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EARLY IDENTIFICATION OF ATTENTION DEFICIT HYPERACTIVITY DISORDER: A MULTIDIMENSIONAL ASSESSMENT PROTOCOL FOR PRESCHOOLERS

by

Nadine Alison DeWolfe

Submitted in partial fulfillment
of the requirements for the degree of
Doctor of Philosophy

at

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Halifax, Nova Scotia
May, 1998

DALHOUSIE UNIVERSITY

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The undersigned hereby certify that they have read and recommend to the Faculty of Graduate Studies for acceptance a thesis entitled "Early Identification of Attention Deficit Hyperactivity Disorder: A Multidimensional Assessment Protocol for Preschoolers"

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Dedicated to children, adolescents, and adults who have ADHD

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ABSTRACT

Surprisingly few studies have been conducted with preschoolers with Attention-Deficit/Hyperactivity Disorder (ADHD) given symptoms must be evident during the preschool period to qualify for diagnosis. The present study was designed to test the construct validity of a clinic-based ADHD assessment protocol with preschoolers. 50 preschoolers, 25 diagnosed with ADHD and 25 normal controls, matched on age, sex, and socioeconomic status, participated in the present study. Preschoolers were individually tested and observed (direct measures) and parents completed questionnaires (indirect measures) to assess preschoolers' levels of attention, impulsivity, hyperactivity, and psychosocial functioning. Preschoolers with ADHD are more inattentive -- exhibiting more errors of omission on a visual Continuous Performance Test (CPT); taking longer to complete the preschool deletion task; and spending shorter periods of time playing with toys. Preschoolers with ADHD are more impulsive -- exhibiting more errors of commission on a visual CPT and deletion task; verbalizing more frequently during tasks with less involvement by the examiner (visual CPT, low-structure play); engaging in more off-task behaviors during the self-paced deletion task. Preschoolers with ADHD are more hyperactive -- exhibiting more out of seat behavior during the auditory CPT and more frequently moving around a play room. Finally, preschoolers with ADHD exhibit impairments in psychosocial functioning -- receiving a higher frequency of examiner commands during the auditory CPT, deletion, and high-structure tasks; higher ratings by their parents indicating more pervasive and severe attention problems, more injury-risk behaviors, more noncompliance, more externalizing and internalizing symptomatology, and fewer prosocial skills; higher ratings of stress emanating from the child and parents' own characteristics, yet parents of preschoolers do not report differences in life event stress, depressive symptomatology, and overall family functioning. The Home Situations Questionnaire-Revised and Child Behavior Checklist-Total correctly classified 100% of the sample (ADHD vs. Normal Control), providing verification of diagnosis (also based on parent information); while the frequency of examiner commands and child verbalizations correctly classified 74% of preschoolers. Discussion focuses on the clinical validity of the protocol, the importance of assessing preschoolers using developmentally appropriate measures across multiple dimensions and using multiple methods of data collection. A discussion of pragmatic and theoretical issues are highlighted.

ABBREVIATIONS AND SYMBOLS USED

Abbreviation/Symbol	Stands for:
ADHD	Attention-Deficit/Hyperactivity Disorder
ADD	Attention-Deficit Disorder
APA	American Psychiatric Association
CBCL	Child Behavior Checklist
CDI	Child Development Inventory
CPRS or CPRS-48	Conners Parent Rating Scale (48 item version)
CPT-A	Continuous Performance Task - Auditory
CPTP-V	Continuous Performance Task for Preschoolers - Visual
cm	centimetre
DFA	Discriminant Function Analysis
DSM-III	Diagnostic and Statistical Manual - 3rd edition
DSM-III-R	Diagnostic and Statistical Manual - 3rd edition - Revised
DSM-IV	Diagnostic and Statistical Manual - 4th edition
F	F- statistic
FAM-III	Family Assessment Measure - 3rd edition
GDS	Gordon Diagnostic System
hr	hour
HSQ-R	Home Situations Questionnaire - Revised
IBC	Injury Behavior Checklist
ISI	inter-stimulus interval
IWK Grace	Isaac Walton Killam Grace Health Centre for Children, Women, and their Families
m	metre
min	minute
ms	millisecond
NC	normal control
p	probability
PDTP	Picture Deletion Task for Preschoolers
PDTP-R	Picture Deletion Task for Preschoolers - Revised
PSI	Parent Stress Index
PSPCSA	Pictorial Scales of Perceived Competence and Social Acceptance
r	Pearson's correlation coefficient
RDLS-R	Reynell Developmental Language Scales - Revised
s	second
SD	standard deviation
SES	socioeconomic status
SSRS	Social Skills Rating System
™	Trade Mark

Abbreviation/Symbol	Stands for:
°	degree
≤	less than or equal to
≥	greater than or equal to
<	less than
>	greater than
%	percentage

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INTRODUCTION

Attention-Deficit/Hyperactivity Disorder (ADHD) is now recognized as the most common neurobehavioral disorder of childhood resulting in the highest number of referrals to mental health services, child neurologists, neuropsychologists, and behavioral pediatricians (Barkley, 1990a; Epstein, Shaywitz, Shaywitz, & Woolston, 1991; Kwasman, Tinsley, & Lepper, 1995; Ross & Ross, 1982; Shaywitz, Fletcher, & Shaywitz, 1994; 1997; Weiss & Hechtman, 1993). The most recent prevalence estimates suggest that ADHD, as defined by the Diagnostic and Statistical Manual of Mental Disorders - 4th edition (DSM-IV; American Psychiatric Association [APA], 1994), occurs in approximately 5 - 7% of the childhood population (Barkley, 1997). Although referral bias is still an unresolved issue (Barkley, 1990b), ADHD continues to be more frequently reported in males than females, with a 3:1 prevalence rate among non-referred populations (Barkley, 1997; Szatmari, Offord, & Boyle, 1989), and a 6:1 rate among clinical samples (Barkley, 1990b; Searight, Nahlik, & Campbell, 1995). ADHD is currently conceptualized as a lifelong disorder (Barkley, 1990b; Barkley & Grodinsky, 1994; Shaywitz et al., 1994; 1997; Weiss & Hechtman, 1993).

The disorder ADHD (DSM-IV; APA, 1994) has received many labels throughout the century, including "hyperactivity", "hyperkinetic syndrome", "Minimal Brain Dysfunction", and "Attention Deficit Disorder". It is one of the most extensively studied childhood disorders, with estimates of over 15,000 professional references published (Alessandri, 1992; Ball & Koloian, 1995; Barkley, 1990b; 1991; Ross & Ross, 1982; Weiss & Hechtman, 1993). Despite this vast literature, ADHD continues to be one of the

less well understood childhood disorders (Kelly & Aylward, 1992).

Clinical Presentation

ADHD is characterized by early onset and persistent patterns of inattention, hyperactivity, and/or impulsivity -- patterns that exceed levels expected for the individual's stage of development (APA, 1994). In as much as this definition is concise, the diagnosis of ADHD continues to pose a challenge given the multidimensional nature of its symptoms and comorbid clinical manifestations (Barkley, 1990a; Denckla, 1992; DuPaul, Anastopoulos, Shelton, Guevremont, & Metevia, 1992; Kelly & Aylward, 1992; Shaywitz et al., 1994; Weiss & Hechtman, 1993).

To assess ADHD it is first necessary to establish the norm or characteristic level of attention, activity, and inhibition among individuals at different, discrete stages of neurobehavioral development (Kelly & Aylward, 1992; Shaywitz et al., 1997; Weiss & Hechtman, 1993). As a developmental disorder, the core symptoms must be present prior to 7 years of age, persist for at least 6 months, and be exhibited in two or more settings (APA, 1987; 1994; McGee, Williams, & Feehan, 1992). Indeed, the environment and task demands may influence the time of onset and severity of ADHD symptoms (Mulhern, Dworkin, & Bernstein, 1994; Shaywitz et al., 1997).

In addition to the neurocognitive and behavioral impairments among children with ADHD, these children also frequently display poor social interactions, poor peer relationships, lowered self-esteem, as well as difficult parent-child relationships (e.g., Alessandri, 1992; Campbell, 1994; Cunningham & Barkley, 1979; deHaas, 1986; Hinshaw

et al., 1997; Kelly & Aylward, 1992; Kelly, Cohen, Walker, Casey, & Atkinson, 1989; Shaywitz et al., 1997; Slomkowski, Klein, & Mannuzza, 1995; Whalen & Henker, 1985). A high level of parental stress and family dysfunction also characterize many of the families of children with ADHD (e.g., Anastopoulos, Guevremont, Shelton, & DuPaul, 1992; Breen & Barkley, 1988; Campbell, 1994; Hinshaw et al., 1997; Mash & Johnston, 1983; Searight et al., 1995). Subsequent to these difficulties, children with ADHD experience many negative sanctions and academic failure (e.g., Kelly & Aylward, 1992; Weiss & Hechtman, 1993).

The face validity of the ADHD presentation is generally agreed upon among clinicians and researchers (e.g., Barkley, 1990b; Denckla, 1992; Weiss & Hechtman, 1993; see Levine & Oberklaid, 1980; Shaffer & Greenhill, 1979; Weinberg & Brumback, 1992 for an opposing position). Impairments in sustained attention, impulse control, and activity regulation have been accepted as the hallmark symptoms of the disorder and any combination of symptoms from these three clusters are indicative of ADHD given that they meet diagnostic criteria (Barbaresi, 1996; Barkley, 1990b; Shapiro & Herod, 1994; Shaywitz et al., 1997). Despite the tremendous gains in the understanding of ADHD, there continues to be disagreement about the essential features of ADHD, the priority of such features, their origin, as well as the existence of subtypes of ADHD (e.g., APA, 1980; 1987; Barkley, 1997; Barkley, DuPaul, & McMurray, 1990; Cantwell & Baker, 1992; Goodyear & Hynd, 1992; Lahey et al., 1994; Searight et al., 1995; Shaywitz et al., 1994; 1997).

Although initially thought to be primarily a deficit of hyperactivity (e.g., Chess,

1960), Douglas (1972) introduced the role that attention and impulsivity also play in ADHD. Later, Douglas (1988) concluded that the deficits apparent in ADHD arise from a central impairment in self-regulation. While Zentall (1985) proposed that a low level of arousal is the main deficit for these children. Most recently, Barkley (1997) emphasized that poor behavior inhibition (i.e., inability to delay responding) is the central impairment in ADHD. Barkley (1997) postulates that the multidimensional presentation of ADHD symptoms arise from the manifestation of deficits in this basic inhibitory response system.

As researchers and theorists continue to debate which dimensions represent the core areas of deficit in this disorder, ADHD continues to be accepted as a multidimensional disorder which can and often does manifest itself as combinations of inattention, hyperactivity, and impulsivity (APA, 1980; 1987; 1994; Barbaresi, 1996; Barkley, 1990b; Barkley, Grodinsky, & DuPaul, 1992; DuPaul et al., 1992; Halperin, Matier, Bedi, Sharma, & Newcorn, 1992; Kelly & Aylward, 1992; Searight et al., 1995; Shaywitz et al., 1997). As previously mentioned, the number and severities of difficulty in any dimension varies not only between children, but also across time and task. Children with ADHD may have difficulty with a range of tasks and exhibit impairments in attention, impulse control, and activity regulation, which for some may also manifest in impaired peer relationships, lowered self-esteem, academic underachievement or failure, and /or compromised parent-child relationships.

Given the changing nature of symptom priority and theoretical understanding, the DSM systems of classification have also undergone many changes in diagnostic criteria and identification of subtypes. Researchers presently recognize that, while the majority of

children diagnosed with ADHD demonstrate hyperactivity and impulsivity, there are also a group of children who exhibit predominately inattentive symptoms without impulsivity or hyperactivity (Searight et al., 1995). These beliefs are reflected in the relatively recent publication of the DSM-IV (APA, 1994) where inattention is listed as one area of deficit, while impulsivity/ hyperactivity is identified as a separate area of deficit. An individual may have either ADHD: Inattentive Type or ADHD: Hyperactive/ Impulsive Type or an individual may have both inattention and impulsivity/hyperactivity which is separately classified as ADHD: Combined Type. Lahey et al. (1994) suggested that the DSM-IV (APA, 1994) and its classification of children with the predominately impulsive/ hyperactive type, the predominately inattentive type, or the combined type will reduce the previously reported widespread heterogeneity of ADHD symptoms, impairment, and demographics. They also suggest that the DSM-IV classification system of ADHD is likely to improve accurate identification of ADHD in preschoolers and may reveal that there is a developmental shift in the manifestation of ADHD from preschool to school-age (Lahey et al., 1994).

Etiology

ADHD is currently described as a clinical presentation derived from genetic, neurological, neurochemical, and/ or environmental factors. The relative contribution of each of these causal factors as yet, is unestablished (e.g., Barkley, 1990b; Weiss & Hechtman, 1993). Some of the genetic, neurologic, biologic, and neurochemical factors have included prenatal and perinatal risk factors, minor neurological signs, biochemical

abnormalities, minor physical abnormalities, physiologic underarousal, neurochemical toxicity, and identified cerebral dysfunction (Rapoport et al., 1978; Searight et al., 1995). The environmental factors have included impoverished financial status, family dysfunction, compromised health status, food additives, sugar, allergens, and non-optimal parenting. However, there is limited evidence that these latter environmental factors play a direct causal role in the development of ADHD (e.g., Barkley, 1990b; Carlson, Jacobvitz, & Sroufe, 1995). Family status and parenting skills may affect the severity of presentation, and in some countries, limited financial means may result in poor health status which may magnify reported primary ADHD-like symptoms or promote secondary symptoms, at times confounding clinical presentation. Weiss and Hechtman (1993) suggest that hyperactivity is the final common pathway of biological and psychosocial antecedent variables. Barkley (1990b) endorses a biological or genetic predisposition to the disorder in which the final disturbance is the result of a variety of neurological etiologies which may be exacerbated by environmental factors.

School-Age Children

Peak age of Referral

The majority of ADHD research conducted to date has focussed on school-age children, aged 6 - 11 years, primarily because the peak age of referral for ADHD is between 7 - 9 years (Ross & Ross, 1982; Weiss & Hechtman, 1993). This peak referral range during the early elementary school years coincides with increased scholastic demands and increased, potentially conflicting, demands for both conformity and

independence. Children are expected to work cooperatively in a structured group, exhibit compliance to structure and procedure, sit still for longer periods of time, and attend to tasks that are scholastically appropriate, but often not of the child's choosing (Weiss & Hechtman, 1993). In addition, this setting typically affords the teacher an opportunity to compare the child to same age and sex peers (Atkins & Pelham, 1991).

Multidimensional Protocols

To date, there is no single evaluation tool for the diagnosis of ADHD and there is still an evolving but not a standard diagnostic protocol (Barbaresi, 1996; Hinshaw et al., 1997; Kelly & Aylward, 1992; Mulhern et al., 1994; Searight et al., 1995; Weiss & Hechtman, 1993). Clinicians continue to rely heavily on parent report, including parent-completed behavior ratings and psychological or psychiatric interview, as the primary source of information in making a diagnosis of ADHD (Barkley, 1991; Searight et al., 1995). However, there are many shortcomings of exclusive reliance on parental ratings, including parental stress associated with parenting a child with ADHD, stress associated with other life events, and presence of parental psychopathology to name a few (Barkley, 1990b; 1991; Edelbrock & Rancurello, 1985; Mulhern et al., 1994). There is often a high level of parent stress reported in families with a school-age child with ADHD (e.g., Anastopoulos et al., 1992; Breen & Barkley, 1988; Mash & Johnston, 1983). Nonetheless, Campbell, Schleifer, & Weiss (1978) and Faraone, Biederman, & Milberger (1995) found diagnoses derived from maternal report to be reliable and accurate.

Barkley (1990b) recently advocated for the use of a multidimensional multimethod assessment protocol so as to increase the rigor and ecological validity of a diagnosis of

ADHD, a belief now shared by many researchers and clinicians (e.g., Atkins & Pelham, 1991; Barbaresi, 1996; Barkley 1990b; 1990c; 1991; Barkley, Fischer, Newby, & Breen, 1988; Cohen, Riccio, & Gonzalez, 1994; DuPaul et al., 1992; Gordon, 1986; Hinshaw et al., 1997; Kelly & Aylward, 1992; Lyman & Hembree-Kigin, 1994; Martin, 1993; Mulhern et al., 1994; Paternite, Loney, & Roberts, 1996; Shaywitz et al., 1994; 1997; Shapiro & Herod, 1994; Schaughency & Fagot, 1993; Shelton & Barkley, 1994; Weiss & Hechtman, 1993). Some of the recommended protocols include: (a) direct measures of attention and impulsivity (e.g., Continuous Performance Tests), (b) direct measures of behavior via behavioral observations, and (c) converging, indirect measures such as standardized rating scales (parent, teacher). In addition, the use of specific information regarding the child's developmental and behavioral histories, previous and current functioning, scholastic achievement, and psychological status (e.g., self-esteem, social skills) may also yield valuable diagnostic information (Barkley, 1990b; 1991; Barkley et al., 1988; Kelly & Aylward, 1992; Lyman & Hembree-Kigin, 1994; Martin, 1993; Searight et al., 1995; Shelton & Barkley, 1994; Weiss & Hechtman, 1993).

Preschoolers

To date, compared to school-age or adolescent populations, relatively few studies have been conducted with preschoolers (see Barkley 1990b; 1997; Campbell, 1985; 1990a; 1995 for reviews). The current and previous DSM diagnostic criteria for ADHD specify that symptoms must be present prior to 7 years (APA, 1980; 1987; 1994). Despite the recognition of this disorders' early onset (e.g., Barkley, 1990b; Campbell, 1995;

Searight et al., 1995; Weiss & Hechtman, 1993), the core of ADHD research appears to focus on the age range that follows the pattern of peak referral range (7 - 9 years) (Ross & Ross, 1982; Weiss & Hectman, 1993). Therefore, given that symptoms must be first evident during the preschool period, it is crucial to assess the cause and correlates of emerging ADHD symptoms in preschoolers to facilitate earlier diagnosis and treatment, and to further investigate the developmental course of this developmental disorder.

Determining the Developmental Course

Stability

As previously mentioned, ADHD is considered to be a lifelong disorder (Barkley, 1990b; Barkley & Grodinsky, 1994; Shaywitz et al., 1994; 1997; Weiss & Hechtman, 1993). Research currently indicates that 50% of preschoolers identified with severe externalizing behavior problems will continue to exhibit externalizing behavior difficulties (e.g., ADD, aggression problems) during elementary school and adolescence (see Campbell, 1995 for review). This statistic suggests there is only a 50% chance a young child will continue to meet the clinical diagnosis, interpreted by some to suggest that early diagnosis is not worth pursuing given this "flip-of-the-coin" probability. However, it is not clear what happens to the remaining 50% of the children with early externalizing problems, who do not continue with a diagnosis consistent with ADHD (according to the DSM series). Some of the possibilities include the fact that these children continue to experience symptoms of ADHD but at a subthreshold level negating formal diagnosis, they continue to have difficulties which are best reflected by a different disorder (e.g., Oppositional Defiant, Anxiety, or Learning Disorders), they "outgrow" their difficulties,

or they were misidentified as having an externalizing behavior disorder (false positive) due to inaccurate assessment and diagnostic criteria used with preschoolers. Nonetheless, such a high rate of diagnostic change, no better than chance for stability of diagnosis, does indicate the need to better understand the factors which influence the early presentation and subsequent amelioration of symptoms of childhood ADHD.

This position is consistent with the recent work of Shaywitz and colleagues (1997) who, recognizing the often overlooked influence of developmental phase on the presentation of the disorder, suggest the possible value in using different patterns of symptoms that fit each developmental stage when making diagnoses. Acceptance of this position necessarily implies the need to collect normative data for specific developmental periods (e.g., preschool period). The development of clinically valid age-appropriate assessment protocols may lead to improved accuracy of early identification, thus facilitating long-term study of the developmental course of ADHD. This will have important implications for estimating prevalence, stability, and prognosis of the disorder as well as for the enhancement of earlier and more appropriate treatment regimes.

Early Intervention

Children with ADHD are at greater risk for comorbid problems (Barkley, 1990a). The development of earlier assessment protocols and clarification of behavioral characteristics in the preschooler may lead to improved accuracy of earlier identification, and also to earlier implementation of more appropriate treatment strategies. Early intervention programs may prevent further development of ADHD-associated features, such as severity of ADHD symptoms, aggression, impaired parent-child or child-child

relationships, adjustment problems, poor academic achievement, deficient social skills, and low self-esteem, many of which have their early roots within the preschool period (e.g., Alessandri, 1992; Barkley, 1990a; Campbell, 1990a; 1994; 1995; Campbell & Ewing, 1990; Campbell, Breaux, Ewing, & Szumowski, 1986a; Campbell & Werry, 1986; Cunningham & Barkley, 1979; Loeber, 1990; Loney & Milich, 1982; Pisterman, McGrath, Firestone, Goodman, Webster, & Mallory, 1989; Mash & Johnston, 1982; Pelham & Bender, 1982; Pelham & Murphy, 1986; Ross & Ross, 1982). Prior, Smart, Sanson, Pedlow, and Oberklaid (1992) found that behavioral difficulties in preschool and the early school years should be routinely interpreted as signals for adverse long-term adjustment problems. Similarly, McGee et al. (1992) found that onset of ADHD during the preschool years was associated with more severe symptomatology in adolescence. The need to better understand the multidimensional nature and developmental course of ADHD is therefore critical to understanding the development of comorbid childhood and adolescent disorders. The relationship among the primary and secondary deficits of ADHD also speak to the importance of early intervention, using a multimodal treatment plan (Lyman & Hembree-Kigin, 1994; Pisterman et al., 1989).

Concomitant Language Impairments

Screening for language delay when examining externalizing behavioral disorders is very important given its frequent concurrent presentation with ADHD and its possible role in later manifestation of psychiatric illness (Cantwell & Baker, 1987). For example, Love and Thompson (1988) found 48% of preschool-age psychiatric outpatients with ADHD also exhibited language impairments. Richman, Stevenson, and Graham (1982) found a

strong association between early language delay and onset of later behavior problems. Cantwell and Baker (1987) found a higher rate of later childhood and adolescent maladjustment and frank psychiatric disorders in individuals who had an early history of Developmental Language Disorder. Ornoy, Uriel, and Tennenbaum (1993) found 55% of preschoolers, who initially presented with hyperactivity, inattention, and language impairment were later diagnosed with learning disabilities. Finally, many children referred for language or speech delay are also noted to exhibit behavior problems leading professionals to question whether the behavior problems reflect ADHD or whether behavior problems have developed in response to frustration with communication difficulties (Billeaud, 1995).

Beitchman, Tuckett, and Batth (1987) studied preschoolers presenting with hyperactivity and language delay, hyperactivity alone, and a clinical nonhyperactive comparison group. They proposed that language status may serve as a differential diagnosis of two types of preschool ADHD (i.e., ADHD plus language delay vs. ADHD alone). These two groups of children may have unique characteristics, suggesting that children with behavior problems and impaired language may have a different neurologic substrate or pathway, thereby present in a different manner and/ or severity for which more specific, unique treatments are indicated. Finally, the identification of ADHD and concomitant language problems is important given that early identification and intervention may be facilitated by addressing both impairments, when present (Billeaud, 1995).

Developmentally Appropriate Assessment

The majority of measures developed to assess ADHD have not been appropriate for preschoolers. The lack of developmentally appropriate, objective measures for the assessment of inattention, hyperactivity, and impulsivity, combined with yet weakly defined (empirically-based operational definitions) parameters of developmentally inappropriate levels of activity, impulsivity, and attention has contributed to limited progress on preschool assessment of ADHD (Barkley, 1990b; 1991; Campbell, 1985; 1990a; 1995). Defiance, high-activity levels, attentional problems, impulsivity, and temper tantrums are common among toddlers, and even though these features may persist into preschool years, they are often not a cause for concern (Campbell, 1995). Some degree of behavioral difficulty is expected in preschoolers as they accommodate to neurodevelopmental and environmental changes (Prior et al., 1992). Certainly, there is more natural variability in preschoolers' behaviors and a wider latitude to what is considered "developmentally appropriate". It is therefore more difficult for professionals to discriminate between preschoolers displaying transient, developmentally appropriate levels of "ADHD-like" behaviors, and those preschoolers whose hyperactivity and distractability pose serious and possibly enduring problems (Campbell, 1995; Lyman & Hembree-Kigin, 1994; Shaywitz et al., 1997).

An additional caveat to early diagnosis is the lack of developmentally appropriate, operationally defined diagnostic criteria in the DSM systems of classification. Although the need for interpreting behaviors within developmental context is clearly stated, no norms are provided regarding the developmental appropriateness of the symptoms/

behaviors listed as diagnostic criteria (Barkley, 1990c; Mulhern et al., 1994; Shaywitz et al., 1997). As a result, researchers have had to rely, almost exclusively upon parent verbal reports and parent-completed child checklists or rating scales in order to assess for the appropriateness of symptoms (see Campbell, 1995). Subsequently, many studies employ cut-off scores on selected rating scales for study participation and group assignment (ADHD vs. control), possibly resulting in compromised interpretation of results.

When parent report is heavily relied upon in the assessment of ADHD, an interesting dilemma ensues regarding the nature of the relationship between parental stress and/ or psychopathology, and the child's behavior (see Campbell, 1995 for review). Evidence for this relationship will be described later. Like professionals, parents of preschoolers often lack an understanding of the levels of attention, impulse control, and activity that might be "typical" for a given developmental stage. Unless the preschooler attends a day care or kindergarten program, parents may not even be aware their child is exhibiting inappropriate behaviors.

Although acknowledging some of these shortcomings, nevertheless, parental ratings play a very important role in the diagnosis of their child. By employing standardized rating scales, the preschooler can then be compared to an age-appropriate normative sample, providing a more objective index of a child's behavior. Parent ratings also provide an ecologically valid portrayal of their preschooler's behavior in the home setting (Barkley et al., 1988). Faraone et al. (1995) have suggested that parent reports are valid indicators of ADHD symptomatology, but Mulhern et al. (1994) suggest that parental ratings should be used as one component of a broad-based assessment. Parental

concern for their children have reliably corresponded with the presence of school-related learning and behavior problems, but were not reliable predictors of a diagnosis of ADHD based on a comprehensive pediatric assessment (Mulhern et al., 1994). Biederman, Keenan, and Faraone (1990) found that a diagnosis of ADHD based on information obtained during a standardized interview with a child's parent was corroborated by teacher reports.

Unless a preschooler is enrolled in a preschool program, parental perceptions are the main source of information about the preschooler's behavior and attention. For those preschoolers attending a day care or kindergarten, important objective information can be conveyed by preschool teachers who have the advantage of comparing preschoolers to their age-mates, as well as observing them in a wide range of age-appropriate activities including situations that truly tax children's sustained attention and behavioral inhibition (Barkley, 1991). According to the diagnostic criteria for ADHD (DSM-IV; APA, 1994), regardless of whether a child attends preschool, the persistence of problem behaviors across situations needs to be assessed. A parent's report about a child's behavior in multiple activities or places (e.g., grocery store, friend's house) may be used to assess the persistence of a child's difficulties (DuPaul, 1990).

Preschool Research

As previously mentioned, several studies of school-age children have produced encouraging results using a multidimensional ADHD assessment protocol (e.g., Barkley, 1991; Barkley et al., 1988). Of the limited preschool studies completed to date, only a few have incorporated a multidimensional assessment protocol (e.g., Byrne, DeWolfe, &

Bawden, in press; Campbell & colleagues, 1982; 1984; 1986a; 1986b; 1986c [cohort 1]; 1991a; 1994 [cohort 2]; Mariani & Barkley, 1997), and even fewer have included samples of clinically diagnosed preschoolers with ADHD (e.g. Byrne et al., in press; Mariani & Barkley, 1997). The results of these studies have been very promising; however, additional study is warranted to better appreciate the early manifestation of primary and secondary areas of deficit associated with ADHD.

Susan Campbell and her colleagues have provided the single largest research base on preschoolers with externalizing behavior problems (see Campbell, 1990a; 1995 for reviews). Their research has primarily examined the early externalizing behavioral and social characteristics of the disorder, as well as the stability of externalizing problems from preschool to school-age. Campbell and her colleagues followed two cohorts of 'parent-referred' or 'hard-to-manage' children, first identified in their preschool-age range (cohort 1: Campbell, Breaux, Ewing, & Szumowski, 1984; 1986a; Campbell, Breaux, Ewing, Szumowski, & Pierce, 1986b; Campbell & Ewing, 1990; Campbell, Ewing, Breaux, & Szumowski, 1986c; Campbell, Szumowski, Ewing, Gluck, & Breaux, 1982; cohort 2: Campbell, 1994; Campbell, March, Pierce, Ewing, & Szumowski, 1991a; Campbell, Pierce, March, & Ewing, 1991b; Campbell, Pierce, March, Ewing, & Szumowski, 1994).

Their first cohort began with a sample of parent-referred 2 - 3 year old preschoolers compared with normal control peers (Campbell et al., 1982). Parents who responded to a poster announcement which offered assessment and parent-training classes for parents who had concerns about their young child's attention span, solo play, tantrums, and/ or defiance, were included in the parent-referred group. The poster also

requested the participation of parents who had no concerns about their child; these parents and children participated as normal controls. Exclusion criteria were applied, including good physical health and no evidence of severe language delay, gross brain damage, sensory impairment, mental retardation, or severe psychiatric disorders. Although participants were well matched on age, there was a statistical difference in the parental educational and occupational level, with controls predominately falling within the mid to upper class families as compared to falling within the working to upper middle class. A formal diagnosis was not made, nor was group assignment dependent on behavior ratings. Group assignment was instead entirely dependent upon parental reports of concern about "ADHD-like" symptoms in their child This sample was subsequently followed at ages 4, 6, 9, and 13 years.

Campbell and her colleagues employed a multidimensional assessment protocol, including responses collected during a structured parent interview, parents rating scales of their children's ADHD behaviors, several cognitive measures of attention and impulsivity (e.g., Matching Familiar Figures, Draw-a-line slowly), as well as direct child behavioral observations during a structured, free play, delay of gratification, and a mother-child interaction task (Campbell et al., 1982). At age 6 years, a classroom observation was added (Campbell et al., 1986c), while at age 9 years, a teacher rating scale, maternal depression inventory, and maternal life event stress scale were added (Campbell & Ewing, 1990).

The second cohort began with a sample of teacher-identified (rating scale) 'hard-to-manage' preschool boys, 2.5 - 4.5 years, and their matched classroom controls

(Campbell et al., 1991a). A group of parent-identified (rating scale) 'hard-to-mange' preschoolers was also recruited. Children with IQ scores below 80 were excluded from the study, as were preschoolers with severe language delay or gross brain damage. Parent-identified preschoolers were significantly younger than teacher-identified and matched-control preschoolers. There was no statistical difference in SES among the groups; the sample predominantly consisted of mid to upper class families. A formal diagnosis (e.g., ADHD) was again not required for inclusion. This sample was followed at ages 4 and 6 years.

In this second cohort, Campbell and her colleagues again employed a multidimensional assessment protocol including responses collected during a structured parent interview, parents and teachers rating scales of the children's ADHD behaviors, parents ratings of their own depression, life event stress, and marital adjustment, several cognitive measures of attention and impulsivity (e.g., Matching Familiar Figures, Continuous Performance Test), as well as direct behavioral child observations within home, laboratory, and preschool visits, and for structured, free play, delay of gratification, resistance to temptation, and mother-child interaction tasks. Campbell and her colleagues also employed a direct measure of the preschoolers' perceived competence and social acceptance. A classroom behavior observation was added at 6 years (Campbell et al., 1994).

In both cohort studies, Campbell and her colleagues found a relationship between early behavioral difficulties and later presentation of hyperactivity and of adjustment problems. As mentioned earlier, over 50% of those children with moderate to severe

impulsivity, hyperactivity, and inattention during the preschool phase presented with ADD or significant aggressive behaviors based on maternal report during elementary school (Campbell et al., 1986c; 1994; Campbell & Ewing, 1990). No children identified as controls in preschool were identified as problem youngsters in elementary school (Campbell et al., 1986c). Campbell (1995) suggested that negative, inconsistent parental behavior and high levels of family adversity were not only associated with the emergence of problems in early childhood, but also would likely predict the persistence of difficulties into the school-age period. However, this argument has been based on the correlational relationship between persisting externalizing behavior problems and high levels of family instability and/ or adversity (Campbell et al., 1986a). While the work by Campbell and colleagues has yielded significant advance in the appreciation of early onset and continuity of ADHD-like symptoms, several outstanding issues remain.

Campbell and colleagues concentrated almost exclusively on the behavioral and social correlates of "behavior problems", with relatively little study of the potentially important role of cognitive correlates. Campbell and her colleagues employed a variety of inclusion criteria, which compromise the degree of generalization of their findings regarding ADHD. First, they study 'hard-to-manage' boys and not formally diagnosed ADHD preschoolers. Second, they excluded only severe language delay/ disorder, yet mild to moderate language delay or deficit can have a relatively large debilitating effect during the early language years of preschool (e.g., McGee, Partridge, Williams, & Silva, 1991; Richman et al., 1982). Furthermore, their assessment of language status was narrow in presentation. Third, it was not stated whether any of the children had comorbid

diagnoses, such as ADHD plus Oppositional Defiant Disorder or Language Disorder. Perhaps the biggest limitation of the Campbell cohorts lies in the heterogeneity of their sample. Without an independent, formal diagnosis of ADHD in exclusion of these other such disorders, it still remains difficult to comment about the patterns and correlates of ADHD among preschoolers.

In a very recent study, Mariani and Barkley (1997) compared a sample of clinically diagnosed 4 - 5 year-old boys with ADHD to a sample of age-matched normal control boys. Preschoolers were screened using the Conners Parent Rating Scale and diagnosed by a clinical child psychologist using the DSM-III-R (APA, 1987) diagnostic criteria for ADHD. In contrast to their normal peers who had to score < 1 SD of the mean on the Conners Parent Rating Scale or the Child Behavior Checklist, preschoolers with ADHD had to meet the DSM-III-R criteria for ADHD and score ≥ 1.5 SDs of the mean on the Impulsive-Hyperactive factor of either the Conners Parent or Teacher Rating Scales. Children whose IQ scores were below 80 were excluded from this study, as were children showing evidence of gross brain damage or other developmental disorders. Groups did not differ significantly in SES; however, preschoolers with ADHD had significantly lower Verbal IQs compared to normal controls.

Mariani and Barkley (1997) employed a multidimensional assessment protocol which included a battery of neuropsychological and pre-academic achievement tests, along with tests of attention and impulsivity (e.g., Continuous Performance Test) and direct behavioral observations. Initially, they analysed all dependent measures using analysis of variance techniques. They found that preschoolers in the ADHD group performed poorer

than controls on a number of neuropsychological tests (i.e., purdue pegboard, and the Kaufman-ABC hand movements, spatial memory, number recall, and porteus mazes), pre-achievement tests (i.e., arithmetic and reading/decoding) and on the CPT (i.e., omission errors and disruptive behavior) as well as on a chip sort task. They empirically reduced their dependent measures to 4 dimensions (i.e., motor control, picture identification-factual knowledge, verbal learning-memory, and working memory-persistence), two of which (motor control, working memory) reliably differentiated the preschoolers with ADHD from normal controls. They concluded that these early deficits are indicative of ADHD and support the concept of disordered neuromaturation (see Barkley, 1997; Mirsky, Anthony, Duncan, Ahearn, & Kellam, 1991; Pennington & Ozonoff, 1996 for discussion).

This work represents a significant addition to the field of ADHD, particularly regarding early onset of the disorder. In particular, these findings add significant information regarding early neurocognitive as well as previously established behavioral profiles. However, shortcomings were evident, some very serious. In contrast to Barkley's earlier work, Mariani and Barkley (1997) did not employ a measure of the preschooler's or the parent's psychosocial functioning. They used the preschool version of the Gordon vigilance task (1982) which requires number recognition despite the fact that there are unresolved issues as to whether this skill is reliably demonstrated among preschoolers (O'Dougherty, Nuechterlein, & Drew, 1984). Most concerning is the fact that the first author (Mariani) was aware of the study hypotheses, knew group membership (conducted interviews and made diagnoses), and tested all preschoolers.

Furthermore, the coder of the videotaped behaviors, whose reliability was not tested in this study, also knew the group membership of preschoolers. These serious methodological flaws limit the generalizability of their findings.

In a recent study, preschoolers diagnosed with ADHD were compared to a sample of age and sex matched-controls (Byrne et al., in press). Preschoolers were screened using the Conners Parent Rating Scale (> 2 SD, Hyperactivity Index) and independently diagnosed by a clinical child psychologist using the DSM-III-R (APA, 1987) diagnostic criteria for ADHD. Of particular note, Byrne et al. (in press) required that all preschoolers exhibit normal expressive and receptive language based on formal assessment. In addition, preschoolers were without neurological damage or other developmental disorders (e.g., Oppositional Defiant Disorder, Autism).

The protocol employed in this study was multidimensional, including measures of psychosocial functioning (child and parent), behavior ratings (i.e., Child Behavior Checklist), direct behavioral observations during structured and unstructured tasks, as well as a newly developed age-appropriate test of impulsivity and attention (i.e., picture deletion task). Byrne et al. (in press) found that preschoolers with ADHD could be differentiated from controls on measures of parental stress and child behavior ratings, as well as by directly observed impulsive child behaviors, examiner commands, and commission errors on the deletion task. From a conceptual framework, the psychosocial and impulsivity dimensions were more likely than the hyperactivity and attention dimensions to discriminate preschoolers with and without ADHD.

This work represents a significant contribution to the field of early preschool

ADHD diagnosis as it provided one of the broadest multidimensional ADHD assessment protocols, with measures of young children's psychosocial, attentional, inhibitory control, and activity functioning. Furthermore, given that preschoolers with delayed language or development were excluded from this study, there is a greater likelihood that the difficulties assessed are actually due to the presence of ADHD and not other comorbid factors. Preschoolers were independently diagnosed with ADHD, the examiner was blind to the final diagnosis of preschoolers, and the behavioral coder was blind to the hypotheses of the study as well as preschoolers' group membership. Finally, the reliability of the behavioral coding as assessed and found to be excellent (kappas ranged from .73 to .99).

Present Study

The results from this recent study by Byrne et al. (in press) were used as a foundation for the present study. The strengths of the previous study were retained (required normal language abilities, screening process, clinical diagnosis, conceptualization of results into dimensions, choice of measures) and the shortcomings were also addressed. First, the sample size was doubled to increase statistical power. Second, groups of ADHD and control preschoolers were more closely matched on SES to ensure that groups would not significantly differ. Third, a parent-rated life event stress scale was added to determine whether increased life events might have contributed to the previously found increased parental stress ratings of parents of children with ADHD. Given Campbell's (1995) interpretation that high adversity and stress among families of preschoolers with externalizing behaviors may be involved as a causal factor in the emergence of the child's

difficulties, other family variables (i.e., SES, life event stress, marital status, family functioning) were incorporated into the design. Fourth, the DSM-IV (APA, 1994) was employed as the current "gold standard" of diagnostic criteria as compared to the use of the DSM-III-R (APA, 1987) in Byrne et al. (in press). Fifth, an indirect measure (parent questionnaire) of the preschoolers' social skills and a direct measure of preschoolers' self-esteem (child-completed) were added to assess group differences on these potentially important psychosocial factors.

Sixth, a parent rating scale, which assessed the preschooler's attention and concentration across a number of settings and activities, was added to provide an assessment of the persistence of the preschoolers' difficulties across settings. Seventh, a parent rating scale of the preschoolers' high-risk or injurious behaviors was added to provide an additional measure of the preschoolers impulsivity, and to assess differences in high-risk behaviors at this early age. Eighth, two developmentally appropriate versions of the Continuous Performance Test were administered so that preschoolers perfomance in the visual and auditory modalities could be compared. In addition, a modified version of the visual search task developed by Byrne et al. (in press) was also used to provide another measure of the preschoolers' self-paced sustained attention and inhibitory control. Finally, preschoolers' behaviors were assessed within varying degrees of structured tasks (high, medium, and low) to optimize the examination of a full range of ADHD behaviors exhibited in a clinic setting.

Rationale

The potential to overidentify or underidentify, to overtreat or undertreat ADHD in

preschoolers will remain until more specific and developmentally appropriate assessment measures and diagnostic criteria are developed which will differentiate between age-appropriate and age-inappropriate levels of impulsivity, activity, inattention, and psychosocial background and functioning (Campbell, 1990a; 1995). Earlier, accurate identification of ADHD, detection of global versus specific deficit patterns, and improved understanding regarding the stability of the disorder is essential to facilitate earlier treatment and prognosis. A close analysis of the pattern and developmental course of the disorder, from its first appearance in the preschool period throughout the lifespan will greatly assist in understanding the primary versus secondary clinical presentation.

Purpose

The main purpose of the present study was to test the clinical validity of a clinic-based ADHD assessment protocol for use with preschoolers. This protocol should be sufficiently broad to assess the multidimensional aspects of ADHD using measures which are developmentally appropriate for young preschoolers, and which share core conceptual and psychometric properties with measures used for older ADHD populations, thereby facilitating study of the developmental course of this disorder.

Methods of Assessment

The present ADHD assessment protocol was designed with the intent to tap the most common multidimensional ADHD characteristics, using a broad based method of assessment. Information about the presence and severity of ADHD symptomatology (i.e., attention, impulsivity, and hyperactivity) and its associated features (i.e., psychosocial

skills) among preschoolers was collected using both direct and indirect measures: (a) direct measures of preschoolers' performance on tasks designed to assess ADHD, (b) direct behavioral observation of "ADHD-like" behaviors in a clinic-based setting, and (c) indirect reports of the child's abilities and difficulties as well as the parent's ratings of their own characteristics using parent-completed rating scales. Each method adds potentially unique information to a comprehensive assessment of the manifestation of ADHD symptomatology among preschoolers.

Direct Measures

There are a number of clinic-based tests of sustained attention and impulsivity which have been widely used with school-age children to evaluate symptoms of ADHD (Barkley, 1990b). The advantage of direct measures is that they provide an objective, potentially less biased assessment than that periodically found in parent and/ or guardian behavioral ratings. Administration of direct tests can be standardized providing a reliable estimate of abilities in a clinic setting (Barkley, 1990b).

However, the use of direct measures as a sole method of assessment is not appropriate given the following limitations. The normative sample and the psychometric properties of these measures are often not well established. Information about the antecedents and consequences of certain behaviors is not assessed, potentially leading to a loss of important information about the functional purpose of ADHD symptoms. At the present time, the interpretation of results may still require clinical inferences because the validity of these measures is still not sufficiently precise, given the absence of normative data on many measures. However, many of these problems can be overcome by

incorporating several other methods of data collection (e.g., direct behavioral observation and parent report) in order to assess the concurrent validity of children's abilities and difficulties (Barkley, 1990b).

Many direct measures have been employed with school-age children referred for an ADHD assessment, and as a result a number of tasks have been developed which reliably discriminate between children with and without ADHD (Barkley, 1990b). The use of direct tests with preschoolers, which are methodologically and conceptually similar to those tests used with school-age children will provide the foundation for longitudinal research, yielding a better appreciation regarding the origin, clinical manifestation, and stability of ADHD characteristics.

Direct Behavioral Observation

Behavioral observations are an important component of an ADHD assessment protocol (Barkley, 1991; Platzman et al., 1992). First, behavioral observations provide objective evidence of a child's reported behavioral and/or attentional difficulties to supplement and, in some cases, to independently verify the information provided by the parent through behavioral questionnaires or through formal psychological interview (Atkins & Pelham, 1991; Barkley, 1990b; 1991). Second, systematic objective behavioral observations may provide additional, and perhaps relatively more ecologically valid information compared to traditional laboratory tests such as tests of vigilance (Barkley, 1990b; 1991; DuPaul et al., 1992). Third, the direct observation and coding of specific, well-defined child behaviors across a variety of tasks or settings, may enable one to ascertain the pervasiveness of these behaviors as well as to identify those behaviors that

are most likely to discriminate (ADHD vs. Non-ADHD) (Platzman et al., 1992).

Nonetheless, the use of behavioral observations in ADHD assessment protocols has been limited (Barkley, 1990b; Platzman et al., 1992). Several reasons for this limited use may be attributed to the relatively high cost to train staff, operationalize behaviors, conduct the session, code and analyse the information obtained from the observational session, a cost that is even higher if more than one setting is to be used (home, school). In addition, the earlier claim that behavioral observations represent a more ecologically valid measure of a child's characteristic behavior than afforded by vigilance tests is not uniformly accepted. Barkley (1990b) discussed the potential problem that arises when the novelty of the observational setting may be sufficiently stimulating to a child and attenuate his or her characteristic behavior. Indeed, parents often report a great deal of frustration when their child fails to exhibit "characteristic" behavior during a clinic visit. However, making observations in multiple settings or activities and on multiple occasions, providing a "warm up" period, and ensuring unobtrusive and natural observations of a child, will increase the likelihood that the child will exhibit more typical and ecologically valid behavior (Barkley, 1990b).

Platzman et al. (1992) conducted a systematic review of studies in which observational measures were incorporated into an ADHD assessment battery. Of the many studies published, the methodology and design of only 39 studies met their reasonable, although not stringent inclusion criteria (i.e., comparison group, participant inclusion criteria, appropriate statistical analyses). In fact, they suggested a cautious interpretation of the findings given the heterogeneity of behaviors targeted, the coding

methods used, the settings in which the behaviors were observed, and the participants' ages. Platzman et al. (1992) concluded that excessive child activity, negative child vocalizations, and off-task child behaviors most clearly differentiated between ADHD and normal controls, behaviors that were particularly discriminating in the classroom setting. Differences in target behaviors across studies is longstanding, sometimes reflecting, in part, an individual researcher's specific hypothesis about the discriminative power of a particular behavior. In addition, because operational definitions of specific target behaviors are either imprecise, or, at the other extreme, very specific and detailed, the behavioral rating code generated may be difficult to implement in other research centres. This is extremely problematic given that it limits the use of a code and the generalizability of findings derived from that code (see Bakeman & Gottman, 1987; Barkley, 1991; Foster, Bell-Dolan, & Burge, 1988; Hartmann & Wood, 1990; Platzman et al., 1992). These findings highlight the need for further study, study which should include appropriate methodology, design, and analyses. In addition, there is need for researchers to agree on a minimal core of 'classic' child behaviors, observed using a core 'classic' method of coding and analysing behavior that would allow more accurate comparisons across studies.

Among the tasks which have been employed in various studies (e.g., free play, structured activity, cooperative activity, simulated school activity, rest period behavior, visual attention, delayed gratification), children's behaviors during free play have most often been observed and have been reasonably successful in differentiating both school-age and preschool children with ADHD from normal control and other clinical groups (e.g., Alessandri, 1992; Byrne et al., in press; Campbell et al., 1982; 1994; Roberts, 1990;

Roberts, Ray, & Roberts, 1984). Children's behaviors in a structured activity have also discriminated children with ADHD from their peers (e.g., Byrne et al., in press; Campbell et al., 1982; 1994; Mariani & Barkley, 1997; Roberts et al., 1984). In addition, children's behaviors during an attention or cognitive test have also successfully discriminated school-age and preschool children with ADHD from peers (e.g., Alberts & van der Meere, 1992; Barkley, 1991; Barkley et al., 1990; Draeger et al., 1986; Harper & Ottinger, 1992; Sykes et al., 1972).

Other observational studies have examined the interactions between parent and child. The findings generally have indicated that children with ADHD can be distinguished from their peers based on these structured observations (e.g., Barkley, 1987; Barkley, Cunningham, & Karlsson, 1983; Cunningham & Barkley, 1979; Mash & Johnston, 1982). This is also the case when child-child interactions are observed when at least one child has been diagnosed as ADHD (e.g., Abikoff & Gittelman, 1985; Cunningham & Siegel, 1987; Klein & Young, 1979; Pelham & Bender, 1982; Wallander, Schroeder, Michelli, & Gualtieri, 1987; Zentall, 1980).

Platzman et al. (1992) noted that given the rapid changes inherent in early neurodevelopment, the few studies of young children, the wide age ranges in studies, and varying inclusion criteria, it is difficult to ascertain the related importance of the manifestation of ADHD within specific developmental phases. That said, there have been several studies in which the samples are more cohesive (i.e., primarily school-age or preschool-age) (e.g., Campbell et al., 1994; Campbell et al., 1986b; Cunningham & Siegel, 1987; Roberts et al., 1984).

Although several coding systems have been employed, the work of Roberts and her colleagues is particularly noteworthy (e.g., Roberts, 1979; 1990; Roberts, Milich, & Loney, 1985; Roberts et al., 1984), given the demonstrated differentiation of not only ADHD and normal control peers, but also from those solely diagnosed with aggression. In an attempt to address the methodological, design, and coding issues earlier noted, Roberts and her colleagues developed a highly structured, multitask observation protocol (i.e., free play, restricted play, restricted academic), using a clear operationally defined behavioral coding system called SOAPS, the Structured Observations of Academic and Play Setting (Roberts, 1979; Roberts et al., 1985). Roberts et al. (1984) and Roberts (1990) found that all three tasks successfully discriminated between hyperactive and control groups and between hyperactive, aggressive, and hyperactive/aggressive groups on certain behaviors. School-age children with ADHD were more fidgety, more frequently out of seat, less on-task, more likely to shift tasks, and generally more active than controls (Roberts et al., 1984). Roberts (1990) found hyperactive school-age children to cross significantly more grids, be more out of seat, shifted tasks more frequently, spent less time on tasks and completed fewer worksheet items compared to children in the aggressive group. Children in the hyperactive + aggressive group also crossed more grids, were out of seat longer, spent less time on-task, completed fewer worksheet items, and were generally more active than children in the aggressive group. Of the three tasks, the restricted academic task was relatively more discriminating, which would not be unexpected given the boys were in school and their behaviors within that setting would likely have been the impetus for referral. This research has highlighted the value of using a

multitask observational protocol in differentiating school-age children with and without ADHD. In the present study, a modification of the SOAPS was used in which a range of well-defined behaviors reflecting preschoolers' inattention, impulsivity, and hyperactivity, were observed.

Tasks in the present study varied in the degree of structure (high, medium, and low) imposed on the preschooler. In the high-structure tasks, continuous interaction between the examiner and the preschooler was required in order for the task to be completed (e.g., language assessment and test of perceived self competence and acceptance). In the medium-structure tasks, after being provided with detailed task instructions about task demands, the preschooler could complete the task independently with no assistance from the examiner. The examiner was prepared to comment or encourage preschoolers if their behavior warranted redirection or command. In two of the three medium-structure tasks, the examiner was in direct view of the preschooler (e.g., preschool deletion task and auditory continuous performance test), whereas, in the third medium-structure task (e.g., visual continuous performance test), the examiner was not in direct view but was monitoring the preschoolers' behavior and prepared to intervene if necessary. In the low-structure task (i.e., play), preschoolers were provided with very little instruction about task demands and their parent was not in direct view of the play area. Although parents were prepared to comment or encourage their child to continue playing if they sought out their parent's attention, their feedback was non-directive.

Indirect Measures

Rating scales have become an important albeit not sufficient component of an

ADHD assessment protocol (Barkley, 1990b; Byrne et al., in press; DuPaul et al., 1992; Edelbrock & Rancurello, 1985). Like any method for collecting assessment data, there are a number of inherent disadvantages as well as advantages in the use of rating scales. Some of the limitations include, vaguely phrased rating items which may be vulnerable to misinterpretation, potential endorsement bias, and failure of rating scales to sufficiently encompass important situational or temporal fluctuations in behavior. In addition, given many rating scales are designed to highlight specific behaviors or topography of behaviors, there may be a concurrent loss of important, at times moderating, information about the child such as the antecedents and consequences of targeted behaviors. Nonetheless, there are numerous advantages in using rating scales, including their relatively time-efficient, cost-effective administration, yielding quantification of typically 'qualitative' descriptions of the individual's symptomatology. Rating scales may reduce the subjectivity of some parents' verbal report by focussing the parent or other rater on specific behaviors, written in a uniform manner for all raters, enabling the collection of information about the frequency and severity of targeted behaviors compared to same age and sex peers (Barkley, 1988; 1990b; 1991; Edelbrock & Rancurello, 1985; Shelton & Barkley, 1994).

Dimensions of Symptomatology

Consistent with the study by Byrne et al. (in press), the current diagnostic protocol included measures which tap each of the core conceptual components of ADHD. The following literature review and summary of the present study was organized according to four ADHD dimensions: attention, impulsivity, hyperactivity, and psychosocial. Barkley

(1991) similarly attempted to organize his results by dimension. Three of these four dimensions represent the hallmark features of the clinical manifestation of ADHD: inattention, poor impulse control, and hyperactivity (e.g., APA, 1994; Barbaresi, 1996; Barkley, 1990b; Barkley et al., 1992; DuPaul et al., 1992; Searight et al., 1995; Shaywitz et al., 1997). The fourth (i.e., psychosocial) dimension includes the range of associated behavioral and social difficulties, reportedly manifested by children with ADHD, along with associated family and parental factors (e.g., Alessandri, 1994; Breen & Barkley, 1988; Campbell, 1995; Mash & Johnston, 1983; Whalen & Henker, 1985).

Attention Dimension

Attention is a multicomponent construct, involving a variety of functions, about which the fields of cognitive psychology, neuropsychology, neurology, neurochemistry, and neurobiology have made enormous contributions (Mirsky et al., 1991). The study of attention is challenging given the variety of processes thought to be involved, the uncertainty as to their corresponding location in the brain, as well as the inherent difficulties in measuring such processes (Ballard, 1996; Barkley, 1997; Posner, 1988). While awaiting the outcome of such investigations, the current need to provide clinical assessment and management for children with attention problems continues.

One of the hallmarks of ADHD is the individual's marked inability to attend to activities and tasks, compared to same age and sex peers (Barkley, 1990b). Although inattention can be exhibited as difficulties with alertness, arousal, selectivity, or distractibility (Barkley, 1990b), impairments in sustained attention are currently considered most evident for children with ADHD (Douglas, 1983).

Direct Measures

The Continuous Performance Test (CPT) and cancellation or deletion tasks have been found to be particularly beneficial in the clinical assessment of attention because they represent a time-efficient, objective measure of attention, which can be compared to clinical interviews, behavioral observations, and the results of standardized questionnaires (Barkley, 1990b). These currently represent an integral part of a multidimensional assessment protocol for ADHD (Barkley, 1990b; 1991; Shapiro & Herod, 1994).

Visual CPT. The CPT involves rapidly identifying (e.g., via button depression) a designated "target" from a series of distracter stimuli. Inattention is typically described using errors of omission -- signals (targets) which the child fails to detect or the child detects but does not respond. Impulsivity is typically described using errors of commission, responses made to no signal (target) (Barkley, 1990b; Campbell, 1995; Corkum & Siegel, 1993; Sostek, Bauchsbaum, & Rapoport, 1980). Errors of commission, reflecting impulsivity will be discussed in a later section (see Impulsivity Dimension).

CPTs have been used for over four decades; the original CPT was developed by Rosvold, Mirsky, Sarason, Bransome and Beck (1956). A multitude of studies employing variations of the CPT now exist, differing in instructions and task parameters (e.g., task duration, inter-stimulus interval, level of processing demands, display time, number of distracters), situational or environmental factors (e.g., noise, temperature), and subject characteristics (e.g., clinical symptoms, demographics) (see Ballard, 1996; Corkum & Siegel, 1993; Losier, McGrath, & Klein, 1996 for reviews). Given such variability in this

large cache of CPTs, it is not unexpected that CPTs have come under scrutiny with respect to the specific parameters and related construct validity (Ballard, 1996; Corkum & Siegel, 1993; Koelega, 1995; Losier et al., 1996).

Notwithstanding the need to conduct further parametric studies, CPTs are widely used and considered a valuable component of a broad-based protocol in assessing ADHD and/or treatment efficacy in school-age children (Barkley, 1990b; 1991; Corkum & Siegel, 1993; Koelega, 1995; Losier et al., 1996). Indeed, the CPT has been shown to be one of the most reliable methods for discriminating children with ADHD from normal children. In one of the most recent reviews of the vast literature on CPTs, Losier et al. (1996) concluded, based on a meta-analysis of the literature, that school-age children with ADHD commit more errors of omission compared to normal controls. However, relatively few studies have examined attention (vigilance) in preschoolers (Campbell et al., 1994; Corkum, Byrne, & Ellsworth, 1995; Harper & Ottinger, 1992; Herman, Kirchner, Streissguth, & Little, 1980; Mariani & Barkley, 1997; Musten, Firestone, Pisterman, Bennett, Youn, & Mercer, 1994).

Corkum et al. (1995) noted three features which make currently available CPTs inappropriate for use with preschoolers. First, CPTs typically require letter or number discrimination, yet many preschoolers may not have fully developed this skill (O'Doughterty et al., 1984). Second, stimuli are typically presented at a rapid rate, that is, the inter-stimulus interval (ISI) may be too short for a preschooler to process the information. Finally, traditional CPTs are designed to tap the limits of sustained attention in school-age children, and as such often exceed the endurance of many preschoolers. In

this regard, several researchers have designed more developmentally appropriate CPTs for use with preschoolers (Campbell et al., 1994; Corkum et al., 1995; Harper & Ottinger, 1992; Herman et al., 1980; Mariani & Barkley, 1997; Musten et al., 1994).

In both the Harper and Ottinger (1992) and Herman et al. (1980) studies, the preschooler was asked to depress a button each time an animal appears on the screen. At varying intervals, a bird appeared on a branch of a tree (Harper & Ottinger, 1992) or a cat appeared in the window of a house (Herman et al., 1980). Harper and Ottinger (1992) found hyperactive preschoolers exhibited significantly more errors of omission than their matched-controls. Herman et al. (1980) studied preschoolers who were and were not exposed to alcohol in utero and failed to find a significant difference in errors of omission on their vigilance task. While these two studies represent an improvement over traditional CPTs by using pictures rather than numbers or letters, reducing task duration, and slowing the rate of stimuli presentation; neither of the tasks included distracter stimuli. Such distracter stimuli are typical of standard CPTs. The absence of such stimuli negate the calculation of commission errors, errors typically calculated in studies of school-age children.

Improving upon this design weakness, Campbell and colleagues (1994) employed a CPT to compare 6 year-old (grade Primary) 'hard-to-manage' boys, with their normal control peers. Children were asked to respond each time a blue square appeared from an array of differently colored (green, blue, orange) shapes (circle, square, triangle). This task also employed picture stimuli, making it more appropriate for younger children. Surprisingly, no group difference in errors of omission were found. It is possible that this

task was too difficult for preschoolers resulting in a floor effect. Although more developmentally appropriate with preschoolers compared to school-age CPTs, the task required the young children to respond after considering not one but two stimulus features (color and shape). In addition, these 6 year-olds were not formally diagnosed with ADHD.

Addressing some of these issues, Corkum et al. (1995) developed a preschool version of the CPT, presenting simple pictures as the target stimulus (i.e., pig's face) and distracter stimuli (i.e., girl's face, lollipop, ice cream cone, sun, flower). In their normative study with typically developing 3 - 5 year-olds, they demonstrated that preschoolers can handle the task demands associated with completing the CPT. In fact, their data confirmed the expected linear developmental progression of performance across age. This developmental study highlights the importance of using an attention measure that was developmentally appropriate, as well as conceptually and procedurally similar to those tests used with school-age children.

Musten et al. (1994) used a modified version of the Gordon Diagnostic System (GDS; 1982), a commercially available CPT often used with school-age children. Preschoolers were asked to depress a button each time a single digit ('1') appeared within a random series of other single digits. In a study investigating the effects of methylphenidate on preschoolers' attention, they found that preschoolers with ADHD exhibited significantly fewer errors of omission when they were taking a high dose (i.e., 0.5 mg / kg) of methylphenidate compared to their baseline performance. As a within-subjects design study, it is not clear how differentiating the GDS (1982) was in regard to

preschoolers with ADHD (untreated) and normal control peers.

Mariani and Barkley (1997), also employing the GDS (1982), found that preschoolers with ADHD exhibited significantly more errors of omission compared to a comparison group. Despite the fact that preschoolers with ADHD had a lower hit rate than a comparison group, Mariani and Barkley (1997) suggested that this task may have been too easy, thereby reducing its discriminative power to differentiate preschoolers with ADHD from those without ADHD. This interpretation needs further discussion and study for several reasons. First, as mentioned earlier, it is not clearly established that preschoolers with or without ADHD can reliably distinguish letters and numbers (O'Dougherty et al., 1984). Second, the control group was not matched to the ADHD group; in fact, the ADHD group had a significantly lower estimated Verbal IQ. Third, the highly stringent inclusion criteria for the normal comparison group[1], may have accentuated group differences and, in turn, may reduce the generalizability of the findings.

In summary, there exist very promising findings regarding the potential use of a visual CPT with preschoolers. Corkum et al. (1995) found that the CPT can be used and understood by preschoolers. Despite a few unresolved issues, recent studies have demonstrated reduced sustained attention (increased omission errors) in preschoolers with ADHD (Harper Ottinger, 1993; Mariani & Barkley, 1997; Musten et al., 1994), although Campbell et al. (1994) failed to find a difference between groups in their sample. Given the previously noted wide use and general clinical validity of the CPT (Barkley, 1990b;

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[1]Normal control children had to score within 1 SD on all scales of the Child Behavior Checklist and Conners Parent Rating Scale-Revised, with the exception that a score within 1.3 SD on the social withdrawal scale was acceptable.

1991; Corkum & Siegel, 1993; Koelega, 1995; Losier et al., 1996) as an important component of a full ADHD assessment protocol, further studies of preschoolers with ADHD have been clearly warranted (Barkley, 1990b; Corkum et al., 1995; Harper & Ottinger, 1992). In the present study, the CPT used by Corkum and colleagues (1995) was used because it was found to be developmentally appropriate for preschoolers and enables scoring of both omission and commission errors.

Auditory CPT. This test also involves rapidly identifying a pre-designated auditory "target" stimulus from a series of auditory distracter stimuli. As is the case for visual CPTs, performance is described using errors of omission (sustained attention) and errors of commission (impulsivity) (Barkley, 1990b; Campbell, 1995; Corkum & Siegel, 1993; Sostek et al., 1980).

Compared to the widely used visual CPTs, there have been fewer studies of attention in the auditory modality using CPTs (see reviews by Ballard, 1996; Cooley & Morris, 1990; Corkum & Siegel, 1993; Koegela, 1995; Losier et al., 1996). In most reviews of the CPT literature, those studies employing auditory CPTs are omitted (Cooley & Morris, 1990; Corkum & Siegel, 1993; Koegela, 1995). Of the auditory CPT studies completed to date, few have been conducted with school-age children with ADHD or a related disorder and no study has been completed with preschoolers who have suspected or confirmed ADHD (e.g., Draeger, Prior, & Sanson, 1986; Keith & Engineer, 1991; Shapiro & Herod, 1994; Sykes et al., 1973; Zentall & Meyer, 1987). Most importantly, there are very few studies that have directly compared auditory and visual CPTs to determine whether attentional impairments are modality specific or pervasive across

modality (Shapiro & Herod, 1994; Sykes, Douglas, & Morgenstern, 1973). Recently, Shapiro and Herod (1994) recommended employing both an auditory and visual vigilance test in the assessment of ADHD in response to their review of the literature.

In an attempt to address the paucity of research conducted with preschoolers, Prather, Sarmento, and Alexander (1995) studied the responses of 3 - 6 year-old typically developing preschoolers on both an auditory and a visual CPT and found high error rates on both tasks. They interpreted this finding as evidence that error rates are inherently high among preschoolers, and as such, concluded that CPTs with preschoolers would not likely yield useful clinical information in assessing impaired attention at this young age (Prather et al., 1995). The absence of a comparison (e.g., ADHD) group serves only to highlight this tenuous conclusion because preschoolers with ADHD may indeed perform differently than normal control preschoolers on this task, thereby providing useful clinical information. In the present study, the auditory CPT developed by Prather et al. (1995) was used given that it appeared to be more appropriate for use with preschoolers (i.e., used animal names with which preschoolers would be familiar) compared to other auditory CPTs used with school-age children (e.g., Sykes et al., 1972; Zentall & Meyer, 1987). Unfortunately, little information about her visual vigilance task was available to enable review of the appropriateness of this task.

Cancellation tasks. In addition to the traditional CPTs, there are several tasks commonly referred to as paper-and-pencil tests of sustained attention or vigilance. In such tests, the child is asked to search and identify (e.g., mark, underline, check) reproductions of the target stimulus from among numerous distracter stimuli, all of which are

simultaneously presented, in contrast to the sequential format of stimulus presentation incorporated in traditional CPTs (Barkley, 1990b). Cancellation tasks typically consist of a matrix of stimuli (usually letters or numbers) organized in a quasi-random fashion and presented on a letter-sized page. The ratio of targets to distracters is high and performance is timed. In the most common version of the cancellation task, the child is required to quickly find and mark with a pencil, all the occurrences of a designated target which is illustrated at the top of the page. Consistent with CPTs (Campbell, 1995; Corkum & Siegel, 1993), performance on this type of task may be described using errors of omission, which are thought to reflect difficulties with sustained attention, and errors of commission, which are thought to reflect impulsive responding (Corkum et al., 1995). In addition, speed of performance (i.e., time to complete task) has been used as a secondary measure of inattention in the adult literature (e.g., Buffett-Jerrott, Stewart, & Teehan, in press).

One of the most valuable aspects of many cancellation tasks is their ecological validity, at least as it relates to assessing school-age children. That is, the paper-pencil format closely parallels academic tasks at the school-age level. In addition, compared to the more mechanical CPTs, cancellation tasks are typically longer, and the stimuli are often more complex (Barkley, 1991). The most commonly employed cancellation task used in ADHD research has been the Children's Checking Test (Margolis, 1972). Children are required to follow along in a booklet as a series of numerals are read from an audiotape, drawing a line through each numeral as it is read and circling any discrepancies between the tape and booklet. Both omission and commission errors can be calculated.

This test has been useful in differentiating school-age children who are experiencing difficulties with sustained attention from those without attentional problems (see Barkley, 1990b; 1991 for discussion).

Despite the fact that cancellation tasks have been widely used with school-age children with ADHD (e.g., Aman & Turbott, 1986; Brown, 1982; Brown & Wynne, 1982; Keough & Margolis, 1976; see Barkley, 1990b; 1991 for review), few studies examined performance using these tasks with preschoolers. Musten et al. (1994) employed a dot-to-dot task while examining the efficacy of stimulant medication in reducing the core symptomatology of ADHD in preschoolers. However, neither low or high doses of methylphenidate yielded improved performance compared to baseline.

Corkum et al. (1995) developed the Picture Deletion Task for Preschoolers (PDTP), which represented an improvement over traditional cancellation tasks in terms of applicability to preschoolers. Corkum et al. (1995) used pictures as stimuli (targets and distracters), decreased the level of motor demands by providing a self-inking stamper (i.e., bingo marker vs. pencil) for identifying targets, developed a training phase to ensure that preschoolers mastered each task demand prior to testing, and lengthened the task to better assess the limits of sustained attention. There were three levels of this task, each progressively increasing in the level of difficulty. The first level required identification of a triangle within an array of shapes, the second level required the identification of a cat within an array of other cats, while the third level required identification of a fish within an array of other fish. Corkum et al. (1995) found the expected developmental linear improvement in performance across chronological age.

Byrne et al. (in press) employed a preliminary version (i.e., using pictures as stimuli) of the PDTP developed by Corkum et al. (1995) in their matched-control study of preschoolers with ADHD. Compared to their controls, the preschoolers with ADHD did not exhibit significantly more errors of omission. Several factors may have affected the results including the fact that, compared to the Corkum et al. (1995) task, the target stimulus changed more frequently, the total task length was shorter, and distracter stimuli may have been more easily distinguishable from the target stimulus. These factors may have made the task too easy (ceiling effect) making it therefore, less powerful in differentiating between the two groups. In the present study, further revisions were made to the PDTP used by Corkum et al. (1995) in order to better assess the limits of preschoolers' sustained attention. The PDTP-R was used to determine whether preschoolers with ADHD would exhibit more inattention than their matched-controls on this newly revised task.

Direct Behavioral Observation

Several observational studies have been conducted in which attention, often described in a variety of ways and observed during various specific activities, was examined. Attention has been measured by the total time spent engaged in play with assigned toys (time play), the number of times shifting between assigned toys (play shifts), the number of play episodes lasting for certain lengths of time (e.g., 20 s, 120 s), the longest duration play with any particular toy (longest duration), and the average duration of play with a toy (i.e., time play / play shifts).

In regard to school-age children with ADHD, the findings to date have been

mixed. Of the studies reviewed by Platzman et al. (1992), only 30% of the studies found group differences (i.e., ADHD vs. Non-ADHD) in their measures of shift in activity. Roberts et al. (1984) found differences in task shifts during restricted academic tasks, and in a restricted play task; however, task shifts did not differentiate school-age children with hyperactivity from normal controls during free play.

The preschool findings appear to be relatively more convergent than the school-age studies. Alessandri (1992) found preschoolers with ADHD spent less total time engaged in play, and more time engaged in transitional activities, compared to their matched-control peers. Campbell et al. (1991a; 1994) found 'hard-to-manage' preschoolers more frequently shifted play and played with toys for fewer 20 second and 120 second intervals compared to controls. In contrast, Byrne et al. (in press) did not find that preschoolers with ADHD more frequently shifted their attention between toys than their matched-control peers.

The findings from these studies should be cautiously interpreted. First, the findings are based on the notably few studies conducted with preschoolers. Second, there are numerous methodological and procedural differences among even this small number of studies, including differences in sample size, participants' ages, duration of observation period, different operational definitions of target behaviors, differences in observational setting and protocol, and most importantly, differences in sample composition (ADHD vs. 'hard-to-manage'). Further study of preschoolers' attentional patterns during independent play is needed. In the present study, the Byrne et al. (in press) protocol was modified and re-applied with a larger sample.

Indirect Measures

As described earlier, questionnaires or systematic parent ratings are a valuable component of a multidimensional, multimethod protocol (Barkley, 1990b; Byrne et al., in press; DuPaul et al., 1992; Edelbrock & Rancurello, 1985). The attention problems scale on the Child Behavior Checklist (CBCL) predominately encompasses inattentive behaviors. Studies have shown a relationship between this attention problems scale and a diagnosis of ADHD in community and clinical samples (Edelbrock & Costello, 1988; Shekim et al., 1986). School-age children with ADHD received significantly higher ratings on the attention problems scale compared to controls (e.g., Anastopoulos et al., 1992; Breen & Barkley, 1988). Preschoolers with ADHD have also been found to exhibit more attention problems compared to same age and sex normal controls using the CBCL (Byrne et al., in press), while other preschool studies do not report findings for individual CBCL scales (Campbell, 1994; Mash & Johnston, 1983).

Attention problems. Chen, Faraone, Biederman, and Tsuang (1994) confirm the relationship between the clinical scales of the CBCL and a DSM-III-R (1987) structured interview diagnosis of ADHD in school-age children. In particular, the attention problems scale was determined to have excellent discriminant capacity and the authors suggest that this scale may help to identify cases likely to meet criteria for ADHD. Although the CBCL inattention factor is so labelled, and is thought to reflect inattention (e.g., can't concentrate, confused, daydreams, poor school work), a few of the items appear to also reflect the constructs of impulsivity and hyperactivity (e.g., acts without thinking, can't sit still).

Home situations. The Home Situations Questionnaire, Revised (HSQ-R; DuPaul, 1990) was specifically designed to assess the pervasiveness and severity of attention problems, rather than general behavior problems, across different situations (e.g., home and school) (Barkley, 1990b; DuPaul & Barkley, 1992). This cross-situational focus is important given the requirement that attentional problems be evident across settings for a diagnosis of ADHD (DSM-IV; APA, 1994). DuPaul and Barkley (1992) found that the HSQ-R provided unique assessment data compared to the frequently employed Conners Parent Rating Scale and CBCL. The HSQ-R could be seen as a "purer" measure of inattention which is not contaminated by the traditional ratings of disruptive behaviors. At least among school-age children, the HSQ-R is a reliable parent questionnaire and a valid measure of attention problems. Parent ratings on this scale were found to be significantly correlated with parent and teacher ratings on a number of criterion measures of ADHD (DuPaul & Barkley, 1992). However, it does not appear that the HSQ-R has been employed with preschoolers to date. Although it was not designed for this age group, all items except, "when asked to do homework" are developmentally appropriate for preschoolers. The present study examined the validity of this measure with preschoolers.

Impulsivity Dimension

Impulsivity is defined as a deficiency in the ability to inhibit a response to situational demands. Impulsiveness may be exhibited when actions are executed too quickly, in an illogical manner, or when actions cannot be withheld while deliberations occur. In some situations an impulsive response pattern may reflect an overbearing need to obtain immediate gratification. In some situations, an impulsive response pattern may

not be able to be stopped once started, even if unpleasant consequences are likely (Schachar, Tannock, & Logan, 1993).

It is widely accepted that children with ADHD exhibit more behaviors that suggest greater impulsivity when compared to peers of the same age and sex, although the specific aspects of impulsivity that prove problematic for children with ADHD are still debated (Barkley, 1990b; Schachar et al., 1993). Along with other researchers such as Milich and Kramer (1986), Schachar and his colleagues (i.e., Schachar & Logan, 1990; Schachar et al., 1993; Schachar, Tannock, Marriott, & Logan, 1995) differentiate the construct of impulsivity from inhibitory control. They suggest that impulsivity is a behavioral construct, while inhibitory control is a cognitive construct, and they propose that deficient inhibitory control leads to the behavioral manifestation, called impulsivity (Schachar et al., 1993). They contend that the overlap of these constructs makes it difficult to delineate the specific nature of "impulsive" impairments among children with ADHD (see Shaywitz et al., 1997 for further discussion). While the resolution of this debate is being examined, the impulsivity construct will be referred to as a unidimensional one. For the purpose of the current review and study, impulsivity will be measured by both cognitive and behavioral means as is typically the case at the present time (e.g., APA, 1994; Barkley, 1990b; 1991; 1997).

Direct Measures

Visual CPT. As noted earlier, a laboratory-based measure of impulsivity (CPTs) continue to be widely used and are considered a valuable component of a broad-based protocol in assessing ADHD and treatment efficacy in school-age children (Barkley,

1990b; 1991; Corkum & Siegel, 1993; Koelega, 1995; Losier et al., 1996). Indeed, the meta-analysis of the CPT literature conducted by Losier et al. (1996) indicated that school-age children with ADHD exhibit more errors of commission (i.e., impulsivity errors) than normal controls.

However, like studies of inattention, few studies have employed the CPT to examine impulsivity among preschoolers for reasons described earlier (Campbell et al., 1994; Corkum et al., 1995; Mariani & Barkley, 1997; Musten et al., 1994). Of the few studies conducted using the CPT with preschoolers with ADHD, Campbell et al. (1994) found a significantly higher number of commission errors among preschoolers identified as 'hard-to-manage' compared to their matched-control peers. As noted earlier, errors of omission (i.e., inattention errors) did not discriminate between the groups. This pattern of more errors of commission and no difference in errors of omission is similar to that found by Byrne et al. (in press) using a cancellation task with ADHD versus matched-control preschoolers.

In their medication study of preschoolers, Musten et al. (1994) did not find that stimulant medication yielded a significant reduction in the number of errors of commission using the GDS (Gordon, 1982). Similarly, Mariani and Barkley (1997) failed to find errors of commission to distinguish preschoolers with ADHD from a comparison control group, also using the GDS. As noted earlier, Mariani and Barkley (1997) suggested that ease of task requirements significantly reduced the discriminative power of the GDS. However, their use of an unmatched (verbal IQ) control group, highly restrictive inclusion criteria for controls, and the possibility that preschoolers could have difficulty

discriminating numbers suggest the need for further study. Addressing some of these issues, Corkum et al. (1995) demonstrated that typically developing 3 - 5 year-old preschoolers exhibit predictable linear age-related improvement in errors of commission (i.e., fewer impulsivity errors with increasing age).

In summary, the findings regarding the use of a visual CPT with preschoolers to measure impulsivity are mixed (Campbell et al., 1994; Mariani & Barkley, 1997; Musten et al., 1994). The developmental appropriateness of the CPTs employed in the clinic studies is questionable and therefore the results must be interpreted with caution. However, Corkum et al. (1995) demonstrated that typically developing preschoolers can understand and engage in an age-appropriate CPT. Given the previously noted wide use and demonstrated clinical validity of the CPT with school-age children (Barkley, 1990b; Corkum & Siegel, 1993; Koelega, 1995; Losier et al., 1996), as a measure of impulsivity and as an important component of a full ADHD assessment protocol, further studies of preschoolers with ADHD are clearly warranted (Barkley, 1990b; Corkum et al., 1995; Mariani & Barkley, 1997).

Auditory CPT. As indicated earlier, there have been fewer studies of impulsivity using auditory CPTs (see reviews by Ballard, 1996; Cooley & Morris, 1990; Corkum & Siegel, 1993; Koegela, 1995; Losier et al., 1996). Of the studies employing an auditory CPT, few studies have been conducted with school-age children with ADHD, and no study has been completed with preschoolers with ADHD (e.g., Draeger et al., 1986; Keith & Engineer, 1991; Shapiro & Herod, 1994; Sykes et al., 1973; Zentall & Meyer, 1987). Shapiro and Herod (1994) concluded that there is strong evidence to support the use of

tests of auditory vigilance in addition to visual vigilance. They found commission errors on auditory vigilance tests to discriminate between children with and without ADHD better than commission errors on the traditionally employed visual vigilance tests. They suggested that this was partly because the auditory CPT is a relatively more ecologically valid task than the visual CPT with reference to the typical demands in the classroom (e.g., following teacher's verbal instructions). Similarly, Sykes et al. (1973) suggested that children with and without hyperactivity are more likely to respond to visual stimuli than they are to auditory stimuli.

Prather et al. (1995) studied the responses of 3 - 6 year-old typically developing children and suggested that because preschoolers commit so many errors, an auditory and visual vigilance task do not yield useful clinical information in assessing attention and impulsivity among preschoolers. However, their tasks have not been tested on preschoolers with ADHD which has prevented an examination of the discriminative validity of the CPT within the auditory modality. Furthermore, they did not specifically address the pattern of impulsive responding on their CPTs. In the present study, the discriminant validity of the Prather et al. (1995) auditory CPT was tested by comparing preschoolers with and without ADHD.

Cancellation tasks. As described earlier, a variety of cancellation tasks currently exist (Barkley, 1990b). One of the more frequently used cancellation tasks with school-age children is the Children's Checking Test (Margolis, 1972). Errors of impulsivity on the Children's Checking Test has been found to successfully differentiate school-age children with ADHD from their peers (Aman & Turbott, 1986; Brown, 1982; Brown &

Wynne, 1982). In addition, the Matching Familiar Figures test (MFFT; Kagan, 1966) has been used as a measure of early impulsivity. The MFFT requires that the child choose the matching pictures from an array of six very similar variants. The MFFT, which has more often been used to measure cognitive strategies or styles (e.g., reflectivity vs. impulsivity; see Kagan, 1976 for review and discussion) and provides a measure of impulsivity (i.e., wrong choices), but not inattention. Results using this task have been conflicting, with neither its ability to discriminate children with ADHD from their peers or its ability to detect stimulant drug effects having been clearly established (Barkley, 1990b). In fact, Barkley (1990b) recommended the MFFT should not be used in clinical practice when making diagnostic decisions about ADHD in children.

Recently, Mariani and Barkley (1997), employing a preschool version of the MFFT, found that 'hard-to-manage' 6 year-olds exhibited significantly more errors of commission (greater impulsive responding) than comparison controls. This finding is encouraging; however, given the previously noted critique of the MFFT by Barkley (1990b), as well as the fact that sustained attention cannot be assessed using this task, suggests that the issue warrants further study.

As discussed earlier, most cancellation tasks used to date are not appropriate for preschoolers. However, the normative study by Corkum et al. (1995) demonstrated that typically developing preschoolers could handle the task demands associated with a developmentally appropriate deletion task. Byrne et al. (in press) employed a preliminary version of the picture deletion task (used by Corkum et al., 1995) in their study of preschoolers with ADHD. Consistent with findings by Mariani and Barkley (1997),

preschoolers with ADHD exhibited significantly more errors of commission on their picture deletion task. Although Byrne et al. (in press) questioned whether the task was too easy and too interesting to adequately assess the limits of preschoolers' sustained attention, it did appear to confirm the impulse control deficiencies associated with ADHD. In the present study, a further revised version of the Corkum et al. (1995) PDTP (i.e., task was lengthened to better tap the limits of sustained attention) was used to determine whether preschoolers with ADHD could be differentiated from their matched-controls in terms of their level of impulsivity.

Direct Behavioral Observations

One of the hallmarks of early neurodevelopment is children's increasing ability to inhibit or self-regulate their behavior. Inattentive or impulsive behavior can be observed in a variety of settings, manifested in an equally varied manner including, spontaneous verbalizing, grabbing, engaging in off-task behaviors, or engaging in unsanctioned activities. Although there is continued debate as to the shared origin or pathway of impulsivity with inattention and/or hyperactivity (see Barkley, 1997; Mirsky et al., 1991; Shaywitz et al., 1997 for discussion), most researchers in this field of study would consider the above-noted behaviors to be more heavily influenced by impulsivity than by inattention and/ or hyperactivity.

The frequency of child spontaneous vocalizations among school-age children does not consistently differentiate children with hyperactivity from their peers; for example, Roberts et al. (1984) did not find any difference between children with and without hyperactivity on this behavior. Platzman et al. (1992) found the frequency of

verbalizations to distinguish between children with and without ADHD in 31% of the studies in which this behavior was assessed. However, when the frequency of negative vocalizations (i.e., negative quality) is assessed, the differentiation between children with and without ADHD increases to approximately half of the studies reviewed (Platzman et al., 1992). Frequency of off-task behaviors also fairly consistently discriminated between ADHD children and controls (Platzman et al., 1992). Roberts et al. (1984) found children with hyperactivity spent significantly less time on-task than normal controls during all three of their observational tasks (free play, restricted play, and restricted academic).

In regard to the few studies conducted with preschoolers, Campbell et al. (1982) and Harper and Ottinger (1992) found that preschoolers with ADHD spent more time engaged in off-task behaviors during medium structure tasks (e.g., CPT and preschool vigilance task). Campbell and her colleagues (1982; 1994) found that 'hard-to-manage' preschoolers exhibited less inhibitory control when asked to delay a response in their 'hidden cookie' task (1982; 1994), and their 'off-limits' train task (1994). In the first task (delay-of-gratification), preschoolers had to wait for an instruction to search for a hidden cookie (Campbell et al., 1982; 1994). In the second task (resistance-to-temptation), preschoolers who were briefly exposed to a highly desirable battery-operated train, were subsequently asked to wait for an experimenter to return before they could play with the train (Campbell et al., 1994). Both tasks have shown moderate success in discriminating between a group of 'hard-to-manage' preschoolers and normal controls. The 'hard-to-manage' preschoolers made more impulsive responses during the cookie task and were also more likely to touch and quicker to touch the train during the delay interval

(Campbell et al., 1982; 1994).

Although these findings are encouraging, there are a number of procedural issues upon which one might improve in order to maximize the discriminative power of such 'inhibitory tasks'. For example, preschoolers in the Campbell studies were not provided with an alternative task while waiting out delay intervals. It is possible that without the option to engage in an alternative activity while waiting for the end of the delay period, the relatively underdeveloped inhibitory control of most young preschoolers might be insufficient. This might result in an overall higher rate of disinhibition and yield a higher false positive rate for clinical screening. In addition, Campbell and her colleagues tested 'hard-to-manage' preschoolers rather than preschoolers with ADHD. In response to this procedural issue, Byrne et al. (in press) presented an alternative task for preschoolers to engage in while inhibiting their desire to play with the unsanctioned toys. They modified the free play task by imposing a single restriction on preschoolers. While preschoolers were permitted to play with any one of four, three-toy sets during the 30-min unstructured task, they were told not to play with a fifth, three-toy set which was left behind by another child. Byrne et al. (in press) found that 77% of preschoolers with ADHD and 0% of their matched-control, normal peers played with the unsanctioned toys. The preschoolers with ADHD also more frequently grabbed test materials and toys during a structured task compared to controls. However, the preschoolers' impulsivity did not manifest in other behaviors such as more spontaneous verbalizations, found to be associated with school-age children diagnosed with ADHD (Platzman et al., 1992).

Although not representing the major focus of their study, Mariani and Barkley (1997) included behavioral observations (i.e., off-task, fidgets, out-of-seat, verbalizations, and plays with objects) during both their two attention-vigilance tasks (i.e., GDS; chip-sort). However, they reported their observational findings as composite scores, which Mariani and Barkley (1997) suggested would reflect an 'estimate of ADHD behaviors'. Preschoolers with ADHD exhibited significantly more of these "ADHD-like" behaviors during both tasks. Nevertheless, this 'estimate' precludes an examination of those particular behaviors which may be more frequent among preschoolers with ADHD, thereby leaving undetermined the relative contribution of inattention, impulsivity, and hyperactivity to this clinical profile. Such composite estimates also preclude comparison with previous preschool and school-age studies.

In summary, the limited number of preschool ADHD studies, and the variability in the findings to date, indicate the need for additional behavioral observation studies with preschoolers, including measures of disinhibition (i.e., impulsive behaviors). Although preschoolers with ADHD do not appear to verbalize more often than their control peers on unstructured tasks (e.g., Byrne et al., in press), preschoolers with ADHD do exhibit more impulsive responses during delay-of-gratification and resistance-to-temptation tasks (Campbell et al., 1982; 1994), are more likely to play with unsanctioned toys during an unstructured task (Byrne et al., in press), are more likely to engage in off-task behaviors during structured tasks (Campbell et al., 1982; Harper & Ottinger, 1992), and are also more likely to be disinhibited (grab) during a structured task (Byrne et al., in press). The

evidence that preschoolers with ADHD exhibit behavior which suggest they are more impulsive than normal controls is increasing. In the present study, measures of impulsivity during several tasks varying in the degree of structure were included to compare the conditions under which preschoolers with ADHD were more likely to exhibit impulsive behavior compared to matched-controls.

Indirect Measures

Injury behavior. There has been growing interest in determining risk factors for childhood injury, largely because injuries are the leading cause of death and a major cause of disability among children between 1-14 years of age (Bijur, Stewart-Brown, & Butler, 1986; Davidson, 1987; Mori & Peterson, 1995; Rivara, 1995). Children with "behavior problems" have been identified as being at greater risk of sustaining injuries than their peers (Davidson, 1987; Hartsough & Lambert, 1985; Lyman & Hembree-Kigin, 1994; Rivara, 1995; Speltz, Gonzales, Sulzbacher, & Quan, 1990).

Barkley (1990b) has suggested that children with ADHD are more likely to encounter accidents and subsequent injuries as a result of their overactive, inattentive, and impulsive pattern of behaviors. Commonly employed behavior checklists used with children with ADHD (Child Behavior Checklist, Conners Parent Rating Scale) lack the specificity necessary to discriminate problem behaviors with varying degrees of injury risk (Speltz et al., 1990). Speltz et al. (1990) developed a reliable parent-completed checklist of specific "risky" behaviors for toddlers and preschoolers which enable the assessment of injury risk among young children (Injury Behavior Checklist [IBC]). The IBC discriminated children who had been injured two times or more from those who had never

or only once been injured.

Many of the "risky" behaviors listed in the IBC appear likely to emerge out of difficulties with impulse control or hyperactivity. The overall category of "risk-taking" behavior is thought to best describe deficient inhibitory control. In the present study, the IBC was used as an indirect measure of impulsivity, to determine whether preschoolers with ADHD are more likely to engage in "risky" behaviors than their matched-control peers.

Demandingness. Of all the individual subscales of the Parent Stress Index (PSI) and a parent self-esteem rating scale, the demandingness factor (PSI) has been found to be one of the best discriminators of a child's ADHD group status (Mash & Johnston, 1983). High scores on the demandingness subscale result when the parent experiences the child as placing many demands on him or her. The factor is seen as a reflection of the child's apparent inability to inhibit requests on demand (Abidin, 1995). The demands are often quite diverse and may result from crying, whining, frequent requests for help, hanging on to parent, as well as a high frequency of minor behavior problems (Abidin, 1995). Parents of school-age and preschool-age children with ADHD frequently rate their child as being significantly more demanding than normal controls, though no more demanding than other clinical groups (Breen & Barkley, 1988; Donenberg & Baker, 1993; Mash & Johnston, 1983).

Hyperactivity Dimension

Hyperactivity is defined as excessive or developmentally inappropriate levels of activity (Barkley, 1990b; Shapiro & Herod, 1994). Hyperactive behaviors often consist of

restlessness, fidgeting, getting out of seat, or unnecessary gross motor movements. These movements are typically irrelevant to the activity or situation in which the child is engaged (Barkley, 1990b). There is a great deal of debate about whether this dimension of ADHD is truly separate from the impulsivity dimension. Although a consensus has not been reached, Achenbach & Edelbrock (1983) as well as Milich & Kramer (1986) were unable to differentiate separate factors for Impulsivity and Hyperactivity in their studies. Barkley (1997) has been advocating to combine these difficulties into one deficit "behavioral disinhibition" yet the empirical support for this position is not offered. This dimension has traditionally been recognized as a core area of deficit among children with ADHD distinct from impulsivity (APA, 1987; Barbaresi, 1996; Barkley, 1990b; Shapiro & Herod, 1996; Shaywitz et al., 1997) and as a result is separately presented and separately analysed in the present thesis.

Direct Behavioral Observations

School-age children with hyperactivity have been shown to be more active, more frequently out of their seats, and more fidgety than controls while engaged in unrestricted play, restricted play, and restricted academic activities (e.g., Roberts et al., 1984). School-age children with ADHD have also been shown to exhibit significantly longer periods of excessive motor (limb) activity while engaged in specific attention tasks (e.g., CPT) than their control peers (Alberts & van der Meere, 1992; Draeger et al., 1986). These findings have also been confirmed in more naturalistic settings (e.g., Porrino et al., 1983).

Relatively few studies have examined activity level of preschoolers with suspected

or diagnosed ADHD (Byrne et al., in press; Campbell et al., 1982; 1994). Although Campbell and her colleagues studied 'hard-to-manage' and not ADHD preschoolers, they found that the 'hard-to-manage' preschoolers were more often out of seat during the course of structured activities, but not during unstructured activities (e.g., free play) (Campbell et al., 1982). More recently, Campbell et al. (1994) found 'hard-to-manage' preschoolers accrued higher actometer scores (inferred hyperactivity based on child's activity as measured by the actometer device worn around the child's waist) irrespective of setting (home; laboratory).

Using a behavioral observation method rather than actometers, Byrne et al. (in press) did not find preschoolers with ADHD to be any more active than normal controls during a low-structure (play) or a high-structure (standardized test) task. Preschoolers with ADHD did not more often get out of seat, fidget, or move around the playroom. These conflicting results with preschoolers may be related to the different samples (e.g., ADHD vs. 'hard-to-manage'), and/ or different measures (actometers - limb movement vs. excess mobility - around play area). In the present study, the Byrne et al. (in press) protocol was modified to measure activity (i.e., out of seat [up/down], grid changes [around room], and extraneous body movements [within seat]) during several tasks varying in degree of structure (low, medium, high).

Psychosocial Dimension

In addition to measures of the core symptoms of ADHD, a comprehensive ADHD assessment battery should include measures of psychosocial functioning given the frequency of associated behaviors and difficulties (e.g., peer rejection, comorbid problems,

parental stress, poor self-esteem) among children with ADHD (Atkins & Pelham, 1991; Shelton and Barkley, 1994).

Direct Behavioral Observation

Direct behavioral observations of school-age children while working in a cooperative fashion with an adult on a set of tasks have shown boys with hyperactivity to be less compliant and more negative toward their mothers compared to their peers (e.g., Barkley, 1987; Barkley et al., 1983; Cunningham & Barkley, 1979; Mash & Johnston, 1982).

Among preschoolers, high maternal behavior ratings of hyperactivity and aggression have been found to be associated with more negative and directive maternal behaviors as well as noncompliant child behavior during an interactive task (Campbell, 1994; Campbell et al., 1986a; 1986b; 1991b). This research suggested that this pattern of behaviors persisted from age 3 - 6 years.

In the present study, the interaction between the preschooler and the examiner was assessed by measuring the frequency of examiner commands during various tasks. Given that the examiner had no preexisting relationship with the child, this measure would result in a different pattern of interaction than might be assessed between the child and his or her parent. However, the examiner's response to the child is more likely to reflect a preschool teacher's behavior toward the child. In addition, the examiner employed an extremely consistent approach to testing children which is likely to reduce the method variance that influences results of parent interaction studies. Examiner commands were issued in response to a broad range of preschoolers' behaviors, including behaviors tapping each of

the following dimensions: impulsive (e.g., the preschooler grabbed for the bingo marker when the examiner was demonstrating its use), inattentive (e.g., the preschooler was not responding to a question or request), and hyperactive behaviors (e.g., the child was getting out of seat during testing); however, examiner commands were coded as a generic category and not designated according to the child's behavior exhibited. The examiner's response to preschoolers in a structured testing situation was previously assessed by Byrne et al. (in press) who found that preschoolers with ADHD received significantly more commands from the examiner than same age and sex normal control preschoolers. The frequency of examiner commands were assessed across a number of tasks varying both in the inherent structure of the task (high and low) and the presence of the examiner (present and absent).

Indirect Measures

Behavioral symptomatology. The Child Behavior Checklist (CBCL) and the Conners Parent Rating Scale (CPRS) are the most widely used behavior rating scales in ADHD research and clinical practice. Both instruments have empirically derived factor clusters and empirically demonstrated discriminative power (e.g., ADHD vs. other psychopathology) (DuPaul & Barkley, 1992). Of these two standardized questionnaires, the Conners Rating Scale has been more widely used, particularly as a valid, cost-effective, screening for ADHD (Edelbrock & Rancurello, 1985). The CPRS has also been sensitive to stimulant drug effects, parent training in child management, and self-control training of hyperactive school-age children (see Barkley, 1990b; Barkley et al., 1988; Horn, Ialongo, Popovich, & Peradotto, 1984; Pollard, Ward, & Barkley, 1983).

The CBCL was designed as a screen for general childhood psychopathology. School-age children with ADHD have been rated by their parents, using the CBCL, as being behaviorally challenging in both the externalizing and internalizing domains; however on average, the internalizing scores often do not fall within the clinical range and are typically lower than the externalizing scores. Depending on clinic sample characteristics, the two scores have been found to be positively correlated (e.g., Barkley et al., 1990; Breen & Barkley, 1988; Hinshaw, Han, Erhardt, & Huber, 1992; see Achenbach and Edelbrock, 1983 for psychometric properties of the CBCL).

Behavior rating scales have typically been administered to parents of school-age children, with only recent focus on preschoolers (Barkley, 1990b; Byrne et al., in press; Campbell, 1985; 1990; 1995; Hinshaw et al., 1992; Mash & Johnston, 1983). Mash and Johnston (1983) found that both 5 year and 8 year-old children identified as hyperactive presented with significant elevations on the CBCL externalizing, internalizing, and social problems factors compared to their non-ADHD peers. Three to five year-old preschoolers with ADHD were rated significantly higher on the CBCL externalizing, internalizing, social problems, attention problems, and aggressive behavior factors compared to their non-ADHD peers (Byrne et al., in press).

Several of the studies conducted with preschoolers with suspected or confirmed attentional problems have employed other parent rating scales to assess preschoolers' behavior. In a series of cohort studies, Campbell and her colleagues (1982; 1984; 1986a; 1986b; 1986c; 1991a; 1991b; 1994) have investigated the stability of problem behaviors using a variety of methods, including behavior rating scales (i.e., the Behar Preschool

Behavior Questionnaire and the Werry-Weiss Activity Scale). Campbell et al. (1982) found that 2-3 year-old behavior-problem toddlers/ preschoolers were rated as more hyperactive, hostile-aggressive, and active than their no-problem peers. This profile was unchanged one year later; however, at this time, preschoolers were rated as less active than they were one-year previously (Campbell et al., 1984). In their second cohort series, 4 year-old 'hard-to-manage' preschoolers were rated by teachers and parents as being more hyperactive, aggressive, noncompliant and inattentive than controls (Campbell et al., 1991b), a profile that persisted 2 years later (Campbell, 1994). Moreover, Campbell (1995) concluded that adult ratings of child behavior have generally shown satisfactory concurrent validity when compared to observations of the child at home, in preschool, in play groups, and in the laboratory.

In the present study, parents of preschoolers were administered the Child Behavior Checklist (dependent measure) and the Conners Parent Rating Scale (inclusion/ exclusion criteria) to assess preschoolers' externalizing and internalizing symptomatology.

Social difficulties. Children with ADHD have durable, recurrent, pervasive, and often escalating social difficulties (Whalen & Henker, 1985). For many children, escalating peer problems are often the main reason they are first brought to the attention of professionals (Cunningham, 1990). The "ADHD-like" behaviors of these children may increase the likelihood of receiving negative sanctions from peers and ultimately, for some children, may lead to social rejection (Cunningham & Siegel, 1987; deHaas, 1986; Milich, Landau, Kilby, & Whitten, 1982; Olson & Brodfeld, 1991; Rubin & Clark, 1983). Rejected preschoolers, compared to their peers, are more aggressive, destructive, and

dominating, engage in more solitary or rough and tumble play, and in fewer prosocial behaviors (Guevremont, 1990). Of particular note, problem boys who are rated as less socially competent than their peers by their parents and teachers, do not rate themselves as less socially competent (Campbell, 1994). This finding attests to the frequent observation that children with ADHD do not exhibit age-appropriate awareness of self and the needs and perceptions of others (Whalen & Henker, 1985). The importance of social competence and peer acceptance is highlighted by the findings of Denham and Holt (1993) who found a relationship between a child's rating of 'likeability' by peers, and his or her friendliness, cooperation, and nonaggression as rated by teachers. Parker and Asher (1987) found early maladjustment of peer relationships significantly increased children's risk for encountering maladjustment and poor self-esteem in later life (see also Campbell & Paulauskas, 1979; Denham & Holt, 1993; Olson & Brodfeld, 1991; Weiss & Hechtman, 1993). Despite the frequently acknowledged social adjustment problems experienced by many young children with ADHD, assessment of social adjustment problems is often relegated to a low priority status in an ADHD assessment protocol (Whalen & Henker, 1985), possibly due to their designation as associated features of ADHD (APA, 1994). In the present study, parents of preschoolers were administered a social skills rating questionnaire to assess the prosocial behaviors exhibited by the preschoolers.

The preschool period is a crucial phase within which the child is afforded numerous opportunities to develop self-esteem. It is also a phase of development during which, not surprisingly, the brain undergoes unparalleled rapid growth, including substrates that are necessary for the perception, processing, and appreciation of social

cues, and a burgeoning sense of self and a sense of how one's behavior affects reciprocity in social situations (Campbell, 1989; 1990). Poor self-esteem as adults has been linked to failure in social and academic areas (Weiss & Hechtman, 1993). Adolescents and young adults who had a childhood diagnosis of ADHD continue to show lowered self-esteem, even when symptoms of the disorder no longer meet diagnostic criteria (Slomkowski et al., 1995). While 6 year-old children earlier identified as 'hard to manage' did not appear to exhibit lowered self-esteem (Campbell, 1994), preadolescents with ADHD did (Kelly et al., 1989). Early identification of social and self-esteem problems, clarification of the relationship between these difficulties and ADHD, and subsequent early intervention may prove to circumvent further problems, improving the quality of life and prognosis for children with ADHD (Bierman & Montminy, 1993). In the present study, preschoolers were administered a direct test of self-competence and social acceptance in order to assess their self-perceptions.

Parent stress. Parents of children with ADHD often experience greater stress in their parenting role than do parents of children without ADHD (e.g., Anastopoulos et al., 1992; Breen & Barkley, 1988; Byrne et al., in press; Campbell, 1994; Campbell et al., 1991a; Donenberg & Baker, 1993; Mash & Johnston, 1983). Campbell (1995) concludes in her review of the literature that children with significantly challenging behavior problems in early childhood are more likely to come from dysfunctional families (e.g., high stress, presence of familial psychopathology) (see Cunningham, Benness, & Siegel, 1988; Lahey et al., 1988). She further postulates that the combination of child behavior problems and unsupportive families are most likely to predict problems that persist into

school-age (Campbell, 1994; Campbell et al., 1991a). An alternative interpretation is that children with behavior problems are more likely to impose high levels of demands on the family which result in greater parental stress and/ or familial dysfunction (Anastopoulos et al., 1992; Barkley, 1990b; Mash & Johnston, 1990). This, in turn, could influence the persistence of behavior problems. Indeed, the relationship between behavior problems and family adversity seem to illustrate a vicious cycle.

Mash and Johnston (1990) examined the relative contributions of the environment, child characteristics, and parent characteristics to parent-child stress. In contrast to the view of Campbell (1995), they found that the major source of parental stress arose from the primary characteristics of the child with ADHD, characteristics leading to associated academic and social disruptions. Most researchers agree that higher parental stress among families with children with ADHD is likely to arise from the interplay of the child's and the parent's characteristics, as well as environmental influences. It is the relative weighting of each contributor that is still unresolved (e.g., Anastopoulos et al., 1992; Breen & Barkley, 1988; Campbell, 1994; Campbell et al., 1991a; Donenberg & Baker, 1993; Mash & Johnston, 1983; 1990). It is therefore important to consider these factors when assessing ADHD, designing therapeutic programs, and formulating a prognosis.

Compared to school-age samples, fewer studies have examined the pattern of stress in parents of preschoolers with similar attentional and behavioral difficulties (e.g., Byrne et al., in press; Campbell, 1994; Campbell et al., 1991a; Donenberg & Baker, 1993; Mash & Johnston, 1983). As yet, the early presence and pattern of stress and the impact on the overall functioning of families with recently diagnosed preschoolers with ADHD

has not been clarified.

Campbell et al. (1986a), consistent with Cohen and Minde (1983) and Schleifer et al. (1975) found that severity of maternal-rated child symptomatology was positively associated with severity of family stress and disruption. More specifically, Campbell et al. (1986a) employed a rating system for the determination of family disruption based largely on demographics, social status, and life event stress. They found that lower social class, ongoing family stress, as well as a difficult mother-child relationship contributed significantly to intake and followup ratings of hyperactivity and aggression. They concluded that low maternal tolerance could not solely account for high behavior ratings because the problem-rated children were observed to be more negative, noncompliant, and inattentive during a direct assessment in the laboratory. Early externalizing problems were predicted to be more likely to persist within the context of family disruption and a negative mother-child relationship.

Although these findings are of notable merit, the Campbell et al. (1986a) interpretation may afford unwarranted weighting on family disruption and the maternal-child relationship as the best predictor of persistent problems; especially given that these family ratings were associated with initial behavior ratings. An additional problem in this study and the later studies by Campbell and her colleagues is their failure to use an objective measure of the parent's perceived level of stress regarding the child's and their own characteristics, as well as the impact of the environment.

McGee et al. (1991) also found that the pervasively hyperactive preschoolers were more likely to come from families with high adversity (e.g., low SES, young maternal age

and poor maternal health). In an attempt to investigate differences between preschoolers with hyperactivity and preschoolers with hyperactivity and aggression, Moffitt (1990) found that preschoolers with hyperactivity and delinquency had greater family adversity (e.g., greater parental separations and more parental psychopathology) than either those with hyperactivity or delinquency alone. It is important to note that children from low SES backgrounds may be more likely to be referred to publicly funded professionals for behavioral assistance. Indeed, referral bias is not uncommon, particularly when access to health care can be determined by one's SES.

Campbell et al. (1991a) conducted another follow-up study with a second cohort of preschoolers seen at ages 3, 4, and again at 6 years (Campbell, 1994). They found that parents of parent-referred 3 year-old boys who were identified as 'hard-to-manage', perceived more family adversity (stressful life events), compared to parents of the matched-control boys. This rating was independent of reported parental depression and marital satisfaction. This pattern persisted after 1 year; while 2 years later, there was greater family instability (i.e., marital status changes) within the 'hard-to-manage' group, even though there was no difference in their marital satisfaction, reported depression, and experience of stressful life events (Campbell, 1994).

In her 1994 follow-up of these young children, Campbell also redefined her 'hard-to-manage' sample: Group I - two informants (mother, father, or teacher) suggest externalizing problems; Group II - one informant suggests externalizing problems; Group III - Control. The results showed that parents in Group I reported significantly more depression, less parental competence, and more overall stress (composite), compared to

parents in either Group II or Group III. There continued to be no differences in life event stress or spousal support between the groups. Campbell suggested that depression may be a discriminating factor among families with preschoolers demonstrating more serious/ pervasive problems.

Mash and Johnston (1983) found that parents of younger (5 years) and older (8 years) children diagnosed with hyperactivity reported significantly higher levels of stress -- stress which was due to both the child's and the parent's characteristics -- compared to parents of typically developing children. Parents of children with hyperactivity reported significantly more symptoms of depression and less reinforcement in their interactions with their children compared to parents of normal controls. These authors did not find stress associated with the marital relationship or life events to differentiate the families of children with and without hyperactivity, at either age. Using discriminant function analysis, Mash and Johnston (1983) found the stress associated with the child's characteristics was the best single predictor of group status (ADHD vs. Control). This finding supports the hypothesis that ADHD exerts a powerful influence over parenting stress, and that the child and parent's characteristics play a more important role in the determination of this stress than do environmental factors. In fact, Donenberg and Baker (1993) found that stress arising from a child's early difficulties may generalize to the family system, if the child's problems are not reduced.

Mash and Johnston (1983) also found that while parents of both younger and older children with hyperactivity had lower self-esteem than parents of normal controls, the parents of the older group of children with hyperactivity had the lowest levels of self-

esteem related to skill/ knowledge as a parent. They suggest that these findings indicate that unsuccessful child-rearing experiences have a cumulative negative impact on parenting self-esteem as it relates to skill/ knowledge as a parent.

Several measures of family functioning, including ratings of parental stress, child impact on families, daily hassles with child, parent-reported competence and depression, and marital functioning were compared among parents of preschoolers with externalizing behavior problems, autism, and normal controls (Donenberg & Baker, 1993). They ensured that stress and adjustment measures were not related to demographic variables by using correlational analysis. Parents of preschoolers with externalizing behavior problems reported levels of impact and stress as high as parents of preschoolers with autism, a much more challenging and disabling condition. Parents of preschoolers with externalizing behavior problems reported more negative impact on social life, more negative, and less positive feelings about parenting when compared to parents of normal controls. In addition, parents of preschoolers with externalizing behavior problems reported significantly higher levels of stress associated with the child's characteristics than parents of normal control preschoolers. These two groups of parents were not found to differ in their ratings of depression, marital functioning, or ratings of daily hassles (Donenberg & Baker, 1993). Findings suggest that externalizing behavior problems among preschoolers have an impact on parental stress.

In a recent study by Byrne et al. (in press), parents of preschoolers with ADHD, compared to parents of normal control preschoolers, rated themselves as being significantly more stressed in relation to parenting their preschooler, experiencing more

depression symptoms, and experiencing a lower sense of parenting competence. However, despite this higher level of parental stress and more symptoms of depression, the parents of preschoolers with ADHD did not rate the family functioning to be less healthy than the parent ratings of the matched-controls. Byrne et al. (in press) suggested that, at this early neurobehavioral age of development, the level of stress reported by families with ADHD is either insufficient in severity or chronicity to manifest in disrupted family functioning or the preschooler is afforded more latitude (i.e., benefit of doubt). The issue of severity of ADHD detrimentally affecting family functioning is indirectly supported by Lewis (1992). He found that school-age children with ADHD plus aggression were at higher risk for family dysfunction compared to those with ADHD only. Nonetheless, the fact that Lewis (1992) did not find family dysfunction in the older families of children with ADHD may suggest at one level that the Byrne et al. (in press) position of a developmental factor is not supported, though their position of a severity factor may be an issue. Further study with both ages, comparing different subtypes (i.e., ADHD, ADHD + aggression, ADHD + Oppositional Defiant Disorder) would be informative.

In summary, parents of preschoolers with ADHD are more stressed. Such stress may manifest in the form of disrupted family functioning depending on the child's age, severity of the child's problem, and the persistence of adult pathology or family dysfunction (Byrne et al., in press; Campbell, 1994; Campbell et al., 1991a; Donenberg & Baker, 1993; Mash & Johnston, 1983). With the exception of the finding of Mash and Johnston (1983), it is unclear what factors contribute most to parental stress, particularly

given a multitude of inclusion or diagnostic criteria used in the studies to date (e.g., ADHD vs. 'Hard-to-Manage'). In the present study, parents of preschoolers were administered a parent stress index and family functioning questionnaire to assess the type, magnitude, and origin of parent-rated stress.

Hypotheses

Many of the hypotheses in this study were based on the results of preliminary work by Byrne et al. (in press). In this previous study, preschoolers with ADHD were rated as more stressful to manage, more impulsive and inattentive, yet not more hyperactive. The first goal of the present study was to verify the previous findings with a larger sample. Second, several newly developed measures of attention and impulsivity, as well as a direct behavioral code were added to determine whether preschoolers with and without ADHD could be discriminated. Third, preschoolers with and without ADHD were compared to determine whether preschoolers with ADHD exhibit modality-specific attentional and inhibitory impairment (auditory, visual, visual-spatial), more frequent high-risk physical injury behavior, and early signs of social impairment and associated lowered self-esteem.

More specifically, compared to matched normal controls, the following hypotheses were made:

Attention Dimension

Direct Measures

Consistent with research in the school-age literature (e.g., Losier et al., 1996) and with trends in the preschool literature (e.g., Mariani & Barkley, 1997), preschoolers with

ADHD will commit more errors of omission on a visual CPT. Consistent with school-age findings by Sykes et al. (1973), but in contrast with Shapiro and Herod (1994), preschoolers with ADHD will commit more errors of omission on an auditory CPT. Consistent with school-age findings (e.g, Barkley, 1991), but in contrast to the findings of Byrne et al. (in press), preschoolers with ADHD will exhibit more errors of omission on the a modified version of the deletion task. With reference to the work of Buffett-Jerrott et al. (in press) who employ time to complete a cancellation task as a measures of inattention, preschoolers in the ADHD group will take significantly longer to complete the deletion task.

Indirect Measures

By employing a larger study sample than Byrne et al. (in press), consistent with preschool studies with ADHD or externalizing problem behaviors, preschoolers with ADHD will play with the assigned toys for shorter intervals. Consistent with previous findings with parents of school-age children with ADHD (e.g., Breen & Barkley, 1988) and parents of preschoolers with ADHD (Byrne et al., in press), parents will rate their ADHD preschoolers as exhibiting difficulty sustaining attention or concentrating in a variety of situations.

Impulsivity Dimension

Direct Measures

Consistent with school-age children with ADHD (e.g., Losier et al., 1996) and with preschoolers with ADHD (e.g, Campbell et al., 1991), and in contrast with Mariani & Barkley (1997), preschoolers with ADHD will commit more errors of commission on a

visual CPT. Consistent with school-age findings (e.g., Shaprio & Herod, 1994), preschoolers with ADHD will exhibit more errors of commission on an auditory CPT. Preschoolers will also exhibit more errors of commission on a deletion task, in keeping with findings of the previous version of this task which was deemed to be a good measure of preschoolers' impulsivity (Byrne et al, in press).

Consistent with the previous findings by Byrne et al. (in press) preschoolers with ADHD will grab more frequently at test materials and toys. Although there exist equivocal findings for school-age children with ADHD (Platzman et al., 1992), preschoolers with ADHD more frequently will exhibit spontaneous verbalizations, particularly in tasks with low-structure and an adult present. In this regard, a modified version of the Byrne et al. (in press) coding system will be used. Consistent with previous findings with school-age children with ADHD (e.g., Roberts et al., 1984) and preschoolers (e.g, Campbell et al., 1982), preschoolers with ADHD more frequently will look away from task. Consistent with previous findings with preschoolers (Byrne et al., in press), preschoolers with ADHD will be more likely to play with 'off-limits' or unsanctioned toys.

Indirect Measures

Consistent with previous findings with school-age children (e.g., Breen & Barkley, 1988) and with preschoolers (Byrne et al, in press), parents of preschoolers with ADHD will rate the preschoolers as more demanding. Consistent with previous findings that children with behavior problems are at greater risk for injury (e.g, Lyman & Hembree-Kigin, 1994), parents of preschoolers with ADHD will rate the preschoolers as more often engaging in potentially risky (i.e., injurious) behaviors.

Hyperactivity Dimension

Direct Measures

In contrast with findings with school-age children (e.g., Roberts et al., 1984) and with preschoolers (Campbell et al., 1982; 1994), but consistent with the previous study by Byrne et al. (in press), preschoolers with ADHD will not get out of seat more frequently during a high-structured task or a low-structured task. However, the frequency may vary according to the degree of task structure (e.g., more in medium-structure tasks). Despite the different measures used to assess movement, consistent with previous findings with school-age children (e.g, Roberts et al., 1984) and preschoolers (e.g, Campbell et al., 1994), preschoolers with ADHD will exhibit more fidgeting or extraneous body movements. Consistent with the trend in the previous study (i.e., Byrne et al, in press), and findings with school-age children (e.g, Roberts et al., 1984), preschoolers with ADHD will be more mobile (i.e., moving about the room).

Psychosocial Dimension

Direct Measures

Consistent with previous findings by Byrne et al. (in press), the behaviors (inattention, impulsive, hyperactive) by preschoolers with ADHD will elicit significantly more commands from the examiner. Given the higher behavioral symptomatology ratings, and lower ratings of prosocial behaviors, preschoolers in the ADHD group will rate themselves as less competent (physical and cognitive combined) and less accepted (peer and maternal combined).

Indirect Measures

Consistent with previous findings with school-age children (e.g., Breen & Barkley, 1988) and with preschoolers (Byrne et al, in press), parents of preschoolers with ADHD will rate their preschooler as exhibiting more broad-band externalizing and internalizing behavior problems, as well as more difficulties with aggression.

Given the current research regarding the prevalence of social difficulties among children with ADHD (e.g., Whalen & Henker, 1985), preschoolers with ADHD will be rated by their parents as exhibiting less developed social skills (SSRS), fewer socially desirable characteristics (PSI), and more social problems (CBCL).

Consistent with previous research with school-age children (e.g., Mash & Johnston, 1983) and with preschoolers (e.g., Byrne et al., in press), parents of preschoolers with ADHD will experience more stress, particularly in the parent-child relationship, preschoolers in the ADHD group will be rated as exhibiting greater resistance to changes in the physical and social environment, exhibiting higher distractibility and hyperactivity, and will be less reinforcing to the parent. Parents of preschoolers in the ADHD group will rate themselves as being less competent in the parenting role and as experiencing more symptoms of depression. Consistent with previous findings by Byrne et al. (in press), parent self-rated stress will not manifest in the overall health/pathology of family functioning in the present study.

METHOD

Participants

A total of 50 preschoolers participated in this study, 25 diagnosed with ADHD and 25 matched controls (i.e., groups were matched for sex, age, and socioeconomic status [SES]). To achieve this sample, a recruitment and screening process was implemented (see Tables 1 and 2 for a summary).

Recruitment

Participants in the ADHD group were patients referred to the Preschool Attention-Deficit Hyperactivity Disorder Clinic, Department of Psychology, IWK Grace Health Centre, a tertiary-care, university teaching hospital. Sixty-two preschoolers were referred to the clinic during the period in which this study was conducted.

Participants in the normal control group were recruited from preschools/daycares in a metropolitan-county area (i.e., Halifax Regional Municipality, Nova Scotia Canada). With permission from preschool directors, letters describing the study were sent home to parents requesting their participation (see Appendix A). Each parent who returned a response card was contacted by telephone and provided further information about the purpose and procedure of the study; their verbal consent to participate was also acquired. Through the 15 preschools contacted, 374 letters were sent home to parents, and 81 response cards (22%) were returned. Although 6 of these parents could not subsequently be contacted (e.g., disconnected telephone), all of the remaining 75 parents agreed to complete the screening questionnaires.

Table 1

Recruitment and Screening for ADHD Participants through the Preschool ADHD Clinic

Stage of Recruitment	Details
# preschoolers referred to ADHD clinic/ screening questionnaire packages sent	62
# screens returned	47 (76%)
attrition	7 parents not interested in assessment 8 parents did not return questionnaires
# referrals deflected after screening	9 (19%)
attrition	6 - developmental delay 1 - oppositional defiant problems 1 - conduct behavior problems 1 - nonclinical range on CPRS
# screened as ADHD/ appt. scheduled	38 (81%)
referral source of those screened as ADHD	26 (68%) - pediatrician 5 (13%) - psychologist 3 (8%) - family physician 4 (11%) - parent
# diagnosed as suspect[2]	3 (8%)
# with other primary disorder	2 (5%)
# diagnosed as ADHD	33 (87%)
# clinic referrals in final ADHD sample	24 (73%)
attrition	4 - no normal control match found 2 - too old 2 - incomplete (1 task only) assessment 1 - procedural change
# recruited from preschools who were diagnosed ADHD	2 (1 of 2 not included in final sample -- no normal control match found)
total # included in final ADHD sample	25

[2]Suspect ADHD - screened as ADHD, diagnosed as Normal Control

Table 2

Recruitment and Screening for Normal Control Participants through Local Preschools/ Daycares

Stage of Recruitment	Details
# screening questionnaire packages sent	75
recruitment source	70 - local preschools 3 - personal contact 2 - laboratory recruitment database
# expressing concern during initial telephone contact about preschooler's behavior and/or attention	7 (2 were deflected; 1 did not return questionnaires; 2 suspects [ADHD/ NC]; and 2 ADHDs)
# screens returned	64 (85%)
attrition	11 parents did not return questionnaires despite reminder telephone calls
# deflected after screening	3 (5%)
attrition	2 - conduct behavior problems 1 - speech and language problems
# screened as ADHD	5 (8%)
# diagnosed as ADHD	2 (40%)
# diagnosed as suspect	3 (60%)
# screened as NC	56 (88%)
# unmatched/ thank you letters sent	28 (50%)
# diagnosed as suspect[3]	2 (4%)
# matched and diagnosed as NC	26 (46%)
attrition	1 - incomplete assessment (not willing to separate from her parent)
# included in final NC sample	25 (45%)

[3]Suspect ADHD - screened as Normal Control, diagnosed as ADHD

Screening

Parents of the 137 (62 referral; 75 control) preschoolers were asked to complete three questionnaires: (a) Child Development Inventory (CDI; Ireton, 1992); (b) Conners Parent Rating Scale (CPRS; Conners, 1990; Goyette, Conners, & Ulrich, 1978); and (c) IWK Grace Developmental Assessment Form, prior to scheduling a clinic appointment (see Table 3). Questionnaires were mailed to the parents, including instructions for completion, and a postage-paid, self-addressed return envelope (see Appendix B). These questionnaires were selected to ensure that none of the children included in this study had a concomitant developmental delay (CDI), and to screen for the presence of hyperactivity/externalizing behavior problems (CPRS Hyperactivity Index subscale). The IWK Grace Developmental Assessment Form provided a basic medical and developmental history in addition to information about familial demographics and SES.

Child Development Inventory (CDI). The CDI (Ireton, 1992) is a revised version of the Minnesota Child Development Inventory (MCDI; Ireton &Thwing, 1974). The CDI is a standardized parent-report questionnaire which provides a screen of a child's current behavioral and developmental status. The CDI includes 270 statements which describe common developmental skills and behaviors of young children (age 0-6½ years), and which can easily be observed by parents in everyday situations. Parents endorse those statements which best describe their child's current developmental skills and behavior by marking Yes or No for each item. Although Ireton (1992) does not provide a time limit for completion, its predecessor (MCDI) required approximately 15-20 min for completion (Byrne, Backman, & Smith, 1986). The CDI yields eight scales (Social, Self-Help, Gross

Table 3

Questionnaires Completed by Parent

Questionnaire	Author	Time to Complete
Screening		
Child Development Inventory (CDI)	Ireton, 1992	20 min
Conners Parent Rating Scale (CPRS)	Conners, 1990; Goyette, Conners, & Ulrich, 1978	10 min
IWK-Grace Developmental Assessment Form	IWK-Grace; various departments	10 min
Subtotal		40 min
Assessment		
Child Behavior Checklist (CBCL)	Achenbach, 1991	15 min
Family Assessment Measure - III (FAM-III)	Skinner, Steinhauer, & Santa-Barbara, 1995	10 min
Home Situations Questionnaire-Revised (HSQ-R)	DuPaul, 1990	5 min
Injury Behavior Checklist (IBC)	Speltz, Gonzales, Sulzbacher, & Quan, 1990	10 min
Parent Stress Index (PSI)	Abidin, 1983; 1990; 1995	20 min
Social Skills Rating System (SSRS)	Gresham & Elliott, 1990	20 min
Total		2 hr

Motor, Fine Motor, Expressive Language, Language Comprehension, Letters, and Numbers), and one composite scale (General Development) which is most often used to infer current global developmental status (Byrne et al., 1986). The CDI is a chronological age-scale; each child's profile is compared to his or her normative age-appropriate sample. A score falling > 2 SD below the child's chronological age suggests the possible existence of a developmental delay. The CDI has satisfactory internal consistency, and construct validity (Ireton, 1992). Given the relatively recent development of the CDI, more validity research has been conducted with its predecessor (MCDI) (e.g., Byrne et al., 1986).

Conners Parent Rating Scale (CPRS). The CPRS (Conners, 1990; Goyette et al., 1978) is a widely used, parent-completed questionnaire in which a child's (3 - 17 years) behavior and attention is rated (Barkley, 1990b; Conners, 1990). Parents are asked to rate 48 symptoms on a 4-point scale with respect to how each item applies to their child (0 = not at all , 1 = just a little, 2 = pretty much, and 3 = very much). The CPRS questionnaire is typically completed in 10 min, from which five factors (Conduct Problem, Learning Problem, Psychosomatic, Impulsive-Hyperactive, and Anxiety), and a composite index score (Hyperactivity Index) are derived. A T-score ≥ 70 on the Hyperactivity Index of the CPRS is typically interpreted as indicating the possible existence of attentional and/or behavior problems (Conners, 1990). The Conners Parent Rating Scale has satisfactory inter-rater reliability (Conners, 1990) and internal consistency (Sandberg, Wieselberg, & Shaffer, 1980). In particular, the Hyperactivity Index was specifically designed to screen for behaviors generally considered to be core symptoms of a formal diagnosis of Hyperactivity. This Hyperactivity Index has indeed been shown to be a highly valid screen

for subsequent formal diagnosis of ADHD (Boyle & Jones, 1985; Satin, Winsberg, Monetti, Sverd, & Foss, 1985).

IWK Grace Developmental Assessment Form. The IWK Grace Developmental Assessment Form is used by various clinic service departments at the IWK Grace Health Centre to collect background information about the child's mother's pregnancy and delivery, the child's developmental and health history, as well as information regarding family composition, family history, and parental formal educational achievement and occupation (from which SES can be calculated). This form is a fill-in-the-blank type of questionnaire and is typically completed in 10 min.

Initial group assignment. Preschoolers with a T-score of $\geq$ 70 on the CPRS Hyperactivity Index were initially assigned to the ADHD group, whereas those with a T-score of $<$ 70 were initially assigned to the normal control group. All children scored within normal limits on the General Development scale of the CDI (i.e., age-equivalent $\leq$ 2 SD), with the exception of four preschoolers (i.e., 3 preschoolers with ADHD and 1 normal control). A review of the four cases revealed that each preschooler had been rated by their parent as exhibiting few age-appropriate social skills (CDI: Social). Statistical analyses of the CDI reveals that the CDI Social and General Development scales are very highly correlated (r=.71) (Ireton, 1992). In these four cases, it was determined that since the internal consistency of the CDI: Social scale drops from .86 to .67 for the age range used in the present study, its screening value for this particular area of development may be reduced. Therefore these four preschoolers were included given that they met all the remaining criteria, especially since they scored within the normal range on the Reynell

Developmental Language Scales (RDLS-R) which was formally administered. No preschooler presented with other psychological or health problems.

ADHD group. Of the 62 clinic-referred preschoolers, 47 (76%) returned their completed questionnaire packages[4]. Of these 47 preschoolers, 9 (19%) were excluded because of a primary diagnosis of Developmental Delay, failure to score within the clinical range on the CPRS Hyperactivity Index, or evidence of Oppositional Defiant or Conduct Disorder[5]. The remaining 38 (81%) clinic-referred preschoolers were therefore eligible for the ADHD group, and had been referred by: pediatricians (68%), psychologists (13%), family physicians (8%), or parent (11%). Of these 38 clinic-referred preschoolers, 3 were diagnosed as suspect ADHD, 1 was diagnosed with a language disorder, and 1 was referred for a follow-up neuropsychology assessment for a complex perceptual-motor impairment. This left 33 preschoolers eligible for the ADHD group (see Table 1).

Normal control group. Of the 75 participants recruited through preschools, 64 (85%) returned their completed questionnaire packages[6]. Of these 64 preschoolers, 3 (5%) preschoolers were excluded because of evidence of other psychological conditions[7] (language difficulties, oppositional defiant behavior, and conduct behavior problems).

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[4]The group was split between those who did not return questionnaires, despite reminder telephone calls (8), and those declining service given the parent's perception that the preschooler's behavior had improved (7).

[5]These referrals were redirected to an appropriate health service.

[6]Parents not returning screening questionnaires within 4-6 weeks, were contacted by telephone (e.g., answer questions or remind them to complete and mail questionnaires).

[7]These parents were provided with information about how they rated their child and if desired, referral information was provided.

Five (8%) met the CPRS Hyperactivity Index criteria for the ADHD group, 2 of whom were diagnosed with ADHD while the remaining 3 were diagnosed as suspect ADHD. The remaining 56 (88%) preschoolers were placed in a participant pool from which 28 (50%) preschoolers were drawn as matched-control participants; 2 of these participants were excluded after being diagnosed as suspect ADHD. Parents of the remaining 28 (50%) preschoolers were sent a letter thanking them for their participation in the screening component of the study (see Table 2).

Final Sample Selection

Child and family history, and parent-completed screening questionnaires (CDI, CPRS, IWK Grace Developmental History Form) were reviewed within the context of an in-depth psychological parent(s) interview. Diagnoses were made by one of two experienced clinical child psychologists, using the DSM-IV (APA, 1994) for classification. Preschoolers were assigned to one of three categories: (a) ADHD (Combined Type, Predominately Inattentive Type, or Predominately Hyperactive-Impulsive Type); (b) normal control; or (c) suspect ADHD (i.e., the preschooler was initially assigned to the ADHD group based on screening but subsequently did not meet formal diagnostic criteria for ADHD, or preschooler was initially assigned to the normal control group based on screening but subsequently met the diagnostic criteria for ADHD). Participants assigned to the suspect ADHD group were not included in this study.

Of the 33 (87%) clinic-referred preschoolers diagnosed with ADHD, 4 were excluded because matched-control participants were not found, 2 were too old to participate, 2 failed to complete the protocol (refusal), and 1 was lost due to procedural

error. This resulted in a final sample of 25 in the ADHD group, 24 preschoolers initially referred to the clinic, and 1 preschooler recruited through a local preschool[8] (see Table 1).

Twenty-six preschoolers assessed as normal controls were seen for the research study; however, 1 preschooler was excluded for failure to complete the protocol because of separation anxiety. As a result, the final sample contained 25 preschoolers assessed as normal controls (i.e., without ADHD) who were matched with the preschoolers in the ADHD group (see Table 2).

Sample. A total of 50 preschoolers (3 - 6 years), 25 preschoolers diagnosed with ADHD (7 Combined Inattentive and Hyperactive/Impulsive Type, 1 Predominantly Inattentive Type, and 17 Predominately Hyperactive/Impulsive Type), and 25 preschoolers diagnosed as normal controls, participated. Participants were matched on sex, chronological age (± 4 months), and socioeconomic status (SES; ± 18 points; Hollingshead, 1975)[9]. The percentage of the sample falling into each social stratum were as follows: High - 20%, High Average - 28%, Average - 18%, Low Average - 24%, Low - 10%. A total of 8 females and 42 males participated, resulting in a 1:5 female to male ratio, close to the 1:6 commonly found ratio for ADHD reported in clinical samples

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[8]Two preschoolers recruited through preschools met the diagnostic criteria for the ADHD group. One of the 2 preschoolers was not included in the final sample because a matched-control participant could not be found. Parents of both of these preschoolers expressed concern about their child's attention and behavior during our initial contact, prior to any discussion about the specific nature of this study.

[9]If there were two working parents in a family, calculation of SES was based on the parent with the higher SES score. SES scores within 18 points were considered a clinic-control match, given this was the average range of point spread between adjacent strata.

(Barkley, 1990b). The mean age for the ADHD group was 4.82 years and the mean age for the normal control group was 4.86 years. This difference was not statistically significant, F (1, 49) = .05, $p > .05$. The mean SES for the ADHD group was 34.40 and for the normal control group, 42.48. This difference was also not statistically significant, F (1, 49) = 3.44, $p > .05$. Although 5 of the 25 preschoolers diagnosed with ADHD were prescribed methylphenidate prior to their assessment, all of these children were medication free for 24-48 hours before their appointment. The majority of preschoolers (21 ADHD and 24 normal control) had some preschool or primary experience[10] prior to their assessment appointment. All preschoolers were free from neurological or neurodevelopmental disorders, and their language abilities were assessed to be within normal limits (see section Assessment Protocol). There was no monetary gratuity offered to the participants or their parents; however, nominal parking or travel expenses were reimbursed to parents of children assessed as normal controls. Table 4 provides a summary description of the final sample, as a function of participant group (ADHD vs. Normal Control).

Materials and Procedure

Assessment Protocol

Upon arrival for their appointment, the parent signed a letter of informed consent (see Appendix C) and the preschooler gave verbal assent to participate. Both parent and

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[10]Preschoolers who were attending preschool but were asked to leave (due to their behavioral difficulties) were included in the preschool experience group. In this regard, 4 preschoolers with ADHD and 0 normal controls were previously expelled from their preschool. For the purpose of this study, preschool experience was defined as attending preschool ≥ 3, half days per week.

Table 4

Description of Final Sample, illustrated by frequencies or means and standard deviations

	ADHD	Normal Control
Age	4.82 years (.69)	4.86 years (.67)
Sex	21 males 4 females	21 males 4 females
SES - numeric score	34.40 (12.51)	42.48 (17.82)
Marital Status of Parent(s)		
Married	16	16
Other	9	9
Preschool/ Primary Experience[a]	21	24
Conners' Hyperactivity Index[b] (screening questionnaire)	85.08 (9.57)	47.24 (8.25)
Received Stimulant Medication prior to Assessment[c]	5	0
Diagnosis (DSM-IV)	7 Combined Type 1 Inattentive Type 17 Hyperactive/ Impulsive Type	25 Normal Control

Note. N=25 preschoolers with ADHD and 25 preschoolers without ADHD. SDs are reported in brackets.

[a]Number of preschoolers with any (≥ 3 half days per week) past experience in preschool or primary school. [b]Expressed as T-scores. [c]These children were medication-free for 24-48 hours prior to their assessment appointment.

preschooler understood that participation was voluntary, and as such could be discontinued at any time if so desired.

The preschooler was assessed by the examiner while the parent was separately interviewed by the psychologist. The assessment protocol included administration of six tasks which were presented in the following predetermined order to all children[11], with a 5 min break occurring after every second task: (a) High-Structure Task: Reynell Developmental Language Scale-Revised (RDLS-R; Reynell & Huntley, 1985); (b) High-Structure Task: Pictorial Scale of Perceived Competence and Social Acceptance (PSPCSA; Harter & Pike, 1983); (c) Medium-Structure Task: Continuous Performance Task for Preschoolers-Visual (CPTP-V; Corkum et al., 1995); (d) Medium-Structure Task: Picture Deletion Task for Preschoolers-Revised (PDTP-R); (e) Medium-Structure Task: Continuous Performance Task-Auditory (CPT-A; Prather et al., 1995); and (f) Low-Structure Task (play) (customized for this study from Roberts et al., 1985). The full assessment protocol was completed in approximately 1 h, 35 min, with an additional 25 min allotted for break time, room changes, and setup. Preschoolers and their parent typically spent 2 h at the IWK Grace Health Centre for participation in this study (see Table 5).

For administration of the High-Structure Task (Reynell Developmental Language Scales-Revised), the Picture Deletion Task for Preschoolers-Revised (PDTP-R), and Continuous Performance Task-Auditory (CPT-A), the preschooler and the examiner were

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[11]The order of the CPTP and PDTP-R were reversed for two children (one from each diagnostic group) due to delay caused by equipment malfunction.

Table 5

Order of Task Presentation

	Author	Time to complete
High-Structure Tasks		
1. Reynell Developmental Test of Language Abilities (RDLS-R)	Reynell & Huntley, 1985	18 min
2. Pictorial Scale of Perceived Competence and Social Acceptance (PSPCSA)	Harter & Pike, 1983	15 min
Medium-Structure Tasks		
3. Continuous Performance Test for Preschoolers -Visual (CPTP-V)	Corkum et al., 1995	14 min
4. Picture Deletion Task for Preschoolers-Revised (PDTP-R)	Adapted from: Corkum et al., 1995	20 min
5. Continuous Performance Test - Auditory (CPT-A)	Prather et al., 1995	8 min
Low-Structure Task		
6. Low-Structure (Play)	Adapted from: Roberts et al., 1985	20 min
Total Time		1 hr, 35 min

seated at a preschool size table and chair, with the examiner seated next to the child; however, for the PDTP-R and CPT-A, the distance between the preschooler and the examiner was increased (to 1 m) allowing the preschooler a sense of working independently, and simultaneously permitting unobtrusive monitoring of the preschooler's performance. For the Pictorial Scale of Perceived Competence and Social Acceptance test, the examiner was seated directly opposite the preschooler. Finally, for the Continuous Performance Test for Preschoolers-Visual (CPTP-V) and the Low-Structure Task (play), the examiner was situated outside the room observing the preschooler on a close-circuit monitor.

Task 1: High-Structure Task: Reynell Developmental Language Scales-Revised (RDLS-R). Administration of the RDLS-R served two purposes. First, the RDLS-R, a direct test of each preschooler's language abilities, was conducted to ensure that language was within normal limits (≤ 1.5 SD). This is a very important issue infrequently addressed in most ADHD studies to date. The RDLS-R is standardized for children aged 1.5 to 7 years. Language skills (expressive or receptive) were within normal limits (≤ 1.5 SD) for all preschoolers comprising the final sample. Given the young age of these children and the absence (excluded by screening) of a language impairment, the RDLS-R was administered in approximately 20 min. The RDLS-R has demonstrated high reliability and acceptable concurrent and predictive validity (Reynell & Huntley, 1985).

Second, given the inherent structure during administration of the RDLS-R, an opportunity to observe the preschooler's behavior during a High-Structure Task was provided. The preschooler's behavior was videotaped, from which attention, impulsivity,

and hyperactivity measures were later coded. The video-camera was positioned on the wall and focussed on the preschooler. The frequency of preschooler grabbing, fidgeting, out of seat, and spontaneous verbalizing[12], and the frequency of examiner commands were coded from the videotaped session (see Appendix D for a detailed summary of the behavioral code)[13].

Task 2: High-Structure Task: Pictorial Scale of Perceived Competence and Social Acceptance (PSPCSA). The PSPCSA (Harter & Pike, 1983) is designed to assess early self-perceptions (4-7 years) of General Competence and Social Acceptance. A series of 24 cards, each illustrating two pictures, is presented. The preschooler is read a brief statement about each pictured child and is then asked to choose the pictured child that is "most like" him/her, and to indicate whether the pictured child is "a lot" or "a little" like him/her. A 4-point scale is used to score the preschooler's responses, ranging from 1 (least competent/accepted) to 4 (most competent/accepted). The administration time is approximately 15 min. Four, 6-item clinical subscales are derived (Cognitive Competence, Physical Competence, Peer Acceptance, and Maternal Acceptance) from which a z-score is calculated for each of two empirically derived factor scores: General Competence and Acceptance (Harter & Pike, 1984). Very good reliability and satisfactory convergent, discriminant, and predictive validity, have been reported (Harter & Pike, 1984). The

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[12]Initially, there was an attempt to code negative verbalizations separate from other verbalizations. However, negative verbalizations were infrequent and reliability could not be achieved. As a result, this distinction in coding was dropped prior to actual coding.

[13]The behavioral codes were derived, in part, from selected codes by Roberts et al. (1985), Forehand and McMahon (1981), and Byrne et al. (in press).

PSPCSA has been found to accurately assess preschooler's perceived competence and acceptance (Campbell, 1994).

Task 3: Medium-Structure Task: Continuous Performance Test for Preschoolers - Visual (CPTP-V). The CPTP-V (Corkum et al., 1995) provided a measure of the preschooler's sustained visual attention and impulsivity. The CPTP-V was specifically designed for use with preschoolers by making age-appropriate modifications to continuous performance tests traditionally used with older children and adults. The CPTP-V was tested with a sample of 60 (3, 4, and 5 year-olds) typically developing preschoolers (i.e., free from developmental and behavioral problems) (Corkum et al., 1995). Their findings strongly supported the construct validity of the CPTP-V as a measure of sustained visual attention and impulsivity for preschoolers. As expected, response latency, omission errors, and commission errors systematically changed with age.

In the present study, the CPTP-V was administered on a 386 personal computer connected to a 47.5 cm color monitor. Each child sat on a preschool-size chair in front of the monitor (60 cm), which was positioned at eye level. During the training phase of the assessment (i.e., instructions and practice), the examiner was seated next to the preschooler inside the chamber. During the test phase, the examiner was seated outside the chamber, and viewed the preschooler on the closed-circuit monitor. The preschooler used an 11 cm x 8 cm Neuroscan™ response pad (single finger button) to respond to the pictures on the screen. A tripod-supported video-camera was located in the corner to the preschooler's right, allowing a simultaneous display and recording of the preschooler's image and behavior during the task.

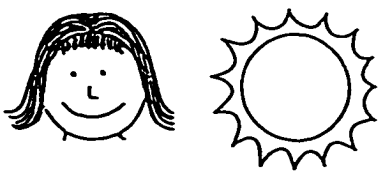
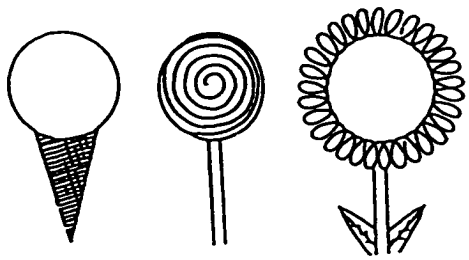
The CPTP-V lasted 13.5 min (familiarization and practice: 5 min; test phase: 8½ min). Six individual, white on black line drawings were presented (pig's face, girl's face, sun, lollipop, ice-cream cone, flower) (see Table 6). All of the pictures shared (75-80% overlap) a common shape (i.e., a circle) but were distinguished by different defining properties. The line drawings were electronically scanned using the Complete Half-Page Scanner™ and the SmartScan Software™ and presented at a visual angle of 12°. The six pictures were presented individually in a randomized sequence for a duration of 750 ms each, with a fixed inter-stimulus interval (ISI) of 1350 ms. The stimuli were randomly presented with the one constraint that the target and each of the distracters occurred once every six trials. Stimulus presentation and response were controlled and recorded using a customized program within the Neuroscan Gentask Program™. The preschooler's task was to depress the response pad key when the target stimulus (pig's face) appeared. Any response (i.e., button depression) occurring during the stimulus presentation or subsequent ISI, was recorded for latency (i.e., stimulus onset to response onset in ms) and accuracy.

During the familiarization trials, the six pictures sequentially appeared on the computer screen and remained on the screen until the preschooler correctly named each one. In the practice trials, randomized sequences of the six pictures were presented until the preschooler had correctly identified (via button depression) the target on two successive occasions, and had not committed an error of commission. The test phase consisted of 240 stimuli presentations, 40 target presentations and 200 distracter presentations.

CPTP-V performance was scored as the percentage of errors of omission, the

Table 6

Continuous Performance Test for Preschoolers - Visual (CPTP-V) Target and Distracter Stimuli

Target	Distracters
	 

percentage of errors of commission, and by response latency (ms) (calculated for errors of commission). Frequency of extraneous body movement, off task behavior, and spontaneous verbalizations by the preschooler, commands by the examiner, as well as duration of time out of seat were coded from the videotapes (see Appendix E for a detailed summary of the behavioral code).

Task 4: Medium-Structure Task: Picture Deletion Task for Preschoolers - Revised (PDTP-R). The PDTP-R, represented a revised form of the original PDTP (Corkum et al., 1995), specifically designed to assess sustained attention and impulsivity in preschoolers, using a paper-and-pencil task. The PDTP-R retained the stimuli and training phase of the PDTP (Corkum et al., 1995), and incorporated several modifications. First, the pages upon which the stimuli were printed were presented as consecutive pages in a booklet. This change facilitated the preschooler's manipulation of the test booklet, thereby allowing more independent work throughout the task. Second, the cat task was increased from two to eight arrays (pages) of pictures, to increase sensitivity to the limits of sustained attention. Third, the fish task was deleted because previous findings showed there to be a significantly large number of errors of omission across all ages (3-5 years), and a significantly large number of errors of commission for the 4-year olds. These findings suggest possible underlying difficulties in stimulus differentiation for the fish task within a timed task, thereby reducing its value in inferring a preschooler's level of sustained attention.

The PDTP-R presents pictures, rather than letters, to the preschooler and a self-inking stamper (i.e., bingo marker), rather than a pencil, is provided to the preschoolers

for task completion. These modifications make the task more developmentally appropriate given that preschoolers cannot be assumed to exhibit satisfactory pencil control and the ability to reliably discriminate letters (see O'Dougherty et al., 1984). Testing of 60 (3, 4, and 5 year-olds) typically developing children (i.e., free from developmental and behavioral problems) supported the validity of the PDTP as an age-appropriate measure of attention in preschoolers (Corkum et al., 1995).

The preschooler's task during the PDTP-R was to visually search an array of pictures, in which both target stimuli and distracter stimuli were presented, and to identify each target. The task was designed with a 4 min training phase, and a 16 min (on average) test phase. The task was presented in booklet format, such that the preschooler could turn pages and work independently. Right and left-handed versions of the task were available. During the training phase, the preschooler was shown how to appropriately hold a washable, self-inking bingo marker, to identify the target pictures, and to use the bingo marker to mark each target (e.g., in a 2 x 6 array). The discrimination and practice arrays were presented until the preschooler accurately identified the target(s) while making no errors of commission.

For the shape task, there were two pages presented; each page consisted of a 10 x 6 array with a triangle as the target and of circle, square, diamond, and octogon as the distracters. The cat task consisted of eight pages; each page consisted of a 10 x 6 array with one cat as the target and four other cats (in varying positions) as the distracters. The arrays were presented within the task booklet, each on a legal-size page with the target picture located at the top-centre of the page. The pictures were arranged in a randomized

fashion, with the only constraint that there were 15 targets and 45 distracters within each array. The test phase consisted of 120 shapes (30 targets, 90 distracters) and 480 cats (120 targets, 360 distracters). The target and distracter pictures for each of the two tasks are illustrated in Table 7.

The preschooler was asked to mark each target picture with the bingo marker as quickly as possible, and told to turn to the next page as soon as the preceding page was completed. If the preschooler demonstrated six consecutive errors at the outset on the first page of either the shape or cat task, the discrimination task was readministered, followed by readministration of the first page.

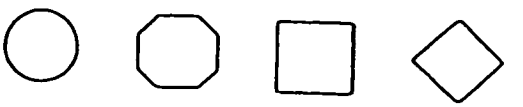
The last array presented in the PDTP-R booklet contained a 10 x 6 array of circles in which the child was asked to mark every circle on the page as quickly as possible. This task was included in order to assess the preschooler's visual-motor speed within the parameters of this PDTP-R without requiring visual search with discrimination (target). Performance on the motor task was measured in terms of speed (time to complete task).

The preschooler's performance during the shape and cat task was measured both in terms of speed (time to complete), percentage of errors of omission, and percentage of errors of commission. During the PDTP-R, the frequency of the preschooler's extraneous body movements, off-task behavior, out of seat behavior, and spontaneous verbalizations, and the frequency of examiner commands were coded from videotapes (see Appendix F for a detailed summary of the behavioral code).

Task 5: Medium-Structure Task: Continuous Performance Test - Auditory (CPT-A). The CPT-A is also known as the "Zoo-Runner", developed by Prather et al. (1995).

Table 7

Picture Deletion Task for Preschoolers - Revised (PDTP-R) Target and Distracter Stimuli

	Target	Distracters
Shape		
Cat		

It is designed to measure preschooler's sustained auditory attention. This task consisted of a training phase and a test phase. During the training phase, the preschooler listened to an audio tape which contained a list of different animal names and was asked to touch a blue target circle (diameter: 10.5 cm; positioned directly in front of the preschooler on a desk) each time the target word ("tiger") was heard. The practice trials included feedback to the preschooler regarding performance. In order to proceed with the test phase, the preschooler had to accurately inform the examiner of the task instructions, thus ensuring the task was understood. The total time for the test phase of the task was approximately 6.5 min.

The test phase consisted of 200 animal names (32 targets, 168 distracters). Each word was presented in sequence, with an average duration per word of 1000 ms, separated by a 2000 ms ISI. The animal names were recorded using a monotone female voice with no inflection on any target or distracter name. The examiner provided the preschooler feedback regarding task accuracy until the first five targets were heard; no feedback was given beyond this point.

The preschooler's performance was measured by percentage of errors of omission, and the percentage of errors of commission. During the task, the frequency of the preschooler's extraneous body movements, out of seat behavior, spontaneous verbalizations, and the frequency of the examiner's nonverbal and verbal commands were coded (see Appendix G for a detailed summary of the behavioral code).

Task 6: Low-Structure Task (play). The Low-Structure Task provided the opportunity to directly observe the preschoolers' self-directed patterns of activity and

attention in a low structure setting (minimal restrictions on behavior), in contrast to the language assessment (High-Structure setting). The Low-Structure setting was essentially an opportunity for the preschooler to independently play with only a few minor restrictions.

The Low-Structure play room observation task developed by Byrne et al., (in press) represented a modification of the Structured Observation of Academic and Play Settings successfully used with school-age children (Roberts et al., 1985). The playroom measured 3.66 m x 6.10 m. The observation area was demarcated with adhesive tape into four quadrants; each quadrant was then subdivided into four equal rectangular grids (.74 m x 1.22 m), yielding a total of 16 grids. This distribution of grids enabled gross motor activity (i.e., mobility) to be monitored. A preschool-size table and chair were positioned in the centre of each quadrant. On each of the four identical preschool-size tables, three toys (Mr. Potatoe Head, Duplo Circus Blocks, and three "Mickey Mouse and friends" coloring sheets with crayons) were identically positioned. This ensured that a preschooler's movement from table to table, within the designated play area, would not be accounted for by the pursuit of a novel toy. However, outside the designated play area, situated on the floor (wall opposite the camera), three additional toys (stuffed green dinosaur, wind-up car, and electronic piano) were visible, but designated as off-limits (preschooler could not play with them). The video camera was fitted with a wide-angle lens and positioned near the ceiling at the midpoint of the end wall. A microphone was located in the middle of the room, suspended from the center of the ceiling, out of the preschooler's reach. The parent was seated at a desk behind a small opaque room

partition located at the end of the playroom (same wall as camera). This room partition shielded the parent and preschooler from each other's view. The playroom was modified to ensure the safety of the preschool child (e.g., removal of curtain draw strings, covered electrical outlets) (see Figure 1 for an illustration of play room setup).

Before entering the playroom, the parent was instructed to be non-directive and to refrain from providing suggestions for activities (e.g., "John, go color me a picture"). If verbal instructions/responses were needed, the parent was encouraged to be vague and non-specific (e.g., "mommy's busy, you go play now"). Upon entry to the observation room, the examiner and preschooler stopped at each table, the toys were identified and the similarity among the toys and the four tables was highlighted. The preschooler was also shown the three off-limits toys on the floor, explicitly told that the toys belonged to another little girl (boy) who had forgotten them, and told not to play with these off-limits toys. The preschooler was shown his or her parent's location in the room, and was instructed to independently play because his or her parent had 'lots of work to do'. After the parent was seated, the camera turned on, and the child was seated at table 1 (nearest the door), the examiner reviewed the instructions one final time before leaving the room. The examiner remained outside the doorway of the play room, observing the session on a closed-circuit monitor. If the preschooler engaged in a dangerous activity, the examiner was prepared to intervene; however, no such intervention was needed during the course of the present study. The examiner re-entered the room after 20 min had elapsed.

The frequency of the preschooler's overall mobility (i.e., grid changes), verbalizations (toward parent), verbalizations (toward self), play with the unsanctioned

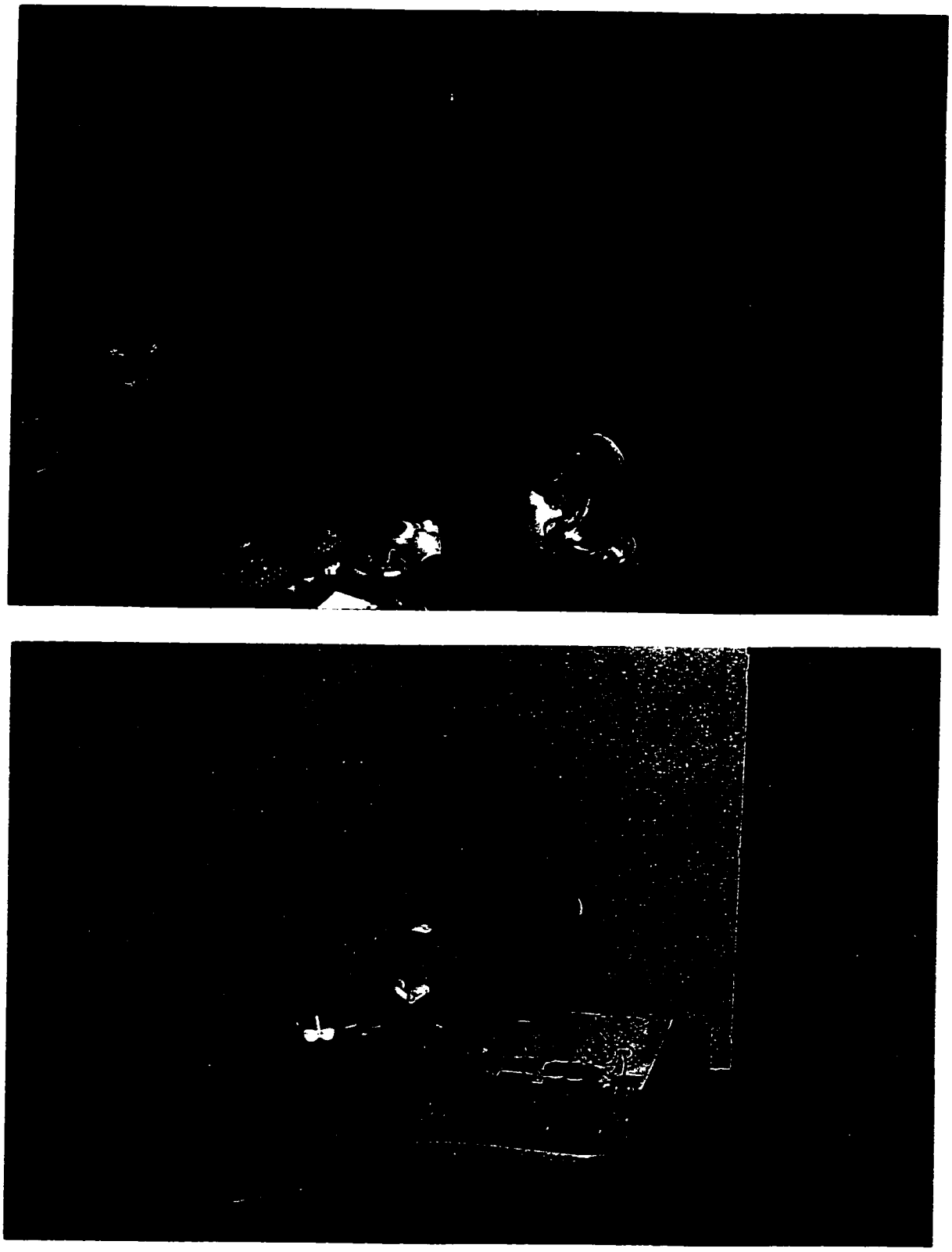
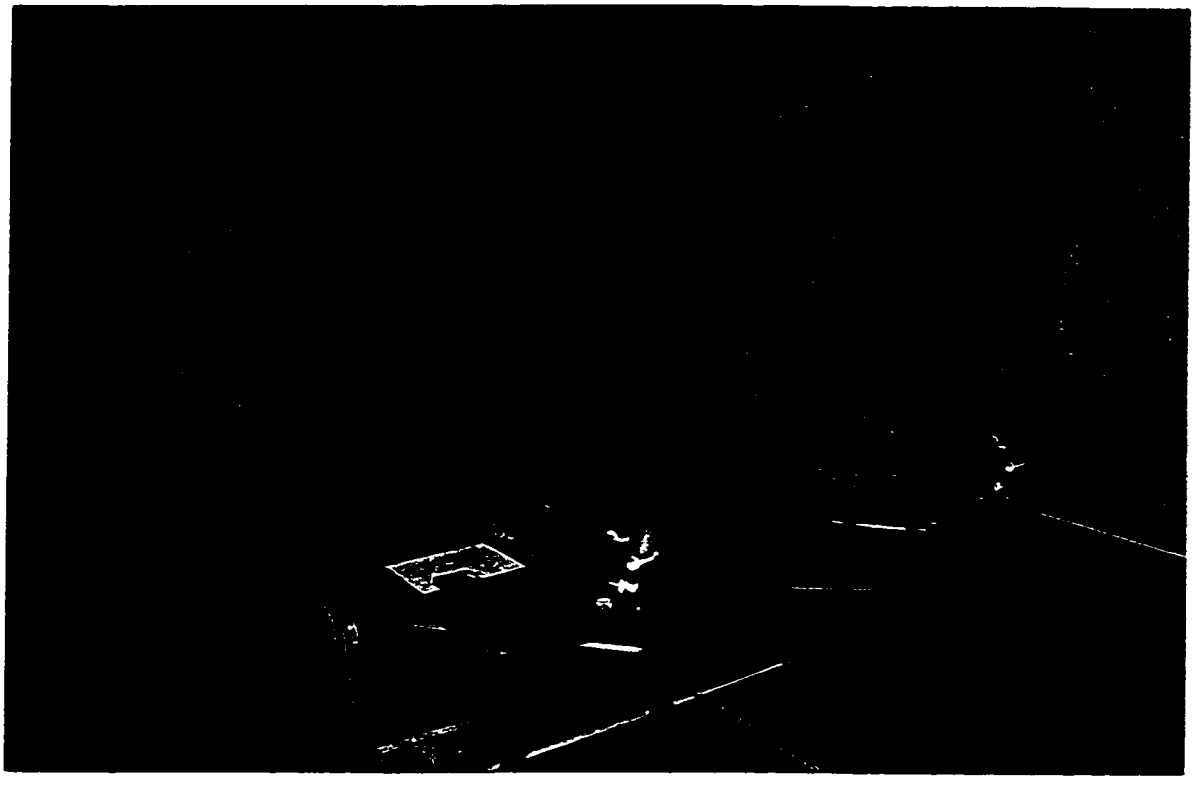
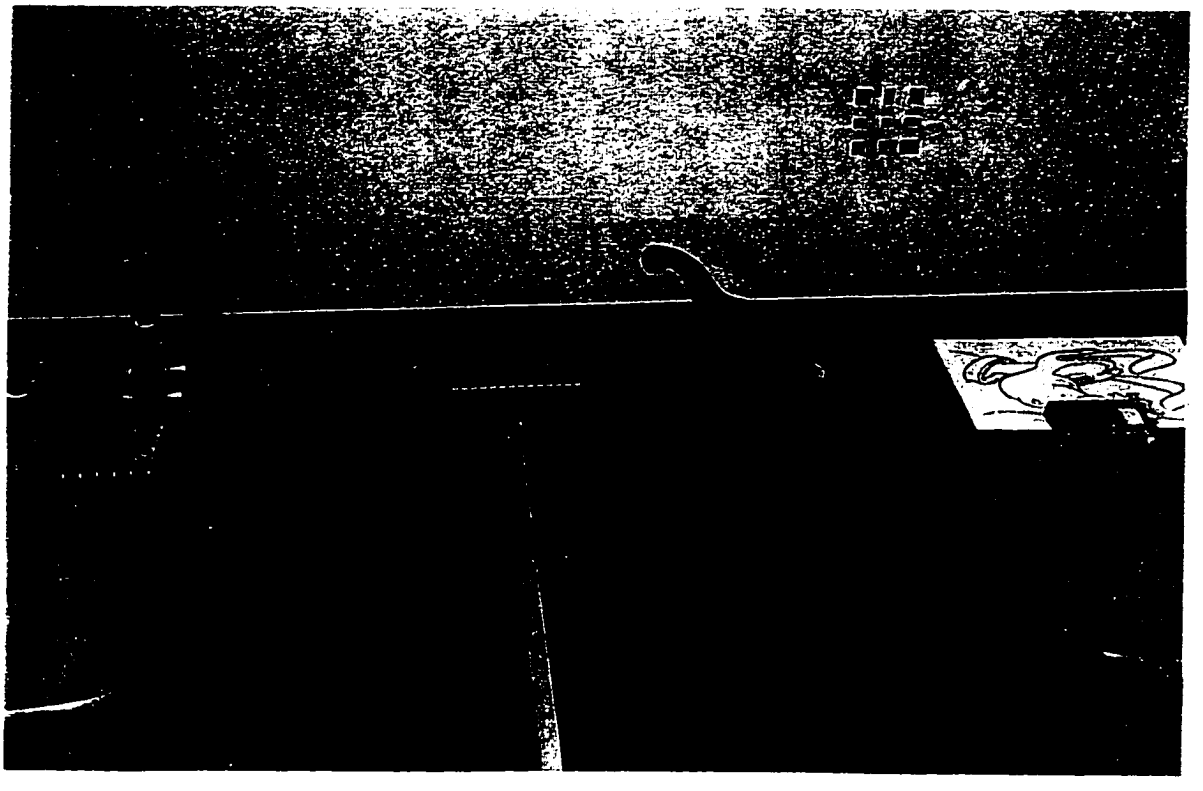


Figure 1. Illustration of Play Room Setup.





toys, and the average duration of time playing with assigned toy were coded (see Appendix H for a detailed summary of the behavioral code).

As noted earlier (see Table 3), at the time of the appointment, each parent was provided six questionnaires [Child Behavior Checklist (CBCL; Achenbach & Edelbrock, 1983; Achenbach, 1991), Family Assessment Measure (FAM-III; Skinner, Steinhauer, & Santa-Barbara, 1995), Home Situations Questionnaire-Revised (HSQ-R; DuPaul, 1990), Injury Behavior Checklist (IBC; Speltz et al., 1990), Parent Stress Index (PSI; Abidin, 1983; 1990; 1995), and Social Skills Rating System (SSRS; Gresham & Elliott, 1990)]. The parents were provided with the opportunity to work on the questionnaires during the session (e.g., Low-Structure Task). Questionnaires not completed during the session could be returned via a postage-paid, self-addressed envelope[14].

Child Behavior Checklist (CBCL). The CBCL (Achenbach & Edelbrock, 1983; Achenbach, 1991) is a widely used standardized, norm referenced questionnaire which contains a list of child behavioral problems and competencies which are rated by the parent to measure the frequency/ intensity of the preschooler's social-emotional and behavioral problems. Separate forms of the CBCL exist for children aged 2 to 3, consisting of 100 items, and for children aged 4 to 18, consisting of 113 items. For both versions of the questionnaire, parents are asked to rate how much each descriptive statement fits their child using a three-point scale (0 = not true, 1 = somewhat or sometimes true, and 2 = very true or often true). The CBCL is written for a fifth-grade

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[14]The majority of parents (approximately 75% of the sample) took some questionnaires home to complete. Questionnaires were returned with 2 weeks following the assessment appointment.

reading level and takes approximately 15 minutes to complete. Scoring of the 2-3 year-old version results in three global scales (Total Problems, Internalizing, and Externalizing) and six narrow-band scales (Anxious/Depressed, Withdrawn, Sleep Problems, Somatic Problems, Aggressive Behavior, and Destructive Behavior). The 4-16 year version results in three global scales (Total Problems, Internalizing, and Externalizing) and eight behavior problem scales (Withdrawn, Somatic Complaints, Anxious/Depressed, Social Problems, Thought Problems, Attention Problems, Delinquent Behavior, and Aggressive Behavior), as well as four other Competence scales for children aged 6-16. A T-score $\geq$ 70 (equivalent to a 98th percentile cutoff) is considered to be within the clinically significant range for the narrow band and global scales of the CBCL.

Both the reliability and the validity of the CBCLs have been assessed extensively (see Achenbach, 1991; 1992 for review), showing very good test-retest reliability and construct, concurrent, discriminant, and criterion-related validity (Achenbach, Edelbrock, & Howell, 1987; Achenbach & Edelbrock, 1983; Martin, Hooper, & Snow, 1986). Norms are provided for separate age groups (e.g., 2-3, 4-5, 6-11, and 12-16 years) (Knoff, 1992). The CBCL measures unique aspects of social-emotional and behavioral status not measured by other parental behavior checklists, and, most importantly, the CBCL is designed as a screen for frank childhood psychopathology (Barkley, 1990b; Knoff, 1992). The CBCL is an important behavior rating scale in a preschool assessment battery (Knoff, 1992).

Family Assessment Measure (FAM-III). The FAM-III (Skinner et al., 1995) is a standardized, norm-referenced questionnaire which is a revised version of an earlier scale

(Skinner, Steinhauer, & Santa-Barbara, 1983). The FAM-III: General Scale, administered in this study, was designed using a process model of family functioning and focuses on ascertaining the level of health and pathology in the family. The respondent is asked to endorse 50 statements using a four-point scale (strongly disagree, disagree, agree, strongly agree). The FAM-III is written for a fifth-grade reading level and takes approximately 10 minutes to complete. Scoring results in an overall rating of family functioning, seven clinical subscales (Task Accomplishment, Role Performance, Communication, Affective Expression, Involvement, Control, and Values/Norms), and two response style scales (Social Desirability and Defensiveness)[15]. A T-score of 60 or above is considered clinically significant for all subscales and the overall scale (Skinner et al., 1995).

Internal consistency and test-retest reliability are satisfactory (Skinner et al., 1995; Jacob, 1995). The FAM-III was found to have clearly defined constructs and stable characteristics as well as demonstrating discriminant, concurrent, and predictive validity. The FAM-III has also been found to reliably discriminate between normal controls and a variety of clinical populations (see Skinner et al., 1995 for review).

Home Situations Questionnaire-Revised (HSQ-R). The HSQ-R (DuPaul, 1990) was designed to assess specific problems with attention and concentration across a variety of situations. A list of 14 activities typically seen in home and public situations are presented (e.g., mealtimes, in supermarket), parents are first to rate whether their child

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[15]The FAM-III manual indicates that high or low T-scores on these scales may distort the overall FAM profile; however, it does not suggest that extreme scores invalidates the responses. In the present study, an equal number of parents from each group (ADHD and NC) achieved scores which may have distorted the profile to some degree. As a result, all profiles were entered into analyses.

exhibits any problems concentrating or paying attention in the identified situation (yes or no); if they respond yes, they are asked to rate the severity of difficulties (1 [mild] - 9 [severe]). The HSQ-R can be completed in less than 5 min. Results are expressed in total number of problem settings and mean severity of endorsed problems. Normative data are available for children > 6 years, for whom a z-score can be calculated. Although this questionnaire was normed for children aged 6 to 12, all situations (with one exception: "when asked to do school homework") appear also appropriate for preschool age children. As a result, this questionnaire was deemed appropriate for use in the present study but given the older age range of the normative sample, results were expressed as raw scores. The HSQ-R therefore provided an estimate of the pervasiveness of cross-situational attention/ concentration problems.

DuPaul and Barkley (1992) found the HSQ-R to possess adequate internal consistency, test-retest reliability, construct validity, and concurrent validity when tested with school-age children. In addition, they found that the HSQ-R contributed unique assessment data and were not redundant with the Conners Parent Rating Scale or Child Behavior Checklist.

Injury Behavior Checklist (IBC). The IBC (Speltz et al., 1990) was designed to measure the behavioral characteristics that predict injury in children. The IBC is a parent-report checklist of specific "risky" behaviors for toddlers and preschoolers. Parents are asked to rate the frequency with which their has child engaged in each of 24 risky behaviors (e.g., runs into street, "takes chances" on playground equipment) during the past 6 months using a 5-point scale (0 = not at all, 1 = very seldom [1 - 2 times], 2 =

sometimes [1 time per month], 3 = pretty often [1 time per week], 4 = very often [> 1 time per week]). The IBC can be completed in 10 min. The IBC, a relatively new instrument, has been tested on 253, 2 to 5 year-old preschoolers, with acceptable reliability, internal consistency, and validity (Speltz et al., 1990). Through analysis comparing the results of the questionnaire to the number of injuries previously incurred by their sample, they found that the IBC discriminated children with two or more injuries from those with one or no injuries. Speltz et al. (1990) found the IBC predicted child injury better than parent ratings of general problem behavior.

Parent Stress Index (PSI). The PSI (Abidin, 1983; 1990; 1995) is a parent self-report instrument designed to measure the relative level of stress in the parent-child system by assessing child characteristics, parent characteristics, family context, and life stress events. The PSI is a well-standardized questionnaire appropriate for parents of children aged 1 month to 12 years. The parent is asked to endorse each of 120 statements on a five-point scale (strongly disagree, disagree, not sure, agree, strongly agree). The PSI is written for a fifth-grade reading level and is typically completed in 20 min. Scoring of the PSI yields six Child Domain scale scores (Distractibility/Hyperactivity, Adaptability, Reinforces Parent, Demandingness, Mood, and Acceptability), a Child Domain total score, seven Parent Domain scale scores (Competence, Social Isolation, Attachment, Health, Role Restriction, Depression, and Relationship with Spouse), a Parent Domain total score, a Total Stress score (equivalent to Child + Parent Domain totals), a Life Events Stress score (to measure situational stressors), as well as a defensive responding score (to

indicate a defensive response style)[16]. Percentile scores are calculated. High scores are defined as those ≥ the 85th percentile.

The PSI has high internal consistency for the child domain scales (Distractibility/Hyperactivity, Adaptability, Reinforces Parent, Demandingness, Mood, and Acceptability), parent domain scales (Competence, Social Isolation, Attachment, Health, Role Restriction, Depression, and Relationship with Spouse), and the three summary scales (Child Domain, Parent Domain, and Total Stress) (Abidin, 1995). Test-retest reliability has been supported across 3-week, 1-month, and 3-month intervals (Abidin, 1995) and discriminant validity has been demonstrated, particularly with ADHD versus control school-age children (e.g., Beck, Young, & Tarnowski, 1990; Barkley et al., 1988).

Social Skills Rating System (SSRS). The SSRS (Gresham & Elliott, 1990) is a standardized, norm-referenced rating system used to document the perceived frequency and importance of those behaviors which influence the development of a child's social competence and adaptive functioning. The SSRS provides the opportunity to broadly assess a range of positive or prosocial behaviors and to briefly assess potential problem behaviors. The SSRS assists in screening children suspected as having significant social problem behaviors. One of two versions of this system were employed in this study depending on the preschooler's age (Parent version for Preschoolers [ages 3-4]; Parent version for Elementary Children [ages 5-18]). The SSRS consists of 49 or 55 items,

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[16]The PSI manual provides a cutoff score which indicates the presence of defensive responding. When parents are found to be highly defensive (no definition provided), ratings for the parent domain characteristics may be distorted. In the present study, 2 parents of preschoolers with ADHD and 3 parents of normal controls exhibited some level of defensive responding on this scale. As a result, all profiles were entered into analyses.

depending on the version administered. Scoring results in two domains: the Social Skills domain provides a comprehensive assessment of the presence of social skills (positive); while the Problem Behavior domain provides a measure of those behaviors that interfere with the acquisition or performance of important social skills (negative). The Social Skills domain consists of four to five subdomains depending on the version administered (Cooperation, Assertion, Self-control, Responsibility, and in the elementary version-Empathy). Parents rate the frequency with which a social behavior occurs on a three-point scale (0=never, 1=sometimes, and 2=very often) and rate their perception of the importance of each behavior, using a three-point scale (0=not important, 1=important, and 2=critical). The Problem Behaviors domain consists of two to three subdomains (Externalizing, Internalizing, and Hyperactivity). Parents rate the frequency with which a problem behavior occurs using the same three-point scale (never, sometimes, and very often), but do not rate their perception of the importance of these behavioral difficulties. The SSRS is written for a third-grade reading level and can be completed in approximately 20 min. Scores less than a standard score of 85 (i.e., <1 SD below mean) are considered clinically significant low scores and scores falling greater than a standard score of 115 (i.e., >1 SD above mean) are considered clinically significant high scores. The interpretation of high versus low scores depends on whether it is the social skills or problem behaviors domain being assessed. Reliability and validity (content, criterion-related, and construct) of the SSRS are satisfactory for the social skills domain, but weaker for the problem behavior domain which was not used in this study (Gresham and Elliott, 1990).

Follow-up

Parents and preschoolers were thanked for their assistance, and the preschoolers each received a Certificate of Appreciation. Questions regarding the protocol and the relevance of the research were encouraged and answered. All participants who were involved in this study were provided with a general summary of the findings at the conclusion of the project.

Preschoolers identified as ADHD or as suspect ADHD were offered services through the Preschool ADHD Clinic or referred to other health services if deemed appropriate. Service could include individual appointments for behavioral management strategies, consultation with preschools or physicians regarding treatment, or participation in the Preschool ADHD Clinic parenting program.

Coding Behavioral Observations

The Interact Software System (Dumas, 1990) was used to obtain a continuous recording of behavior. The Interact program is highly flexible, allowing customized data collection, editing, transformation, and analyses in real time (Dumas, 1990). The codes used in the present study were derived, in part, from selected codes designed by Roberts et al. (1985), Forehand and McMahon (1981), and Byrne et al. (in press).

Behavioral coding was conducted by three trained research assistants (uninformed regarding specific study hypotheses and each preschooler's group assignment). The primary researcher conducted reliability coding only. Coding of the behavioral observations was conducted on the High-Structure Task: Language Assessment, Medium-Structure Task: Continuous Performance Test for Preschoolers-Visual, Medium-

Structure Task: Continuous Performance Test-Auditory, Medium-Structure Task: Picture Deletion Task for Preschoolers-Revised, and Low-Structure Task: Play. All tapes were randomly ordered prior to coding to ensure the sequence of coding was not biased in favor of a specific group (ADHD vs. normal control). Coders were trained with the coding system through discussion, practice tapes, and employing the INTERACT tutoring program. Inter-observer agreement (within a 10 s window) was achieved by unannounced, randomly assigned reliability checks on 25% of participants for each observer on each of the tasks (i.e., calculating reliability between research assistants and with the primary researcher). As presented in Table 8, inter-observer agreement values (kappa coefficient) were adequate to high, ranging from .68 to .97 (M=.84) (see Bakeman & Gottman, 1986).

Organization

The results of the above-described tasks and parent questionnaires will henceforth assigned to one of four dimensions (i.e., attention, impulsivity, hyperactivity, and psychosocial), reasoned to represent the core conceptual components of ADHD (Barkley, 1990b). These dimensions were used in previous work with preschoolers with ADHD and found to be helpful in conceptualizing and presenting findings regarding ADHD assessment (Byrne et al., in press). Table 9 illustrates this conceptualization by summarizing how the dependent measures, tasks, and methods of assessment fit within the dimension framework proposed.

Attention dimension. Errors of omission on the Continuous Performance Test for Preschoolers-Visual (hereafter referred to as the Visual CPT), the Continuous

Table 8

Kappa Coefficients for Behavioral Variables

	Kappa Coefficient				
Child Behavior	High-Structure	CPTP-Visual	PDTP-R	CTP-A	Low-Structure
Extraneous Body Movement	.75	.68[a]	.71	.81	--
Grabs	.75	--	--	--	--
Mobility	--	--	--	--	.86
Off-Task	--	.81	.84	--	--
Out of seat	.85	.97	.95	.96	--
Play with assigned toys	--	--	--	--	.85
Play with unsanctioned toys	--	--	--	--	.88
Verbalizes	.76	.82	.84	.91	.74[b]
Examiner Behavior					
Commands	.84	.95	.89	.91	--

[a]Kappa coefficient was calculated based on a continuous 15-s agreement window. [b]Verbalizations to parent only.

Table 9

Dependent Measures, Tasks, and Method of Assessment according to Dimension Conceptualization

	DIMENSION			
	Attention	Impulsivity	Hyperactivity	Psychosocial
DIRECT	■ CPTP-V Omissions ■ PDTP-R Omissions ■ CPT-A Omissions ■ PDTP-R Time to Complete ■ Play Episode duration	■ CPTP-V Commissions ■ PDTP-R Commissions ■ CPT-A Commissions ■ Grabs ■ Spontaneous Verbalizations ■ Off-Task ■ Unsanctioned Toy Play	■ Out of Seat ■ Extraneous Movements ■ Mobility	■ PSPCSA (Competence and Acceptance) ■ High-Structure Commands ■ CPTP-V Commands ■ PDTP-R Commands ■ CPT-A Commands
INDIRECT	• HSQ-R • CBCL Attention	• IBC - Risk Behavior • PSI Demand.	---	• CBCL (Ext.& Int.) • SSRS • PSI (Child, Parent, & Life Event Stress) • FAM

Performance Test-Auditory (hereafter referred to as the Auditory CPT), the Picture Deletion Task for Preschoolers (hereafter referred to as Deletion Task), time to complete the Deletion Task, and the average play episode (start-stop) during the Low-Structure Task represented direct measures of the preschoolers' attention. Parental ratings on the Home Situations Questionnaire-Revised and the CBCL Attention factor represented an indirect measure of the preschoolers' attention and concentration in non-clinic settings.

Impulsivity dimension. Errors of commission on the Visual and Auditory CPTs, the Deletion Task, frequency of grabbing, spontaneous verbalizing, off-task behaviors, and play with unsanctioned toys represented direct clinic-based measures of impulsivity. The PSI Demandingness scale and the Injury Behavior Checklist score gleaned from parental ratings represented indirect, non-clinic measures of the preschooler's impulsivity.

Hyperactivity dimension. The frequency of in-seat extraneous movements, out of seat behavior, and general mobility (around playroom) represented direct clinic-based measures of hyperactivity.

Psychosocial Dimension. The frequency of examiner commands represented direct clinic-based measures of psychosocial functioning (i.e., interaction with an unfamiliar adult). The Pictorial Scale of Perceived Competence and Social Acceptance represented a direct clinic-based measure of the Psychosocial Dimension. The Child Behavior Checklist (Externalizing, Internalizing), Social Skills Rating System (Social Skills), Parent Stress Index (Child, Parent Domains, Life Stress), and Family Assessment Measure: General (Overall functioning) represented the indirect measures of psychosocial functioning in a non-clinic setting, gleaned from parental ratings.

RESULTS

Data Screening

Data were double-checked to ensure correct values were entered into the database. Data screening and analyses were conducted using the SPSS for Windows, version 6.1.3 statistical package (Norusis, 1995). Missing values were infrequent and nonsystematic (see Table 10). The matched pair cases were deleted from analyses on these few variables. As a result, all analyses were conducted on an equal N, matched sample.

Analyses of Individual Dependent Measures

Analysis of Variance (ANOVA) tests were planned for the core data analyses, and therefore, the distributions of variables were evaluated to ensure ANOVA assumptions were met. First, in regard to the normal distribution, each variable was assessed by viewing the distribution of values for each group and by examining skewness and kurtosis values. All variables met the distribution criteria for ANOVA procedures (Grimm, 1993; Howell, 1992; Keppel & Zedek, 1989; Kerlinger, 1986; Norusis, 1993; Tabachnick & Fidell, 1996). Second, in regard to independence, the assumption of independent observations was met. Third, in regard to the controversial assumption of homogeneity of variance, there continue to be conflicting views with supporting empirical evidence, regarding the validity of this assumption. Increasing evidence reveals that the ANOVA procedure is remarkably robust even to the most extreme violations of this assumption (Grimm, 1993; Howell, 1992; Keppel & Zedek, 1989; Kerlinger, 1986; Norusis, 1993; Tabachnick & Fidell, 1996; Tomarken & Serlin, 1986). Furthermore, even for those

Table 10

Number of Cases (N=50) with Missing Values by Dependent Measure.

Dependent Measure	# cases missing	# matches omitted	Total Missing	Explanation for Missing Data
Indirect Measures				
CBCL	1 pair (NC & ADHD)	already missing	2	CBCL for 2-3 years old administered to 3 year-old participants (factors not comparable to 4-16 version)
PSI	1 NC	1 ADHD	2	Did not complete "relationship with spouse" section of questionnaire
FAM-III	0	0	0	
SSRS	2 ADHD 1 NC	2 NC 1 ADHD	6	Incorrect version of SSRS administered (2); too many items missing (1)
IBC	0	0	0	
HSQ-R	0	0	0	
Direct Tests				
PSPCSA	0	0	0	
CPTP-V	0	0	0	
PDTP-R	0	0	0	
CPT-A	0	0	0	
Direct Behavioral Observations				
RDLS-R	0	0	0	
CPTP-V	1 NC	1 ADHD	2	equipment malfunction
PDTP-R	0	0	0	
CPT-A	0	0	0	
Low Structure Play	0	0	0	

Note. NC = Normal Control; ADHD = Attention Deficit Hyperactivity Disorder

wishing to test for homogeneity of variance, there is increasing criticism that the most often used tests of homogeneity of variance are overly conservative (Tabachnick & Fidell, 1996).

Nonetheless, for the present study, it was determined that an arguably more conservative approach to analyses would include a test of homogeneity of variance. In this regard, the highly conservative Levene test of homogeneity of variance was employed (Norusis, 1993). Where indicated, appropriate transformations were conducted based on a review of the distributions for variables; logarithmic, inverse, or square root transformations were employed accordingly (Howell, 1992; Tabachnick & Fidell, 1996). Homogeneity of variance was retested following data transformations and where this assumption was met, analyses proceeded[17]. Those variables not meeting the assumption of homogeneity of variance were analyzed using nonparametric analyses (Siegel, 1956).

Unless specified otherwise, univariate ANOVAs were conducted for each dependent variable to test for a priori predicted differences between the ADHD and normal control groups. An alpha level of .05 was used for all statistical tests except where noted[18]. To further ensure a conservative approach to data analyses, each derived questionnaire factor was only analysed if group differences on the overall or total questionnaire score was found to be statistically significant. For example, individual PSI

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[17]Transformed data were used to calculate ANOVA; however, nontransformed means and standard deviations are reported in tabular form for purposes of simplicity and clarity (Howell, 1992; Tabachnick & Fidell, 1996).

[18]Where no a priori predictions were made, a Bonferroni correction was applied to reduce the likelihood of making Type 1 error.

child domain subtests were analysed only if group differences on the Total Child Domain score was found to be statistically significant. Furthermore, statistical analyses were only conducted for those questionnaire factors about which group differences were a priori hypothesized.

Attention Dimension

The tasks and variables used to measure preschoolers' attention are summarized in Table 11. The results of the analyses conducted on the Attention Dimension are described in Table 12 and Figure 2. Compared to their matched peers, preschoolers with ADHD committed more errors of omission on the Visual CPT, F (1, 48) = 6.23, $p < .05$, but did not commit more omission errors on the Auditory CPT, F (1, 48) = 3.52, $p > .05$, or the Deletion Task[19], F (1, 48) = 2.76, $p > .05$ (see Figure 2). Preschoolers with ADHD took significantly longer to complete the Preschool Deletion Task compared to preschoolers in the normal control group, F (1, 48) = 4.86, $p < .05$ (see Table 12). However, preschoolers did not differ in the time to complete the motor task on the Preschool Deletion Task, F (1, 46) = 3.61, $p > .05$ (ADHD M=77.79 s, SD=42.81, NC M=59.00 s, SD=16.45)[20]. In addition, during the Low-Structure task (play), preschoolers with ADHD engaged in shorter play episodes (start/stop play) on average, compared to their matched peers, F (1, 48) = 9.81, $p < .01$ (see Table 12).

Outside the clinic, parents noted there was a significant difference in the number of

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[19]Error scores and time to complete task was prorated for 3 preschoolers with ADHD because they were unable/unwilling to complete all 8 pages of the task.

[20]Transformed (Inverse) for analysis.

Table 11

Attention Dimension: Tasks, Variables, and Scores used

Test/ Questionnaire	Variable	Scores used
▪ Continuous Performance Test for Preschoolers - Visual (CPTP-V) [M]	Omission Errors	Percentage[a]
▪ Picture Deletion Test for Preschoolers - Revised (PDTP-R) [M]	Omission Errors Time to Complete	Percentage[a] Time in min
▪ Continuous Performance Test - Auditory (CPT-A) [M]	Omission Errors	Percentage[a]
▪ Low Structure Play [L]	Play Episode Duration	Time in min
• Home Situations Questionnaire (HSQ)	Attention Problems	Number of 14 activities/ settings
• Child Behavior Checklist (CBCL)	Attention factor	T-score

Note. ▪ Clinic-based observation/ testing. • Non-clinic parent rating. [M] = Medium-Structure Task. [L] = Low-Structure Task.

[a]Percentage of errors on trials where that error could occur.

Table 12

Attention Dimension: Mean Scores, Standard Deviations, and F-Statistics

Variable	ADHD		NC		
	Mean	(SD)	Mean	(SD)	F (1,46/48)
Omission Errors					
▪ CPTP-V	32.20	(19.68)	19.00	(17.68)	6.23*
▪ PDTP-R	20.27	(18.32)	13.07	(11.62)	ns
▪ CPT-A	43.50	(26.65)	30.13	(23.69)	ns
▪ PDTP-R Time to complete	15.43	(8.20)	11.07	(5.54)	4.86*
▪ Low-Structure Play Episode duration	.90	(.51)	1.60	(.89)	9.81[a]***
• HSQ Attention problems	10.60	(1.87)	3.16	(1.91)	193.82****
• CBCL Attention Problems	69.29	(8.45)	51.21	(2.40)	3.50[b]****

Note. ▪ Clinic-based observation/ testing. • Non-clinic parent rating. SDs in brackets.
[a]Transformed (Log_{10}) for analyses. [b]Mann-Whitney U test.
* $p < .05$. ** $p < .01$. **** $p < .0001$

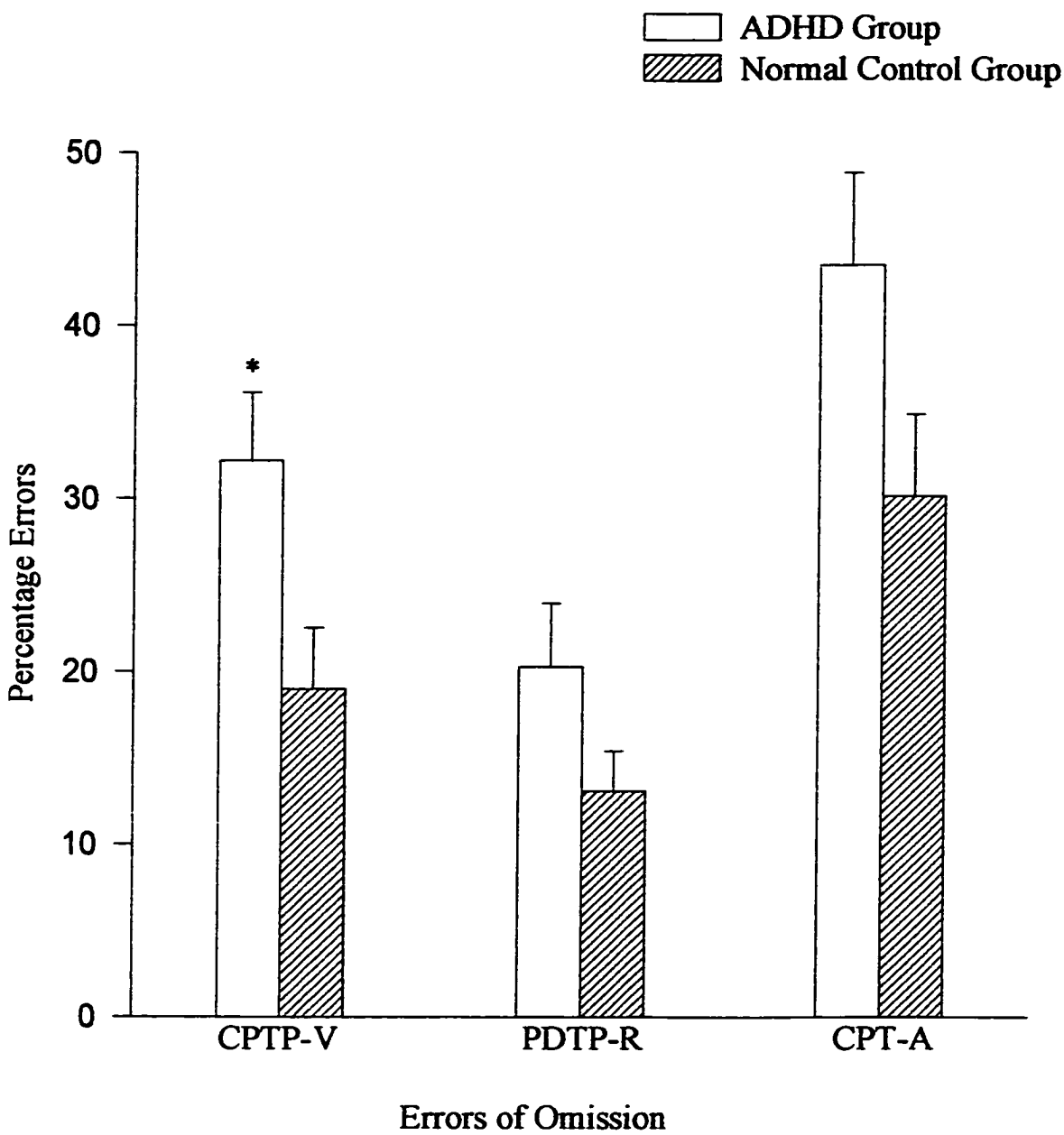

Figure 2. Percentage errors of omission on the CPTP-V, PDTP-R, and CPT-A for the ADHD and normal control groups with standard error bars and an asterik (*) denoting a significant between-groups effect.

situations endorsed by parents on the Home Situations Questionnaire-Revised. Preschoolers with ADHD exhibited difficulty with attention or concentration in more situations than their matched peers, F (1, 48) = 193.82, $p < .0001$ (see Table 12). Similarly, preschoolers with ADHD were rated by their parents as exhibiting more Attention Problems on the Child Behavior Checklist, U (N=48) = 3.50, $p < .0001$, compared to ratings by parents of their matched peers (see Table 12).

Impulsivity Dimension

The tasks and variables used to measure preschoolers' impulsivity are summarized in Table 13. The results of the measures assessing the Impulsivity Dimension are described in Table 14 and Figure 3. Compared to their matched peers, preschoolers with ADHD committed more errors of commission on the Visual CPT, F (1, 48) = 5.30, $p < .05$, and on the Deletion Task, F (1, 48) = 19.27, $p < .001$, but did not commit more commission errors on the Auditory CPT, F (1, 48) = 1.59, $p > .05$ (see Figure 3).

The frequency of verbalizations during Low- (play), Medium- (CPTs and deletion task), and High-Structure (language assessment) observations were recorded and analyzed. Compared to their matched-control peers, there was a significantly higher frequency of non-specific spontaneous verbalizations exhibited by preschoolers with ADHD during the Visual CPT[21], F (1, 46) = 4.84, $p < .05$ (see Table 14). However, there was no group difference in the frequency of preschooler's spontaneous non-specific verbalizations during the High-Structure Task, F (1, 48) = 2.00, $p > .05$, the Deletion

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[21]Behavioral observation data from one participant was not available due to equipment malfunction; as a result, data from his matched peer was also excluded from these analyses.

Table 13

Impulsivity Dimension: Tasks, Variables, and Scores used

Test/ Questionnaire	Variable	Score(s) used
▪ Continuous Performance Test for Preschoolers - Visual (CPTP-V) [M]	Commission Errors	Percentage[a]
	Spontaneous Verbalizations	Frequency
	Off-Task	Frequency
▪ Picture Deletion Test for Preschoolers - Revised (PDTP-R) [M]	Commission Errors	Percentage[a]
	Spontaneous Verbalizations	Frequency
	Off-Task	Frequency
▪ Continuous Performance Test - Auditory (CPT-A) [M]	Commission Errors	Percentage[a]
	Spontaneous Verbalizations	Frequency
▪ High-Structure Task (RDLS-R) [H]	Grabs	Frequency
	Spontaneous Verbalizations	Frequency
▪ Low-Structure (Play) [L]	Verbalizations to Parent	Frequency
	Unsanctioned Play	# who touched ≥ 1 time
• Injury Behavior Checklist (IBC)	Risk taking behavior	Z-score
• Parent Stress Index (PSI)	Demandingness	Percentile

Note. ▪ Clinic-based observation/ testing. • Non-clinic parent rating. [H] = High-Structure Task. [M] = Medium-Structure Task. [L] = Low-Structure Task.
[a]Percentage of errors on trials where that error could occur.

Table 14

Impulsivity Dimension: Mean Score, Standard Deviations, and F-Statistics

Variable	ADHD		NC		
	Mean	(SD)	Mean	(SD)	F (1,46/48)
Commission Errors					
▪ CPTP-V	18.12	(18.34)	8.00	(12.11)	5.30*
▪ PDTP-R	11.88	(21.66)	1.31	(1.64)	19.27***
▪ CPT-A	8.79	(7.72)	5.86	(8.67)	ns
Spontaneous Verbalizations					
▪ CPTP-V	13.75	(12.34)	7.38	(7.03)	4.84*
▪ PDTP-R	37.35	(17.52)	31.01	(13.51)	ns
▪ CPT-A	8.36	(6.28)	7.73	(7.60)	ns
▪ High-Structure	34.00	(17.35)	27.13	(16.96)	ns
▪ Low-Structure[a]	16.64	(14.29)	8.28	(7.46)	6.72*
Off-Task					
▪ CPTP-V	35.58	(17.89)	32.33	(16.83)	ns
▪ PDTP-R	25.00	(12.76)	18.14	(10.99)	4.15*
▪ High-Structure Grabs	.39	(1.22)	.29	(.78)	ns
▪ Low-Structure Unsanctioned Play	15		9		ns[b]
• IBC Risk-Taking Behavior	1.17	(1.44)	-.82	(.69)	61.00[c]****
• PSI Demandingness	91.17	(10.34)	36.54	(27.90)	19.50[c]****

Note. ▪ Clinic-based observation/ testing. • Non-clinic parent rating. SDs in brackets.
[a]Spontaneous Verbalizations to Parent. [b]Test of Proportions. [c]Mann-Whitney U test.
* $p < .05$. *** $p < .001$. **** $p < .0001$.

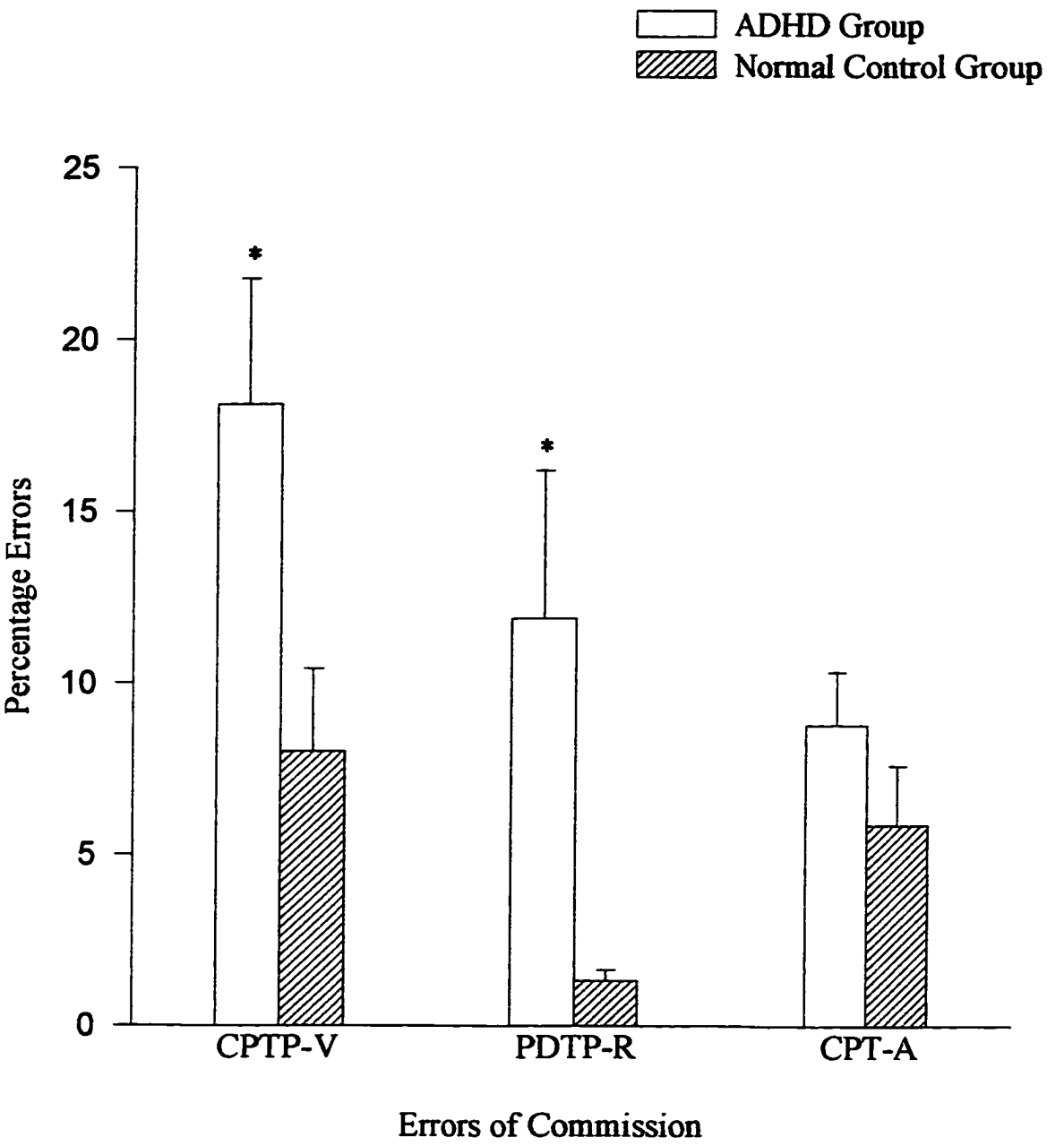

Figure 3. Percentage errors of commission on the CPTP-V, PDTP-R, and CPT-A for the ADHD and normal control groups with standard error bars and an asterik (*) denoting a significant between-groups effect.

Task, F (1, 48) = 2.06, $p > .05$, the Auditory CPT, F (1, 48) = .10, $p > .05$, or during the Low-Structure Task, F (1, 48) = 3.05, $p > .05$ (see Table 14). In regard to preschoolers specific verbalizations, preschoolers with ADHD exhibited significantly more verbalizations directed to parent compared to normal controls, F (1, 48) = 6.72, $p < .05$ during the Low-Structure Task (play) (see Table 14).

Preschoolers with ADHD more frequently looked away from a task than their matched peers during the Deletion Task, F (1, 48) = 4.15, $p < .05$, but not during the Visual CPT, F (1, 46) = .42, $p > .05$ (see Table 14). The Auditory CPT by nature could not be analysed for off-task behavior (no reference point). Despite a trend toward preschoolers with ADHD being more likely to play with the off-limits toys during the Low-Structure Task (see Table 14), a test of proportions revealed no difference in unsanctioned play[22], z (N=50) = 1.70, $p > .05$. During the High-Structure Task, there was also no significant group difference on grabbing (toys or test materials), F (1, 48) = .12, $p > .05$ (see Table 14).

In regard to preschool risk behavior (Injury Behavior Checklist), preschoolers with ADHD were rated by their parent as more frequently engaging in behaviors that might result in injury, compared to their matched peers, U (N=50) = 61.00, $p < .0001$ (see Table 14). Preschoolers with ADHD were also rated to be more noncompliant (Demandingness) on the Parent Stress Index, U (N=48) = 19.50, $p < .0001$ (see Table 14).

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[22]The number of preschoolers per group who touched the unsanctioned toys at least once.

Hyperactivity Dimension

The tasks and variables used to measure preschoolers' activity levels are summarized in Table 15. The results of analyses conducted on the Hyperactivity Dimension are described in Table 16. Compared to their matched peers, preschoolers with ADHD more frequently got out of seat during the Auditory CPT, F (1, 48) = 9.37, $p < .01$, but not during the Deletion, F (1, 48) = 1.01, $p > .05$, or High-Structure tasks (language assessment), F (1, 48) = .35, $p > .05$. There was also no difference in the amount of time spent out of seat during the Visual CPT, F (1, 46) = 3.63, $p > .05$ (see Table 16).

The preschoolers with ADHD did not more frequently exhibit extraneous movements (e.g., fidgeting) during the Visual CPT, F (1, 46) = .60, $p > .05$, the Auditory CPT, F (1, 48) = .08, $p > .05$, the Deletion Task, F (1, 48) = .66, $p > .05$, or during the High-Structure Task (i.e., fidgets), F (1, 48) = 1.28, $p > .05$ (see Table 16). In contrast, analysis of the Low-Structure Task revealed that preschoolers with ADHD exhibited significantly more activity[23] in the playroom than their matched peers, F (1, 48) = 9.61, $p < .01$ (see Table 16).

Psychosocial Dimension

The tasks and variables used to measure preschoolers' psychosocial functioning are summarized in Table 17. The results of analyses conducted on the Psychosocial

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[23]Extreme cases (outliers) were modified for descriptives and analyses because this variable was not normally distributed. Deviant cases were identified using the boxplot and their values were recoded by adding a value 1 unit larger than the most extreme value (not an outlier) in the distribution (Tabachnick & Fidell, 1996).

Table 15

Hyperactivity Dimension: Tasks, Variables, and Scores used

Task/ Questionnaire	Variable	Score(s) used
▪ Continuous Performance Test for Preschoolers - Visual (CPTP-V) [M]	Out of Seat Extraneous Movement	Duration of time (s) Frequency
▪ Picture Deletion Test for Preschoolers - Revised (PDTP-R) [M]	Out of Seat Extraneous Movement	Frequency Frequency
▪ Continuous Performance Test - Auditory (CPT-A) [M]	Out of Seat Extraneous Movement	Frequency Frequency
▪ Low-Structure (Play) [L]	Mobility	Frequency of grid changes

Note. ▪ Clinic-based observation/ testing. [M] = Medium-Structure Task. [L] = Low-Structure Task.

Table 16

Hyperactivity Dimension: Mean Scores, Standard Deviations, and F-Statistics

Variable	ADHD		NC		
	Mean	(SD)	Mean	(SD)	F (1,46/48)
Out of Seat					
▪ CPTP-V (in sec)	119.29	(138.11)	42.50	(71.95)	ns[a]
▪ PDTP-R	1.66	(2.23)	1.03	(2.20)	ns
▪ CPT-A	2.23	(2.77)	.36	(.76)	9.37[b]**
▪ High-Structure	3.61	(3.10)	3.00	(4.08)	ns
Extraneous Movement					
▪ CPTP-V	9.46	(6.39)	8.08	(5.90)	ns
▪ PDTP-R	16.10	(11.54)	13.57	(10.40)	ns
▪ CPT-A	10.47	(7.38)	10.98	(5.37)	ns
▪ High-Structure Fidgets	18.98	(13.40)	22.91	(11.01)	ns
▪ Low-Structure Mobility[c]	44.88	(19.09)	28.24	(18.86)	9.61**

Note. ▪ Clinic-based observation/ testing. SDs in brackets.
[a]Transformed (Log_{10}) for analyses. [b]Transformed (Inverse) for analyses. [c]Extreme cases (outliers) modified for descriptives and analyses.
** $p < .01$.

Table 17

Psychosocial Dimension: Tasks, Variables, and Scores used

Task/ Questionnaire	Variable	Scores used
▪ Pictorial Scale of Perceived Competence and Social Acceptance (PSPCSA)	Competence Acceptance	Z-score Z-score
▪ High-Structure Language Assessment [H]	Examiner Commands	Frequency
▪ Continuous Performance Test for Preschoolers - Visual (CPTP-V) [M]	Examiner Commands	Frequency
▪ Picture Deletion Task for Preschoolers - Revised (PDTP-R) [M]	Examiner Commands	Frequency
▪ Continuous Performance Test - Auditory (CPT-A) [M]	Examiner Commands	Frequency
• Child Behavior Checklist (CBCL)	Externalizing Internalizing	T-score T-score
• Social Skills Rating System (SSRS)	Social Skills	Standard Score[a]
• Parent Stress Index (PSI)	Child Domain Parent Domain Life Events	Percentile Percentile Percentile
• Family Assessment Measure - 3rd edition (FAM-III)	Overall Rating	T-score

Note. ▪ Clinic-based observation/ testing. • Non-clinic parent rating. [M] = Medium-Structure Task. [L] = Low-Structure Task.
[a]Lower score = fewer social skills.

Dimension are presented in Table 18.

When preschoolers' self-perceptions were assessed using the Pictorial Scale of Perceived Competence and Social Acceptance, there was no significant difference between the ADHD and Normal Control groups on either the Competence Scale, F (1, 48) = .04, p > .05, or Acceptance Scale, F (1, 48) = 1.39, p > .05 (see Table 18).

As noted earlier, in response to preschoolers' behavior during the administration of the high structure language assessment, visual CPT, auditory CPT, and deletion task, examiner commands were issued and recorded. More frequent examiner commands were issued to preschoolers with ADHD during the high structure task (RDLS-R), F (1, 48) = 11.18, p < .01, the deletion task, F (1, 48) = 13.23, p < .001, and the auditory CPT, F (1, 48) = 8.92, p < .01. However the behavior of preschoolers with ADHD during the visual CPT did not elicit more frequent examiner commands, F (1, 46) = 1.33, p > .05.

As predicted, parental ratings on the Child Behavior Checklist revealed that preschoolers with ADHD had significantly higher scores than their matched peers (normal controls) on Externalizing, F (1, 46) = 80.00, p < .0001 and Internalizing, F (1, 46) = 9.98, p < .01 broad band factors (see Table 18). A 2x2 (diagnosis by domain) ANOVA with repeated measures was conducted in order to assess the interaction between these variables. Results revealed a significant interaction between group and domain on the CBCL suggesting that the difference between the ADHD group and NC group is greater for the externalizing scores compared to the internalizing scores, F (1, 46) = 13.78, p < .01. Preschoolers with ADHD were also rated on the Child Behavior Checklist as

Table 18

Psychosocial Dimension: Mean Scores, Standard Deviations, and F-Statistics

Variable	ADHD		NC		F (1,46/48)
	Mean	(SD)	Mean	(SD)	
▪ PSPCSA					
Competence	-.58	(1.22)	-.63	(.93)	ns
Acceptance	.14	(.86)	-.13	(.73)	ns
Examiner Commands					
▪ High-Structure	8.25	(6.36)	3.71	(3.46)	11.18[a]**
▪ CPTP-V	8.67	(8.12)	2.67	(3.87)	ns[b]
▪ PDTP-R	21.84	(12.38)	10.57	(4.81)	13.23[b]***
▪ CPT-A	11.37	(8.83)	4.97	(4.31)	8.92[b]**
• CBCL					
Externalizing	69.00	(8.55)	48.54	(7.24)	80.00****
Internalizing	56.21	(12.32)	46.08	(9.73)	9.98**
• SSRS					
Social Skills	85.00	(15.01)	107.59	(11.96)	30.49****
• PSI					
Child Domain	86.17	(19.12)	29.23	(22.52)	89.11****
Parent Domain	60.46	(30.95)	37.40	(30.39)	6.78*
Life Event Stress	51.44	(33.76)	52.13	(35.67)	ns
• FAM-III					
Overall Family Functioning	50.12	(9.95)	48.88	(8.54)	ns

Note. ▪ Clinic-based observation/ testing. • Non-clinic parent rating. SDs in brackets.
[a]Transformed (Square root) for analyses. [b]Transformed (Log_{10}) for analyses.
* $p < .05$. ** $p < .01$. *** $p < .001$. **** $p < .0001$

exhibiting more Aggressive Behavior, U[24] (N=48) = 16.00, p < .0001 (ADHD M=72.33, SD=11.26; NC M=52.17, SD=3.50), and Social Problems, U (N=48) = 46.00, p < .0001 (ADHD M=62.75, SD=8.06; NC M=51.13, SD=2.66) compared to their matched-controls.

Preschoolers with ADHD were also rated by their parents (Social Skills Rating System) as exhibiting significantly fewer age-appropriate social skills than their matched-control peers, F (1, 42) = 30.49, p < .0001 (see Table 18).

Parental ratings on the Parent Stress Index revealed no between-group difference in ratings of Life Event Stress (e.g., divorce, started new job), F (1, 46) = .00, p > .05. However, as predicted, parents of preschoolers in the ADHD group reported significantly more stress in relation to their preschooler's behavioral characteristics (Child Domain), F (1, 46) = 89.11, p < .0001, and in relation to their own or family characteristics (Parent Domain), F (1, 46) = 6.78, p < .05, compared to parents of matched-control preschoolers (see Table 18). A 2x2 (diagnosis by domain) ANOVA with repeated measures was conducted in order to assess the interaction between these variables. Results revealed a significant interaction between group and domain on the PSI suggesting that the difference between the ADHD group and NC group is greater for the child domain scores compared to the parent domain scores, F (1, 46) = 20.85, p < .001.

Parents of preschoolers with ADHD, also rated their preschoolers as exhibiting fewer socially desirable characteristics (Acceptability), F (1, 46) = 8.48, p < .01 (ADHD M=61.71, SD=23.59; NC M=39.88, SD=28.17), being less reinforcing (Reinforces

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[24]U = Mann-Whitney U test (nonparametric).

Parent), F (1, 46) = 10.18, $p < .01$ (ADHD M=63.98, SD=23.64; NC M=41.88, SD=24.35), being more resistant to change in the physical and social environment (Adaptability), F (1, 46) = 18.23, $p < .001$ (ADHD M=77.52, SD=28.07; NC M=43.25, SD=27.54), and as exhibiting more inattention and activity (Distractability/ Hyperactivity), U (N=48) = 3.00, $p < .0001$ (ADHD M=93.98, SD=9.85; NC M=23.38, SD=22.39), compared to parental ratings of the matched controls. Parents of preschoolers with ADHD rated themselves as less competent in their role as a parent (Competence), F (1, 46) = 19.07, $p < .001$ (ADHD M=71.42, SD=28.82; NC M=35.58, SD=28.02), but contrary to hypothesis, they did not rate themselves as having significantly more symptoms of depression, F (1, 46) = 2.33, $p > .05$ (ADHD M=57.44, SD=31.74; NC M=43.21, SD=32.87), compared to parents of normal controls.

In contrast to these group differences, there was no difference between parents' ratings on the overall index of family functioning on the Family Assessment Measure-III: General Scale, F (1, 48) = .22, $p > .05$ (see Table 18). The FAM-III: GS T-scores for the overall scale and all subscales were well within normal limits. Consistent with the conservative approach to analyses previously outlined, no further analyses were conducted. For an overall summary of the results listed by dimension, see Table 19 (direct measures) and Table 20 (indirect measures).

Discriminant Function Analyses

The use of a multidimensional assessment protocol not only allows address of practical assessment and theoretical issues (Barkley, 1991; Hinshaw et al., 1997; Mariani

Table 19

Summary of Significant Findings for Direct, Clinic-Based Observation or Testing according to Dimension Conceptualization

Attention	Impulsivity	Hyperactivity	Psychosocial
Errors of Omission	Errors of Commission	Out of Seat	PSPCSA
✓ CPTP-V	✓ CPTP-V	High-Structure	Competence
PDTP-R	✓ PDTP-R	CPTP-V	Acceptance
CPT-A	CPT-A	PDTP-R	
		✓ CPT-A	Examiner Commands
PDTP-R	Grabs		✓ High-Structure
✓ Time to Complete	High-Structure	Extraneous Movements	CPTP-V
		CPTP-V	✓ PDTP-R
Play Episode duration	Spontaneous Verbalizations	PDTP-R	✓ CPT-A
✓ Low-Structure task	High-Structure	CPT-A	
	✓ CPTP-V		
	PDTP-R	Fidgets	
	CPT-A	High-Structure	
	✓ Low-Structure		
		Mobility	
	Off-Task	✓ Low-Structure	
	CPTP-V		
	✓ PDTP-R		
	Unsanctioned Toy Play		
	Low-Structure		

Note. ✓ Statistically significant finding.

Table 20

Summary of Significant Findings for Indirect, Non-Clinic Parent Observation according to Dimension Conceptualization

Attention	Impulsivity	Hyperactivity	Psychosocial
✓ HSQ	✓ IBC - Risk Behaviour	---	CBCL
			✓ Externalizing
✓ CBCL Attention	✓ PSI Demandingness		✓ Internalizing
			✓ SSRS
			PSI
			✓ Child Domain
			✓ Parent Domain
			Life Stress
			FAM

Note. ✓ Statistically significant finding.

& Barkley, 1997; Mirsky et al., 1991; Shaywitz et al, 1997), but also provides an opportunity to evaluate the relative predictive value (diagnosis) of the various measures within the protocol. In this regard, it was thought valuable to determine which of the commonly used measures employed in this study would best predict diagnostic classification (ADHD vs. Normal Control) in this relatively large preschool sample.

Discriminant Function Analysis (DFA) is a statistical procedure which is, in comparison to other statistical procedures, highly sensitive to sample size, multivariate normality, participant to variable ratio, linearity, and homogeneity of variance-covariance matrices. Violation of assumptions for DFA are not uncommon (Stevens, 1986; Tabachnick & Fidell, 1996) and DFA is less affected by the violation of these assumptions when classification is the focus of the analysis, as is the case in this study. However, in these analyses, adherence to the assumptions (univariate outliers and homogeneity of variance-covariance) were enforced by modifying outliers and transforming variables (Tabacknick & Fidell, 1996). Only those variables meeting these DFA assumptions and which were found to be significant (group differences) in the previously reported analyses were included in the DFA.

In this regard, two separate DFAs were conducted. The first DFA was conducted with four variables derived from parent-completed standardized questionnaires in order to examine the relationship between a diagnosis (ADHD vs. NC) and parents' ratings on selected questionnaires. Preschoolers' scores on the injury behavior checklist and CBCL attention factor were not entered into this analysis given their heterogeneity of variance. Diagnosis (i.e., ADHD vs. NC) was the chosen grouping variable, and the parent's ratings

(i.e., CBCL-total problems, PSI-total stress, SSRS-social skills, and HSQ-R-number attention problem situations) were used as predictor variables. Given that the indirect measures (parent questionnaires) and the 'gold standard' DSM-IV (APA, 1994) diagnoses (parent interviews) were based on parental report, this DFA should be interpreted cautiously.

The results of this forward step-wise DFA showed that diagnosis is best predicted by a weighted linear combination of the scores obtained on the HSQ-R and CBCL (see Table 21). The resultant function was found to discriminate significantly between groups ($\chi^2 = 64.49$, df = 2, $p < .0001$). Each of the remaining parent-completed questionnaire scores (PSI-total stress and SSRS-social skills) added little predictive power to the discriminant function and thus failed to enter into the regression equation. However, when combined, the scores on the two parent-rated variables correctly identified 100% of the sample as to diagnostic status. The resultant regression equation for the ADHD group is ADHD = - 45.31 + 1.07 CBCL Total T-score + 1.52 HSQ-R (number problem situations). The resultant regression equation for the normal control group is NC = -20.30 + .85 CBCL Total - .23 HSQ-R # problem situations.

The second DFA was conducted separately given that the predictor variables and diagnoses were independently derived. In order to examine the relationship between a diagnosis of ADHD and the preschooler's performance during direct clinic-based tests, nine variables from the direct assessment measures were included. The frequency of out of seat behavior during the auditory CPT was not entered into this analysis given the heterogeneity of variance. Diagnosis (i.e., ADHD vs. NC) was the chosen grouping

Table 21

Summary Table for Results of Stepwise Discriminant Function Analysis (Classifying Preschoolers with ADHD and Normal Controls) for the Indirect Parent Questionnaires

Step Number	Variable Entered	F-Value to Enter	# Variables Included	Approximate F-Statistic	Degrees of Freedom
1	HSQ-R	158.87	1	158.87****	1 38
2	CBCL	4.93	2	90.10****	1 37

**** $p < .0001$.

variable, and the direct assessment measures (i.e., Visual CPT Omission Errors, Visual CPT Commission Errors, Deletion Task Commission Errors, Deletion Task Time to complete, Examiner Commands, Child Verbalizations, Off-Task, Mobility, and Average Play Episode) were used as predictor variables. This DFA analysis was conducted in order to assess how well the direct information based on preschoolers' performance and behavior during clinic tests predicted preschoolers' diagnoses (ADHD vs. NC).

The results of this forward step-wise DFA showed that diagnosis is best predicted by a weighted linear combination of the scores obtained on the Frequency of Examiner Commands (across three tasks: High-Structure [language] + PDTP-R + CPT-A) and the Frequency of Child Verbalizations (across two tasks: CPTP-V + Low-Structure [play]) (see Table 22). The resultant function was found to discriminate significantly between groups ($\chi^2 = 21.94$, df = 2, $p < .0001$). Each of the remaining direct clinic measures (visual CPT omissions, visual CPT commissions, deletion task commissions, deletion task time to complete, off-task, mobility, and average play episode) added little predictive power to the discriminant function and thus failed to enter into the regression equation. However, when taken together, the scores on the two direct clinic measures correctly identified 74% of the sample as to diagnostic status; 72% of the ADHD group and 76% of the normal control group were correctly identified for this function. The resultant regression equation for the ADHD group is ADHD = - 27.17 + 9.21 Child Verbalizations + 25.67 Examiner Commands. The resultant regression equation for the normal control group is NC = -17.21 + 6.38 Child Verbalizations + 21.07 Examiner Commands.

The regression equations can be used to classify future cases with knowledge of

Table 22

Summary Table for Results of Stepwise Discriminant Function Analysis (Classifying Preschoolers with ADHD and Normal Controls) for the Direct Clinic-Based Measures

Step Number	Variable Entered	F-Value to Enter	# Variables Included	Approximate F-Statistic	Degrees of Freedom
1	Examiner Commands	22.88	1	22.88****	1 46
2	Child Verbalizations	3.93	2	14.14****	1 45

**** $p < .0001$.

the child's scores on the discriminating measures. The child can then be assigned to the group with the largest value of the classification function. Nevertheless, the accuracy of the classification functions for a new sample would be lower than the classification reported in the current sample.

DISCUSSION

This study examined the clinical validity of a multidimensional assessment protocol specifically designed to assess ADHD in preschoolers. The protocol incorporated multidimensional aspects (i.e., attention, impulsivity, hyperactivity, and psychosocial) of ADHD using multiple assessment measures (i.e., parent report, direct tests of preschoolers' attention and impulsivity, as well as behavioral observations) which were developmentally appropriate for preschoolers. The preschool protocol shares many psychometric and conceptual properties with those used in ADHD assessment of school-age children which may facilitate future study of continuity of the diagnostic profile. To facilitate transition from the results section, the discussion will be organized according to each of the protocol dimensions.

Attention Dimension

Direct Measures

Although the use of visual CPTs with preschoolers with suspected or confirmed attention and behavior problems has revealed promising findings (Harper & Ottinger, 1992; Mariani & Barkley, 1997; Musten et al., 1995), these paradigms have been criticized for either their developmental inappropriateness for preschoolers or methodological problems (Campbell et al., 1994; Harper & Ottinger, 1992; Mariani & Barkley, 1997). Using a newly designed computer CPT for preschoolers (Corkum et al., 1995), preschoolers with ADHD in the present study were more inattentive (i.e., exhibited more errors of omission) when they were required to sustain visual attention. This finding is consistent with research with school-age children with ADHD (Barkley, 1990; 1991;

Corkum & Siegel, 1993; Koegela, 1995; Losier et al., 1996).

In contrast to their performance on a visual CPT, on an auditory CPT, preschoolers with ADHD were equally attentive as their matched-controls. The initial interpretation of this contrast is that early inattention is modality specific. By comparison, Shapiro and Herod (1994) did not find school-age children with ADHD to be inattentive on either a visual or auditory task, while Sykes et al. (1973) found school-age children with hyperactivity to be more inattentive, on a composite variable (auditory CPT + visual CPT). Alternatively, the pattern of results found in the present study may reflect differences in task design and procedure. In this regard, the assessment protocol had a set task order (visual CPT - 3rd task; auditory CPT - 5th task), the examiner was absent for the visual CPT, but present for the auditory CPT (see Draeger et al., 1986), and the method of response differed (visual CPT - button depression; auditory CPT - touching target). To address these issues, a research study aimed at controlling these procedural differences is underway in the Preschool Attention Deficit Hyperactivity Disorder Clinic, IWK Grace Health Centre. This study will more clearly ascertain whether early modality-specific attention deficits exist in ADHD preschoolers compared to normal controls.

In regard to the deletion or cancellation task, preschoolers with ADHD were equally attentive as their matched-controls. This finding is consistent with the results of an earlier version of this task which did not differentiate preschoolers with and without ADHD (Byrne et al., in press). The current picture deletion task for preschoolers was an expanded version of the tasks employed by Byrne et al. (in press) and Corkum et al. (1995), revised to better assess the limits of preschoolers' attention to a paper-pencil

visual search task. The absence of differences on this task are in contrast to studies with school-age children with ADHD who have been found to be more inattentive than their normal-controls peers (see Barkley 1990; 1991 for review). Although preschoolers' attention as measured by omission errors continued to unsuccessfully differentiate between groups of children (ADHD vs. Normal Control), preschoolers with ADHD took significantly longer to complete this task than their peers, also consistent with Byrne et al (in press). In contrast to the visual search component of the deletion task, there was no significant difference between groups in the time taken to complete the motor task (a measure of psychomotor speed). Perhaps preschoolers with ADHD are slowing down to compensate for their inattention, resulting in equivalent performance levels (i.e., no difference in errors of omission) on the deletion task. This pattern of findings provides support for interpreting time to complete the deletion task as an additional measure of inattention. Alternatively, the failure to find different rates of omission errors may reflect preschoolers' inexperience with these types of tasks at this stage of development. Finally, it is also possible that the task may have been so novel and engaging for young preschoolers (hands-on, stamping picture) that an existing attentional impairment may be temporarily masked.

Preschoolers' attention to task during a low-structure play setting differentiated those with and without ADHD in the present study. The duration play episode (start - stop) for toys during this task was shorter among preschoolers with ADHD compared to their matched-controls, suggesting a briefer attention span even during self-initiated play. This finding is consistent with behavioral observation studies conducted with preschoolers

with either ADHD or externalizing problem behaviors (Alessandri, 1992; Campbell, 1991a; 1994), although in contrast to a previous study conducted in this clinic (Byrne et al., in press). The smaller sample size of the Byrne et al. (in press) study may account for varied findings; however, the means in their study were quite similar across groups, though the variability of play shifts in the ADHD group was quite heterogeneous. In contrast to this pattern with preschoolers, Roberts and associates (1984) did not find shorter episodes of play exhibited by school-age children with hyperactivity. This may reflect the fact that as the child matures, at least for low-structure, self-selected activity, sufficient vigilance can be exhibited by children with ADHD. The current findings are consistent with common parental complaints that preschoolers referred for ADHD seem less able to become engaged in a task, move quickly from one activity to another, and spend less time with each task compared to his or her playmates (Barkley, 1990b).

Indirect Measures

In regard to indirect measures of attention, parental ratings of preschoolers' attention and concentration suggest that preschoolers with ADHD have more persistent and significant difficulties than matched-controls in a range of different activities and settings. Preschoolers with ADHD were also rated as exhibiting attentional problems within the clinical range, scores which were significantly higher than those of the matched controls. This parental-rated child profile is consistent with previous research with school-age children with and without ADHD using these measures (CBCL and HSQ-R) (Barkley et al., 1990; Breen & Barkley, 1988; DuPaul & Barkley, 1992) and consistent with parent ratings of ADHD preschoolers' attention problems on the CBCL reported in

Byrne et al. (in press).

In summary, compared to normal control preschoolers, preschoolers with ADHD exhibit more inattention, demonstrated by their lower vigilance on a computerized visual CPT, slower performance on the deletion task, and shorter average play episodes during low-structure toy play. Compared to parents of normal controls, parents of preschoolers with ADHD report that their preschoolers exhibit significant attention difficulties outside the clinic setting. In fact, parents report that concentration problems are pervasive across a variety of situations and activities.

Impulsivity Dimension

Direct Measures

In the present study, preschoolers with ADHD were more impulsive (i.e., exhibited more errors of commission) when they were required to sustain attention for visually presented material, although not for auditorally presented material. The interpretation of this finding has provided limited guidance from the paucity of multimodal CPT research conducted to date. Shapiro and Herod (1994) found school-age children with ADHD were significantly more impulsive on both auditory and visual CPTs, with the auditory task being more discriminating than the visual task. Sykes et al. (1973) found children with hyperactivity to be more impulsive than controls on the auditory and visual CPTs combined. It is possible that the current results reflect a modality specific impairment in impulsivity. Given the inconsistency in the pattern of findings, it may also reflect procedural differences between the auditory and visual CPTs utilized. As described earlier, further study is required to address these issues. Nevertheless, when presented

with the visual-search cancellation task, the preschoolers with ADHD were significantly more impulsive than their matched controls. This finding is consistent with the recent results of Byrne et al. (in press) using an earlier version of this cancellation task.

However, Mariani and Barkley (1997) did not find preschoolers with ADHD to be more impulsive on a preschool version of a Matching Familiar Figures test (MFFT). The MFFT has often been used as the cancellation test of choice among school-age studies; however, results of this tasks' discriminative power in detecting ADHD versus normal controls have been mixed (see Barkley, 1990). Indeed findings have been so varied with the MFFT across a variety of populations that Barkley (1990) recommended against employing the MFFT in clinical assessment of ADHD. The picture deletion task for preschoolers employed in the present study was designed to be conceptually and procedurally more similar to the cancellation tasks used with school-age and adolescent children with ADHD (e.g., Aman & Turbott, 1986; Brown & Wynne, 1982).

Upon qualitative analysis of response pattern, the preschoolers appeared to make two types of commission responses on this task. In the first type preschoolers erroneously "stamped" a non-target stimuli either without realizing the error or with quick recognition of their mistake (e.g., they might say "oops" and look at the examiner). In the second type, preschoolers' commission errors resulted from what appeared to be "intentional" inappropriate use of the stamper (e.g., smearing ink, coloring stimuli, or connecting target or non-target stimuli by paths). The first type of error appeared to be more "impulsive", as traditionally conceptualized, while the second type of error appeared more "intentional" or "noncompliant". Nevertheless, the second type of error may also reflect the ADHD

preschoolers' impulsivity, as demonstrated by their inability to inhibit the urge to smear, color, or connect stimuli. These inappropriate responses were unlikely to be the result of their misunderstanding or inability to carry out the task correctly given that the administration of the task involved teaching preschoolers how to appropriately use the stamper and requiring preschoolers to demonstrate the ability to identify and mark only the target stimulus from an array of distracters, as well as allowing reminder commands to be issued by the examiner in response to predetermined off-task behaviors (e.g., pooling ink, smearing, marking too many nonconsecutive stimuli).

Scoring criteria developed for this task were objective and strict; any 2 mm x 2 mm mark on a target or nontarget stimuli resulted in either an accurate response or commission error. The observation that two qualitatively different types of commission errors were being committed was post-hoc and as a result, were not scored separately. In future studies, this issue could be addressed further through the development of a priori coding or scoring guidelines. Based on observation of preschoolers in the present study, both types of error are likely to differentiate preschoolers with ADHD from normal controls. However, the base rate of the second, more "intentional" error is likely to be higher than the first, traditional error of commission. A particular challenge for researchers in describing and documenting these two potentially different error types will be the attempt to operationalize the child's level of "intentionality" and determine his or her ability to inhibit response.

Partially complementing the above-noted impulsivity demonstrated on the visual CPT and preschool deletion task, preschoolers with ADHD were significantly more verbal

than their matched controls during the visual CPT and they verbalized to their parent more often during the low-structure (play) task. It is noteworthy that during both of these tasks there was not an adult within view (examiner or parent), arguably requiring more self-regulation. Initiating verbal contact with the examiner or parent may have resulted from the preschooler's inability to independently focus on the task at hand. In support of this interpretation, there was no difference in the frequency of spontaneous verbalizations during tasks where the examiner was present and sitting beside the preschooler (preschool deletion task, auditory CPT, and high-structure task). Therefore, preschoolers appear to be able to inhibit the urge to spontaneously verbalize when there is presence of or more direct attention from an adult. This is supported by Draeger et al. (1986) studying school-age children.

Previous findings regarding verbalizations are equivocal as to their power in differentiating groups of school-age children with and without ADHD (see Platzman et al., 1992 for review). In addition, Byrne et al. (in press) did not find that verbalizations distinguished preschoolers with ADHD from normal controls in either a low or a high-structure task. However, the coding system in the present study employed a frequency of discrete verbalizations strategy whereas the coding system employed in the Byrne et al. (in press) study was based on an interval coding method in which verbalizations were coded if they occurred in the preceding 10 s interval. This previous coding system was employed due to impediments to high quality audiotape recording and resulting difficulty determining end points of discrete verbalizations. Roberts et al. (1984) measured vocalizations of school-age children during three tasks: free play; restricted play; and

restricted academic. Vocalizations did not distinguish between school-age children with and without hyperactivity on any of the tasks. However, during Roberts et al. (1984) behavioral observations the examiner was not only out of the child's view within the room, but was absent from the room, and the child was therefore unable to initiate verbalizations. Platzman et al. (1992) stated that in approximately 50% of the studies they reviewed, school-age children with hyperactivity vocalized significantly more frequently than controls; there was no discussion about the type of tasks or presence of the examiner, in which significant differences emerged. In the Platzman et al. (1992) review, negative verbalizations were one of three behaviors most likely to discriminate children with ADHD from controls. However, in the present study, the frequency of negative verbalizations was relatively infrequent and very difficult to code reliably.

Frequency of looking away from task was observed during the visual CPT and picture deletion task; off-task behavior (based on eye-gaze) was not coded in the auditory CPT given the inherent non-visual nature of this task. Preschoolers with ADHD looked away from task significantly more frequently during the picture deletion task, reflecting greater impulsivity during this task; however, the two groups did not differ in this behavior during the visual CPT. Although off-task behaviors typically consisted of the preschooler looking away from the task for very brief periods, at times preschoolers looked away in order to engage in other, "more interesting" behaviors (e.g., shaking the bingo marker). Previous findings indicate that the frequency of off-task behaviors discriminates between ADHD and non-ADHD children in approximately 50% the studies reviewed by Platzman et al. (1992). School-age and preschool-age children have been found to spend

significantly longer periods of time off-task during a variety of self and experimenter-paced tasks (Campbell et al., 1982; Harper & Ottinger, 1992; Roberts et al., 1984).

In the present study, the deletion task reflects the only task, with the exception of the low-structure play task, in which the preschooler controlled the pace of the task. Looking away from the deletion task did not result in the preschooler missing targets, rather, it may have enabled the preschooler to put the demands of the task "on hold" while attending to something other than the task at hand. During the visual CPT the task continued regardless of the preschooler's off task behavior. This suggests that preschoolers with ADHD may indeed have been sensitive to the fact that they could not "stall" the visual CPT by looking away. Indeed some researchers have hypothesized that a child's performance (i.e., omission and commission errors) improves during self-paced, rather than experimenter-paced activities (Alberts & van der Meere, 1992; Draeger et al., 1986; Sykes et al., 1973). However, they do not speculate about the impact that locus of control may have on a child's impulsive behaviors, particularly as it applies to preschoolers.

As discussed earlier, compared to normal controls, preschoolers with ADHD took significantly longer to complete the self-paced deletion task. This may further support the premise that during this time "off", preschoolers with ADHD engaged in more task irrelevant, impulsive behaviors (e.g., shaking the bingo marker, looking away, commission errors) thereby extending the task duration. It is important to note that although off-task behavior was predominately conceptualized as reflecting impulsive behavior, it may also be interpreted as reflecting inattention (see Barkley, 1997; Mirsky et al., 1991; Shaywitz et

al., 1997 for discussion). Given the absence of a measure of preschooler's covert state of arousal or attention, as typically measured by neuroelectrophysiological or neurochemical methods, it is difficult to speculate about the underpinnings of their looking away behavior. The frequency of this behavior has important implications for children in terms of their approach to independent school-work tasks, and subsequent accuracy.

Contrary to previous findings (Byrne et al., in press), preschoolers with ADHD in the present study did not differ in inhibitory control as inferred from the frequency of grabbing at test materials and toys during a high-structure language assessment. In part, this discrepancy in findings may be attributable to testing space constraints which resulted in less direct access to the materials (RDLS-R). Despite the fact that Byrne et al. (in press) found preschoolers with ADHD to engage in more frequent unsanctioned toy play compared to their matched-control peers (77% of ADHD group versus 0% of Non-ADHD group), in the present study, although there was a clear trend in this direction (60% of ADHD versus 36% of Non-ADHD), preschoolers with ADHD were not significantly more likely to play with the unsanctioned toys during the low-structure (play) task. Compared to the previous study, normal control preschoolers in the present study were more likely to play with the unsanctioned toys and preschoolers with ADHD were somewhat less likely to play with the unsanctioned toys. The origin of the different findings is difficult to explain given that the instructions and play room setup were identical in these studies. At the present time, two potentially mediating factors are of note. First, the normal control group in the present study represented lower SES preschoolers and they were better matched with the preschoolers with ADHD compared

to Byrne et al. (in press). Second, the overall length of the current protocol was extended and preschoolers completed four additional tasks (i.e., approximately 1 hr) prior to the low-structure observation. This may have produced a fatigue or order effect for preschoolers, resulting in a change in their performance from the previous study (Byrne et al., in press).

The present findings also contrast that of Campbell and her colleagues. They found preschoolers identified as 'hard-to-manage' exhibited less inhibitory control than non-ADHD peers during a 'delay-of-gratification' and 'resistance-to-temptation' task (Campbell et al., 1982; 1994). The inhibitory response task in the present study was similar to the resistance-to-temptation task employed by Campbell et al. (1994). However, the two tasks differed in one important way. Byrne et al. (in press) query whether the procedure employed by Campbell et al. (1994) results in a higher false-positive rate of identification given that normal control preschoolers may be more likely to engage in use of an unsanctioned toy in situations where there is no alternative activity presented. The test of response inhibition employed in the present study, with this inherent advantage, continues to hold great promise; however, given the conflicting results in this study versus Byrne et al. (in press), further research is warranted. In response to the possible order effect, preschoolers' behavior during this task could be compared for two set orders (beginning and end of a 2 hr protocol). This will likely reveal important information about the impact that novelty of an experimenter and fatigue may play on preschooler' impulsivity.

Indirect Measures

As expected, preschoolers with ADHD were rated by their parents as engaging in significantly more high risk behaviors. The overall category of "risk taking" behavior has been conceptualized as a manifestation of deficient inhibitory control in the present study. This finding has a number of implications for child safety and health care service delivery. Children with "behavior problems" have been identified as being at greater risk for sustaining injuries compared to peers (e.g., Davidson, 1987; Lyman & Hembree-Kigin, 1994; Speltz et al., 1990). Through better identification of children with impulse control difficulties, injury prevention programs can be directed. This may decrease child injuries, which are currently the leading cause of death and disability among children between 1-14 years of age (e.g., Bijur et al., 1986; Rivara, 1995).

Preschoolers with ADHD were also rated by their parent as exhibiting more demanding or noncompliant characteristics compared to parent ratings of normal controls. Parents of school-age children with ADHD, and now preschool-age children with ADHD, frequently rate their child as being significantly more demanding on this measure, compared to normal controls (Breen & Barkley, 1988; Donenberg & Baker, 1993; Mash & Johnston, 1983).

In summary, preschoolers with ADHD exhibit more errors of commission (impulsivity) on a visual CPT and a visual-search deletion task compared to normal control preschoolers. Preschoolers with ADHD also exhibit more impulsive behaviors (spontaneous verbalizations and off-task behaviors) compared to controls during a few of the tasks presented. Compared to parents of normal controls, parents of preschoolers

with ADHD indicate that their preschoolers exhibit more risk taking behaviors and are more demanding than their matched peers.

Hyperactivity Dimension

Direct Measures

In the present study, preschoolers with ADHD were more active than normal control peers during the auditory CPT and the low-structure play task; however, preschoolers did not differ in their activity level during the high-structure language, visual CPT, or deletion tasks. Preschoolers with ADHD did not exhibit any more frequent extraneous body movements or fidgets than normal controls during any of the tasks included in the present protocol. The definition of extraneous body movements was quite broad in definition and at least as currently defined, yielded little discriminative power. In contrast, previously-tested school-age (e.g., Alberts & van der Meere, 1992; Draeger et al., 1986; Roberts et al., 1984) and preschool children (e.g., Campbell et al., 1994) were found to engage in more fidgeting or extraneous body movements (as measured by actometers). The present findings are consistent with Byrne et al. (in press) who failed to find preschoolers with ADHD to be more fidgety than matched controls during a structured task.

There is preliminary evidence to suggest that preschoolers' hyperactivity may depend on issues of task demand and, of course, measurement. In the current study, preschoolers with ADHD got out of seat more frequently during the auditory CPT, yet not during the high-structure language task or the medium-structure preschool deletion task. Further, there was also no difference found for the duration of time spent out of seat

during the medium-structure visual CPT. It is possible that during the auditory CPT, preschoolers with ADHD were more likely to get out of seat given the arguably more tedious nature of this task which did not have any continuous visual demands (or visual target). Perhaps preschoolers with ADHD got up in an attempt to self-regulate their attention to task, as suggested by Alberts and van der Meere (1992). Some of these results find support from the work of Roberts et al. (1984); they found school-age children with hyperactivity to be more out of seat than normal controls in unrestricted play, restricted play, and restricted academic tasks. In addition, Campbell et al. (1982; 1994) found preschoolers identified with externalizing behavior problems got out of seat more frequently during a structured task. Byrne et al. (in press) did not find preschoolers with ADHD to be any more likely to get out of seat during either an unstructured or a structured task.

In the present study, preschoolers with ADHD were more likely to move around the play room compared to normal controls. These findings are consistent with Porrino et al. (1983) who found that children with ADHD are more active in naturalistic settings compared to normal controls, as well as with Roberts et al. (1984) who found school-age children with hyperactivity to be more active in their laboratory tasks. However, the present findings are inconsistent with Campbell et al. (1982) who did not find preschoolers identified with problem behaviors to be more active (actometer recordings of limb movement) during an unstructured or home-based task. Byrne et al. (in press) also did not find preschoolers with ADHD to be significantly more active during the same unstructured task. However, there was a clear trend in this direction in the previous study. The larger

sample size of the present study may afford a more robust test of this important variable.

In summary, compared to normal controls, preschoolers with ADHD exhibit some traditional hyperactive behaviors such as out of seat and mobility, during the assessment protocol.

Psychosocial Dimension

Direct Measures

Preschoolers with ADHD received significantly more commands from the examiner compared to their normal control peers during the high-structure language assessment, and the medium-structure deletion, and auditory CPT tasks. These findings are consistent with Byrne et al. (in press) who found preschoolers with ADHD received more examiner commands than matched controls during a structured task (Byrne et al., in press). In the present study, preschoolers with ADHD did not receive more examiner commands than their peers during the visual CPT, a finding which is not surprising given that the examiner is not directly in view of the preschooler during the task and subsequently has less opportunity for interaction. Examiner's commands arose in response to preschoolers' inattention (e.g., request for repetition of a question or instruction or reminders to listen carefully), impulsivity (e.g., flipping pages before request, off task, spontaneous and task irrelevant questioning by preschooler), and hyperactivity (e.g., out of seat, leaving the visual CPT task area). However, the origins (i.e., the child's behavior) that resulted in the examiner's commands were not designated separately. This issue could be addressed in future work and would provide an opportunity to compare the child's behaviors to determine those behaviors most likely to

result in examiner commands.

In summary, compared to normal controls, preschoolers with ADHD behave in a fashion which elicits more frequent examiner commands compared to normal control preschoolers.

Indirect Measures

Behavioral symptomatology. Parental perceptions of their preschooler's characteristics, their own characteristics, and overall stress and family functioning was assessed through parent completed standardized questionnaires. Consistent with recent previous findings with preschoolers (e.g., Byrne et al., in press; Mash & Johnston, 1983) and school-age children (e.g., Barkley et al., 1990; Breen & Barkley, 1988), preschoolers with ADHD are rated as exhibiting more externalizing and internalizing behavior problems than their matched-normal control peers. Other preschool studies employing different behavior ratings measures have found similar profiles (hyperactivity, hostility/ aggressiveness, and activity (Campbell et al., 1982; 1984; 1991; 1994). As with most clinic studies, further corroboration of externalizing problems is of value, and to a degree, reassuring given the preschoolers with ADHD were initially referred for attention and/or behavioral problems. On the externalizing broad band factor, the preschoolers with ADHD not only scored significantly higher than their peer controls, but as a group their mean score also fell within the Borderline Clinical range. More specifically, preschoolers with ADHD were rated as more aggressive, similar to the recent findings of Byrne et al. (in press).

Preschoolers with ADHD were also rated as having significantly more

internalizing symptoms. However, in contrast to the externalizing factor, the group mean score was within the Normal range. Average scores on this broad band factor suggest that anxiety, depression, and somatic difficulties are not contributing significantly to the preschoolers' presentation. Present analyses indicated that there was a significantly greater difference between the ADHD and normal control groups on the externalizing factor compared to the internalizing factor. It may be informative in future studies to determine whether higher internalizing scores among preschoolers in the ADHD versus Normal Control group may be reflecting the parent's heightened sensitivity to their child's behavior or whether this finding may indicate the emergence of a secondary level of impairment.

Social difficulties. As noted earlier, impaired or underdeveloped social skills have been more often found among children with ADHD (Whalen & Henker, 1985), contributing to concurrent and later poor peer relations and lowered self-esteem (e.g., Campbell & Paulauskas, 1979; deHaas, 1986; Denham & Holt, 1993; Kelly et al., 1989; Milich et al., 1982; Olson & Brodfeld, 1991; Parker & Asher, 1987; Rubin & Clark, 1983; Slomkowski et al., 1995; Weiss & Hechtman, 1993). Consistent with these findings, in the current study, preschoolers with ADHD were rated by their parents (CBCL, PSI, SSRS) as significantly less socially mature, exhibiting fewer socially desirable characteristics, and prosocial behaviors, compared to parental ratings of their matched-control peers. Despite this early neurodevelopmental and neurobehavioral stage of development, the preschoolers with ADHD scored a full standard deviation below average with regard to prosocial behaviors, whereas their matched-control peers scored within the

average range. Several other measures of social competencies (i.e., social maturity and socially desirable characteristics) were below average for the preschoolers with ADHD and average for their matched-controls.

In the present study, given the ethical issues surrounding peer-rated measures of social acceptance in young children (e.g., Asher & Dodge, 1986; Guevremont, 1990; Hayvren & Hymel, 1984; Olson & Lifgren, 1988), such a measure was not employed in this study. Therefore, it is not possible to determine how much the preschoolers in this study have experienced rejection or negative sanctions by their peers at this early stage of development, as has been found in school-age children (e.g., Cunningham & Siegel, 1987; deHaas, 1986) and preschool children (e.g., Milich et al., 1982; Olson & Brodfeld, 1991; Rubin & Clark, 1983). However, the presence of externalizing behaviors, including aggression and immature social skills suggest that the preschoolers with ADHD in the present study are at risk for current and/or later peer social rejection.

As might be expected, peer and social rejection often lead to lowered self-esteem, as has been found previously among school-age children with hyperactivity ranging from 6 to 12 years (e.g., Kelly et al., 1989; Slomkowski et al., 1995). However, for ADHD preschoolers rated as socially immature, the present findings do not suggest that they perceive themselves as less socially competent. That is, no difference was found between the preschoolers with ADHD and their matched-controls on the Pictorial Scale of Perceived Competence and Social Acceptance (PSPCSA) (Harter & Pike, 1984). Using this same measure, Campbell (1994) also failed to find a difference in perceived self-competence and acceptance among her sample of 6 year-olds ('hard-to-manage' versus

normal controls).

One interpretation of this finding is that at this early stage of development, preschoolers with ADHD have yet to experience sufficiently frequent and/ or intense negative sanctions from multiple sources, regrettably afforded school-age children. In addition, at this young age the parameter of one's personal space needs, competencies, and those of one's peers are still being learned and may contribute to the preschooler's current self-perceptions. This is supported by the work of Harter and Pike (1984) who suggested that very young children may not have the ability to make accurate judgements about self competence and social acceptance. Preschoolers and primary grade children may provide over-inflated responses on such measures as the PSPCSA. These young preschoolers may believe competency reflects appraisal of the ideal or preferred versus actual self-image. Most young children may have yet to forge the link between one's social skills and peer acceptance, a link likely more evident at the elementary school level (Harter & Pike, 1984).

Alternatively, the measure employed in this study may be insensitive to the detection of the early manifestations of preschoolers' impaired self-perceptions. Further investigation of young children with difficulties with impulse control, overactivity, and inattention will assist in identifying the processes and time-line within which social skill deficits manifest in peer conflict, social isolation, and result in lowered self esteem.

Parent stress. Parenting preschool-age and school-age children with ADHD has been shown to be associated with significant parental stress (Anastopoulos et al., 1992; Breen & Barkley, 1988; Byrne et al., in press; Campbell et al., 1994; Donenberg & Baker,

1993; Mash & Johnston, 1983). In the present study, this association with preschoolers and their families was replicated. Parenting a preschooler with ADHD was found to be associated with higher overall parental stress. Consistent with Anastopoulos et al. (1992), yet contrary to Campbell et al. (1991), this stress does not appear to be best accounted for by family or environmental factors. In the present study, major life events (e.g., death, financial difficulties, birth of a baby, job loss), socioeconomic status (matched sample), or marital status did not differ between groups. Furthermore, there was no group difference in parents' ratings of overall family functioning.

Parents of preschoolers with ADHD did report experiencing clinically significant stress associated with their child's characteristics relative to the controls. Consistent with previous findings with preschool-age and school-age children, a higher proportion of the overall stress in families of the current sample of preschoolers with ADHD was related to the child's characteristics, rather than due to the parents' marital problems, report of depressive symptomatology, situational, and/ or environmental factors (Byrne et al., in press; Donenberg & Baker, 1993; Mash & Johnston, 1983; 1990). Present analyses indicated that there was a significantly stronger difference between the ADHD and normal control groups in terms of stress associated with the child's rather than parent's own characteristics. The specificity of this pattern of scores to ADHD using the PSI requires comparison with a clinic-control group. Studies in which such a comparative group was used found that childhood behavior disorders appear to affect family stress levels in similar ways (e.g., Breen & Barkley, 1988; Donenberg & Baker, 1993). Future work assessing the pattern of stress among families of various clinic groups will be informative.

Nonetheless, the level of stress in families with ADHD is notable. Indeed, parents of previously studied preschoolers with ADHD reported similar levels of stress as parents of preschoolers with Autism, an arguably more challenging and disabling developmental disorder than ADHD (Donenberg & Baker, 1993). Furthermore, families of preschoolers with ADHD have reported higher stress ratings than those of school-age children with ADHD (Mash & Johnston, 1983). These findings suggest that the pattern (i.e., child versus parent-related) and severity of stress during the preschool period may relate to the fact that early child-parent conflict often arises from establishing boundaries for acceptable behavior. This is a challenging task for even non-ADHD preschoolers, but is likely magnified for preschoolers with ADHD. With accommodation to and/ or change in form or severity of ADHD symptoms, the level of stress and parent-child conflict may reduce over time; however, these children may still pose an above-average challenge (see Campbell, 1995 for review). The design and implementation of early treatment programs should respond to this inferred developmental shift in parent-child interaction. For example, programs may benefit from the development of strategies which address early symptomatology and the establishment of clear parent-child boundaries.

Upon further investigation of the source of parental stress, preschoolers with ADHD are seen by parents as exhibiting fewer socially desirable characteristics, being less adaptable to change, being more demanding, and more inattentive and active. Not unexpectedly, parents of preschoolers with ADHD rate parenting as less reinforcing and themselves as less competent parents. However, consistent with some findings with preschoolers with ADHD (Campbell, 1994; Donenberg & Baker, 1983), but in contrast

with others (Byrne et al., in press; Campbell, 1994; Mash & Johnston, 1983), the parents of preschoolers with ADHD in the present study did not rate themselves as having more depression-like characteristics, despite elevated self-reported stress, concern with parental competence, and the pervasive nature of their preschooler's challenging ADHD characteristics. The equivocal results across studies suggest that the presence of depressive symptoms in parents of preschoolers with ADHD is not absolute. The question yet to be addressed is whether early depressive symptoms will be magnified with continued unresolved ADHD. Although Mash and Johnston (1983) found parents of their preschoolers to exhibit depressive characteristics, parents of their older children with ADHD were not reporting symptoms of depression. This finding is inconsistent with those of other studies in the ADHD school-age literature (e.g., Cunningham et al., 1988; Befera & Barkley, 1985; Breen & Barkley, 1988) in which parents report more problems with depression. A 1 year follow-up study of the current sample which may help to address this issue is presently underway in the Preschool ADHD Clinic, IWK-Grace Health Centre. The continued absence of depressive symptoms among this sample of parents who were not found to exhibit more depression characteristics during their child's preschool years will be informative.

Furthermore, the parents' perception of family functioning would indicate that the challenges of parenting a preschooler with ADHD, at least at this early neurodevelopmental and neurobehavioral stage, are not sufficient to detrimentally affect the majority of family activities; the overall family functioning (FAM-III) for both groups of preschoolers was within the healthy range. This finding is consistent with the recent

work by Byrne et al. (in press) who proposed that parents of preschoolers with ADHD initially act as a "buffer", preventing the stress of raising a challenging preschooler from negatively affecting general family functioning. Given that families of school-age children with complex aggression and hyperactive problems have been found to be at higher risk for family dysfunction (Lewis, 1992), it may be that at this early stage of parent-child interaction, the stress is not sufficiently severe to disrupt family functioning. In this regard, Donenberg and Baker (1993) suggest that unless the child's problems are reduced, the persistence of a high degree of stress attributed to the child during the early years may subsequently generalize to the family system. Mash and Johnston (1983) found parents of younger and older children with hyperactivity to report lower levels of parenting self-esteem than parents of controls, particularly in terms of the degree of valuing/ comfort derived from the parenting role. Interestingly, parents of the older children with hyperactivity rated themselves as lacking in competence as it pertains to their skill/ knowledge as a parent. In the current study, parents of preschoolers with ADHD were already rating themselves as feeling less competent in the parenting role, despite the fact that they were not exhibiting more depressive symptoms than parents of the matched-controls. The potential cumulative impact of this pattern of stress for families of children with ADHD warrants further longitudinal study to clarify diagnostic, prognostic, and treatment issues. Indeed the presence and severity of parental stress, parental psychopathology, and familial dysfunction has important implications for developing treatment programs and possibly leading to different prognosis (Hinshaw et al., 1997).

Like the overwhelming majority of similar studies, these ratings are provided by

one parent, typically mothers. Despite the trend toward more shared parental responsibilities between parents in present society, mothers continue to be the main caregivers of young children. It is possible that additional ratings obtained by other family members would reveal a different profile. In addition, like the overwhelming number of studies, the parental ratings reflect the parents' perceptions within the time frame of the assessment.

In summary, according to parental ratings, preschoolers with ADHD present with more externalizing and internalizing behavior symptomatology and also with more impaired social skills compared to matched-controls. However, at this early stage of development preschoolers with ADHD do not perceive themselves as less socially skilled or competent. Compared to parents of normal controls, parents of preschoolers with ADHD self-report higher stress and lower competency (parenting) associated with characteristics of themselves, their child, and their environment. These findings confirm the clinical value of parent ratings of behavior, social skills, and stress within a multidimensional assessment protocol for ADHD.

General Discussion

Barkley (1990b), among many established researchers, advocates for the use of a multidimensional assessment protocol to increase the rigor and ecological validity of a diagnosis of ADHD (e.g., Barkley, 1990a; 1990c; 1991; Barkley et al., 1988; Byrne et al., in press; Campbell, 1994; Campbell et al., 1982; 1984; 1986a; 1986b; 1986c; 1991; 1994; DuPaul et al., 1992; Hinshaw et al., 1997; Kelly & Aylward, 1992; Lyman & Hembree-

Kigin, 1994; Mariani & Barkley, 1997; Mulhern et al., 1994; Searight et al., 1995; Shelton & Barkley, 1994; Shaywitz et al., 1994; 1997; Weiss & Hechtman, 1993). The majority of multidimensional studies have been employed with the school-age population. The findings of the present study indicate that developmentally appropriate measures assigned to a multidimensional protocol hold promise in the early identification of preschoolers who present with symptoms of ADHD.

The present findings also address the main goals proposed during the conception of this project. First, all preschoolers were able to understand and engage in the tasks presented, suggesting that the tasks are indeed developmentally appropriate. Second, the pattern of results across measures indicated that preschoolers with ADHD manifest symptoms across multiple skill dimensions using multiple methods of data collection. Third, the indirect parent-completed questionnaires provide excellent convergent information (parent reports and ratings) while the direct clinic tests provide information which facilitates formal diagnoses among preschoolers referred for professional service.

Implications

Multidimensional Symptoms

The design and findings of this study have a number of important implications for the clinical assessment of ADHD, the development of intervention programs, as well as for further research. Preschoolers with ADHD can be differentiated from normal control peers based on the multidimensional protocol employed. This suggests that early identification of ADHD is indeed possible. Early identification, when followed with intervention may prevent further development of ADHD-associated features, such as

aggression, impaired parent-child or child-child relationships, adjustment problems, poor academic achievement, deficient social skills, and low self-esteem (e.g., Alessandri, 1992; Campbell, 1995; Cunningham & Barkley, 1979; Pisterman et al., 1989; Pelham & Murphy, 1986; Mash & Johnston, 1982).

Overall, preschoolers with ADHD were both rated as and found to be more inattentive, impulsive, and active, as well as rated as having more psychosocial impairments compared to normal controls. Nevertheless, as might be expected, when comparing the measures which discriminated between preschoolers with ADHD and normal controls, all tasks were not equally discriminating. This suggests that certain tasks add unique information to the assessment process.

Indirect Measures versus Interview

A comparison of the indirect information based on parental report indicated that the number of situations in which preschoolers were rated as exhibiting attention problems and an overall rating of problem behavior (i.e., externalizing and internalizing combined) are the most discriminating indirect measures in terms of the predicting the presence or absence of ADHD. Classification of preschoolers into diagnostic groups was excellent, indicating that the derived quantitative score(s) emerging from these two questionnaires provide excellent verification of group membership which was also based on parent report (DSM-IV interview). Indeed, these results suggest that the Home Situations Questionnaire-Revised and the Child Behavior Checklist provide information that is highly predictive of diagnosis.

At first glance, this finding has very important implications regarding the cost-

benefit analysis of the need to formally diagnose preschoolers. Given the time consuming nature of conducting an in-depth psychological interview with parents, the provision of two questionnaires appears to be equally discriminating. However, the present analysis compared only those preschoolers who were screened using strict inclusion criteria and diagnosed (ADHD or Normal Control) following a thorough parent interview (DSM-IV). Preschoolers who were rated just under the cut-off scores for inclusion (e.g., CPRS criteria, language status, evidence of developmental delay or comorbid behavioral difficulties) or failed to meet diagnostic criteria during the interview were not included in the current analyses. Without the interview and strict screening process, these two questionnaires would likely be less discriminating in classification.

In addition, the interview process provides the opportunity for clinicians to assess the parent's perspective about their child's difficulties. It is not unlikely to find cases where 'everyone else' sees a problem and the parent does not, or where the parent is convinced there is a problem and others are not convinced. In either case, strict reliance on parental ratings would be misleading.

Most importantly, the current 'gold standard' is provided through psychological/ psychiatric interview with the parent and the indirect measures yielding correct classification are also based on parent information. This fact, coupled with the shared items found in both the DSM series and the questionnaires are likely to significantly inflate agreement.

Validity of Direct Measures

Behavioral observations versus direct performance measures. A comparison of the

direct in-clinic measures indicated that the frequency of examiner commands (composite) and the frequency of the child's verbalizations (composite) were the most discriminating of diagnostic status among the direct clinic measures entered into this analysis. As mentioned earlier, examiner commands reflect the presence of a range of preschoolers' "ADHD-like" behaviors including those that best represent inattention, impulsivity, and hyperactivity which occurred during three tasks (i.e., high-structure [language], deletion task, and auditory CPT). The frequency of examiner commands also yields information about the preschoolers' interaction with an unfamiliar adult. Child verbalizations best represent the preschoolers' difficulty with impulsivity during two tasks (i.e., visual CPT and low-structure [play]). This finding suggests that direct behavioral observations may account for more variance than performance measures (e.g., omission and commission errors) in predicting diagnosis. This is not to suggest that the other measures would not predict diagnostic status in the absence of the behavioral observations (and subsequent factoring out of shared variance). This result suggests only that these behavioral observations account for more variance in overall diagnostics compared to other measures. The pattern of results also suggests that preschoolers' behavior during each of the five tasks contributed significantly to the overall classification of diagnosis (evidenced by the breakdown of the composite variables previously listed).

Influence of DSM-IV. At this point, given that diagnoses were based on DSM-IV (APA, 1994) diagnostic criteria, it is imperative to review the role of the DSM-IV in conceptualizing the present findings. Review of the current diagnostic criteria have important implications for determining the value of the direct tests employed in the present

study. The diagnostic criteria for ADHD indicate that the impulsive-hyperactive subtype may be more readily identifiable than the inattentive subtype within the preschool population. Many of the diagnostic items listed for the attention dimension reflect behaviors and tasks that are less age-appropriate for preschoolers (e.g., makes careless mistakes in schoolwork, difficulty organizing tasks and activities). This may inherently bias the overall diagnosis of ADHD to favor ADHD: Hyperactive/ Impulsive Type or ADHD: Combined Type, rather than ADHD: Inattentive Type.

Although the DSM-IV is the current gold standard in terms of diagnosing ADHD, it may not be the best detector of inattention difficulties in very young children. It is possible that the under valuing of the direct measures (e.g., inattention) among preschoolers in the current sample is confounded by a potential bias toward selecting preschoolers who exhibit hyperactive-impulsive symptoms, at least according to the DSM-IV (APA, 1994). As a result, it would be premature to exclude use of any direct test included in the current protocol at this time. Establishing the ecological validity of these measures is imperative, as is controlling the influence of potentially systemic confounds in diagnosis.

Level of structure. Results of the current assessment across low, medium, and high structure observations have implications for future research and designing intervention programs. Based on the current findings, preschoolers with ADHD appear to have less difficulty, both in terms of their behavior and task performance, during activities with inherently greater structure (presence of examiner; one-to-one testing). For example, during the high-structure language assessment, the structure might have been sufficient to

reduce the opportunity for many "ADHD-like" behaviors. The higher number of examiner commands presented to preschoolers with ADHD reflects the fact that ADHD-like behaviors have not been eliminated. This suggests a greater need for structure and direction during formal testing of young preschoolers with ADHD.

In tasks with medium structure, preschoolers with ADHD performed more poorly when the examiner was absent. On the other hand, the behaviors of preschoolers with ADHD were more likely to discriminate them from their control peers during independent tasks where the examiner was present though less directive. Finally, on the low-structure play task, preschoolers with ADHD were more inattentive, impulsive, and active than controls. The few restrictions of this task arguably afforded greater opportunity for the core ADHD features to present.

From a clinical perspective, some of these finding may have implications for intervention programs and for classroom management. Preschoolers with ADHD exhibit behavior requiring a great deal of direction, repetition of instructions, behavioral and attentional cues from the examiner. There is some evidence to suggest that these preschoolers benefit from this structure in the present study given that preschoolers' performance was more aligned with controls during tasks (e.g., auditory CPT, high-structure [language]) with greater structure (e.g., one-to-one testing/ presence of examiner, examiner controlled task). Teachers frequently comment that school-age children with ADHD benefit from an increase in commands and one-to-one assistance, to assist academic performance, and to reduce challenging behavior (e.g., Campbell, Endman, & Bernfeld, 1977; Pfiffner & Barkley, 1990). Further study of the impact of

structure on preschoolers' behavior and performance would be an asset. This preliminary pattern of findings has important implications for the design of multidimensional, multimethod research protocols. Indeed, preschoolers with ADHD may not exhibit their characteristic behavior in all settings or tasks. Under use of multistructured tasks in assessment protocols might lead to a higher rate of false negatives or positives depending on the smaller number and type of tasks used.

Opportunity for Longitudinal Study

Finally, tasks employed in the current protocol were designed to be procedurally and psychometrically similar to the measures used to assess ADHD among school-age children (e.g., CPTs, deletion/cancellation tasks, structured observation, injury risk profile, psychosocial). From a methodological point of view, this contribution should facilitate cohort and longitudinal studies, yielding valued information as to the stability of ADHD diagnosis as well as information about its developmental course from preschool to school-age to adolescence. Campbell and her colleagues have studied the stability of externalizing behavior problems from preschool to school-age and found that 50% of preschoolers with early externalizing problems continue to have difficulties during their elementary and adolescent years (see Campbell, 1995). However, these estimates of stability require further study. For most of Campbell's studies, the preschoolers were identified as 'hard-to-manage' rather than being formally diagnosed. When these preschoolers were followed up during elementary school, the DSM-III or DSM-III-R was the diagnostic manual employed, negating specific ADHD diagnostic types afforded in the DSM-IV. Finally, the preschool participants in the Campbell studies were not assessed

using psychometrically and procedurally comparable school-age measures of attention, impulsivity, and hyperactivity. The findings of the present study provide the opportunity to conduct cross-sectional and longitudinal studies of ADHD employing measures which share psychometric and procedural properties for preschool to adolescence.

Limitations

It would be valuable to extend the present study by including other clinic-groups for comparison (e.g., Oppositional Defiant Disorder, Language Disorder). This would allow one to determine whether the protocol can distinguish among preschoolers with other or comorbid clinical disorders.

In the present study, the examiner was aware of initial referral status. However, the examiner was blind to the final diagnosis, which was made independently by one of two highly experienced clinical child psychologists. One of the few variables which may have been potentially influenced (if at all) by this information is examiner commands. However, the examiner commands were clearly operationally defined prior to coding, and the results showed the statistical significance of this variable was task dependent. Therefore, examiner commands did not exist in a pervasive manner. The videotapes were coded by one of three reliable observers who were blind both to the hypotheses of the study, and to the preschooler's group membership (diagnosis). Finally, all preschoolers were taught to complete the tasks using identical, specific instructions (pre-study, rehearsal script).

A final potential constraint relates to the order of task presentation within the assessment protocol. In the present study, task order was not randomized between

participants because of the sample size and the number of tasks administered. There is no information at this time regarding the impact of order of presentation on performance. It is still unclear whether certain patterns of findings were specific to the order in which the tasks were administered. For example, given that this assessment protocol was completed over a 2-hr time period, preschoolers may have been more fatigued near the completion of testing. For example, if the low-structure play task had been administered earlier in the protocol, it is possible a different pattern of findings on this task may have emerged. Regardless, it is important to note that both groups of preschoolers experienced the same order of tasks, yet group differences were found. Although additional study assessing the impact of order on task performance would be valuable, most clinic protocols present a single order of task administration.

Future Directions

The present findings provide additional information upon which future lines of research may be formulated. Researchers recognize the importance of clarifying the developmental course of ADHD (Applegate et al., 1997; Barkley, 1990; 1997; Campbell, 1985; 1990; 1995; Hart, Lahey, Loeber, Applegate, & Frick, 1995; Lahey et al. 1994). As acknowledged earlier, Campbell and her colleagues have contributed enormously to this endeavor. However, more recent research has revealed interesting hypotheses about the developmental course of ADHD, though the conclusions require further research. For example, Lahey et al. (1994) suggested that the DSM-IV (APA, 1994) will improve the accurate identification of preschool children. They speculated that according to the DSM-IV, many preschoolers will qualify for the predominately hyperactive-impulsive, as

opposed to the predominately inattentive type of ADHD. They argue that until children are faced with the demands on their attentional capacity during elementary school, they will not exhibit maladaptive levels of inattention (Lahey et al., 1994). In this regard, Hart et al. (1995) found that hyperactive and impulsive symptoms decreased with age while inattention symptoms did not. They suggested that these findings support the notion that there are different patterns of symptoms that develop over time. Barkley (1997) reasons that the predominately hyperactive-impulsive type of ADHD may simply be conceptualized as a developmental precursor to the combined type.

In support of these views, Applegate et al. (1997) found that the age of onset of impairment for their sample of children aged 4 - 17 was significantly earlier for children with the hyperactive-impulsive type of ADHD compared to the combined type, and the age of onset of impairment for children with the combined type of ADHD was significantly earlier than those with the inattentive type. In this regard, when parents were asked the age of onset of children's impairment, 98% of the children with a hyperactive-impulsive diagnosis had impairment prior to age 7, 82% of the children with a combined diagnosis had impairment prior to age 7, and only 57% of the children with an inattentive diagnosis had impairment prior to age 7 (Applegate et al., 1997).

However, as mentioned earlier the DSM-IV (APA, 1994) could inadvertently be biased toward selecting a sample of preschoolers of the ADHD: Hyperactive-Impulsive Type, given the potentially age-inappropriate diagnostic criteria for the inattention dimension. In addition, preschoolers who exhibit hyperactive and/ or impulsive symptoms are much more likely to be referred for professional assistance than are preschoolers with

attentional impairment only, a group who may not be detected at all (Barkley, 1990b). These biases confound the current view of the manifestation of ADHD whereby type may vary as a function of neurodevelopmental phase.

The current research supporting these claims has arisen from an analysis of samples of preschoolers studied during the DSM-IV field trials. There have been no controlled studies of preschoolers, diagnosed according to the DSM-IV and representing the various subtypes of the disorder who have been followed longitudinally. In addition, until present, there has been only one other study (i.e., Mariani & Barkley, 1997) which has documented that preschoolers diagnosed with ADHD exhibit attentional impairment on traditionally employed vigilance tasks. There has been a lack of developmentally appropriate direct measures of attention, impulsivity, and hyperactivity which have been empirically demonstrated to differentiate between preschoolers with diagnosed ADHD and normal controls. There have also been few studies which have employed a multidimensional, multimethod protocol, comprised of measures which are psychometrically and procedurally similar to those measures commonly employed with school-age children. Finally, although Campbell and her colleagues assessed the developmental correlates and stability of externalizing behavior problems in preschool to ADHD in school-age, her studies relied on the DSM-III (APA, 1980) and DSM-III-R (APA, 1987) diagnostic criteria, rather than the current DSM-IV (APA, 1994).

Further research would be informative if the above-noted issues were addressed so as to more confidently assess whether the hyperactive-impulsive subtype is indeed a developmental precursor to the inattentive subtype or combined subtype of ADHD (see

Barkley, 1997 for discussion). Longitudinal follow-up of the present study provides an excellent opportunity to build upon this research. Additionally, the development of age-appropriate diagnostic criteria to better assess for impaired attention in preschoolers will be advantageous.

A primary issue that emerges from a discussion of the present research relates to the need to expand the current theoretical conceptualization of ADHD. Barkley (1997) recently recommended that there be increasing emphasis placed on developing the theoretical underpinnings of ADHD given that research in this field is often essentially atheoretical (Barkley, 1997). In an attempt to provide a unifying model of ADHD, Barkley (1990; 1997) proposes that deficits in behavioral inhibition lie at the root of ADHD and that this impairment can manifest in a variety of symptoms (cf. Schachar et al., 1993). Barkley (1997) further postulates that ADHD arises from a disruption in the normal developmental processes regarding self-regulation. Although this theory appears promising, there is currently limited empirical support (Barkley, 1997).

To date, the approach to understanding ADHD has focused on describing its core manifestations, generally conceded to include inattention, impulsivity, and/ or hyperactivity. The field of ADHD has rapidly evolved using this approach and new developments in the measurement and understanding of the relative importance of each symptom has emerged (Searight et al., 1995). The DSM system of classification reflects the changing emphasis and emerging consensus about the cluster of ADHD symptoms, while simultaneously shaping future study. The diagnostic criteria for ADHD (APA, 1994) currently reflects the presence of two dimensions of impairment, the predominately

inattentive type and the predominately hyperactive-impulsive type which may manifest singly or in combination. With the introduction of the DSM-IV, it is the first time that the presence of attentional impairment is not necessary for a diagnosis of ADHD. However, consistent with all previous editions of DSM, there exists very little empirical evidence validating these subtypes. This lack of empirical support provides a tenuous framework within which to design and conduct costly clinic studies.

Barkley (1997), together with other researchers (e.g, Schachar et al., 1993; Mirsky et al., 1991; Shaywitz et al., 1997), suggests that current research in ADHD has been focused too narrowly on individual impairments, negating the development of a comprehensive model encompassing the origin, manifestation, and neurodevelopmental aspects of the disorder. Barkley (1997) proposes what he describes as a comprehensive model which accommodates a broader view of the cognitive deficits associated with ADHD. He suggests that it is of paramount importance to assess children's executive functioning, given that at least four executive functions (i.e., working memory, self regulation of affect-motivation-arousal, internalization of speech, and reconstitution [behavioral analysis and synthesis]) depend on response inhibition for effective performance. Certainly, Barkley is not the only researcher to suggest that there is great need to look beyond the overt manifestation of symptoms.

Mirsky et al. (1991) also advocate for a broader conceptualization of the deficits in ADHD. They proposed the need to examine facets of attention (e.g., encode, focus, sustain, shift) which require one to include and go beyond the traditional single measure of vigilance. They suggest that their model will assist in the determination of the nature of

the attentional deficits in children with ADHD. This examination may subsequently clarify diagnostic issues regarding currently proposed subtypes of ADHD (DSM-IV). The lack of consensus about the specificity of an attention deficit in ADHD may reflect the fact that a broader investigation of the components of attention has not been forthcoming until recently. Investigation of higher level attentional and cognitive processes may more reliably reveal deficits specific to ADHD, thereby aiding diagnosis and treatment.

The need for additional research using multidimensional protocols, with a strong theoretical framework is clearly apparent. Barkley (1997) and Mirsky et al. (1991), along with others (e.g., Schachar et al., 1993; Shaywitz et al., 1997) have recognized the importance of expanding the conceptualization of ADHD, requiring the assessment of executive functioning, multiple components of attention, modality-specific impairment in attention, and cognitive-behavioral constructs of impulsivity. These areas of inquiry are likely to direct the future of the field.

Although this study was not designed to address these theoretical issues, its employment of a multidimensional, multimethod assessment protocol may assist the development of a broader conceptualization and assessment of ADHD. The findings of the present study also serve to emphasize the importance of addressing developmental issues with regard to ADHD assessment. Future research incorporating components of the Mirsky et al. (1991) model of attention may serve to specify more clearly the nature of preschoolers' impairment and subsequently, facilitate the design of more specific treatment protocols.

Conclusion

The findings of the present study provide valued information regarding the early manifestation and assessment of ADHD. Similar to school-age populations, the pattern of results with preschoolers reveal that across measures, preschoolers with ADHD exhibit symptoms of attention, impulsivity, hyperactivity, and psychosocial impairment. The developmentally appropriate assessment protocol will facilitate future longitudinal and cross-sectional study of ADHD.

APPENDIX A

Recruitment Letter for Normal Controls: Sent to Parents through Preschools

May 1996

Dear Parent,

We are conducting a study of behavior and attention patterns in preschool-age children at the IWK Grace Health Centre. We have asked the director of your child's preschool for permission to contact you about the possibility of participating in this study. We are interested in working with children ranging in age from 3 years to 5 years-11 months.

Your child's participation would assist us in determining how children's attention and play skills may relate to their behavior. If you and your child agree to participate in this study, you will be asked to complete three questionnaires which will be mailed to you at your home. You may also be asked to visit the IWK Grace with your child on one occasion for approximately 2 ½ hours. This appointment would be scheduled at your convenience. This visit would involve assessing your child's attention and observing how your child plays alone and with you. None of these tests are harmful and all test results will be completely CONFIDENTIAL. This study has been reviewed and approved by the IWK Grace Research Ethics Board and the Dalhousie University Ethics Board.

We anticipate that your voluntary participation in this study will make a significant contribution to our understanding of behavior patterns in preschoolers. We are currently studying a wide range of children and hope to identify the levels of attention and behavior typical among children in this age group.

If you and your child may be interested in participating, please complete the enclosed form and return it to us in the postage-paid envelope provided. By sending this form you are NOT committing to being involved in our study; however, you are providing us with permission to contact you to offer further information and answer any questions you may have. At this time, you will be asked if you wish to be involved in our research study. If you have any questions, please contact one of us at 428-8454.

Thank you for taking the time to consider our request.

Sincerely,

Nadine A. DeWolfe, B.A.Hon
Ph.D. Student
Dalhousie University

Joseph M. Byrne, Ph.D.
Psychologist
IWK Grace Health Centre

Harry N. Bawden, Ph.D.
Psychologist
IWK Grace Health Centre

✂

YES, I am interested in receiving additional information about your study. I understand that I will be contacted by telephone and provided with more detailed information regarding this study. However, I am not committing to participation in your study at this time.

Parent's Name: _____

Telephone #: _____

Best Time to Call: _____

Child's Name: _____

Child's Preschool: _____

Child's Date of Birth: _____/_____/_____
day month year

APPENDIX B

Letter to Parent Accompanying Screening Questionnaires: Clinic Referrals

Preschool Attention Deficit Hyperactivity Disorder Clinic

Department of Psychology

Date _____

Dear _____,

We have received a request for _____ to be seen in the Preschool Attention Deficit Hyperactivity Disorder Clinic, IWK Grace Health Centre, Department of Psychology for an assessment. This assessment was requested by _____.

Young children often behave differently at home than they do in new situations. It would be helpful for our understanding of your child if you would complete the enclosed forms. This will give us some information about your child's history and information about his/her behavior, attention, and development. There are no right or wrong answers. You know your child better than anyone and we want to use this knowledge to help with our assessment of your child.

Three forms have been enclosed for you to complete: 1) Developmental Assessment Form, 2) Child Development Inventory, 3) Conners Parent Rating Scale. Please fill out these questionnaires as soon as possible and return them to us in the self-addressed, stamped envelope which has been enclosed. An appointment cannot be scheduled until the questionnaires are completed and reviewed by our clinic.

If your child's difficulties are the type that are best served by this clinic, we will schedule an appointment. As a tertiary care health centre, children and their parents are often invited to participate in research. The Preschool Attention Deficit Hyperactivity Clinic is currently involved in a research study. You and your child may be interested in participating in this study. However, your decision to participate is voluntary. Your decision to participate in our study WILL NOT affect the care of your child in our clinic.

If you would like further information, please contact me at 428-8454. Thank you.

Sincerely,

Joseph M. Byrne, Ph.D.
Director, Attention Deficit Hyperactivity Disorder Clinic
Department of Psychology

c:/ referral source

Letter to Parent Accompanying Screening Questionnaires:
Normal Controls

Date _____

Dear _____,

Thank you for agreeing to participate in our study of behavior and attention patterns in preschool-age children at the IWK Grace Health Centre. As I indicated on the telephone, your assistance with this project will make a significant contribution to our understanding of behavior and attention patterns in preschoolers.

As you know, there are two stages of involvement in this study. The first stage is the completion of three questionnaires which have been enclosed with this letter. Please complete these forms as soon as possible and return them in the enclosed postage paid, self-addressed envelope. You will notice that the forms have been identified by a file number. Please do not place your name or your child's name on these forms. In this way, the confidentiality of your responses will be ensured. These forms will give us some information about your child's history and information about his/her behavior, attention, and development. There are no right or wrong answers. You know your child better than anyone. You may find some questions more difficult to answer than others. I would encourage you to choose the answer that best fits rather than deliberating or second guessing your responses. However, please try to indicate a response for each item. On the developmental history form, one section asks for the age at which your child first met various milestones. If these are difficult for you to recall, give your best guess or leave them blank.

After I receive these forms I may be contacting you to request your involvement in stage 2 of this study. You may remember that this would involve visiting the IWK Grace Health Centre with your child on one occasion for approximately 2 ½ hours. Only some children will be asked to participate in this stage. This is to ensure that we see a range of "typically developing" children who are different ages and so we see both boys and girls. Regardless of the level of your involvement, the information you provide to us will assist in our understanding of the range of behaviors and the course of development for preschool children.

All information provided to us will be confidential. If we have any concern about your child's attention, behavior, or development, you will be contacted and this information will be shared with you.

Thank you for your assistance with our study. If you have any questions or comments, please contact one of us at 428-8454.

Sincerely,

Nadine A. DeWolfe, B.A.Hon
Ph.D. Student
Dalhousie University

Joseph M. Byrne, Ph.D.
Psychologist
IWK Grace Health Centre

Harry N. Bawden, Ph.D.
Psychologist
IWK Grace Health Centre

APPENDIX C

Informed Consent
Participation in Research for Clinic Referrals

N. A. DeWolfe, J. M. Byrne, & H. N. Bawden
Department of Psychology, IWK-Grace Health Centre

This is a research study about behavior and attention problems in preschool children. Your child has been referred to our clinic because of concern about his/her behavior and/or attention. Your participation in this study will assist us in determining the factors which may contribute to the presence of behavior and attention problems in young children.

If you agree to participate, this study will involve assessing your child's language abilities, attentional level, play patterns, and self-esteem. You and your child will be videotaped so that we can study how your child plays and interacts by him/herself as well as with others. In addition to testing and observing your child, you will be asked to participate in an interview with a Psychologist. The interview will focus on your child's developmental history and behavior. We will also provide you with eight standard questionnaires which ask about your child's development, behavior, attention, as well as your feelings about your family and yourself. As a result, your participation will require one visit (approximately 2 ½ hours) to the IWK Grace Health Centre and will also require you to spend time at home to complete the questionnaires. None of these tests are harmful.

All information collected for this study will be completely CONFIDENTIAL. Neither your name or your child's name will appear on any questionnaires or videotapes. All information collected will be identified by a code number only.

Your decision to participate in this study is voluntary. Even after signing this consent form, if for any reason you wish to withdraw from the study, please feel free to do so. Your decision not to participate will in no way affect your child's present or future care in the Preschool ADHD Clinic or at the IWK Grace Health Centre.

After the scheduled appointment at the IWK Grace, the Clinical Child Psychologist will meet with you and your family to discuss the results and your concerns related to your child's behavior. If it is found that your child requires treatment, you will be offered clinical service through the Preschool ADHD Clinic.

Your participation will help us learn new information about behavioral difficulties and attention deficits in young children. This information will assist in the service of children who are referred for diagnosis and treatment. You will be provided with a summary of the overall results of this study when it is completed.

We are very grateful for your assistance.

I have read and understand the above explanation. All of my questions have been answered to my satisfaction.

I _____ hereby give consent for my participation

and that of my child, _____. I understand that if I have any questions concerning this project I may telephone the following people: Ms. Nadine DeWolfe, Dr. Joseph Byrne, or Dr. Harry Bawden at 428-8454.

Signature _____

Obtained
Informed _____
Consent

Date _____

☐ YES ☐ NO I give permission to be contacted about future research projects on attention problems in preschool children. I understand that participation is completely voluntary, and by signing this form, I am not obligated to participate in any future research presented to me.

Informed Consent
Participation in Research for Controls

N. A. DeWolfe, J. M. Byrne, & H. N. Bawden
Department of Psychology, IWK-Grace Health Centre

This is a research study about behavior and attention problems in preschool children. We do NOT think that your child has a behavior or attention problem; however, your participation in this study will assist us in determining the factors which may contribute to the presence of behavior and attention problems in other young children.

If you agree to participate, this study will involve assessing your child's language abilities, attentional level, play patterns, and self-esteem. You and your child will be videotaped so that we can study how your child plays and interacts by him/herself as well as with others. In addition to testing and observing your child, you will be asked to participate in an interview with a Psychologist. The interview will focus on your child's developmental history and behavior. We will also provide you with eight standard questionnaires which ask about your child's development, behavior, attention, as well as your feelings about your family and yourself. As a result, your participation will require one visit (approximately 2 ½ hours) to the IWK Grace Health Centre and will also require you to spend time at home to complete the questionnaires. None of these tests are harmful.

All information collected for this study will be completely CONFIDENTIAL. Neither your name or your child's name will appear on any questionnaires or videotapes. All information collected will be identified by a code number only.

Your decision to participate in this study is voluntary. Even after signing this consent form, if for any reason you wish to withdraw from the study, please feel free to do so. Your decision not to participate will in no way affect your child's present or future care at the IWK Grace Health Centre.

Although your participation in this study may not provide any immediate benefit to you or your child, we believe that it will help us to learn new information about behavioral difficulties and attention deficits in young children. This information will assist in the service of children who are referred for diagnosis and treatment. You will be provided with a summary of the overall results of this study when it is completed.

If, through your participation, your child is identified as having significant attention or behavior problems, you will be contacted by the Psychologist and invited to meet to discuss your child's results. If it is found that your child requires treatment, you will be offered clinical service through the Preschool ADHD Clinic.

We are very grateful for your assistance.

I have read and understand the above explanation. All of my questions have been answered to my satisfaction.

I _____ hereby give consent for my participation

and that of my child, _____. I understand that if I have any questions concerning this project I may telephone the following people: Ms. Nadine DeWolfe, Dr. Joseph Byrne, or Dr. Harry Bawden at 428-8454.

Signature _____

Obtained
Informed _____
Consent

Date _____

☐ YES ☐ NO I give permission to be contacted about future research projects on attention problems in preschool children. I understand that participation is completely voluntary, and by signing this form, I am not obligated to participate in any future research presented to me.

APPENDIX D

Task 1 (High Structure):
Reynell Developmental Language Scales - Revised (RDLS-R)

Coding Key

Begin/ End Session	k
ACTORS	
Child	c
Examiner	n
CHILD BEHAVIORS (frequency measures)	
Fidgeting	f
Grabbing	g
Spontaneous Verbalizations	v
Out of Seat	o
EXAMINER BEHAVIORS (frequency measures)	
Commands	e

Guidelines for Coding

Begin Coding	When the examiner lays the first of 8 initial test objects on the table, the behavioral observation shall begin.
End Coding	After the child responds to the last question, "What will happen?", the behavioral observation shall be concluded.
Interact Code	Typing "k" will mark the beginning and ending points of this observation. Typing "exit" or "quit" and [enter] will end the observation early.

ACTORS

Child (c)

Definition
The child does the acting or the acting is directed toward the child.

Elaboration
All targeted actions during each session should be appropriately designated as being performed by or toward the child.

Example
The child tells the examiner about his dog [cvc or v only]. The child squirms in his seat [cfc or f only].

Interact
This code is the default for actors 1 and 2. If a code is not specified in positions 1 or 3, the INTERACT cleanup program will designate the child as the actor.

Examiner (n)

Definition
The examiner does the acting.

Elaboration
All targeted actions during each session should be appropriately designated as being performed by the examiner.

Example
The examiner asks the child to pay attention [nec].

Interact
This code will be identified as actor 1 (position 1).

BEHAVIORS

Fidgeting (f)

Definition
The child squirms (i.e., bottom moves in seat but is not just a shift in position), rocks in his/her chair, or fidgets his/her hands, arms, legs or feet. A squirm or fidget will be coded

when there is an *obvious repetitious movement* (i.e., movement must be two or more repetitions) which last for more than a brief moment in time.

Elaboration
The squirm or fidget must be clearly repetitive and involve either the child's entire body, bottom, legs, arms, hands, or feet. However, "deliberate" repetitious movements toward oneself or play directed toward test materials are not included in this category (e.g., picking at face, twirling cards around, or tapping toys on table). This category should not be coded if the movement is from side to side once or up and down once. Each discrete squirm/fidget should be coded whereby a 3-second pause (i.e., an obvious break in the child's movement) is an indication of the endpoint. Each movement or fidget must end prior to a new fidget being coded. Repositioning is not coded nor counted as a continuation of fidget. Facial grimaces (e.g., stretching mouth open or scrunching face) will not be coded.

Example
Do code: Child slides his arms across the table and back three times; the child shakes his legs up and down a number of times; child moves his bottom around in his chair repeatedly without pausing in between wiggles; child tousles his/her hair; or rocks back and forth in chair (i.e., chair legs lose touch with floor→must tip back or tip forward to code and returning to original position is not coded; each series of repetitive rocks is coded whether one rock or more; any 3-sec. break or pause between tips will designate new onset)[cfc or f only].
Do not code: Child slides his arms across the table and back once, picks at his/her face, scrunches up mouth, pulls at lip, scratches self, or taps horse on table.

Interact
This code will be identified as a behavior string (position 2). This symbolizes an action made by the actor.

Grabbing (g)

Definition
The child grabs at test materials or other toys.

Elaboration
Grabbing is coded when the child *tries* to take test materials into his/her own hands when there is no request to handle the objects. The child need only *attempt* to take possession of the object. Grabbing will not be coded when the child merely picks up an object off the table during the testing (even if this is not required in directions); rather it must be an obvious "grab" for an object. This can be coded for grabbing at materials used during testing or at other toys/objects in the room. The child's grabbing behavior will be obvious by its inappropriateness or interference with the testing situation.

Example
Do code: The child tries to take the brush out of the examiner's hand, or grabs for a toy on the floor [cgc or g only].
Do not code: The child picks up the spoon in response to the examiner's question "where is the spoon?", or picks up objects as they are laid out on the table prior to testing.

Interact
This code will be identified as a behavior string (position 2). This symbolizes an action made by the actor.

Spontaneous Verbalizations (v)

Definition
Verbalizations must be spontaneous (i.e., not in response to the examiner's questions) but can be related or unrelated to questions/test items.

Elaboration
To be scored, all verbalizations must be *spontaneously initiated* by the child. The examiner's verbalizations will not be coded under this category (see Examiner Commands). Each discrete verbalization will be coded whereby the conclusion of each utterance is indicated by a 3-second pause (i.e., an obvious break in the child's stream of verbalizing). Any verbalizations which occur in response to test questions, the examiner's direct questions, or requests to repeat comments are not spontaneous and will not be coded. For example, if the child names test objects or states their location (e.g., "there"), in response to a question, (e.g., "where is the ball?"), or the child repeats directions to self while carrying out his/her response, verbalizations will not be coded. Likewise, if the child responds "I don't know" to a test question, this will not be coded. However, if the child makes a comment or asks a question unrelated to the test, verbalization will be coded. If the child asks a question about the test (e.g., "in there?"), asks for directions to be repeated, lists the test objects (before any request to work with the materials), or makes a comment about test items (e.g., "look a boy and a girl"), these will be coded as verbalizations. If the child answers the examiner's question (which is not coded) and continues with a spontaneous verbalization (i.e., not in response to the question), these comments or questions by the child will be coded. An exception to this general rule is the following: during the "definitions" subtest, verbalizations by the child will not be coded if he/she elaborates on the meaning of a word even if the elaboration is completely off-task and appears spontaneous (the child may just be answering question incorrectly and should not be penalized). Verbalizations must be audible words, that is, vocalizations, such as barking, whistling, "umm-ing", or sighing will not be coded.

Example
Do code: The child asks, "does the farmer go in too?", chats for 45 seconds without any pauses (of 3 seconds or more), goes on to say, after being asked about dogs at home, "we have a blue van" [cvc or v only].
Do not code: The examiner asks the child if he has any dogs at home and the child says, "Yes, and his name is Sparky", responds "I don't know" to a test question, says "stinky sock" in response to a question, "What is this?" [sock].

Interact
This code will be identified as a behavior string (position 2). This symbolizes an action made by the actor.

Out of Seat (o)

Definition
The child gets up from his/her chair.

Elaboration
The child may be in physical contact with the chair but his/her weight may not be completely supported by the chair. Out of seat will be coded if the child's bottom loses contact with the chair for even a brief moment if his/her weight is no longer supported by the chair, even if the child is leaning against the chair (e.g., one leg resting on the chair). However, it will not be coded if child is kneeling on chair (i.e., both legs are under child thereby supporting weight).

Example
Do code: If the child stands up to reach across the table for another toy, or stands beside chair with one leg resting on the chair [coc or o only].
Do not code: If the child sits at the tip of the chair or raises slightly up but the chair *clearly* continues to support his weight.

Interact
This code will be identified as a behavior string (position 2). This symbolizes an action made by the actor.

Commands (e)

Definition
The examiner gives a suggestion or order to the child to which a behavioral response is requested. These requests will not be coded if they are direct questions from the test.

Elaboration

Each discrete command will be coded so long as they do not immediately follow one another (i.e., the child must have the opportunity to comply before a second command may be coded). Commands will be coded if their purpose is to command, cue, or coax the child to pay attention, behave appropriately, or continue the testing. Using the child's name to elicit attention (via tone) will also be coded as a command. Any prompts or elaborations of directions (not taken from Reynell), e.g., "you show me", "just guess, tell me what you think", "try your best" will be coded. Any directions from the Reynell will not be coded as commands (e.g., "tell me more"). Any requests to help the examiner put toys away, set objects up on the table, or replace toys on table rather than holding them will not be coded. Any "you can..." requests will not be coded given that they are not clear commands and because the intention of these comments are to provide further instructions/ explanation of the task and do not directly request a behavior response.

Example

Do code: "Be careful!", "Watch it!", "Pay attention here!", "Just wait a second!", "Listen carefully", "Think carefully, hmmmm?", "Leave them out here!", "Put that down", "Wait and see!", and "Jonathan! listen!" [nec or ne].

Do not code: "Let's just keep these out here for now" (because I carry out the behavioral request in this situation and put the animals in appropriate place), "There, can you put the rest in there now?", "Put two of the horses together", "We'll just leave that here for now", "What do you think?", "Which one?", or "How many pets do you have?".

Interact

This code will be identified as a behavior string (position 2). This symbolizes an action made by the actor.

APPENDIX E

Task 3 (Medium Structure): Continuous Performance Task for Preschoolers-Visual (CPTP-V)

Coding Key

Begin Session	k
ACTORS	
Child	c
Examiner	n
CHILD BEHAVIORS (frequency measures)	
Extraneous Body Movement	i
Off-Task	t
Verbalizations	v
CHILD SETTINGS (duration measures)	
Out of Seat	o
EXAMINER BEHAVIORS (frequency measures)	
Commands	e

Guidelines for Coding

Begin Coding	When the examiner steps onto the ramp leaving the sound chamber, the behavioral observation shall begin. Practice trials will not be coded.
End Coding	This session time is specified and as a result, the behavioral observation shall conclude at the sound of the beep (at 8½ minutes). Set time limit at 9 minutes and auto beep frequency for 510 seconds. If the child refuses to complete this task, the session may be ended early (see below).
Interact Code	Typing "k" will mark the beginning and ending point of this observation. Typing "exit" or "quit" and [enter] will end the observation early.

Note: Due to the large number of behaviors to be coded on this task and the speed at which many of them occur; it will be necessary to code this tape using two sweeps through a tape. In the first sweep, out of seat and off-task will be coded and in the second sweep, verbalizations, extraneous body movements, and examiner commands will be coded. Special notations will differentiate these two files (i.e., an "i" will follow the participant number for duration and an "ii" will follow the participant number for frequency).

ACTORS

Child (c)

Definition
The child does the acting or the acting is directed toward the child.

Elaboration
All targeted actions during each session should be appropriately designated as being performed by or toward the child.

Example
The child squirms in his seat [cic or i only].

Interact
This code is the default for actors 1 and 2. If a code is not specified in positions 1 or 3, the INTERACT cleanup program will designate the child as the actor.

Examiner (n)

Definition
The examiner does the acting or the acting.

Elaboration
All targeted actions during each session should be appropriately designated as being performed by the examiner.

Example
The examiner tells the child to keep working [nec].

Interact
This code will be identified as actor 1 (position 1).

BEHAVIORS

Extraneous Body Movement (i)

Definition
(a) The child squirms (i.e., bottom moves in seat but is not just a shift in position) or rocks in his/her chair or fidgets his/her arms, legs, hands, or feet OR (b) the child uses or manipulates test materials in a way which is not necessary for task completion.

Elaboration
(a) Extraneous body movement will be coded when there is an *obvious repetitious movement* (e.g., squirm or fidget of two or more repetitions) which lasts for more than a brief moment in time. The squirm or fidget must be clearly repetitive and involve either the child's entire body, bottom, arms, legs, hands, or feet. This should not be coded if the movement is from side to side once or up and down once or is a stretch of any kind (e.g., arms outstretch in air or quick shake of head in order to wake up). Tapping the response pad will be coded as long as the child is tapping the response pad and the response pad is not moving (caution: these taps must be obvious and not be confused with button pressing which is not coded). Each discrete squirm/fidget should be coded whereby a 3-second pause (i.e., an obvious break in the child's movement) is an indication of the endpoint. Each movement or fidget must end prior to coding a new extraneous body movement. Repositioning is not coded nor counted as a continuation of a body movement. Facial grimaces (e.g., stretching mouth open or scrunching face) will not be coded.
(b) Extraneous body movement will also be coded when there is a "deliberate" attempt by the child to use or manipulate the test materials in a way that is inappropriate or unnecessary for task performance. This movement should last for more than a brief moment in time; however, it need not be repetitious in nature. For example, holding

response pad up in air would be coded even if child is not continuously moving arms. Each discrete attempt should be coded whereby a 3-second pause (i.e., and obvious break in the child's movement) is an indication of the endpoint. Extraneous activity directed toward the response pad will be coded, e.g., flipping response pad around, attempting to remove its cover, or banging it against hand. If child raises response pad above his/her shoulders, drops below lap area, or moves to side of torso (L or R), extraneous body movement should be coded; the response pad is now considered out of position and behavior is task extraneous (and therefore distracting).

Example

Do code: Child shakes his legs up and down a number of times without stopping, rocks back and forth in chair (i.e., chair legs lose touch with floor→must tip back or tip forward to code and returning to original position is not coded; each series of repetitive rocks is coded whether one rock or more; any 3-sec. break or pause between tips will designate new onset), fidgets with his/her hands, tousles his/her hair, squirms to a laying position across two chairs, raises arms outward or upward (even while still holding response pad) and leaves arms outreached for a few seconds, places response pad at eye level while responding, or attempts to look under response pad cover [cic].

Do not code: Child picks at his/her face, sticks out tongue, briefly stretches arms straight out toward the ceiling or monitor, scratches self, takes tape off wall, rubs belly, plays with participant #.

Interact

This code will be identified as a behavior string (position 2). This symbolizes an action made by the actor.

Off-task (t)

Definition

When the child's attention is directed away from the computer screen (i.e., child looks away from the computer) and/or is not holding/touching the response pad, he/she is coded as off-task. If the child cannot be seen by the coder, he/she will be designated as off-task.

Elaboration

The child, who turns his/her head or eyes away from the screen by more than 45° in either the vertical or horizontal direction and/or is not holding the response pad, will be coded as off-task. This will be coded each time the child turns his/her head or eyes to look away from the monitor or he/she places response pad on floor, chair, etc. This will be coded regardless of how briefly attention toward the task is lost. However, if child flutters his/her eyes or blinks a lot or shifts eye gaze to left (away from camera), be careful to code only when child *clearly* looks away. This category should be coded at the outset if child is off-task when task begins.

Example
Do code: If the child looks down toward the response pad, looks toward the video camera, drops the response pad but continues to look in the direction of the monitor, turns to look outside the chamber, leaves eyes closed (not a mere blink), or actually comes out of chamber [ctc].
Do not code: If the child moves head or eyes slightly to the side (less than 45°).

Interact
This code will be identified as a behavior string (position 2). This symbolizes an action made by the actor.

Verbalizations (v)

Definition
Verbalizations must be spontaneous and can be related or unrelated to the task at hand.

Elaboration
To be scored, all verbalizations must be *spontaneously initiated* by the child. The examiner's verbalizations will not be coded under this category (see Examiner Commands). Each discrete verbalization will be coded whereby the conclusion of each utterance is indicated by a 3-second pause (i.e., an obvious break in the child's stream of verbalizing). If the child asks a question about the task, comments on the task, or talks while completing the task, verbalization will be coded. Whether the child utters one word, e.g., "there" or several words, e.g., "there, I got ya", while carrying out the task, each should be coded as a verbalization. If the child asks a question while carrying out a task, e.g. "how many more pigs?", this should be coded. If the child names the pictures or counts targets as he/she proceeds, these will also be coded as verbalizations. Any verbalizations which occur in response to the examiner's direct questions or requests to repeat comments will not be coded. Verbalizations must be audible words, that is, vocalizations or sound effects, such as barking, whistling, umm-ing, or sighing will not be coded.

Example
Do code: The child asks, "can I come out now?", talks to self while playing game, names each picture as it appears [cvc or v only].
Do not code: The child hums or sighs while playing the game.

Interact
This code will be identified as a behavior string (position 2). This symbolizes an action made by the actor.

Out of Seat (o)

Definition
The child gets up from his/her chair.

Elaboration
The child may be in physical contact with the chair but his/her weight may not be completely supported by the chair. Out of seat will be coded if the child's bottom loses contact with the chair for even a brief moment given that his/her weight is no longer supported by the chair (unless he/she is pushing self back in chair to adjust position). Out of seat will be coded even if the child is leaning against the chair (e.g., one leg resting on the chair). However, it will not be coded if child is kneeling on chair (i.e., both legs are under child thereby supporting weight). This should be coded at outset if child is out of seat when task begins. Unless child is seated in his/her designated child-size chair, he/she will be out of seat.

Example
Do code: If the child stands in front of the monitor, or stands beside chair with one leg resting on the chair [coc].
Do not code: If the child sits at the tip of the chair, rocks back and forth, or raises slightly up but the chair *clearly* continues to support his weight.

Interact
This code will be identified as a behavior string (position 2). This symbolizes an action made by the actor.

Return to Seat (oo)

Definition
The child returns to his/her chair.

Elaboration
The child's weight must become completely supported by the chair. Return to seat will be coded if the child's bottom regains contact with the chair or he/she kneels on the chair, even for a brief moment. It will not be coded if the child only leans against the chair (e.g., one leg is resting on the chair). This category should be coded at the outset if child is seated when coding begins.

Example
Do code: If the child sits down at the tip of the chair or if he/she returns to the seat after standing up for one brief moment [here both coc and cooc are coded]; child kneels on both legs and weight is supported by chair [cooc].
Do not code: If the child stands beside chair with one leg resting on the chair [coc].

Interact
This code will be identified as a behavior string (position 2). This symbolizes an action made by the actor.

Commands (e)

Definition
The examiner gives a suggestion or order to the child to which a behavioral response is requested. These requests are likely to be reminders to continue working and proceed with the task. Be careful to not confuse statements, e.g., "there's more coming"; "I'll tell you when"; "it's important to get all of them", with commands.

Elaboration
Each discrete command will be coded so long as they do not immediately follow one another in same breath without a pause or chance for the child to comply. Commands will be coded if their purpose is to command, cue, or coax the child to pay attention, behave appropriately, or continue with the task. Most comments made to the child by the examiner during this task will be in the form of a command to continue working on the task. Comments such as "I'm busy" shall not be coded as a command; however, if it is followed by "get all the pigs!" it will be coded as a command.

Example
Do code: "Keep working please!", "Stay in there", "Sit down and keep working", "Be sure to get all the pigs", "I need you to keep getting all the pigs", "Remember, you are looking for the pigs", "Just a little while more", "Ssshhh!" [nec].
Do not code: "I'm out here getting ready", "I'm doing my work".

Interact
This code will be identified as a behavior string (position 2). This symbolizes an action made by the actor.

APPENDIX F

Task 4 (Medium Structure): Picture Deletion Task for Preschoolers-Revised (PDTP-R)

Coding Key

Begin Session	k
ACTORS	
Child	c
Examiner	n
CHILD BEHAVIORS (frequency measures)	
Extraneous Body Movement	i
Off-Task	t
Verbalizations	v
Out of Seat	o
EXAMINER BEHAVIORS (frequency measures)	
Commands	e

Guidelines for Coding

Begin Coding	When the examiner provides a cue to begin the shape task, e.g., "Ready, go!", the behavioral observation shall begin. The stopwatch beep will be used as a signal that the shape task has concluded; coding will temporarily cease at this signal. The examiner's "ready go" signal will signal the onset of coding for the cat task. Time taken for shape or cat identification and task instruction shall not be coded. At conclusion of shape task, coder will await (do not fast forward) the beginning of cat task and resume coding.
End Coding	When the examiner stops the stopwatch or otherwise indicates the conclusion of the cat task, the behavioral observation shall be concluded.
Interact Code	Typing "k" will mark the beginning and ending points of this observation. Typing "exit" or "quit" and [enter] will end the observation early.

ACTORS

Child (c)

Definition
The child does the acting or the acting is directed toward the child.

Elaboration
All targeted actions during each session should be appropriately designated as being performed by or toward the child.

Example
The child squirms in his seat [cic or i only].

Interact
This code is the default for actors 1 and 2. If a code is not specified in positions 1 or 3, the INTERACT cleanup program will designate the child as the actor.

Examiner (n)

Definition
The examiner does the acting.

Elaboration
All targeted actions during each session should be appropriately designated as being performed by the examiner.

Example
The examiner tells the child to keep working [nec].

Interact
This code will be identified as actor 1 (position 1).

BEHAVIORS

Extraneous Body Movement (i)

Definition
(a) The child squirms (i.e., bottom moves in seat but is not just a shift in position) or rocks in his/her chair or fidgets his/her arms, legs, hands, or feet OR (b) the child uses or manipulates test materials in a way which is not necessary for task completion.

Elaboration
(a) Extraneous body movement will be coded when there is an *obvious repetitious movement* (e.g., squirm or fidget of two or more repetitions) which lasts for more than a brief moment in time. The squirm or fidget must be clearly repetitive and involve either the child's entire body, bottom, arms, legs, hands, or feet. This should not be coded if the movement is from side to side once or up and down once or is a stretch of any kind (e.g., arms outstretch in air or quick shake of head in order to wake up). Each discrete squirm/fidget should be coded whereby a 3-second pause (i.e., an obvious break in the child's movement) is an indication of the endpoint. Each movement or fidget must end prior to coding a new extraneous body movement. Repositioning is not coded nor counted as a continuation of a body movement. Facial grimaces (e.g., stretching mouth open or scrunching face) will not be coded.
(b) Extraneous body movement will also be coded when there is a "deliberate" attempt by the child to use or manipulate the test materials in a way that is inappropriate or unnecessary for task performance. This movement should last for more than a brief moment in time; however, it need not be repetitious in nature. For example, holding blotter above head would be coded even if child is not continuously moving his/her arms. Each discrete attempt should be coded whereby a 3-second pause (i.e., and obvious break

in the child's movement) is an indication of the endpoint. Activity directed toward the bingo marker will also be coded, e.g., shaking/rolling/wiggling marker or stamping self. This will be coded as long as marker is in the air (while searching for targets, while off-task, or while on the way to the page). However, rolling or tapping marker once it touches the page will not be coded (no matter how irrelevant they may seem). The endpoint (where counting begins) of each "i" will be when the extraneous movement stops or when the marker hits the page.

Example

Do code: Child shakes his legs up and down a number of times without stopping, moves his bottom around in his chair repeatedly without pausing in between wiggles, rocks back and forth in chair (i.e., chair legs lose touch with floor→must tip back or tip forward to code and returning to original position is not coded; each series of repetitive rocks is coded whether one rock or more; any 3-sec. break or pause between tips will designate new onset), fidgets with his/her hands, tousles his/her hair, stretches arms outward or upward when the stretch becomes a lingering arms in air kind of movement, shakes bingo blotter, taps bottom side (not sponge) on table, flies marker through the air, rolls marker on table, holds marker up to head or eyes (above chin) and moves head with stamper to page (endpoint here is indicated by removal of blotter from head), picks at bingo marker using finger, or intentionally stamps self [cic].

Do not code: Child picks at his/her face, scratches self, turns/flips pages in test booklet, stretches arms in air, blotter while sponge is marking on page, stamps page starting at a position well over head (big arc), attempts to separate glued pages when turning page, touches marker to head and then independently stamps page, smears, pools, or squeezes ink on page (with finger or blotter), or gestures using the bingo marker to search or show completed areas of work.

Interact

This code will be identified as a behavior string (position 2). This symbolizes an action made by the actor.

Off-Task (t)

Definition

When the child's attention is directed away from the task at hand (i.e., child looks up or away from the task booklet) and/or is not holding the bingo marker, he/she is coded as off-task. However, if child puts marker down to turn to next page, off-task should not be coded unless he/she looks away from the page.

Elaboration

The child, who moves his/her head or eyes away from the task booklet in either the vertical or horizontal direction and/or is not holding the bingo marker, will be coded as off-task. This will be coded each time the child's attention is directed away from the task, i.e., he/she is no longer searching for targets, turning the pages, or holding the marker.

This will be coded regardless of how briefly attention is lost. Even if the child is not performing the task as requested, e.g., is smearing or pooling ink, off-task will not be coded as long as the child's attention is focused on the task.

Example
Do code: If the child looks at the examiner, looks toward the videocamera or mirror, plays with blotter (e.g., puts finger on blotter ink or watches blotter as shaking it), doesn't touch bingo marker (even if looking at page-unless turning page) [ctc].
Do not code: If the child moves head or eyes slightly to the side but attention has not clearly left the booklet, smears ink on page, shakes blotter while looking at the task booklet (coded as an extraneous movement), or turns pages back and forth.

Interact
This code will be identified as a behavior string (position 2). This symbolizes an action made by the actor.

Verbalizations (v)

Definition
Verbalizations must be spontaneous and can be related or unrelated to the task at hand.

Elaboration
To be scored, all verbalizations must be *spontaneously initiated* by the child. The examiner's verbalizations will not be coded under this category (see Examiner Commands). Each discrete verbalization will be coded whereby the conclusion of each utterance is indicated by a 3-second pause (i.e., an obvious break in the child's stream of verbalizing). Any verbalizations which occur in response to the examiner's direct questions or requests to repeat comments will not be coded. If the child asks a question about the task, comments on the task, or talks while completing the task, verbalization will be coded. Whether the child utters one word, e.g., "there" or several words, "e.g., that one is the same" while carrying out the task, each should be coded as a verbalization. If the child asks a question while carrying out a task, e.g. "how many more pages?", this should be coded. If the child names or counts the targets or pages as he/she proceeds, these will also be coded as verbalizations. Verbalizations must be audible words, that is, vocalizations, such as barking, whistling, umm-ing, or sighing will not be coded.

Example
Do code: The child asks, "am I finished yet?", talks to self while stamping cats, asks about a toy in the room [cvc].
Do not code: The child hums while stamping.

Interact
This code will be identified as a behavior string (position 2). This symbolizes an action made by the actor.

Out of Seat (o)

Definition
The child gets up from his/her chair.

Elaboration
The child may be in physical contact with the chair but his/her weight may not be completely supported by the chair. Out of seat will be coded if the child's bottom clearly loses contact with the chair for even a brief moment given that his/her weight is no longer supported by the chair. If the child is reaching for the top part of the booklet, "o" will be coded only if it is very obvious they are out of seat and not just reaching for the top. Out of seat will be coded even if the child is leaning against the chair (e.g., his leg is resting on the chair). However, it will not be coded if the child is kneeling on chair (i.e., both legs are under child thereby supporting weight).

Example
Do code: If the child stands up to reach across the table, or the child stands beside chair with one leg resting on the chair [coc].
Do not code: If the child sits at the tip of the chair, rocks back and forth in chair, or raises slightly up but the chair *clearly* continues to support his weight.

Interact
This code will be identified as a behavior string (position 2). This symbolizes an action made by the actor.

Commands (e)

Definition
The examiner gives a suggestion or order to the child to which a behavioral response is requested. These requests are likely to be directives or reminders to continue working and proceed with the task.

Elaboration
Each discrete command will be coded so long as they do not immediately follow one another in the same breath without a pause or chance for the child to comply. Commands will be coded if their purpose is to command, cue, coax, or remind the child to pay attention, behave appropriately, or continue with the task. Most comments made to the child by the examiner during this task will be in the form of a command to continue working on the task. Comments such as "I'm doing my work here" shall not be coded as a

command; however, if it is followed by "keep working!" it will be coded as a command. If the child is given commands about task performance, e.g. "you don't need to cover him all over", these should also be coded. In this task, repeating directions is considered a command given that directions are often requests for certain task related behaviors.

Example

Do code: "Keep working please!", "Be sure to get all the ones like the guy at the top", "I need you to keep stamping please", "Press lightly with the stamper please", "Turn the page when you have got all the ones on this page", "Just a little while more", or "You know how this game works!" (a cue to remind child to proceed by turning pages, etc.), "There's more pages for you to get" "You can go on to the next page when this page is done", "Tell me when you're done", "Only 2 more pages" [nec].

Do not code: "I'm busy doing my work", any assistance from the examiner to turn pages, "those are supposed to be stuck" (referring to glued pages), "as soon as we're done this game" (often these comments are followed by commands but cannot stand on their own as commands).

Interact

This code will be identified as a behavior string (position 2). This symbolizes an action made by the actor.

APPENDIX G

Task 5 (Medium Structure): Continuous Performance Task-Auditory (CPT-A)

Coding Key

Begin Session	k
ACTORS	
Child	c
Examiner	n
CHILD BEHAVIORS (frequency measures)	
Extraneous Body Movement	i
Verbalizations	v
Out of Seat	o
EXAMINER BEHAVIORS (frequency measures)	
Commands	e

Guidelines for Coding

Begin Coding	When the first word, "cat" from the *test* phase is heard, the behavioral observation shall begin. Practice trials will not be coded.
End Coding	This session time is specified and as a result, the behavioral observation shall conclude automatically at the end of this task when the examiner says "it's over" or otherwise concludes the task (at approximately 7 minutes). If the child refuses to complete this task, the session may also be ended early. Behaviors occurring during any break taken in this task will not be coded.
Interact Code	Typing "k" will mark the beginning and ending point of this observation. Typing "exit" or "quit" and [enter] will end the observation early.

ACTORS

Child (c)

Definition
The child does the acting or the acting is directed toward the child.

Elaboration
All targeted actions during each session should be appropriately designated as being performed by or toward the child.

Example
The child squirms in his seat [cic or i only].

Interact
This code is the default for actors 1 and 2. If a code is not specified in positions 1 or 3, the INTERACT cleanup program will designate the child as the actor.

Examiner (n)

Definition
The examiner does the acting.

Elaboration
All targeted actions during each session should be appropriately designated as being performed by the examiner.

Example
The examiner tells the child to keep working [nec].

Interact
This code will be identified as actor 1 (position 1).

BEHAVIORS

Extraneous Body Movement (i)

Definition
(a) The child squirms (i.e., bottom moves in seat but is not just a shift in position) or rocks in his/her chair or fidgets his/her arms, legs, hands, or feet OR (b) the child uses or manipulates test materials in a way which is not necessary for task completion.

Elaboration

(a) Extraneous body movement will be coded when there is an *obvious repetitious movement* (e.g., squirm or fidget of two or more repetitions) which lasts for more than a brief moment in time. The squirm or fidget must be clearly repetitive and involve either the child's entire body, bottom, arms, legs, hands, or feet. This should not be coded if the movement is from side to side once or up and down once or is a stretch of any kind (e.g., arms outstretch in air or quick shake of head in order to wake up). Each discrete squirm/fidget should be coded whereby a 3-second pause (i.e., an obvious break in the child's movement) is an indication of the endpoint. Tapping, banging, etc. on the table will only be coded if it does not occur on the target dot (must be outside the 8½ x 11 page); otherwise the behavior will be coded as a response (e.g., hit or commission). Each movement or fidget must end prior to coding a new extraneous body movement. Repositioning is not coded nor counted as a continuation of a body movement. Facial grimaces (e.g., stretching mouth open or scrunching face) will not be coded.

(b) Extraneous body movement will also be coded when there is a "deliberate" attempt by the child to use or manipulate the test materials in a way that is inappropriate or unnecessary for task performance. This movement should last for more than a brief moment in time; however, it need not be repetitious in nature. For example, turning target dot over. Each discrete attempt should be coded whereby a 3-second pause (i.e., and obvious break in the child's movement) is an indication of the endpoint. In the previous example, the dot will have to be returned to table before counting can begin and a new extraneous body movement becomes eligible. Activity directed toward the blue target dot will be coded if it is irrelevant to performance, e.g., moving page back and forth repetitively, twisting and flipping it around, "walking" fingers around it (because this is a purposeful/intentional behavior as long as it occurs on target page), or crumpling it up and throwing on the floor. Hitting target dot with body parts other than hands (e.g., head, face, elbows) will be coded. However, regardless of frequency, intensity, and accuracy, any touching, tapping, hitting, or banging of dot with hand will not be coded because these behaviors are relevant to task.

Example

Do code: Child shakes his legs up and down a number of times without stopping, moves his bottom around in his chair repeatedly without pausing in between wiggles, rocks back and forth in chair (i.e., chair legs lose touch with floor→must tip back or tip forward to code and returning to original position is not coded; each series of repetitive rocks is coded whether one rock or more; any 3-sec. break or pause between tips will designate new onset), fidgets with his/her hands, tousles his/her hair, fidgets with target dot, throws it on floor, crumples/folds it, twists it around on table, or lifts it up off the table [cic].

Do not code: Child picks at his/her face, stretches arms straight out toward the ceiling, makes weird faces; pulls or picks at face, picks at corner of target dot page but doesn't lift off table, blows page (unless ends up moving about), plays pat-a-cake to dot, karate chops dot with hand, hand-over-hand responding to dot.

Interact
This code will be identified as a behavior string (position 2). This symbolizes an action made by the actor.

Verbalizations (v)

Definition
Verbalizations must be spontaneous and can be related or unrelated to the task at hand.

Elaboration
To be scored, all verbalizations must be *spontaneously initiated* by the child. The examiner's verbalizations will not be coded under this category (see Examiner Commands). Each discrete verbalization will be coded whereby the conclusion of each utterance is indicated by a 3-second pause (i.e., an obvious break in the child's stream of verbalizing). Any verbalizations which occur in response to the examiner's direct questions or requests to repeat comments will not be coded. If the child asks a question about the task, comments on the task, or talks while completing the task, verbalization will be coded. Whether the child utters one word, e.g., "there" or several words, e.g., "there, I got ya", while carrying out the task, each should be coded as a verbalization. If the child asks a question while carrying out a task, e.g. "how much longer?", this should be coded. If the child repeats the name of the words heard, these will also be coded as verbalizations. Verbalizations must be audible words, that is, vocalizations, such as barking, whistling, umm-ing, or sighing will not be coded.

Example
Do code: The child asks, "am I done?", or talks to self while task proceeds.
Do not code: The child hums or sighs while listening.

Interact
This code will be identified as a behavior string (position 2). This symbolizes an action made by the actor.

Out of Seat (o)

Definition
The child gets up from his/her chair.

Elaboration
The child may be in physical contact with the chair but his/her weight may not be completely supported by the chair. Out of seat will be coded if the child's bottom loses contact with the chair for even a brief moment given that his/her weight is no longer supported by the chair. Out of seat will be coded even if the child is leaning against the

chair (e.g., one leg resting on the chair). However, it will not be coded if child is kneeling on chair (i.e., both legs are under child thereby supporting weight).

Example
Do code: If the child stands beside table, or stands beside chair with one leg resting on the chair [coc].
Do not code: If the child sits at the tip of the chair, rocks back and forth, or raises slightly up but the chair *clearly* continues to support his weight.

Interact
This code will be identified as a behavior string (position 2). This symbolizes an action made by the actor.

Commands (e)

Definition
The examiner (a) gives a suggestion or order to the child to which a behavioral response is requested. These requests are likely to be directives or reminders to continue working and proceed with the task OR (b) makes a non-verbal request.

Elaboration
(a) Each discrete command will be coded. Commands will be coded if their purpose is to command, cue, or coax the child to pay attention, behave appropriately, or continue with the task. Most comments made to the child by the examiner during this task will be in the form of a command to continue with the task. Comments such as "I'm busy" shall not be coded as a command; however, if it is followed by "keep listening for tiger!" it will be coded as a command.
(b) This will be coded when the examiner makes any non-verbal request to which a behavioral response is requested or implied/carried out. For example, a non-verbal request will be coded when the examiner removes the child's hands from the target dot (when the child rests hand on dot for extended periods of time without moving it), when the examiner returns the target dot to an appropriate position in an attempt to redirect the child's behavior, or pushes child's chair in closer to the table.

Example
Do code: "Keep working please!", "Listen carefully", "Sit down", "Make sure you listen", "Wait for tiger", "Just a little longer", the examiner moves child's hand from target dot to another position, or returns the target dot to an appropriate position in front of the child [nec].
Do not code: "I'm doing my work", "I don't know", or if child or examiner engage in any other nonverbal behavior.

Interact

This code will be identified as a behavior string (position 2). This symbolizes an action made by the actor.

APPENDIX H

Task 6 (Low Structure Play Task)

Coding Key

Begin Session	k

ACTORS

Child	c
Parent	m
Assigned Toys	x
Unsanctioned Toys	d

CHILD BEHAVIORS (frequency measures)

Grid Change	a
Verbalizations	v

CHILD SETTINGS (duration measures)

Begin Play/Play Change	pp
End Play	p

Guidelines for Coding

Begin Coding	When the examiner leaves the free play observation room (i.e., the door shuts), the behavioral observation shall begin.
End Coding	This session time is specified and as a result, the behavioral observation shall conclude automatically at the end of this task (at 20 minutes). Set time limit at 20 minutes. If the child refuses to complete this task, the session may be ended early (see below).
Interact Code	Typing "k" will mark the beginning and end of this observation. Typing "exit" or "quit" and [enter] will end the observation early.

ACTORS

Child (c)

Definition
The child does the acting.

Elaboration
All targeted actions during each session should be appropriately designated as being performed by the child.

Example
The child tells his mother that he needs to pee [cvm or vm only]. The child plays with an assigned toy [cppx or ppx].

Interact
This code is the default for actors 1 and 2. If a code is not specified in positions 1 or 3, the INTERACT cleanup program will designate the child as the actor.

Parent (m)

Definition
The acting is directed toward the parent.

Elaboration
All targeted actions during each session should be appropriately designated as being performed toward the parent.

Example
The child tells his parent he is bored [cvm].

Interact
This code will be identified as actor 2 (position 3).

Assigned Toys (x)

Definition
The child plays with one of the three assigned toys (i.e., Mr. Potatoe Head, blocks, or coloring).

Elaboration
All play toward an assigned toy should be appropriately designated as being directed toward that object. The play need not be located on the tables to be coded. This will be coded when the child plays with, carries, touches, involves, or picks up an assigned toy.

Example
The child begins to play with Mr. Potatoe Head [cppx]. The child stops coloring [cpx].

Interact
This code will be identified as actor 2 only (position 3).

Unsanctioned Toys (d)

Definition
The child plays with one of the three unsanctioned toys (i.e., piano, dinosaur, or car).

Elaboration
All play toward an unsanctioned toy should be appropriately designated as being directed toward that object. This will be coded when the child plays with, carries, touches, involves, or picks up an unsanctioned toy.

Example
The child begins to play with the dinosaur [cppd]. The child stops playing with the car [cpd].

Interact
This code will be identified as actor 2 only (position 3).

BEHAVIORS

Grid Change (a)

Definition
Grid change is recorded each time the child moves from one grid into another.

Elaboration
Both of the child's feet must completely cross the line to be coded. As a result, straddling the line will *not* be coded. If the child leaves the play area or otherwise disappears from the videotaped area, *only* those grid changes that *can be seen* will be coded.

Example
The child runs across three grids [cac, cac, cac]. The child walks to the next table crossing two grids [cac, cac].

Interact
This code will be identified as a behavior string (position 2). This symbolizes an action made by the actor.

Verbalizations (v)

Definition
Verbalizations must be spontaneous and can be related or unrelated to the toy play.

Elaboration
To be scored, all verbalizations must be *spontaneously initiated* by the child. The parent's verbalizations will not be coded. Each discrete verbalization will be coded whereby the conclusion of each utterance is indicated by a 3-second pause (i.e., an obvious break in the child's stream of verbalizing). Any verbalizations which occur in response to a parent or the examiner's direct questions will not be coded; however, this should be an infrequent occurrence. If the child asks a question, comments on the play session, or talks to self while playing, verbalization will be coded. Whether the child utters one word, e.g., "there" or several words, e.g., "I'm having fun out here!", each will be considered a verbalization. Verbalizations must be audible words, that is, vocalizations, such as barking, whistling, umm-ing, or sighing will not be coded. Singing will be coded as a verbalization as long as the words to the songs are audible words (not humming or "la-la's"). The actor toward whom the verbalization is directed (self or parent) should be designated.

Example
Do code: The child asks, "when can we go home?" [cvm]; the child talks to self while playing [cvc]; the child speaks for 5 seconds, stops for 3 seconds and speaks for another 5 seconds [code cvc twice].
Do not code: The child hums or sighs while playing.

Interact
This code will be identified as a behavior string (position 2). This symbolizes an action made by the actor.

Begin Play/Play Change (pp)

Definition
The child begins to play (i.e., becomes engaged) with an assigned or unsanctioned toy (see Actors: x, d) in the playroom.

Elaboration

The beginning of play with a toy will be coded when the child picks up, carries, touches, or involves an assigned or unsanctioned toy in his/her play or activity. Any *change in play* from one toy to another should be indicated by this code. For example, if the child is playing with one toy and switches to another toy, play change will be coded (preceded by an end play for the previous toy play). In fact, any change in play from any one toy at a particular table or on floor to play with a different toy (at either the same or another table, i.e., *even if it is the same toy at another table*) indicates a change in play. Play change will also be coded if the child is playing with one toy and adds a second, different toy to play (one play change will have been coded for the addition of each new toy). Play with toys need not occur at a table; in fact, play can be occurring *while* the child is walking around the room or sitting on the floor as long as he/she remains in the play area (see leaves play area). The child need not be actively "playing", e.g., if the child is carrying a toy to show his/her mother a completed product, toy play will still be in effect (i.e., until he disappears from view); however, it must be touched initially to indicate change in play. In the event that a child plays with a toy, leaves it, and returns to play with the same toy at the same table without playing with any toys in the meantime, play change will be coded again (given that child's attention must have been otherwise engaged in the meantime; resulting in change in play). Duration of time spent playing with toys will be obtained and as a result, this code will remain in effect until end play is coded. The beginning of play will therefore be preceded by its pair (i.e., end play) though not necessarily immediately before, except for the first coding of "pp". The type of toy in which the play is directed (assigned or unsanctioned) should be designated by the appropriate actor code.

Example

Do code: The child begins to play with Mr. PH [cppx], begins to color and then starts pushing crayons into Mr. PH holes [cppx, cpx, cppx], plays with piano and then touches the dinosaur [cppd, cpd, cppd].

Do not code: The child looks at a toy; or plays with a toy after leaving it for a brief moment (less than 3-seconds).

Interact

This code will be identified as a behavior string (position 2). This symbolizes an action made by the actor.

End Play (p)

Definition

The conclusion of play with a given toy (i.e., he/she clearly stops attending to the toy) will indicate the end of play.

Elaboration

End play will be demonstrated by the child's leaving a toy aside to either play with another toy or by a clear disengagement with a toy. Unless the child has *clearly* become disengaged from toy (e.g., by initiation of play with new toy), this will not be coded until there has been a 3-second lapse in touch or toy involvement. At times it may be difficult to determine the moment in which the child becomes disengaged with a toy; this will require some subjective judgement as to when play ends. The direction of the child's attention may be helpful in this regard (i.e., if the child looks away from the toy and is not touching it, he is likely to be finished playing). In situations where there is play with several toys at once, end play must be coded for each sequence of play change. After a toy play has ended, if it is re-engaged at a later point, the pairing of end play and play change should be recoded (given that this now demonstrates the onset of play with a new toy). If the child is not involved in play with a toy, the child will be coded as remaining uninvolved (end play will have been the last code designated). In this way, we will be able to measure the duration of time spent *not* playing with toys. For example, if the child concludes playing with a toy (coded as "p") and begins to daydream, gaze off into space, run around room, visit his/her mother, or climb on windowsill, he/she will not be engaged in toy play and will be off-task. The end of play code will always be preceded by its pair (i.e., begin play). The type of toy in which the play was directed (assigned or unsanctioned) prior to play ending should be designated by the appropriate actor code. When the child leaves the play area, end play must always be coded regardless of whether or not the child was carrying a toy when he disappeared. However, when he/she reemerges into view (i.e., returns to play area), begins to play will be coded again.

Note: By leaving the play area, the child is either seeking attention from adult or is distracted by the outdoors or bathroom. As a result, leaving the play area overrides any assumption that the child is continuing to play by carrying the toy. In all other cases, if the child does not leave play area and carries a toy while walking around the room, he/she will be continuing to play (even if looking around and not at toy).

Example

Do code: The child stops coloring [cpx]; stops playing piano [cpd]; or begins to play with Mr. PH and blocks at same time [cpx, cppx].
Do not code: The child carries Mr. PH to show mother interesting face; or drops toy briefly to pick up another part (not clear disengagement of play).

Interact

This code will be identified as a behavior string (position 2). This symbolizes an action made by the actor.

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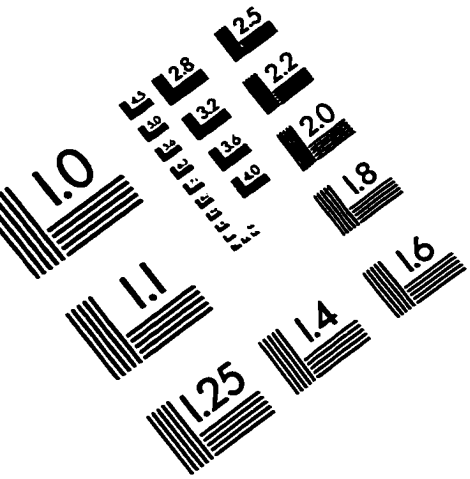
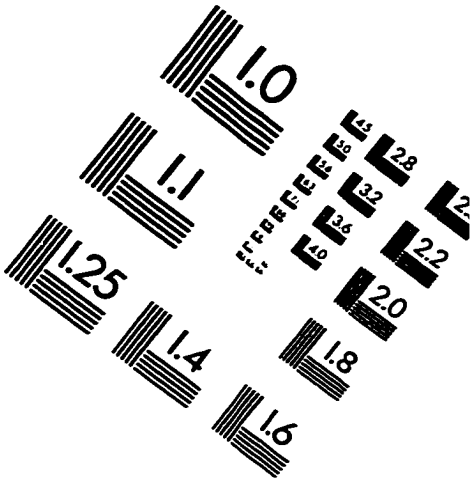
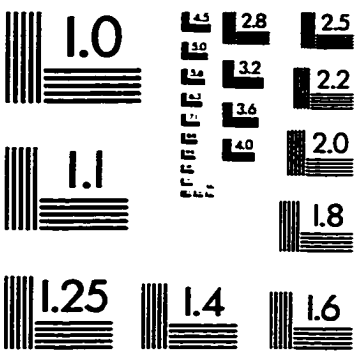
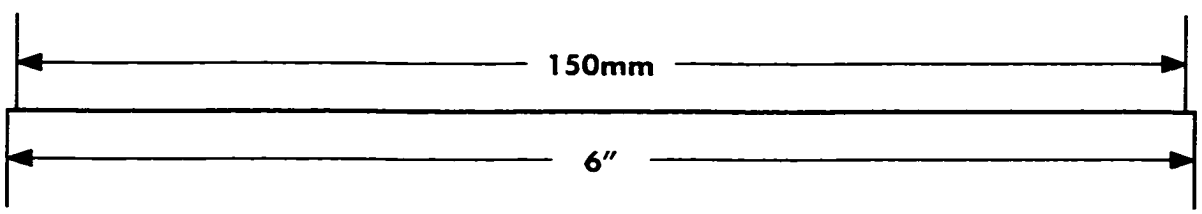
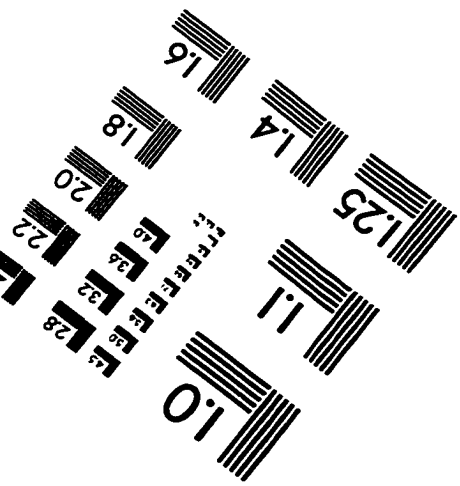
IMAGE EVALUATION TEST TARGET (QA-3)

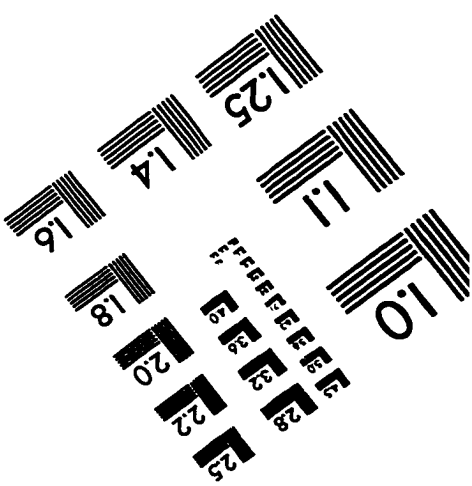












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