic structure, there are important feedback loops occurring between levels. In essence, early levels set the stage for later levels.

[4] Corresponding Social Problem-Solving Skills refer to the parts of Dodge's (1986) model which correspond with and are most salient in view of developmental level and particular executive function skills. Behavioral Enactment, which is does not appear, occurs at all points in the process no matter which steps have been completed or omitted.

This representation is based on work by: Becker, et al., 1987; Davidson, 1994; Dawson, 1994; Dennis, 1991; Dodge, 1986; Luria, 1973; Passler, et al., 1985; Stuss, 1992; Welsh, et al., 1991; and others.

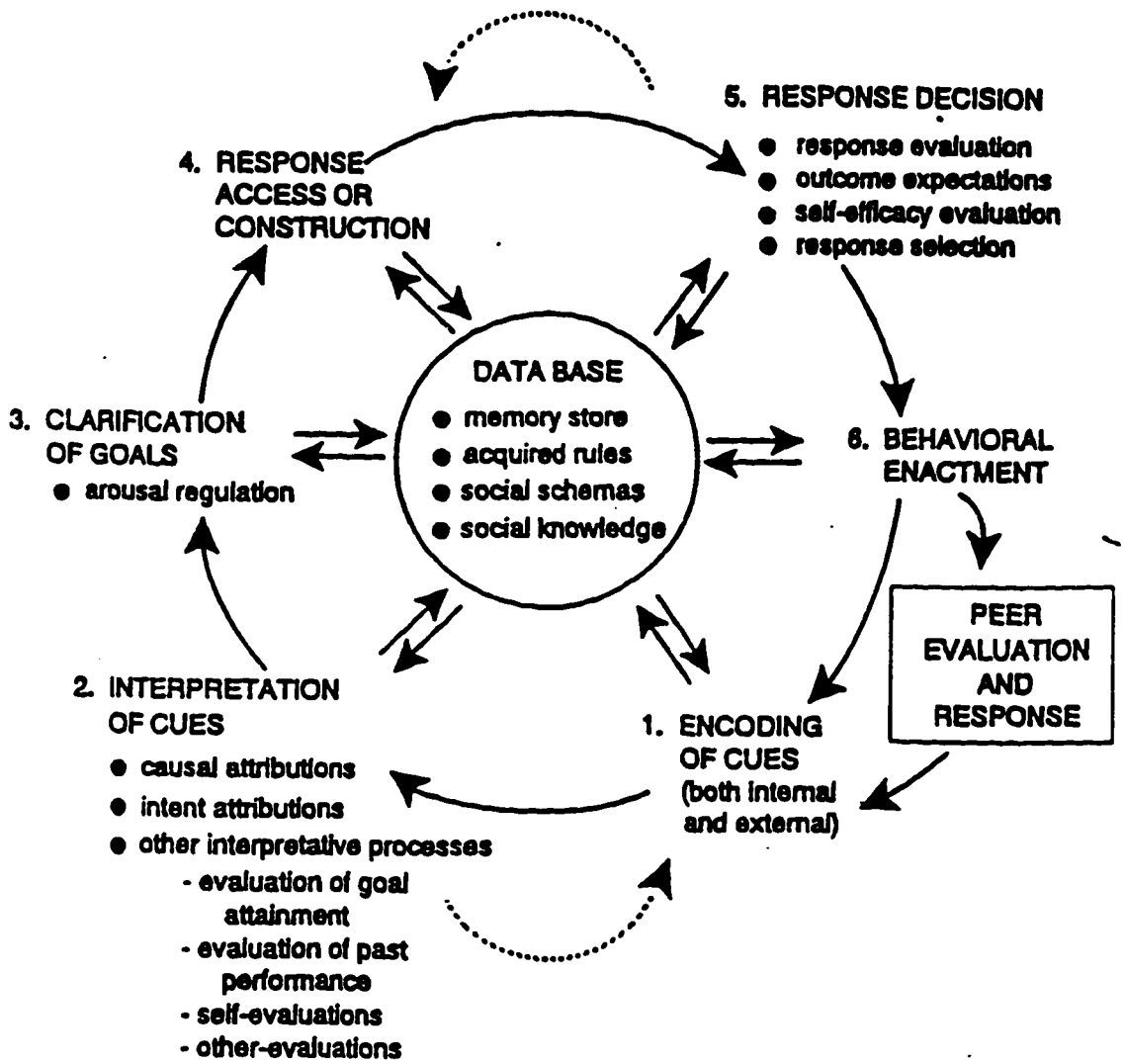

Figure 2. Reformulated Social Information-Processing Model of Social Competence (Crick & Dodge, 1994)

CHAPTER 2: METHODS

Subjects

Fifty-eight children (30 maltreated and 28 non-maltreated), 4-5 years old, participated in this study. The maltreated sample consisted of children enrolled at Childhaven, a therapeutic childcare facility for maltreated children. All children who attend Childhaven have suffered documented incidents of abuse and are referred by Child Protective Services (CPS).

The maltreated sample included children who had experienced different types and degrees of child abuse and/or neglect (i.e., neglect, physical abuse, sexual abuse). Children who attend Childhaven are a heterogeneous group in this regard, and sample size precluded the possibility of making a distinction between different groups of maltreated children. Several studies in this area have included such a general group of maltreated children (Alessandri, 1991; Coster, Beeghly, Gersten, & Cicchetti, 1989; During & McMahon, 1991; Lynch & Cicchetti, 1991). Only one child in the maltreated sample had experienced only sexual abuse.

The non-maltreated sample consisted of children who attended preschool or daycare programs located in the greater Seattle area. The majority of this group (17 children) attended a state-funded program that is the equivalent of Head Start. The remainder of this group was recruited from daycare/preschool programs that served children from a range of socioeconomic categories. To ensure that children in the control group were non-maltreated, parents were asked to endorse a statement giving permission for the principal investigator to verify, through a review of CPS records, that no substantiated reports of maltreatment were ever made. Six children who had parental consent to participate as part of the control group had to be dropped from analyses because this CPS review revealed at least one substantiated report of maltreatment. Although parents of children in the control group were asked specifically about the possible existence of reports of maltreatment, in these six cases, parents had denied any history of abuse while CPS records showed otherwise.

Attempts were made to balance the two groups on a number of background variables. Specifically, the groups were balanced on the following variables: age, gender, and ethnicity. The maltreated group was significantly lower than the non-maltreated group with regard to both maternal education level and socioeconomic status. These group comparisons are shown in Table 1. All of the maltreated children were documented recipients of public assistance because they had open CPS cases. Because this did not necessarily represent their socioeconomic

status and little other information was available, maternal education level was used as the covariate in analyses of group differences.

Measures

Both groups of children were administered tasks from three different categories: cognitive skills, EF, and SPS skills. In addition, teachers completed ratings of each child's behavior on the Behavior Assessment System for Children (BASC-Reynolds and Kamphaus, 1992). These measures are outlined in Figure 3.

Cognitive Skills

Vocabulary Subtest of the Wechsler Preschool and Primary Scale of Intelligence - Revised (WPPSI-R, Wechsler, 1989)

This measure provided a general assessment of children's verbal ability. Because the subtest is administered orally and children must reply verbally it gives an adequate indication of both expressive and receptive language ability. For this research, the initial three pictures children are asked to identify were not used and all children were given credit for these items. The vocabulary subtest shows a high correlation with Full Scale IQ (Sattler, 1990) and thus can be utilized as an estimate of general verbal intelligence. The standardized subtest score was used in analyses.

Continuous Recognition Memory (Brown & Scott, 1971)

This task was used as a discriminant measure in a study of EF conducted by Welsh et al., (1991). Findings showed that four year olds performed as well as adults and that performance was inversely related to performance on EF tasks, at least for the older children in their sample. This is a continuous picture-recognition task that includes 100 pictures mounted on 8x8 inch cards. For this study, the pictures were drawn from the following four categories: jungle animals, plants, insects, and food. An equal number of cards from each category were used. Forty-four pictures were duplicated and presented a second time in the deck, separated from the initial presentation by 0, 5, 10, 25, or 50 cards. The remaining 12 cards appeared only once and were considered filler items. Children responded "yes" or "no" as to whether a single picture had been presented earlier in the deck. Children were first administered a practice trial with a smaller deck of 10 cards (4 duplicates and 2 singles) to ensure understanding of the procedure. The dependent measure was the total number of items correct out of 100.

Executive functioning (EF)

Measures utilized to assess EF in young children have largely been adapted from those used for similar assessment purposes with adults. There are few measures that have been utilized successfully and/or standardized with children in the age group targeted in this study

(ages 4-5), but no standardized battery of EF measures currently exists for preschool-aged children. Such a battery was designed for use in this study after careful review of developmental studies examining EF in young children. The proposed battery consisted of the measures covering conceptual areas within the construct of EF related to attention, inhibitory control, and planning skills as described below.

The Continuous Performance Test (Loong, 1988)

The Continuous Performance Test (CPT) assessed sustained attention. In this task (Loong, 1988), children viewed a random series of letters as they appeared on a computer screen and were instructed to press the space bar each time the letter "A" appeared (Letter Cancellation Task). This task continued for five minutes. For this study, children were scored on the number of omission errors (i.e., the number of times an "A" appeared and no response was made), and on the relative percentage of correctly cancelled items. This score was computed by dividing the number of targets correctly cancelled by the total number of attempts.

Visual Search Task (Welsh et al., 1991)

Selective attention and organized search skills were measured through performance on this task which requires organized search of a visual stimulus display for a target item. This task has been found to be differentially sensitive to frontal lesions in adults (Teuber, Battersby, & Bender, 1955). Children were timed on one practice trial and each of eight test trials as they searched for target items interspersed among distractor items. Items consisted of black and white drawings of common objects such as food, animals, clothing, and shapes. Each trial was composed of eight occurrences of the target embedded in a display of 32 distractors displayed on an 8 1/2 x 11 inch sheet of white paper. The target item was displayed and circled at the top of the page. For each trial, the child was instructed to find all the items that "look the same" as the circled target at the top of the page as quickly as possible. When the child pointed to an item, it was crossed out by the interviewer. The child was timed from the presentation of the stimulus until s\he indicated that s\he was finished. The same pool of figures was used for targets and background stimuli across the eight trials, thus providing an opportunity to examine disrupted set maintenance across trials. Each child was given an inefficiency score which was computed by dividing response time by the number of correct responses minus the number of incorrect responses (false alarms). This score was calculated for each of the eight trials and then averaged across all trials for a total score. A perseveration index was also obtained by taking the total number of incorrect responses that had been a previous target item and dividing it by the total sum of incorrect responses (false alarms), previous target items and misses.

Again, this score was calculated for each of the eight trials and then averaged across all trials for a total score.

Day-Night Task (Gerstadt, Joo Hong, & Diamond, 1994)

This task is designed to serve as a preschool equivalent to the Stroop color-word task (Stroop, 1935) and measures response inhibition and basic working memory ability. Two types of cards were used in this task, white cards each with a yellow sun and black cards each with a moon and stars. There were two training cards and 16 testing cards. The experimenter showed the child a black card and gave the instruction, "when you see this card, I want you to say 'day'." The child was then asked to repeat the word "day." The experimenter then removed the card and presented a white card and gave the instruction, "when you see this card, I want you to say 'night'." The child was then asked to repeat the word "night." The experimenter then showed a white card, but gave no instruction. If the child responded correctly, the experimenter proceeded to the next trial. In the case of an incorrect response, on either this trial or the second trial, the instructions were given again and these trials were counted as practice. The total score in this task was the number correct out of 16.

Three Pegs Task (Belamore & Wozniak, 1984)

This task was developed for use with preschool-aged children to measure response inhibition and working memory. Children are presented with a cobbler bench toy that has three colored pegs aligned in the following order: red, yellow, green. Children were first asked to identify each color. After correct identification of colors (achieved by all children in this study), the interviewer gave the initial instructions: to tap the red peg first, then the green peg, then the yellow peg. The child was then given a wooden hammer and allowed to follow the instruction. If s/he was successful, the same instruction was given and the child was asked follow the instructions again to confirm the successful performance. If the child was unable to follow the initial instruction, the interviewer gave the initial instruction followed by a demonstration. If the child was successful on this trial, s/he was asked to confirm by tapping the red peg, then the green peg, then the yellow peg (with no demonstration). If the child was unsuccessful on either of these trials, the interviewer gave the instruction and demonstration again along with the additional request that the child say each of the colors as s/he taps the peg. If successful on this vocal trial, the child was asked to confirm as before. The child had to pass the initial trial and the confirmation trial to be given credit for that trial level. The highest performance level was to tap the pegs in the proper order with only the oral instructions and no type of demonstration or vocalization. The child's score on this measure reflected the level at which s/he was successful in tapping the pegs in the correct order (i.e., Instruction Only, Demonstration, Vocal) as

described above. There was also a scoring category for those children who were unsuccessful with this task. In this task, higher scores reflected poorer performance.

Tapping Test (Diamond & Taylor, 1996)

This task, which is thought to be a measure of behavioral inhibition, was originally developed by Luria (1966; 1973), who found that adult performance reflected frontal lobe functioning (Becker et al., 1987; Passler et al., 1985). The task requires children to respond to a particular stimuli with an opposite response. In this study, a thick wooden pencil was used to tap on a table or desk. It was clearly demonstrated to the child that if the interviewer taps one time, the child is to tap two times, and if the interviewer taps two times, the child is to tap one time. The child was allowed as many as two practice trials where s/he was corrected if a mistake was made. After two possible practice trials, 16 test trials occurred and the number correct out of 16 served as the total score.

Children's Version of the Tower of Hanoi (Welsh, Pennington, Ozonoff, Rouse, & McCabe, 1990)

This disk-transfer task has been used to study the planning capacities of both children and adults (Klahr & Robinson, 1981; Simon, 1975). The Tower of Hanoi assesses the ability to plan and carry out a sequence of moves that transform an initial disk arrangement into a goal state that matches the experimenter's disks. Welsh et al. (1991) showed that this task falls on a "planning" factor when used with children and is not significantly correlated with IQ. A deficit in this type of planning has been demonstrated in adults with frontal lobe damage (Shallice, 1982). In the version adapted for children, the child and the experimenter each have in front of them a row of three pegs. This task can be constucted using Fisher-Price Brand "Rock-a-Stack" toys which consist of large tapered pegs and brightly colored rings, referred to as disks (M. Welsh, personal communication, 10/94). The problem is presented in the context of a story in which the disks are monkeys (large Daddy, medium Mommy, and small Baby), who jump from tree to tree (peg to peg). The rings are classified for the child and the experimenter explains that the child has copycat monkeys that want to look just like the experimenter's monkeys. The following three rules are in operation: 1.) only one disk can be moved at a time; 2.) at no point can a larger disk be placed above a smaller disk on any peg; and 3.) disks must be on a peg or in the child's hand at all times. In addition to the initial configuration, the goal configuration is always physically present. The experimenter's disks are set up in the goal configuration as a model, and the child's disks are in the initial configuration. The child is asked to move his or her disks so that they will look just like the experimenter's disks. The procedure begins with a familiarization phase where children are allowed to handle the disks and show what "good" moves and "bad"

moves look like (e.g., a "bad" move would have a larger disk placed on a smaller disk). In the familiarization phase the problems presented involve only one move and a child must successfully solve two problems before continuing to the test problems.

There are two types of problems which can be presented, each with a different goal state. One is a flat-ending problem, where the goal state involves having each peg occuppied by a disk. The other is a tower-ending problem, where the goal state involves having all the disks stacked on one peg in a tower formation. Klahr and Robinson (1981) demonstrated that children under age six have great difficulty with flat-ending problems, therefore, only tower-ending problems were used in this study. In the 3-disk version of this task, six problems which vary in their initial disk configuration and level difficulty are presented. The least difficult problem involves two moves and the most difficult problem involves seven moves and results in shifting the entire stack of disks from the first peg to the third peg. In this study, all children began with the two move problem. The problems must be completed in the fewest number of moves possible, with no rule violations, twice in succession; and children were given six trials to achieve this criterion for each problem. A trial was limited to 20 moves. Testing continued until the child was unable to complete a problem twice in succession within the six trials allowed. The entire series of problems required from 10-30 minutes depending on the ability of the child.

Scoring was based on the number of trials it took for the child to successfully solve each problem (i.e., a variable number of points are awarded based upon which pair of trials the child is able to solve the problem). Scores were also given for the raw number of trials and the ratio of rule violations to trials. Specific analysis of rule violations has not yielded useful information beyond the scores mentioned above (Welsh, personal communication, 10/96), and thus were not analyzed for this study.

Social Problem-Solving (SPS)

These measures were developed by Dodge and his colleagues and have been used extensively in research with school-aged children of varying ages (see Dodge, 1986 and Dodge, et al., 1986).

Videotape stimuli and procedures adapted from Dodge et al., (1986)

In order to thoroughly assess social information processing at the first four steps of the model, the procedures described below have been selected from Dodge et al. (1986).

The original video stimuli consist of 24 vignettes which are presented on a portable television monitor. Each vignette, which lasts approximately 30 seconds, involves child actors portraying a negative event. For 12 of the vignettes, the protagonist is rebuffed in a peer-entry attempt and in the other 12 vignettes, the protagonist is provoked by a peer (e.g., having one's

block tower knocked over by another child). The intention of the peer is systematically varied across vignettes to appear either hostile, non-hostile, or ambiguous. Because the children who participated in this study were younger than those previously assessed using this measure, only eight vignettes were shown (4 in the first session and 4 in the second session). Only those vignettes depicting non-hostile and ambiguous peer intentions with regard to the negative event were used, as research has shown that aggressive children tend to differ most in their responses to ambiguous intentions (Dodge et al., 1984; Dodge, personal communication, 1994).

Each child was asked to imagine that s/he was the protagonist (the child wearing the numbered shirt) in the vignette before watching it, and then asked several questions after viewing the segment. Next, the child was asked to watch portrayals of different types of responses to the negative event (i.e., aggressive, inept, competent) and answer some additional questions regarding the quality of those responses.

There are different sets of video stimuli portraying boys and girls. While girls and boys viewed different stories, the type of story (peer entry & provocation) and the intent (non-hostile & ambiguous) were kept equivalent. Different actors were utilized to avoid confounds between actor and type of intent portrayed.

After viewing videotaped scenerios, children were asked questions designed to tap each of the five social information-processing steps in Dodge's (1986) model.

Encoding. Immediately after viewing the vignette, the child was asked to describe what happened in the story. Responses were scored using a coding system which reflected how much correct versus incorrect information the child presented, along with consideration of whether or not the child recognized that the target child suffered some sort of provocation by his/her peers. Responses with incomplete/incorrect information received no points, one point was awarded for a response that reflected understanding of the provocation involved, and two points were awarded for a completely correct response. These scores were then summed across similar types of stories to yield two summary scores, one for ambiguous stories and one for nonhostile stories. This scoring method is similar to that used by Dodge and his colleagues (Dodge & Price, 1994). Also used in some analyses was the number of incomplete/incorrect responses and the number of responses that reflected understanding of the provocation for both ambiguous and non-hostile stories.

Representation. To determine the child's assessment of the intent of the peer involved in the provocation or rebuff in the vignette, s/he was next asked if the peer was "being mean" or "not being mean." The order of presentation of these two options was varied. An attempt was made to combine the responses to the ambiguous video stories with the responses to the Home

Interview with the Child (HIWC - Dodge, 1988) vignettes, as this type of story has most successfully distinguished between children with and without disruptive behavior problems (Dodge, 1980; Dodge et al., 1984; Steinberg & Dodge, 1983). However, because the correlation between the separate representation scores from the video stories and the HIWC was so low, this was not possible. There were additional concerns about the age-appropriateness of some of the demands of the video stimuli. As a result, responses to the representation question from the video stories were not used in data analysis, which relied completely on responses to the representation question in the HIWC.

Response generation. The child was next asked what s/he would do in the situation depicted (initial response), and what s/he would do if the first response did not work (second response). These two responses were coded for effectiveness using the following coding categories: "aggressive" (includes verbal and non-verbal aggression, as well as physically assertive responses), "passive/inept" (includes "I don't know" responses, as well as any response that does not directly address the identified problem), "adult help-seeking", and "prosocial " (includes any use of an appropriate self-reliant way for the child to meet his/her needs in the conflict situation). Only aggressive and prosocial responses were used in data analysis as these were the most relevant to current hypotheses and most salient for this age group. Initial responses yielded one score for aggressive responses in ambiguous stories and one score for aggressive responses in non-hostile stories. Two scores for prosocial responses were computed in the same way. The scores for ambiguous stories reflected a sum of responses in the particular coding category from both this video measure and the corresponding response generation question from the HIWC. Second responses also yielded scores for aggressive and prosocial responses for both ambiguous and non-hostile stories.

Response evaluation. After viewing each of the three response portrayals (i.e., aggressive, inept, or competent) shown following each vignette, the child was asked if "that's a good thing or a bad thing to say or do". The order of presentation of "good thing" and "bad thing" was varied. Children was then asked if it was "a little good/bad" or "very good/bad." The order of these alternatives was also varied. The score used, based on methodology used by Dodge and his colleagues (Dodge & Price, 1994), was the level of endorsement of aggressive responses summed across similar types of stories. Two scores resulted, one for ambiguous stories and one for nonhostile stories.

Home Interview with the Child (HIWC - Dodge, 1988)

To further assess children's processing at various social information-processing steps, hypothetical vignettes accompanied by matching cartoon pictures were presented to each child.

There were 8 stories, focusing on either peer group entry or peer provocation situations. The intent was ambiguous in all stories. The cartoon picture were shown to the child while the interviewer read the accompanying vignette. Each child was then asked to pretend to be the child receiving the negative outcome (e.g., gets rejected, gets hit with the ball), and respond to questions assessing two areas of social information-processing skills. Representation skills were assessed by asking whether the protagonist was "being mean" or "not being mean." The order of presentation of these two options was varied. These responses were averaged across stories and served as the representation variable in all data analyses. Response generation was assessed by asking the child to describe what s/he would do in the same situation. These responses were coded and combined with the scores from ambiguous video stories as described above.

Behavioral Adjustment

Teacher Ratings of Behavior - (BASC - Behavioral Assessment System for Children (Reynolds & Kamphaus, 1992)

Behavior ratings were completed by preschool/daycare teachers for all children. Conceptually, it was important to include ratings of positive social competence along with ratings of both externalizing and internalizing behaviors. The BASC includes a large number of subscales, all of which could not be included in data analysis. Those scales that have been included were chosen for their conceptual importance. Attention Problems and Aggression were chosen to represent externalizing behavior problems, even though Attention Problems are not included in the Externalizing Composite score on the BASC. The Attention Problems scale includes items addressing cognitive and motivational difficulties such as short attention span, trouble concentrating, distractibility, forgetfulness, listening ability, and difficulty following directions, while the aggression scale addresses confrontational behaviors used in social interaction (e.g., bullying, arguing, teasing, blaming, hitting, etc.). Anxiety was chosen to represent internalizing problems. Social Skills was chosen to represent positive social competence. The BASC consists of 148 items. Responses are made on a 4-point scale ("never", "sometimes", "often", "always"). Percentile scores for each of the subscales mentioned above were used in data analysis. The Teacher-Report Scale of the BASC is reported to have high internal consistency and test-retest reliability, as well as validity, as reported in the manual.

Procedure

Parental consent and child assent was obtained for all subjects. Background information was taken from Childhaven documents for children in the maltreated group. A brief parent telephone screening interview was conducted for children in the non-maltreated group in order to

gather background information. As described above, children in the non-maltreated group were also screened for records of substantiated reports of abuse made to Child Protective Services.

Children were interviewed individually during at least two sessions conducted on different days. The average length of sessions was one hour. Order of testing was standard, although deviations were unavoidable for children who showed significant behavioral difficulties during the interviews. Session one began with half of the video stories, followed by Visual Search, the CPT, the HIWC, Recognition Memory, and the Tapping Test. Session two began with the remaining video stories, followed by the Day-Night Task, the Tower of Hanoi, Vocabulary, and the Three Pegs Task. Interviews took place at the facilities of the preschool/daycare program and were conducted by the principal investigator or trained undergraduate assistants.

Cognitive Skills	Vocabulary Subtest (WPPSI-R, Wechsler, 1989) Recognition Memory (Brown & Scott, 1971)
Executive Functioning (EF)	
Sustained Attention	Continuous Performance Test (Loong, 1988)
Selective Attention/Organized Search	Visual Search (Welsh, Pennington, Ozonoff, Rouse, & McCabe, 1990)
Inhibitory Control	Day-Night Task (Gerstadt, Joo Hong, & Diamond, 1994) 3 Pegs Task (Belamore & Wozniak, 1984) Tapping Test (Diamond & Taylor, 1996)
Planning	Tower of Hanoi-Children's Version (Klahr & Robinson, 1981)
Social Problem-Solving	Video Stimuli (Dodge et al. 1986) Home Interview with the Child (HIWC-Dodge, 1988)
Behavioral Adjustment	BASC - Teacher Report Scale (Reynolds & Kamphaus, 1992)

Figure 3. Measures

Table 1. Demographic information

Variable	Maltreated	Non-maltreated	Chi Square	df	p-value
Maternal Education Level (n=49)			12.55	2	.002
<high school grad	63.6%	18.5%			
<4yr college	36.4	59.3			
>4yr college	0	22.2			
Ethnicity (n=57)					ns
Caucasian	44.8	50.0			
AA/Biracial	37.9	35.7			
Other	17.2	14.3			
Gender (n=58)					ns
Female	53.3	57.1			
Male	46.7	42.9			
Family Income Level (n=58)			25.77	6	.001
Public Assistance	100.0	39.3			
<10,000	0.0	14.3			
10,001-20,000	0.0	10.7			
20,001-30,000	0.0	14.3			
30,001-40,000	0.0	7.1			
40,001-50,000	0.0	3.6			
>50,000	0.0	10.7			
Test Age (months) (n=57)	61.3[a] (5.8)[b]	61.4a (5.0)[b]			ns[c]

[a] mean score
[b] standard deviation
[c] one-way ANOVA result

CHAPTER 3: RESULTS

Data analysis proceeded through several steps. The initial stage of data analysis focused on data reduction, and factor analysis was conducted to determine the appropriate factor structure for variables related to executive functioning (EF). A confirmatory factor analysis was then conducted to determine the goodness-of-fit for this factor structure. Once the factor structure was determined, correlations between each of the factors and social problem-solving (SPS) as well as behavioral outcomes (BASC teacher ratings) were calculated. Data reduction among SPS variables and teacher ratings was achieved through conceptual considerations as well as through examination of correlations among all three groups of variables. This process is described below. Next, group differences were examined using a series of one-way ANCOVAs and Chi Square analyses. To examine the ability of both EF and SPS variables to predict behavioral outcome, a series of multiple regressions was conducted. Finally, path analyses in regression were utilized to assess direct and indirect prediction of teacher ratings of both social skills and attention problems by components of EF and particular SPS skills based on a priori hypotheses.

Treatment of Missing Data

As the consideration of missing data is important in all data analysis, different methods were used at the factor analytic stage to determine whether missing data (relevant to some of the variables associated with EF) substantially influenced the outcome of analyses. Three different methods for treating missing data were attempted. Pairwise and listwise deletion of missing data, as well as substituting the mean for missing data, were conducted with little difference noted in the results of analyses. Listwise deletion of missing data was the method chosen for all further analyses as it is the most conservative.

Data Reduction

Because of the large number of variables derived from the measures used during data collection, it was necessary to carefully examine the associations among these variables in relation to the hypotheses upon which this study was based in order to reduce the data set to a manageable size.

Development of Factors Assessing EF

Performance on individual EF tasks was examined initially. Means and standard deviations, as well as the results of group comparisons conducted with maternal education as the

covariate, are illustrated in Table 2. There were no significant differences between groups on EF tasks, except for on the CPT, where non-maltreated children performed better than maltreated children on both omission errors and relative percentage correct.

The correlations between all EF variables were examined next. As illustrated in Table 3, there were many significant correlations among the EF variables. Recognition Memory was included as a discriminant task and was not expected to be significantly associated with any EF variables. However, findings were not consistent with this expectation. Correlations between Recognition Memory and EF variables ranged from -0.46 to 0.47. The majority of these correlations were significant, and indicated that good performance on Recognition Memory was associated with good performance on EF tasks. From these higher than expected correlations, it appears that, at least for this age group, Recognition Memory cannot be considered a discriminant task. However, because Recognition Memory was not conceptualized as a component of EF, it was not included in factor analysis. The Vocabulary subtest score from the WPPSI-R was also significantly correlated with many of the EF variables. However, as verbal intelligence was intended to help balance the groups on verbal intelligence and was not conceptually related to the factor structure as described below, it also was not included in factor analysis.

Initial principal components factor analysis was conducted including all of the variables seen in Table 3, with the exception of Recognition Memory and Vocabulary. Different conceptual groupings of the variables based on previous research were considered and analyses extracting three, four, and five factors were conducted. Results suggested that a four factor solution offered the best explanation of the data based on theory and previous research on EF. The four factor solution included the following composite scales: (1) Sustained Attention was based upon scores derived from the Continuous Performance Test (i.e., relative percentage correct and number of misses); (2) Selective Attention/Organized Search was based on scores derived from the Visual Search Task (i.e., inefficiency score and perseveration score); (3) Inhibitory Control was based upon total scores from the Tapping Test, Day-Night Test, and the Three Pegs Test; and (4) Planning was based upon scores derived from the Tower of Hanoi (i.e., the total planning efficiency score, number of trials, and number of rule violations). Together, these four factors accounted for 74 percent of the variance among all EF variables. The four factor scores were created through use of standardized scores which were unit weighted and then averaged. Higher scores on Sustained Attention and Selective Attention/Organized Search indicated poor performance, while the reverse was true for Inhibitory Control and Planning. After the original principal components analysis, the data was submitted for

confirmatory factor analysis (using EQS) to determine the goodness-of-fit for this particular conceptualization of EF factors. The analysis determined that this particular four factor structure was a good fit to the data (see Figure 4), with X^2 (x,29)=22.40, p<.80. Note that in this method, a nonsignificant p-value indicates that the model fits the data. The Bentler-Bonett Normed Fit Index = .89, and the Comparative Fit Index = 1.00, supporting the conclusion of an acceptable fit. Intercorrelations of these factors ranged from -.38 to .74, suggesting that these factors were not redundant, yet were sufficiently related that they could be considered together or differentiated in regression models based on conceptual and theoretical reasoning to identify unique contributions to child outcomes. Based on previous research, there was reason to believe that each of the factors identified would provide distinct information about EF despite often high correlations with other factors.

Relationships Between EF, SPS, and Behavioral Adjustment

Correlations among the EF factors, SPS variables, and teacher ratings of behavior on the BASC are shown in Tables 4-6. As can be seen in Table 4, all EF factors were significantly correlated with teacher-rated Attention Problems on the BASC, suggesting that children with higher levels of Attention Problems have more difficulty with all measured areas of EF. All EF factors, with the exception of Selective Attention/Organized Search, were significantly related to teacher-rated Social Skills. Aggression was not correlated with any of the EF factors, suggesting that EF may not be related to aggressive behavior as measured by the BASC. Anxiety was significantly correlated only with Selective Attention/Organized Search, suggesting that children who are more anxious are also more inefficient on the Visual Search Task.

With regard to SPS variables, correlations shown in Table 5 suggest that Social Skills are negatively related to incomplete/incorrect encoding in non-hostile peer conflict situations, positively related to generation of prosocial responses in both ambiguous and non-hostile peer conflict situations and negatively related to generation of aggressive responses in non-hostile peer conflict situations. Children with higher teacher-rated Attention Problems were more likely to make incomplete or incorrect descriptions of non-hostile peer conflict situations and less likely to offer prosocial responses in peer conflict situations (both ambiguous and non-hostile). Surprisingly, Aggression was not significantly correlated with any of the SPS variables, nor was teacher-rated Anxiety.

Significant associations were found between several of the EF factors and SPS variables, as seen in Table 6. Poor Sustained Attention was related to a greater likelihood of making an incomplete/incorrect response in both ambiguous and non-hostile situations, more prosocial responding (both initial and second responses), and less aggressive responding for

ambiguous situations (second response only). Selective Attention/Organized Search was associated poorer encoding in non-hostile stories, with offering hostile attributions in the HIWC, and with less aggressive responding in ambiguous situations (second response only). Inhibitory Control was positively related to strong encoding skills in ambiguous situations. There was also a positive relationship between Inhibitory Control and the use of prosocial responses in non-hostile situations (both initial and second responses). Finally, better performance on Inhibitory Control was associated with a lower likelihood of endorsing aggressive responses given in both ambiguous and non-hostile situations. Planning was significantly associated with variables at all social information-processing steps except for representation. Children with higher scores in Planning also had better encoding skills in ambiguous situations, were more likely to offer prosocial responses and less likely to offer aggressive responses in all situations, and were less likely to endorse aggressive solutions in both ambiguous and non-hostile situations.

Effects of Maltreatment

Executive Function (EF)

Group differences between maltreated and non-maltreated children were examined through the use of one-way ANOVA with maternal education level as the covariate. Results of these analyses may be seen in Table 7. See Appendix A for a detailed presentation of group differences among individual EF measures that comprise the four factors. Significant group differences were found only the Sustained Attention factor ($F(1,50)=9.00$, $p<.004$). A two-way ANCOVA with gender and group as the factors was significant for Sustained Attention ($F(1,52)=10.23$, $p<.002$). For this analysis, mean scores indicated that maltreated girls did especially poorly on Sustained Attention, while non-maltreated girls did well (maltreated - $x=.54$; non-maltreated - $x=-.78$). Scores for the two groups of boys were similar (maltreated - $x=.12$; non-maltreated - $x=.06$), and much less extreme than the girls' scores.

Social Problem-Solving (SPS)

Group differences between maltreated and non-maltreated children were examined through the use of one-way ANOVA with maternal education level as the covariate. The only group differences found among the SPS variables, as seen in Table 8, were in responses to the encoding questions. Maltreated children were more likely to give incomplete/incorrect responses in both ambiguous and non-hostile situations ($F(1,55)=4.02$, $p<.05$ & $F(1,55)=4.32$, $p<.04$, respectively). There was a trend toward non-maltreated children more frequently recognizing that some type of provocation had occurred. In general, differences in group scores suggest that non-maltreated children tend to be better encoders and are less likely to endorse aggressive responses. It should be noted that when the ANOVAs were conducted without the maternal

education covariate, several group differences emerged. Maltreated children were significantly more likely to give incomplete or incorrect descriptions of both ambiguous and non-hostile peer conflict situations. In addition, non-maltreated children were significantly more likely to give prosocial responses when faced with an ambiguous peer conflict situation.

Teacher Ratings of Behavioral Adjustment (BASC)

Percentile scores were compared for each of the four subscales of the BASC, again with maternal education level as the covariate, as seen in Table 9. Results showed the maltreated group with significantly higher scores on the Attention Problems subscale than non-maltreated children. There were no significant differences between groups on the other BASC subscales used in analyses (i.e., Aggression, Social Skills, Anxiety), although mean differences favored the non-maltreated group. In fact, mean differences between the two groups were approximately two-thirds of a standard deviation, and when group differences were measured without the maternal education covariate, significant group differences were also found for the Aggression and Anxiety subscales.

Predicting Behavioral Adjustment

To examine the separate contributions of EF and SPS skills toward predicting behavioral outcome, hierarchical multiple regressions were conducted separately for the criterion variables of teacher-reported Aggression, Attention Problems, Social Skills, and Anxiety. In the hierarchical model, variables were entered in the following order: maternal education level in the first step, followed by group status in the second step. The third and fourth steps utilized a forward entry method with the criterion of the F statistic being significant at $p<.10$. All EF factors were entered at step three in the regression equations. As there are multiple steps in the social information-processing model, each needed to be considered separately. Given the sample size, it was desirable to choose carefully the models tested to reduce the number of analyses conducted. If a SPS variable was significantly correlated with behavioral adjustment, the complete set of SPS variables at that particular step of the social information-processing model was entered at the fourth and final step. Separate regressions were conducted for SPS variables at the different steps of the social information-processing model, if indicated by significant correlations between SPS and behavioral adjustment. The final variables chosen to represent EF and SPS in the regression equations were based on the results of the forward entry regression method. Results of these regression models may be seen in Table 10-12.

Externalizing Problems

Although the Attention Problems subscale is not included in the Externalizing Composite on the BASC, Aggression and Attention Problems were chosen to represent

externalizing problems and were examined in separate regression models (see Table 10). Aggression was predicted only by maternal education level. Attention Problems, however, were predicted by Selective Attention/Response Organization. None of the SPS variables explained unique variance in either Aggression or Attention Problems using the forward entry method.

Positive Social Competence: Social Skills

Inhibitory Control made a significant contribution toward predicting teacher-rated Social Skills. With regard to SPS variables, even when entered after the EF factor, the percentage of initial prosocial responses in ambiguous situations added significantly to the prediction of Social Skills. In a separate regression equation, the percentage of second responses that were prosocial (in non-hostile situations) made a significant contribution to predicting Social Skills beyond the contribution made by the Inhibitory Control factor. These results may be seen in Table 11.

Internalizing Problems: Anxiety

The Anxiety subscale of the BASC was chosen to represent internalizing behavior problems. Anxiety was significantly predicted by level of maternal education but not by group status. At step three, Selective Attention/Organized Search was the only EF factor found to significantly predict Anxiety. SPS skills did not make a significant prediction beyond that accounted for by previously mentioned variables. These results may be seen in Table 12.

Path Analyses

To assess specific relationships that were hypothesized among EF, SPS, and behavioral adjustment variables, several path analyses in regression were conducted in order to examine models involving predictors of both teacher-rated Attention Problems and teacher-rated Social Skills. For both of these areas of behavioral adjustment, the main question investigated whether EF skills are direct or indirect predictors of behavioral outcome. In the case of indirect predictions, the question was whether component EF skills influence particular SPS skills in predicting behavioral adjustment. Effects of maternal education was omitted from path analyses because it had minimal effect in earlier regression models. The total number of subjects varied for different models and ranged from 52 to 57. Variables were entered into equations based on a priori hypotheses discussed previously. Paths are represented by the standardized regression coefficients in each model.

Attention Problems

Two models involving prediction of teacher-rated Attention Problems were tested (see Figures 5 and 6). The first model examined the influence of Sustained Attention, encoding, and representation on teacher-rated Attention Problems. The second model was identical to the first

except that Inhibitory Control replaced Sustained Attention as the component of EF used to predict Attention Problems. Encoding was represented by the composite summary score for only ambiguous video vignettes and stories. The representation variable was based upon the number of attributions of hostile intent made in the HIWC only. Both direct and indirect effects were of interest in each model.

In the first model, the path coefficients indicated that Sustained Attention had a direct influence on Attention Problems ($t(48)=2.92$, $p<.005$) and on encoding ($t(51)=-2.03$, $p<.05$). Sustained Attention did not have a direct influence on representation. Encoding had a direct influence on representation ($t(50)=2.15$, $p<.04$), but not on Attention Problems. Representation had no direct effect on Attention Problems. With regard to indirect effects, Sustained Attention was found to have an indirect influence on Attention Problems through encoding and representation ($t(47)=151.05$, $p<.001$). Encoding had an indirect influence on Attention Problems through representation ($t(48)=249.58$, $p<.001$).

The model involving the influence of Inhibitory Control indicated that this component of EF has a direct influence on Attention Problems ($t(52)=-2.77$, $p<.008$), as well as on encoding skills ($t(54)=4.34$, $p<.001$). No other direct paths between variables were significant. With regard to indirect effects, Inhibitory Control influenced Attention Problems through the SPS variables of encoding and representation ($t(51)=13.99$, $p<.001$). Encoding had an indirect influence on Attention Problems through its effect on representation ($t(52)=13.17$, $p<.001$).

Social Skills

As seen in Figure 7, the model involving prediction of teacher-rated Social Skills examined whether Planning has a direct influence on Social Skills, or an indirect effect through skills in response generation. In this model, response generation was denoted by prosocial responding in ambiguous social conflict situations. The standardized regression coefficients indicated that Planning has neither a direct nor an indirect effect on teacher-rated Social Skills, although it did have direct influence on prosocial response generation ($t(52)=3.19$, $p<.002$). Prosocial response generation directly influenced Social Skills ($t(52)=2.97$, $p<.005$).

When response generation was denoted by aggressive responding in ambiguous social conflict situations, the path coefficients changed somewhat (see Figure 8). Planning had a direct influence on Social Skills ($t(51)=2.34$, $p<.02$), and on generation of aggressive responses ($t(52)=-2.46$, $p<.02$). Planning also had an indirect influence on Social Skills through generation of aggressive responses ($t(52)=-172.22$, $p<.001$). Generation of aggressive responses had no direct influence on Social Skills.

Summary

Path analysis through regression allowed for testing direct and indirect influences of EF components and particular SPS skills on Attention Problems and Social Skills. Both Sustained Attention and Inhibitory Control were found to have a direct influence on Attention Problems, and Planning had direct influence on Social Skills only in a model where aggressive responding represented response generation. Indirect influences on Attention Problems and on Social Skills were found as well.

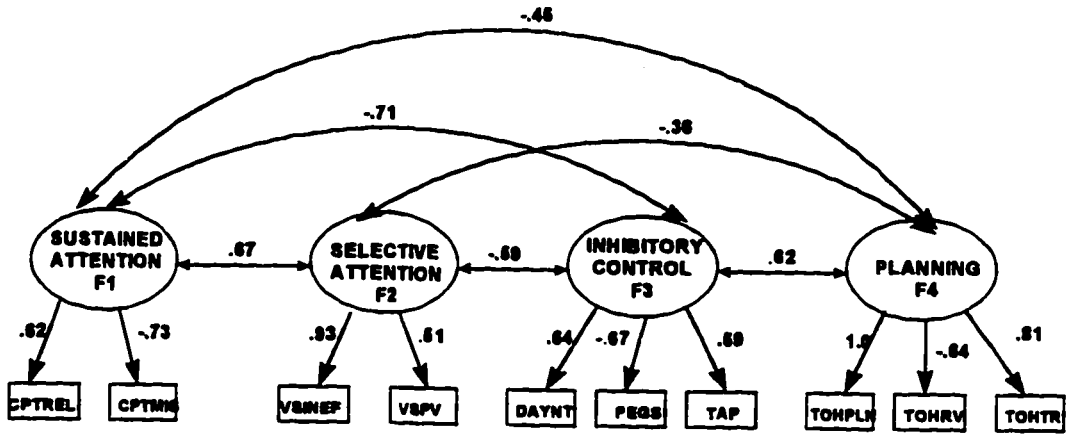

Figure 4. Confirmatory Factor Analysis for Executive Functioning Variables

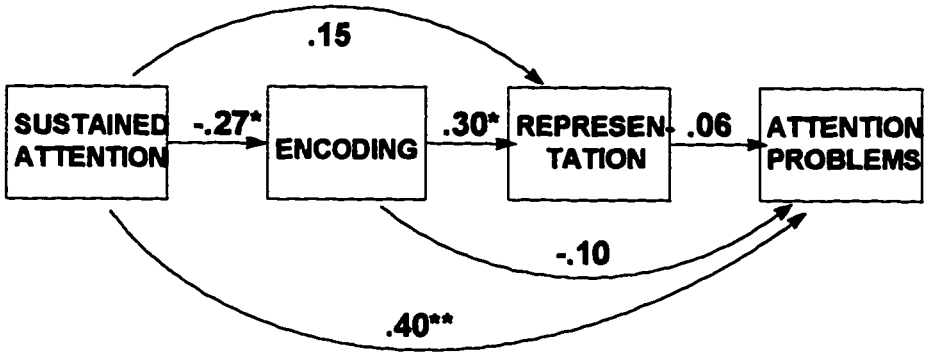

Figure 5. Path Analysis of Teacher-Rated Attention Problems Predicted by Sustained Attention, Encoding & Representation (Ambiguous Stories Only)

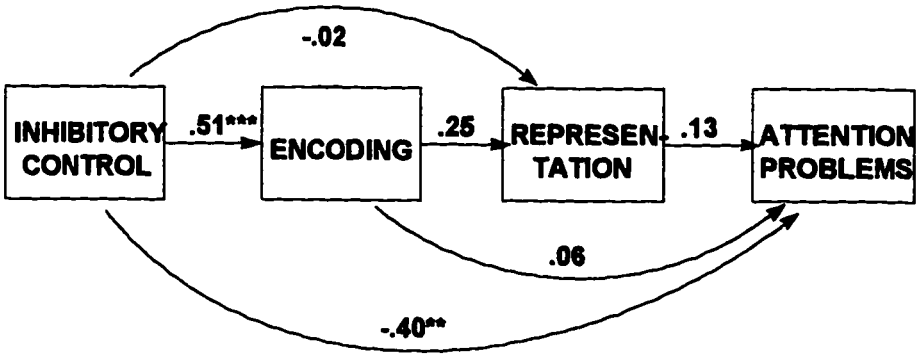

Figure 6. Path Analysis of Teacher-Rated Attention Problems Predicted by Inhibitory Control, Encoding, & Representation (Ambiguous Stories Only)

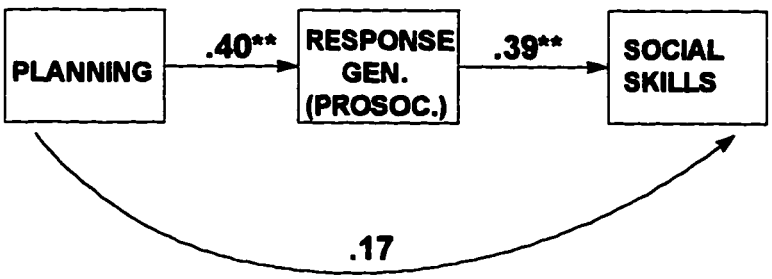

Figure 7. Path Analysis of Teacher-Rated Social Skills Predicted by Planning and Prosocial Response Generation (Ambiguous Stories Only)

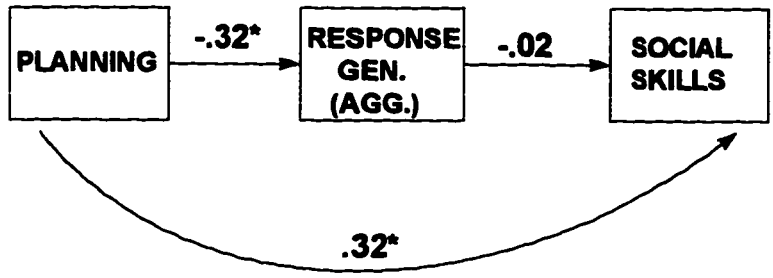

Figure 8. Path Analysis of Teacher-Rated Social Skills Predicted by Planning and Aggressive Response Generation (Ambiguous Stories Only)

Table 2. Differences Between Maltreated and Nonmaltreated Children on Individual Executive Functioning Tasks with Maternal Education Level Covaried

	Maltreated			Nonmaltreated			Main Effect (Group)	
	Mean	Std Dev	N	Mean	Std Dev	N	F	p-value
Executive Functioning Vars.								
CPT Relative % Correct	39.00	15.08	29	55.69	25.10	24	7.05(1,50)	.01
CPT Omission Errors	56.58	24.27	29	34.17	28.70	24	5.21(1,50)	.03
Day-Night	11.97	4.08	29	12.11	4.25	28	0.49(1,56)	ns
Tapping Test	8.77	4.44	30	9.68	5.93	28	0.00(1,57)	ns
3 Pegs Task	2.38	1.32	29	1.96	1.22	27	2.30(1,55)	ns
TOH Planning Efficiency	8.79	7.81	29	12.39	10.00	28	0.06(1,56)	ns
TOH Rule Violations	0.53	0.21	27	0.47	0.22	28	0.21(1,54)	ns
TOH Number of Trials	10.06	6.51	29	11.64	5.17	28	0.66(1,56)	ns
Visual Search Efficiency	5.42	2.83	28	5.41	4.28	28	0.46(1,55)	ns
Visual Search Perseverations	5.15	3.88	28	3.51	4.32	28	0.44(1,55)	ns

Table 3. Bivariate Correlations Between all Executive Function Variables

	CPTMIS	CPTR%	VISINEF	VISPV	DAYNT	PEGS	TAP	TOHPLAN	TOHRV	TOHTRL	RECMEM	VOCAB
EF Factors:												
Sustained Attn												
CPTMIS	1.00											
CPTR%	-.45***	1.00										
Selective Attn												
VISINEF	.36**	-.44***	1.00									
VISPV	.23	-.28*	.48***	1.00								
Inhibition/ Working Memory												
DAYNT	-.29*	.29*	-.40**	-.28*	1.00							
PEGS	.16	-.36**	.37**	.14	-.41***	1.00						
TAP	-.41**	.33*	-.29*	-.03	.31*	-.48***	1.00					
Planning												
TOHPLAN	-.34**	.31*	-.34**	-.17	.45***	-.39**	.32*	1.00				
TOHRV	.30*	-.32*	.26	.06	-.14	.26*	-.22	-.65***	1.00			
TOHTRIAL	-.22	.17	-.25	-.07	.38**	-.35**	.20	.81***	.43***	1.00		
Other Variables:												
RECMEM	-.22	.41**	-.41**	-.23	.31*	-.23	.31*	.47***	-.46***	.33*	1.00	
VOCAB	-.51***	.34**	-.41**	-.17	.45***	-.36**	.37**	.38**	-.33*	.31*	.18	1.00

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

Table 4. Bivariate Correlations Between Teacher-Rated Behavior & Executive Function Factors

	Teacher Ratings of Behavior			
	Competence	Externalizing		Internalizing
	SOCSK	AGGRESS	ATTN	ANX
Executive Function Factors				
Sustained Attention	-.35*	.01	.43***	.14
Selective Attention	-.10	.00	.41**	-.29*
Inhibitory Control	.37**	-.01	-.40**	-.05
Planning	.33*	-.07	-.27**	.03

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

Table 5. Bivariate Correlations Between Teacher-Rated Behavior & Social Problem-Solving Variables

	Teacher Ratings of Behavior			
	Competence	Externalizing		Internalizing
	SOCSK	AGGRESS	ATTN	ANX
Social Problem-Solving Variables				
Encoding				
Ambiguous Stories (sum)	.16	-.07	-.19	-.01
Nonhostile Stories (sum)	.30*	-.01	-.32**	-.03
Ambiguous - Incomplete Resp.	-.16	-.07	.23	-.01
Ambiguous - Provocation in Resp.	.12	-.01	-.17	.02
Nonhostile - Incomplete Resp.	-.33**	.08	.39**	.11
Nonhostile - Provocation in Resp.	.27	-.18	-.35**	-.24
Representation - HIWC only				
Ambiguous Stories - Hostile Attrib.	-.03	.08	.08	.09
Response Generation (1st choice)				
Ambiguous Stories - AGG	-.15	.14	.17	.05
Ambiguous Stories - PRO	.46***	-.09	-.35**	-.13
Nonhostile Stories - AGG	-.30*	-.00	.06	.08
Nonhostile Stories - PRO	.43***	-.13	-.24	-.10
Response Generation (2nd choice)				
Ambiguous Stories - AGG	.01	.10	.15	-.05
Ambiguous Stories - PRO	.17	-.17	-.21	-.07
Nonhostile Stories - AGG	-.13	.13	.05	.13
Nonhostile Stories - PRO	.41**	-.20	-.31*	-.14
Response Evaluation (AGG)				
Ambiguous Stories	-.18	-.15	.14	-.03
Nonhostile Stories	-.12	.02	-.02	-.04

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

Table 6. Bivariate Correlations Between Executive Function Factors & Social Problem-Solving Variables

	Executive Function Factors			
	SUSTATTN	SELCTATTN	INH/WM	PLAN
Social Problem-Solving Variables				
Encoding				
Ambiguous Stories	-.27*	-.22	.51**	.36**
Nonhostile Stories	-.28*	-.27*	.33**	.09
Ambiguous-Incomplete Resp.	.36**	.23	-.42***	-.34**
Ambiguous-Provocation in Resp.	-.22	-.15	.21	.32*
Nonhostile-Incomplete Resp.	.31*	.23	-.31*	-.10
Nonhostile-Provocation in Resp.	-.17	-.09	.15	.10
Representation - HIWC only				
Ambiguous Stories-Hostile Attrib.	.07	.26*	.10	-.08
Response Generation (1st choice)				
Ambiguous Stories - AGG	.15	.14	-.20	-.32*
Ambiguous Stories - PRO	-.40**	-.17	.24	.40*
Nonhostile Stories - AGG	.15	.07	-.23	-.27*
Nonhostile Stories - PRO	-.26	-.09	.31*	.61***
Response Generation (2nd choice)				
Ambiguous Stories - AGG	.33*	.29*	-.26	-.36**
Ambiguous Stories - PRO	-.34**	-.24	.25	.41**
Nonhostile Stories - AGG	.22	.04	-.16	-.32*
Nonhostile Stories - PRO	-.31*	-.16	.31*	.45***
Response Evaluation (AGG)				
Ambiguous Stories	.20	.25	-.40**	-.38**
Nonhostile Stories	.07	.05	-.31*	-.33**

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

Table 7. Differences Between Maltreated and Nonmaltreated Children on Executive Functioning Factors and Cognitive Skill Variables with Maternal Education Level as a Covariate

	Maltreated			Nonmaltreated			Main Effect (Group)	
	Mean	Std Dev	N	Mean	Std Dev	N	F	p-value
Executive Functioning Factors								
Sustained Attention	0.35	0.63	29	-0.43	0.90	24	9.00(1,50)	.004
Selective Attention	0.10	0.78	28	-0.10	0.93	28	0.00(1,55)	ns
Inhibitory Control	-0.10	0.78	29	0.07	0.77	27	0.08(1,55)	ns
Planning	-0.09	0.81	27	0.16	0.89	28	0.78(1,54)	ns
Other Cognitive Variables								
Recognition Memory	75.38	19.03	29	78.07	20.72	28	0.29(1,56)	ns
Vocabulary	6.93	3.01	29	8.30	3.37	27	0.26(1,55)	ns

Table 8. Differences Between Maltreated and Nonmaltreated Children on Social Problem-Solving Variables with Maternal Education Level as the Covariate

	Maltreated			Nonmaltreated			Main Effect (Group)	
	Mean	Std Dev	N	Mean	Std Dev	N	F	p-value
Social Problem-Solving Variables								
Ambiguous Stories								
Encoding (sum)	2.20	1.47	30	2.62	1.61	27	0.81(1,57)	ns
Encoding - Incomplete Resp.	0.59	0.27	30	0.44	0.29	28	4.02(1,55)	.05
Encoding - Provocation in Resp.	0.28	0.27	30	0.43	0.28	28	3.61(1,55)	.06
Representation - HIWC only	0.68	0.29	30	0.64	0.24	28	0.21(1,57)	ns
Response Gen. AGG (1st alt.)	0.03	0.77	30	-0.03	0.85	28	0.30(1,55)	ns
Response Gen. PRO (1st alt.)	-0.21	0.50	30	0.23	1.12	28	1.71(1,55)	ns
Response Gen. AGG (2nd alt.)	0.23	0.33	30	0.14	0.25	28	0.02(1,57)	ns
Response Gen. PRO (2nd alt.)	0.08	0.15	30	0.10	0.17	28	0.01(1,57)	ns
Response Eval. (endorse AGG)	7.91	2.40	30	7.70	2.62	28	0.07(1,57)	ns
Nonhostile Stories								
Encoding (sum)	2.23	1.79	30	3.04	1.82	28	2.63(1,57)	ns
Encoding - Incomplete Resp.	0.58	0.33	30	0.40	0.29	28	4.32(1,55)	.04
Encoding - Provocation in Resp.	0.28	0.27	30	0.42	0.27	28	3.78(1,55)	.06
Response Gen. AGG (1st alt.)	0.16	0.27	30	0.14	0.27	28	0.00(1,57)	ns
Response Gen. PRO (1st alt.)	0.12	0.17	30	0.15	0.27	28	0.28(1,57)	ns
Response Gen. AGG (2nd alt.)	0.24	0.30	30	0.12	0.23	28	1.55(1,57)	ns
Response Gen. PRO (2nd alt.)	0.08	0.18	30	0.11	0.21	28	0.71(1,57)	ns
Response Eval. (endorse AGG)	7.77	2.57	30	7.39	2.17	28	0.23(1,57)	ns

Table 9. Differences Between Maltreated and Nonmaltreated Children in Behavioral Adjustment Variables (BASC subscales) with Maternal Education as the Covariate

	Maltreated			Nonmaltreated			Main Effect (Group)	
	Mean	Std Dev	N	Mean	Std Dev	N	F	p-value
Teacher Ratings of Behavior								
Social Skills	32.86	27.47	29	45.89	29.19	28	1.17(1,56)	ns
Aggression	71.93	27.00	29	54.18	34.30	28	1.19(1,56)	ns
Attention Problems	66.62	26.00	29	45.18	28.70	28	5.37(1,56)	.02
Anxiety	73.00	20.00	29	54.96	24.03	28	3.48(1,56)	.07

Table 10. Regression Results Predicting Externalizing Problems as Measured by the BASC

AGGRESSION (N=49)

Step	Variable Entered	Multiple R	F	df	R^2 Change	Beta
1	Maternal Education Level	.28*	4.00	1,47	.08*	-.28*
2	Group Status	.33	2.93	2,46	.03	-.22
3	Executive Function Factors	NO VARIABLES ENTERED THIS STEP				
4	SPS - Representation	NO VARIABLES ENTERED THIS STEP				

* $p<.05$

ATTENTION PROBLEMS (N=49)

Step	Variable Entered	Multiple R	F	df	R^2 Change	Beta
1	Maternal Education Level	.14	1.00	1,47	.02	-.14
2	Group Status	.29	2.14	2,46	.06	-.30
3	EF - Selective Attention	.51**	5.28	3,45	.18**	.42**
4	SPS - Representation (HIWC only)	NO VARIABLES ENTERED THIS STEP				

** $p<.01$

Table 11. Regression Results Predicting Positive Social Competence as Measured by the BASC Subscale Social Skills

SOCIAL SKILLS (N=49)

Step	Variable Entered	Multiple R	F	df	R^2 Change	Beta
1	Maternal Education Level	.19	1.71	1,47	.04	.19
2	Group Status	.21	1.08	2,46	.01	.12
3	EF - Inhib. / WM	.39+	2.67	3,45	.11	.33*
4	SPS - 1st Response Gen. (AMB/PRO)	.53**	4.22	4,44	.13	.39**
****						
4	SPS - 2nd Response Gen (NHOS/PRO)	.47*	3.17	4,44	.07	.29*

\+ p<.10
* p<.05
** p<.01

Table 12. Regression Results Predicting Internalizing as Measured by the BASC Subscale Anxiety

ANXIETY (N=49)

Step	Variable Entered	Multiple R	F	df	R^2 Change	Beta
1	Maternal Education Level	.32*	5.38	1,47	.10	-.32*
2	Group Status	.41**	4.69	2,46	.07	-.31
3	EF - Selective Attention	.58***	7.47	3,45	.16	-.41**
4	SPS Variables		NO VARIABLES ENTERED ON THIS STEP			

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

CHAPTER 4: DISCUSSION

This study examined relationships between executive functioning (EF), social problem-solving skills (SPS), and behavioral adjustment. In order to obtain data reflecting a range of skills in these areas, the performance of maltreated and non-maltreated preschool-aged children on tasks related to both EF and SPS was examined. In addition, each child's behavioral adjustment was rated by classroom teachers or daycare providers.

While the maltreated group was successfully balanced with the non-maltreated group on age, gender, ethnicity, and verbal intelligence (as measured by the Vocabulary subtest of the WPPSI-R), it was not possible to fully balance the groups on either maternal education level or family income level. Although group differences favored the non-maltreated group on each of these variables, maternal education and SES was lower for this group than would be expected for a normal control group, as intended in this study.

Components of EF

Among the major goals of this study was to identify a clear factor structure among the group of tasks used to assess EF. While several studies have examined EF tasks and found them to be appropriate for use with young children (Becker et al., 1985; Passler et al., 1987; Welsh et al., 1991), none of these focused only on preschoolers and none differentiated between component EF skills for this particular age group. Studies utilizing factor analyses have suggested that EF may be broken down into component skills (Levin et al., 1991; Welsh et al., 1991) but do not necessarily agree on the nature of these components. There seems to be even less clarity with regard to findings from studies focusing only on preschoolers. Cole et al., (1993) utilized several EF tasks with preschoolers and regarded them as falling into a single EF factor. Gnys and Willis (1991) found that Verbal Fluency and the Tower of Hanoi did not differentiate along verbal/nonverbal lines. Because the tasks used in each of these studies were somewhat different, it is difficult to compare their findings. This study utilized tasks previously used to examine EF in an attempt to generate a useful battery for assessing EF in preschoolers.

A clear factor structure was identified for this sample of preschoolers. It appears that measures of EF may be differentiated according to their demands on types of attentional skills, response inhibition, and planning. Working memory is conceptualized as a component of each of the factors. The following four factors were derived in this study: Sustained Attention, Selective Attention/Organized Search, Inhibitory Control, and Planning. While the factors

identified do not exactly match the two hypothesized (i.e., Attention/Self-Regulation and Planning/Strategy Formation), the broad distinction between skills related to attention and those related to planning did emerge. In general, the factors identified suggest more differentiation among EF skills than expected. Selective Attention was found to be distinct from Sustained Attention, and Inhibitory Control was distinct both from these specific attention skills and from Planning. Conceptually, these factors can be viewed along a continuum of increasing complexity. Tasks making up the factors based on both sustained and selective attention involve following one simple rule that remains consistent throughout the task. Tasks included on the Inhibitory Control factor involve at least two rules which must be kept in mind, and each has a competing prepotent response that must be inhibited. The Tower of Hanoi task, which forms the basis for the Planning factor, requires the most complex group of skills, as it involves the ability to think ahead and formulate a plan of action, in addition to the skills described for the other three factors. Increasing demands on working memory are made in the progression from tasks tapping mainly attentional skills to those requiring complex planning ability.

Interestingly, for this sample, Recognition Memory did not emerge as a discriminant task as it has in research with children from several age groups (Welsh et al., 1991) and with preschoolers who have PKU (Welsh et al., 1990). Significant correlations indicated that good performance on Recognition Memory was associated with good performance on most of the EF measures. In addition, the children involved in this study generally did not do as well as expected on this task. Because this task was apparently more novel and difficult for this sample, it is possible that it tapped components of EF that are not activated in children who are more familiar with the task. In essence, it is possible that task demands were quite different for the current sample. There is some suggestion as well that recognition memory tasks may indeed require use of component EF skills. A recent review by Wheeler, Stuss, and Tulving (1995) of studies examining adult patients with frontal pathology found disrupted performance in recognition memory.

Similar findings emerged for the children's verbal ability (as measured by the Vocabulary subtest from the WPPSI-R). Verbal ability was not expected to be related to EF, but results showed that children with better verbal ability performed better on all components of EF. Welsh et al., (1990) found significant correlations between scores on Verbal Fluency and Visual Search and Full Scale IQ but not between scores on the Tower of Hanoi and Full Scale IQ. It appears that there may be some sort of relationship between intelligence and EF, but that relationship is not yet clear. Welsh and her colleagues (1990) feel that the study of EF has implications for

differentiating between components of intelligence such as fluid versus crystalized intelligence, with fluid intelligence being possibly more associated with EF.

Relationships Between EF and SPS

It was hypothesized that particular components of EF would be related to particular SPS skills. Significant relationships were expected in two main areas. An EF factor based on measures of attention and self-regulation was expected to be significantly related to SPS skills involved in encoding and representation, and an EF factor based on measures of planning skills was expected to be significantly related to SPS skills involved in response generation and evaluation. While relationships between the four EF factors actually identified in this study and particular SPS skills did not fully confirm these hypotheses, several major associations were identified that are consistent with those expected. Sustained Attention was broadly related to both encoding skills and response generation. Specifically, children who responded when asked to describe what they had seen in the video stories by making incorrect or significantly incomplete statements showed deficits in Sustained Attention. Deficits in Sustained Attention were also associated with decreased likelihood of offering initial or subsequent prosocial responses in ambiguous social conflict situations and greater general likelihood of responding aggressively after the failure of an initial response. Selective Attention/Organized Search seemed the less salient of the two attention factors with regard to SPS skills, showing very specific relations with SPS skills. It was related to poorer overall encoding in only non-hostile social conflict situations, to hostile attributions on the HIWC, and to an increased likelihood of responding aggressively in ambiguous social conflict situations after the failure of an initial response. The particular salience of Sustained Attention may be related to the fact that deficits in sustained attention are a critical characteristic of children with clinically significant attention problems (Barkely et al., 1992). To function effectively in the social arena, it is necessary to continuously scan for social cues. Deficits in Sustained Attention make it extremely difficult to engage in accurate encoding and, subsequently, skillful response generation.

There was also a strong positive relationship between Inhibitory Control and encoding skills. This relationship corresponds closely with those originally hypothesized and fits the developmental model presented earlier which posits a continuum of skills related to both EF and SPS where a child must have sufficient control over responding before successful encoding of cues in social conflict situations can take place.

Planning had strong relationships with variables at both the response generation step and response evaluation step. As hypothesized, it was the EF factor with the broadest and strongest relationship with steps related to generating and evaluating responses which may be

applied to social conflict situations, suggesting that the ability to think ahead and formulate a plan of action is associated with more effective responding.

Relationships Between SPS and Behavioral Adjustment

While there were some significant relationships between SPS skills and behavioral adjustment, they were fewer than expected given previous findings in this area (Dodge, 1980; Dodge, Pettit, Bates, & Valente, 1995) where consistent relationships between deficient SPS skills and aggressive behavior have been found. Neither Aggression nor Anxiety were significantly related to any social information-processing variables. Although the current sample did not consist of children with significantly high levels of teacher-rated aggression, in contrast to most of the previous research on behavioral adjustment and SPS skills, the lack of association between aggression and SPS skills was particularly surprising. It may be that the social information-processing model (Crick & Dodge, 1994; Dodge, 1986) has variable utility with different populations. Dodge and Price (1994) found more modest relations between the five social information-processing steps and behavioral adjustment in a normative sample. They also found that the adjustment of older children was incrementally predicted by more steps of the model than was true for younger children. For this sample of competent children, variables related to response generation only added to significant predication of adjustment of the younger group, while encoding and enactment were also significant for the older group. Developmentally, it makes sense that the prediction of adjustment is more complex in older children. That encoding skills were more relevant for the older group is counter to the hypotheses of this study and may suggest that encoding requires more complex skills than expected. Milich and Dodge (1984) used social information-processing variables to predict group membership for hyperactive/aggressive, normal control, and other psychiatric clinic boys through discriminant function analysis. None of the groups were predicted with complete accuracy and the number of misclassifications was not uniform among groups suggesting that different social information-processing steps had variable predictive power depending on the type of group. In their study, the most distinct pattern was identified in the hyperactive/aggressive group. It is also possible that particular steps of the model are better predictors for particular groups, for example, representation has been shown to be particularly important for aggressive boys, who consistently show a hostile attributional bias (Dodge et al., 1984).

Not surprisingly, Social Skills were significantly associated with response generation, particularly initial responses. Children with strong Social Skills ratings were much more likely to generate prosocial responses in social conflict situations. Children rated high on Attention Problems had deficient encoding skills and showed less ability to generate prosocial responses.

In general, these results suggest that problems with attention, separate from aggressive behavior, are highly associated with SPS skills in the current sample of preschoolers. The importance of behaviors related to attention in this age-group is striking and, given the total lack of findings for aggression in this study, suggests that clinically significant problems with attention may developmentally precede or form some basis for clinically significant problems with aggression. Skillful allocation of attentional resources may be necessary for achieving the self-regulation necessary for reigning in aggressive impulses that are becoming less and less socially acceptable as the child grows older. Indeed, Barkley (1997) considers ADHD to be a problems with behavioral inhibition.

Relationships Between EF and Behavioral Adjustment

Each of the four EF factors was also significantly related to some aspect of behavioral adjustment. Sustained Attention, Inhibitory Control, and Planning were all related to Attention Problems and Social Skills, while Selective Attention/Organized Search was related to Attention Problems and Anxiety. Surprisingly, none of the EF factors was related to Aggression. However, Nigg et al., (submitted) found that EF in first grade predicted aggression and inattention in third grade. It is possible that the current lack of findings for aggressive behavior is related to theyounger sample. Aggressive behavior is more normative for preschoolers, making it more difficult to distinguish deviant patterns of social responding. Strong relationships between all four EF factors and Attention Problems provide further evidence for the salience of developing skills related to attention during the preschool years. There is a growing number of studies showing a connection between Attention Problems and EF (Barkley, 1997, Barkley et al., 1992; Reader, Harris, Schuerholz, & Denckla, 1994) in general. In addition, the preschool years have been noted as a critical time for the development of self-regulatory skills (Kopp, 1982), including attentional processes (Cooley & Morris, 1990; McKay, Halperin, Schwartz, & Sharma, 1994), and may be an important juncture for the interaction of cognitive and social skills dependent on them.

Effects of Maltreatment

Because of the significant differences found between groups on maternal education, comparisons between maltreated and non-maltreated children were made only after the effects of maternal education level were removed. Examination of group differences produced some interesting and unexpected results. Most unexpected was how few group differences were found across all of the main areas assessed (i.e., EF, SPS, behavioral adjustment). Surprisingly few group differences were found with regard to performance on EF tasks. Differences were found only on Sustained Attention (measured by the Continuous Performance Test), suggesting that

maltreated children have greater difficulty with this skill than non-maltreated children. A gender by group interaction indicated that maltreated girls performed particularly poorly while non-maltreated girls performed particularly well. Boys' scores were less extreme and the two groups were quite similar. There are no norms available for this age group on the CPT used in this research, but the data that is available from the training manual (Loong, 1988) indicates that the preschoolers involved in this study performed substantially below a normal control group just a few years older. As maltreated children performed significantly worse than non-maltreated children on Sustained Attention but not on other components of EF, it is likely that maltreated children are particularly deficient in this area of functioning. This finding seems even more robust when differences in teacher-rated Attention Problems are considered. These differences also favor non-maltreated children.

Possible explanations for this difference in Sustained Attention may be found in several areas. Deficits in sustained attention are a defining feature of clinically significant attention problems (Barkley et al., 1992). It has been demonstrated that preschoolers show a high degree of stability in behavior problems, including problems with attention, at least into the early school years. This stability, however, is largely dependent on quality of care given by the mother and other environmental stressors (Egeland, Kalkoske, Gottesman, & Erickson, 1990). As maltreated children are more likely to have low quality care and stressful home environments, it follows that they would be more likely to show disruptive behavior problems, including problems with attention. Carlson, Jacobvitz, and Sroufe (1995) found that inattentiveness and hyperactivity in middle childhood was predicted in part by contextual factors such as early caregiving. Perry and his colleagues (Perry, Pollard, Blakley, Baker, & Vigilante, 1995) hypothesize that early traumatic experiences can influence the course of neurodevelopment. They suggest that one effect of early traumatic experiences might be a tendency toward hyperarousal, a sort of vigilance that makes sustained attention quite difficult. Symptoms of Post Traumatic Stress Disorder (PTSD), including hyperarousal, have been noted in children who have experienced maltreatment (Lipovsky, 1991; Yule & Canterbury, 1994). While none of these explanations have rigorous empirical support at this time, they do provide possible scenarios through which maltreated children might be deficient in Sustained Attention as compared to the balanced comparison group utilized in the current research.

Few group differences were found on the SPS variables in the current study. Maltreated children gave significantly more incomplete/incorrect responses than non-maltreated children, which indicates that they have significantly more difficulty with encoding than non-maltreated children. With regard to teacher ratings of behavior on the BASC subscales, maltreated children

were found to have significantly higher levels of Attention Problems than non-maltreated children. No other group differences were found when the effects of maternal education were removed. As mentioned, when the effects of maternal education were not covaried, Anxiety and Aggression were also significantly higher in maltreated children.

Despite the scarcity of significant group differences, examination of mean scores favored the non-maltreated group in all areas, as expected, particularly on measures of behavioral adjustment. Both groups performed lower than expected on many of the measures, which suggests that the non-maltreated group should not be considered a normal control group. This finding was consistent with conceptual reasons for choosing this particular control group.

The lack of significant differences between these two groups raises questions about the influence of the experience of maltreatment versus associated third variables (e.g., low maternal education level, chaotic family conditions, fostercare and discontinuous caregiving) on some of the skills and behaviors measured in this study. Another third variable of particular importance for this sample is the effectiveness of therapeutic interventions for maltreated children. All maltreated children were involved in therapeutic interventions aimed at reducing some of the risk associated with maltreatment. It is possible that intervention effects reduced differences between the two groups on cognitive variables. Despite possible positive effects of therapeutic interventions (Oates et al., 1995), the behavioral adjustment of the maltreated group was markedly worse than that of the non-maltreated group, suggesting that maltreated children may have great difficulty translating cognitive skills into appropriate behavior. One of the mechanisms which may be involved translating knowing into doing is competent allocation of attention. Interestingly, the group differences that did emerge in the current study were all related to children's ability to attend, continuously apply rule-governed behavior to a situation, and gather information needed in order to proceed competently in social situations. Analysis of group differences seems to provide additional support for the salience of attentional skills during this early period of social development.

Given the differences found in encoding skills and the conceptual reasoning that these skills provide the foundation for successful processing at subsequent steps, it was surprising that no differences were found at subsequent steps of the social information-processing model. Corresponding to this is the finding from the path analyses that neither encoding nor representation directly influenced teacher-rated Attention Problems. One explanation for this might be related to the idea that the "data base" is especially limited or biased in these children. It is possible that children at this developmental level, children with significant skill deficits, and/or children with particular types of experiences have stereotypical ways of responding to

social conflict situations. It may be that response generation, for example, is more dependent on encoding in children who are more competent, and children who are less competent may always choose an ineffective response, such as hitting, regardless of the contextual cues involved in the particular situation. This may be one explanation for the finding that the number of alternative responses generated increases with age (Downey & Walker, 1989; Spivak et al., 1976), and, presumably, experience. One other possible explanation is that the social information-processing model itself (Crick & Dodge, 1994; Dodge, 1986) may have varying ability to explain behavioral adjustment depending on the age and particular characteristics of the children being assessed. As suggested above, particular steps of the model may be more salient for certain groups of children and less important for others.

Predicting Behavioral Adjustment

One of the main hypotheses of this research was that EF provides, at least partially, a foundation for competent SPS, which, in turn, has been shown to be related to positive behavioral adjustment. One hypothesis was that the effects of EF would be mostly indirect and mediated through specific SPS skills. In fact, the expectation was that particular EF factors and specific steps in the social information processing model would be more or less associated with particular types of behavioral adjustment. Although the pattern of correlations found between EF and SPS was not as comprehensive and systematic as expected, it did confirm the expectation that attention skills and inhibition would be related to encoding and planning would be related to response generation. The correlations provided a guide for further examination of the power of components of EF and SPS skills, both separately and together, to predict areas of behavioral adjustment. Initial regression models were created utilizing all of the EF factors and those SPS variables which correlated significantly with the selected behavioral adjustment variables. In the initial models, variables were entered based on satisfaction of statistical requirements in a forward entry model. Subsequent path analysis models, to be discussed further below, were generated based on a priori hypotheses.

Aggression was not at all predicted by either EF or SPS as was suggested by the simple correlations. The lack of findings for SPS was particularly unexpected given the number of studies that have found aggressive children, mainly boys, to show deficiencies in various social information-processing steps (see Crick and Dodge, 1994 for a review). The lack of such findings in this study may be related to the current sample being younger, more gender balanced, and generally less aggressive than those previously studied.

Anxiety was predicted only by Selective Attention/Organized Search. It makes intuitive sense that children who are anxious would have difficulty responding in an organized way and selectively attending to aspects of a task.

The two areas of behavioral adjustment that were most successfully predicted by EF and SPS are Attention Problems and Social Skills. Attention Problems were significantly predicted by components of EF only. Specifically, Selective Attention/Organized Search accounted for eighteen percent of the variance in Attention Problems in the forward entry model. It should be noted as well that Sustained Attention and Inhibitory Control also accounted for significant variance in Attention Problems when entered individually, suggesting that attention and self-regulatory skills are important in predicting problems with attention separate from problems with aggressive behavior.

Social Skills were significantly predicted by Inhibitory Control, which uniquely accounted for eleven percent of the variance. After the effects of this EF factor were accounted for, an additional thirteen percent of the variance in Social Skills was accounted for by the child's ability to make an initial prosocial response in ambiguous social conflict situations. In a separate analysis, the child's ability to make a subsequent prosocial response in non-hostile social conflict situations accounted for an additional seven percent of the variance in Social Skills after the effects of the Inhibitory Control had been accounted for. These results suggest that development of the ability to inhibit undesired responses, along with expanding working memory capacity, contributes to better Social Skills. The ability to generate initial and subsequent prosocial responses in social conflict situations further increases the likelihood that children will earn high Social Skills ratings from their preschool teachers. The results of these analyses indicate that response generation has unique ability to predict teacher ratings of Social Skills beyond that already accounted for by Inhibitory Control.

The results of the initial regression analyses indicate that component EF skills significantly predict areas of behavioral adjustment, particularly Attention Problems and Social Skills, and that certain SPS skills have predictive influence above and beyond those component EF skills. As expected, Inhibitory Control, conceptualized as more complex than the basic skills of sustained and selective attention, was associated with response generation, a skill thought to be directly influenced by encoding and representation skills in Dodge's (1986) model. These analyses provide initial limited support for the developmental continuum of skills related to EF and SPS described earlier in this paper. The findings also suggest that Social Skills and Attention Problems are the areas of behavioral adjustment most likely to be affected by

interventions aimed at improving skills related to EF and skills associated with social information-processing.

The path analyses conducted provided some important information beyond that offered by the initial regressions with regard to the direct and indirect effects of components of EF and SPS skills on behavioral adjustment. Two different models examined the prediction of Attention Problems. The first looked at the influence of Sustained Attention and the first two social information-processing steps (encoding and representation) on teacher-rated Attention Problems. The second model was identical except that Inhibitory Control was substituted for Sustained Attention as the component of EF. Neither model indicated a direct influence of encoding or representation on Attention Problems. Both components of EF showed a direct influence on Attention Problems, as well as a direct influence on encoding. The direct influence of encoding on representation was not strong as expected, but it was significant in the Sustained Attention model. In this model, Sustained Attention influenced encoding which influenced representation, as hypothesized, although, as mentioned above, representation did not have a direct influence on Attention Problems. Analyses of indirect effects indicated that both Sustained Attention and encoding have indirect influence on Attention Problems. The same relationships were significant in the model involving Inhibitory Control. These indirect relationships provide support for the hypothesis that EF influences behavioral adjustment through its effects on SPS.

Path analyses examining the prediction of Social Skills indicated that while Planning did not directly influence teacher-rated Social Skills in a model including generation of prosocial responses, it did have a direct influence when the model considered generation of aggressive responses. Planning directly influenced the ability to generate both aggressive and prosocial responses in peer conflict situations. Prosocial response generation skills directly influenced Social Skills, while generation of aggressive responses did not. Perhaps the first signs of good planning skills may be seen in a decrease in aggressive responding rather than in an immediate increase in prosocial responding. Planning indirectly influenced Social Skills through response generation in both models. Children with good planning skills generated more prosocial responses and were rated by their teachers as having more proficient social skills. Poor planners generated more aggressive responses and were seen by their teachers as having more social skills deficits. Overall, it appears that planning skills significantly aid the prediction of this area of positive social competence and prosocial response generation seems to be one important mediator through which planning skills have their influence.

Limitations of the Current Research

While the significant relationships identified between areas of behavioral adjustment and both EF factors and SPS variables clearly support an association between these areas of functioning, findings involved specific relationships between particular variables rather than dominant and pervasive patterns of relationships. It may be that some of the EF and SPS skills measured in this study are not sufficiently well developed in this age group to uncover such comprehensive patterns. As stated above, children in both groups tended to score below expected levels for their age group on both on norm-referenced tests and on the SPS measures. It is also possible that some of the instruments chosen were not fully appropriate for preschool-aged children. As mentioned above, there is no clear guide for choosing appropriate measures of EF for preschool-aged children. Similarly, Dodge's social information-processing model has been primarily tested on school-aged boys (Crick & Dodge, 1994). Little information exists for children younger than kindergarten-aged. In general, the preschoolers in this study showed overall poor performance, particularly on the video measure, where many were noted to have difficulty remaining engaged with the task. For example, many children failed to even orient physically to the video screen by the time the response evaluation portion of each story was shown. Prior research in this area has shown that the format of the measures used has a great influence on the patterns of performance on social information-processing variables. For example, Milich and Dodge (1984) found that boys responded differently to open-ended versus forced choice questions. The lack of clearly validated and reliable measures of both EF and SPS for preschool-aged children is likely to have made it much more difficult to identify strong relationship patterns between these two groups of variables in the current research.

This research should be viewed as a beginning effort in improving the quality of measurement of EF and SPS in preschoolers and understanding the relationships between these two areas of functioning and behavioral adjustment. The power to detect these relationships is dependent on both the measurement instruments used and the sample. As already mentioned, this study has limitations with regard to the measures utilized. In addition, the size of the sample precluded in-depth analyses of gender and group differences, and, more importantly, gender by group interactions. Given significant gender by group interactions found for Sustained Attention, along with trends toward significant interactions for Planning and Attention Problems, it is likely that there are different patterns of relationships between EF, SPS, and behavioral adjustment for different subgroups (e.g., maltreated girls, non-maltreated girls, maltreated boys, non-maltreated boys) which might be detected in a larger sample.

It will be important for future studies to use these results and others from similar research to continue to improve on an EF battery for preschool-aged children. Measurement of SPS skills in preschoolers is another area which is in great need of improvement in terms of the instruments and methods used. These findings cannot be generalized to a normative sample of preschoolers because of the nature and size of the current sample. A replication study with a larger group of maltreated and non-maltreated preschoolers would allow in-depth examination of important gender and group differences. Gender differences are a particularly important focus because so much of the research on the social information-processing model has used only boys. Additionally, replication with a larger community-based sample is required if findings are to be applied to preschool-aged children in general. Finally, future support for the developmental model generated would best be tested through longitudinal research.

Summary

This research is among the first to examine aspects of EF in preschool-aged children and its possible relation to behavioral outcome. It is the only study that has attempted to examine possible associations between aspects of EF and aspects of SPS as conceptualized in Dodge's social information processing model (Crick & Dodge, 1994; Dodge, 1986). Major findings of this study include finding a coherent factor structure among the EF variables used with these preschool-aged children, finding significant associations between particular components of EF and specific SPS skills, and showing that both EF and SPS skills significantly predict teacher ratings of behavioral adjustment. In some cases the hypothesized model of EF having indirect influence on behavioral adjustment through SPS skills was tentatively supported, but these relationships must be investigated further. Findings provide fertile ground for future research in this area.

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VITA

Julie Perkins Quamma

University of Washington

1997

EDUCATION

Doctor of Philosophy, UNIVERSITY OF WASHINGTON, Seattle, Washington (1997).

Major:	Child Clinical Psychology
Minor:	Developmental Psychology
Dissertation Title:	Social Problem-Solving Skills and Executive Functioning in Maltreated and Non-maltreated Preschoolers
Advisor:	Mark T. Greenberg, Ph.D.
Awards:	American Psychological Association Dissertation Award (9/95) The Gatzert Dissertation Fellowship Award - University of Washington (6/96)

Psychology Intern, UNIVERSITY OF WASHINGTON, Department of Psychiatry and Behavioral Sciences (1995-1996).

M.S. UNIVERSITY OF WASHINGTON, Seattle, Washington (1993).

Major:	Child Clinical Psychology
Thesis Title:	Children's Experience of Life Stress: The Role of Family Social Support and Social Problem-Solving Skills as Protective Factors

B.A. UNIVERSITY OF VERMONT, Burlington, Vermont (1987) - Magna Cum Laude.

Major:	Psychology
Awards:	Member of Phi Beta Kappa (1987) Outstanding Senior in Psychology Award (1987)

CLINICAL EXPERIENCE

9/95-6/96 **Psychology Intern, Psychology Internship Program, Department of Psychiatry and Behavioral Sciences, University of Washington.** Completed rotations on several services, including Rehabilitation Medicine (Adults and

Children), Inpatient Psychiatry (Children), Outpatient Psychiatry (Children), and Neuropsychological Assessment (Children).

9/91-8/95 **Staff Therapist, Psychological Services and Training Center, University of Washington.** Responsible for assessment, diagnosis, and treatment of children, adults, and families in both short- and long-term therapy. Clients' presenting problems have included disruptive behavior problems, depression, anxiety, learning disabilities, somatic complaints, and family conflicts. Therapeutic orientations employed have included cognitive-behavioral, family systems, psychodynamic, and both structured cognitive behavioral and non-directive psychodynamic play therapy. Supervisors assigned on a case-by-case basis.

1/94-8/94 **Clinical Psychology Play Therapy Practicum, Childhaven, 1345 22nd Street NE, Auburn, Washington.** Responsible for individual play therapy with preschoolers (ages 4-5) referred to Childhaven, a therapeutic day treatment facility. All children at Childhaven have experienced some form of maltreatment, as documented by Child Protective Services (CPS). Children experiencing particular problems in the classroom with disruptive, aggressive, or withdrawn behavior are referred for long-term weekly play therapy. Play therapy was primarily non-directive and guided by psychodynamic and object-relations orientations. Cognitive-behavioral interventions were utilized as well. Also observed a parent support group and participated in case conferences with Childhaven staff and professional consultants. Supervisor: Margaret Kennedy, M.S., Associate Director of Childhaven.

4/93-6/94 **Clinical Psychology Family Therapy Practicum, Psychological Services & Training Center, University of Washington.** Received didactic and practical training in structural and strategic family therapy, including in vivo and group supervision. Responsible for direct intervention as a co-therapist with one family. Participated as a member of a family therapy team observing from behind a one-way mirror with two additional families. Supervisors: Corey Fagan, Ph.D. & Kimberly Barrett, Ed.D.

9/92-6/93 **Clinical Psychology Assessment Practicum, High Risk Assessment Team, Child Development and Mental Retardation Center, University of Washington.** Responsible for psychological and cognitive assessments of children ages 2-16 using a wide variety of assessment instruments (e.g., Bayley Scales of Infant Development, Stanford-Binet Intelligence Scale, Wechsler Intelligence Scale for Children, Wechsler Preschool and Primary Scale of Intelligence, Wide Range Scale of Memory and Learning, Wide Range Achievement Test, the Vineland Adaptive Behavior Scales, and various projective tests). Presenting problems included severe disruptive behavior problems, attention deficits, developmental delay, autism, learning disabilities, FAS, Cerebral Palsy, Fragile X Syndrome, Angelman's Syndrome, and maltreatment history. Worked as part of a multidisciplinary team, participated in case conferences, and provided parent feedback. Supervisors: Mimi Acosta, Ph.D. & Lisa Kahan, Ph.D.

9/93- **Training in Neuropsychological Assessment of Children, University of**

12/93 **Washington.** Course involved both didactics and practical experiences. Didactics included information on brain development and a comprehensive overview of neuropsychological assessment instruments used with children. Practical experience emphasized both administration and interpretation of neuropsychological assessment batteries. Completed one comprehensive evaluation of a 16 year old female presenting with attention deficits and learning disabilities. Observed one comprehensive evaluation conducted by the instructor. Interpreted four evaluation profiles. Instructor/Supervisor: Margaret Semrud-Clikeman, Ph.D.

9/93- **Training in Consultation, University of Washington.**
12/93 Course emphasizing consultation in school settings which involved both didactics and practical experiences. Didactics included instruction on various consultation techniques and interventions for common classroom management problems, etc. Practical experiences included simulating a consultation and presenting an in-service program. Instructor: Margaret Semrud-Clikeman, Ph.D.

9/92- **Consultant and Group Leader, YWCA School's Out Consortium, Seattle,**
6/93 **Washington.** Funded by a grant to provide consultation about and implementation of psychoeducational groups for young children (kindergarten & 1st graders) at afterschool care facilities. Led small groups using materials based on the PATHS (Promoting Alternative Thinking Strategies) Curriculum and emphasizing skills in self-control and emotional understanding. Also consulted with staff members about ways to generalize material in the larger program. Supervisor: Carol Kusche, Ph.D.

9/91- **Clinical Psychology Practicum, FAST (Families & Schools Together) Track**
6/93 **Project, University of Washington.** Responsible for planning and co-leading social skills training groups for 1st & 2nd graders at high risk for developing disruptive behavior problems. Group sessions were held once each week for 1st graders and twice a month for 2nd graders throughout the school year and followed a specially written curriculum designed to promote the development of skills in self-control, emotional understanding, interpersonal problem-solving, and developing friendships.
Supervisor: Mark T. Greenberg, Ph.D.

1/88- **Psychiatric Technician, Psychiatric Inpatient Unit, Danbury Hospital,**
9/88 **Danbury, CT.** Worked as part of a multidisciplinary team with adolescent and adult patients presenting with a wide variety of acute and chronic mental and emotional disorders. Major responsibility was for daily patient care which included emotional support, help with problem-solving, and assistance with self-care. Also responsible for conducting intakes, helping write care plans, supervising outings for patients, and keeping progress notes. Participated in rounds and community meetings. Supervised by Unit head nurse and nurse educator.

9/86- **Counseling Intern, John Read Middle School, Redding, CT.**
12/86 Individually designed undergraduate practicum. Worked as assistant to the school guidance counselor. Responsible for co-leading groups on problem-solving and emotional understanding at the 6th, 7th, & 8th grade levels, co-

leading a group for children of divorce, and meeting weekly with individual "at risk" students on problem-solving and coping skills. Supervisor: Elizabeth Ault, Guidance Counselor, John Read Middle School; & Lynne Bond, Ph.D., Faculty Supervisor, University of Vermont.

TEACHING EXPERIENCE

3/97-6/97 **Instructor, Department of Psychology, University of Washington.** Instructor for upper level undergraduate course, Child and Adolescent Behavior Disorders (Psychology 410).

1/92-3/92 **Instructor, Department of Psychology, University of Washington.** Primary instructor for course, Social-cognitive assessment of school age children. Responsible for training interviewers in assessment skills within ongoing research project, including theory and administration for intellectual, behavioral, and personality assessments.

RESEARCH EXPERIENCE

1/92-6/95 **Research Assistant, FAST (Families and Schools Together) Track Project, University of Washington.** Assisted in research evaluating a preventive intervention research project targeting children at high risk for developing severe disruptive behavior problems. Responsibilities included both data collection and supervising data collection in several different areas. Conducted screening interviews with kindergarten teachers and parents. Participated in home visits of families involved in the project which included conducting a battery of assessments with the child and behavioral observations of a parent/child activity (used macroanalytic coding system). Trained individuals to conduct behavioral observations, sociometric interviews, and administer a variety of assessment instruments to children. Helped coordinate data collection in public schools. Co-Principal Investigators: Mark T. Greenberg, Ph.D., & Robert J. McMahon, Ph.D.

9/90-12/94 **Research Assistant, PATHS (Promoting Alternative THinking Strategies) Project, University of Washington.** Assisted in research evaluating an elementary school-based curriculum which emphasized self-control, emotional understanding, and interpersonal problem-solving skills. Responsible for interviewing children and training interviewers (using a variety of assessment instruments to measure cognitive and social-cognitive skills), supervising undergraduate research assistants, and conducting data analyses. Co-Principal Investigators: Mark Greenberg, Ph.D. and Carol A. Kusche, Ph.D.

6/89-7/90 **Research Assistant, Yale University, New Haven, Connecticut.** Assisting in research comparing moral development in two cultures: the U.S.A. and India. Responsible for recruiting subjects and organizing data collection, interviewing subjects (both children and adults), transcribing and coding data, conducting literature reviews, and conducting preliminary data analysis. Principal Investigator: Joan Miller, Ph.D.

9/85- **Research Assistant, University of Vermont, Burlington, VT.**

1/86 Assisted with data collection for dissertation research comparing 2 different types of social skills training programs implemented in elementary school classrooms. Responsible for planning & conducting group sessions according to a curriculum and administering pre- and post-intervention assessment interviews with children. Faculty Supervisor: Lynn Bond, Ph.D.

PUBLICATIONS

Greenberg, M.T., Kusche, C.A., Cook, E.T., & Quamma, J.P. (1995). Promoting emotional competence in school-aged children: The effects of the PATHS Curriculum. *Development and Psychopathology, 7(1),* 117-136.

Quamma, J.P., & Greenberg, M.T. (1994). Children's experience of life stress: The role of family support and social problem-solving skills as protective factors. *Journal of Clinical Child Psychology, 23,* 295-305.

Kusche, C.A., Quamma, J.P., Cook, E.T., & Greenberg, M.T. (in preparation). Cognitive, neuropsychological, and emotional functioning in children with different subtypes of learning disabilities.

Nigg, J.T., Greenberg, M.T., Quamma, J.P., & Kusche, C.A. (conference submission). Development of the Stroop effect in normal and learning disabled children: A three year longitudinal investigation.

Nigg, J.T., Quamma, J.P., & Greenberg, M.T. (submitted). A 2-year longitudinal study of neuropsychological performance in relation to competencies and symptoms in elementary school children.

Nigg, J.T., Quamma, J.P., & Greenberg, M.T. (submitted). A 2-year longitudinal study of neuropsychological performance in relation to competencies and symptoms in elementary school children.

Quamma, J.P., & Greenberg, M.T. (in preparation). The influence of situational context on children's social problem-solving strategies.

PRESENTATIONS

Nigg, J.T., Greenberg, M.T., Quamma, J.P., & Kusche, C.A. (conference submission). Development of the Stroop effect in normal and learning disabled children: A three year longitudinal investigation.

Quamma, J.P. & Greenberg, M.T. (1992, May). The influence of situational context on children's social problem-solving strategies. Poster presented at the Meeting of the Western Psychological Association, Portland, OR.

Quamma, J.P. & Greenberg, M.T. (1993, April). Children's experience of life stress: The role of family support and social problem-solving skills as protective factors. Poster presented at the Meeting of the Society for Research in Child Development, New Orleans, Louisianna.