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The Development of a Measure of Attention in Children

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THE DEVELOPMENT OF A MEASURE OF ATTENTION IN CHILDREN

BY

JANETTE BAIRD

A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF THE

REQUIREMENTS FOR THE DEGREE OF

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PSYCHOLOGY

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Abstract

A study was conducted to evaluate the effectiveness of a Preschool Measure Of Attention (PMA) to measure three factors of attention in young children; focus, shift and vigilance. The parents of 148 children rated their children on the PMA, a measure of temperament and on a scale of attentional problems. The results of the study suggest that two factors of attention; vigilance and focus/distractibility, were measured in this group. Age differences in the performance of the sample on these attentional factors were not found to be significant. However the age of the children accounted for 5 percent of the variance in the performance across the attentional factors, which suggests that age is an important consideration when evaluating the attentional capacities of children.

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Finally I wish to dedicate this study to my husband and children for their never-ending support throughout this process.

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Introduction

Justification for research

Attention and attentional disorders are an important area of enquiry for researchers who are interested in cognitive and developmental psychology. Attention is viewed as an important component of cognitive processing. The description of attentive acts can be applied to covert physical activities and to complex internal cognitive processes such as problem solving. Although there has been a long history of studying the behavioral and mental manifestations of attention, there is limited reference in the research literature as to a putative model of the development sequence of early attentional processes in young children.

Attention deficit / hyperactivity disorder (ADHD) is a major psychiatric disorder that is estimated to affect between 3-5% of all grade school children (Barkley, 1997). ADHD constitutes one of the most common referrals for child psychiatric services in the US today. Many children including preschool children receive daily psychostimulant medication to treat this disorder. Current diagnostic practice (DSM-IV, 1994) differentiates between three forms of ADHD: ADHD predominately inattentive, ADHD predominately hyperactive and impulsive, and ADHD combined type. It is estimated that up to 50% of children diagnosed with some form of ADHD will demonstrate the criterion symptoms into adulthood (Lavigne, et al., 1998).

However, the diagnosis and manifestation of attentional problems in children, particularly school-age children, are major concerns of researchers and professionals. The present research is intended to explore how the components of attentional processes could be measured in young children, with a view to looking at the developmental

sequence of these attentional processes, and to suggest if differences among same age children could be indicative of later attentional problems.

Literature Review and Theoretical Framework

Psychology and Attention

As early as the 1890's introspectionists such as William James were trying to define the operationalization of attention as a process that involved consciousness, concentration and focus. James postulated that the components of attention could be measured by studying conditions where attentive processes were lacking, such as in people experiencing confusion (Gazzaniga, Ivry, & Magnun, 1998).

Attention can perhaps be best conceptualized as an internal process that underlies most of the cognitive activities in which we engage. All of our sensory processes utilize our attentive capacities. We use attention when we detect and perceive visual, auditory or physical stimuli, and when we engage and disengage with our external environment. Attention at a primary physiological level is related to our global arousal state and can be demonstrated by small voltage changes, as measured by an electroencephalogram (EEG), that parallel neural activities (Gazzaniga, et al., 1998).

Filter Theories

Broadbent in the 1950's argued that the role of attention as a cognitive activity was to serve as a gatekeeper between selecting relevant stimuli and suppressing the processing of irrelevant stimuli (Luck & Girelli, 1998). A stimulus is described as relevant if it is appropriate to the goal-directed behavior of the individual. The neurological and psychological mechanisms that influence the selection of relevant stimuli and the control of goal-directed behavior will be discussed later in this literature

review when theories of executive functions and behavior inhibition are examined.

According to Broadbent (Corbetta, 1998), attention is a limited-capacity process that restricts the amount of information that can be passed into higher order neural areas that act on the information. This gated system allows for information that should be attended to pass into higher order processing and consciousness, and for irrelevant information to be held in abeyance. Broadbent's model is used to explain the results of dichotic listening experiments. In these studies, participants are asked to listen to two separate verbal messages being relayed through earphones to the left and right ear. In such a situation the participant usually reports fully the message in the ear that he/she is asked to attend to, but can relay very little information about the unattended message.

However, it had been noted during such studies, that if the unattended message contained some pertinent information, such as the name of the participant, then the portion of the message in the unattended ear that was personally relevant was also attended to (Gazzaniga, et al., 1998). This finding suggests that attention is also operating at a preconscious level to filter in information from the unattended stimuli that could also be relevant.

Psychologists recognize that attention is not a unitary phenomenon that can be used to explain the mechanisms for the control and arousal of cognitive processes, but rather, just as there are different types of linguistic processes that involve different neural and computational circuits, the same is also true for attention.

Three core elements of attention have been identified through research on animals and humans. These are *focus*, *vigilance*, and *shift* (Mirsky, Anthony, Duncan, Ahearn, & Kellam, 1991). *Focus* refers to the selection of a specific target from an

array of stimuli. This may involve a visual, auditory, or both, sensory selection (Johnson, 1998). *Vigilance* is demonstrated when an individual can maintain focus and attention on a stimulus or task over time. In humans the temporal component of vigilance is affected by several factors, such as the degree of novelty in a task, the age of the individual, and the length of time that attention has to be sustained. Just as an individual has to demonstrate the ability to sustain attention to successfully engage with a task or stimulus, it is also adaptively important that an individual be able to *shift* the focus of attention. All these attentional capacities change as a result of development (Mirsky, et al., 1991; Johnson, 1998).

Executive Functions and Working Memory

Executive functions are mentioned extensively in the research literature on attention. In his seminal article on ADHD, Barkley (1997) states that cognitive activities, which direct most of our behavioral responses, are in turn controlled by executive functions that regulate what the person will do with information or actions. These executive functions, which are sets of internal mental organizations directed towards self-attaining behaviors, are the “when” and “whether” aspects of behavior regulation. The four neuropsychological executive functions described by Barkley are: working memory; self-regulation of emotions; motivation and arousal; internalizing of speech and reconstruction, which is the analysis and synthesis of behavior. According to Barkley, the individual must maintain vigilance throughout the stages of the cognitive processing of external stimuli, by inhibiting motor responses to irrelevant tasks and maintaining attention on the goal-directed task by limiting sensory input from distractions.

In order to engage in goal-directed behavior and to persist in a task, the child, or adult has to bring behavior under internal self-control using the four previously defined executive functions. To do this successfully, the child will have to inhibit motor responses to irrelevant tasks and to maintain attention on the goal-directed task by limiting sensory input from distractions. Children without ADHD perform these operations more successfully than children with ADHD, and do so often without immediate reward. Barkley's model of ADHD is also founded in the importance of the pre-frontal area of the cortex in controlling such neuropsychological functions.

In his most recent writing on ADHD, Barkley reports that it was Karl Pribram who first described the self-regulating activities that are termed executive functions, and that Pribram defined the prefrontal cortical areas as the neural sites of the executive functions (Barkley, 2000). Barkley describes how best to operationalize the concept of executive functions; these meta cognitive functions are goal-directed, inhibit distractions, are used in problem solving, allow the flexible shifting of actions to meet task demands, and maintain vigilance towards goal attainment and towards self awareness (Barkley, 2000).

Barkley and others have also noted the importance of working memory in attention and as a component in executive functions. The theory of working memory has been most associated with the research of Baddley and Hitch (1986; see Barkley, 2000). Working memory is a very dynamic component of the human memory system, and it provides a means by which information related to the order of activities and stimuli actions in goal-directed behavior is maintained in the absence of the component stimuli. Working memory is activated during the critical delay period between the

presentation of stimuli and the initiated response, during which times the executive cognitive functions are involved in planning and guiding the initiation of behavior that is goal-directed (Barkley, 2000).

Baddley proposed that there were three components of working memory; a visual-spatial sketchpad used in non-verbal working memory, a phonological rehearsal loop for verbal working memory, and a central executive that controls the rehearsal of both verbal and non-verbal working memory. Key to the concept of working memory is its dynamic composition. Working memory is task oriented and as the demands of the tasks change so too must the elements of working memory. Attention plays an important role in working memory theory. The individual must maintain the components of working memory by inhibiting the processing of competing but non-relevant stimuli. Working memory, as measured by various neuropsychological tests, is often deficient in disorders of attention (Barkley, 2000).

Neurophysiology of Attention

Neuropsychologists and neuroscientists are interested in the neural systems that are involved in attentional processes and in describing how these systems operate. Advances in recording mechanisms have made it easier to monitor the brain in an active state and to infer what neural areas are involved with particular activities. It is usual in neuropsychological research into attention and other cognitive processes to find that imaging techniques such as Positron Emission Tomography (PET) and functional Magnetic Resonance Imaging (fMRI) have been utilized. It must be remembered that these imaging techniques are showing physiological changes that take place in the brain when a person is engaged in particular activity. The presence of attention or any other

cognitive process during these recordings is implied from the experimental design of the research.

Cortical Areas

The frontal lobes are referred to in cognitive theories as the primary area of the central nervous system (CNS) that regulates executive function and attention. As this area is central to the research that examines the neurological mechanisms that underpin the executive and regulatory functions of attention, it is worthwhile to examine the structure of this brain area and to discuss the wide-ranging interconnections between this part of the CNS and other cortical and sub-cortical structures.

The frontal lobes are the largest portion of the cerebral cortex, occupying about a third of the total surface area, and includes everything that is anterior to the central fissure (Carlson, 1998). They are divided into three parts, the motor cortex, the pre-motor cortex and the prefrontal cortex, the last area being the largest part of the frontal lobes.

The most impressive feature of the frontal cortex is the connections that the three areas that comprise it have with other regions in the CNS. The frontal cortex connects with other hemispheric areas through inter and intra- hemispheric projections and commissures; but it also connects extensively with sub-cortical regions. These frontal cortical and sub-cortical connections are both sensory and motor. The sub-cortical areas that have reciprocal innervations with the frontal cortex include, the thalamic nuclei, basal ganglia, cerebellum, amygdala, hippocampus and the brainstem nuclei (Gazzaniga, et al., 1998).

In a comprehensive review of 275 PET and fMRI studies, Cabeza and Nyberg

(2000) discussed what information arose about the neural areas involved in a variety of cognitive processes, including attention and working memory. Both PET and fMRI are examples of hemodynamic neuroimaging methods; PET measures blood flow changes using a radioactive tracer, fMRI measures changes in blood oxygen levels associated with increased blood flow. These imaging techniques measure changes in blood flow, as an increase in blood flow into a particular brain region is associated with an increase in neural activity and oxygen consumption by the neural area.

PET and fMRI imaging techniques offer good spatial resolution. A brain area of 3-6mm can be identified. However, there is poor temporal resolution as it takes a few seconds to get the feedback information about changes in blood flow associated with a particular brain area. Not being able to determine brain activity changes in real time poses a problem for researchers; monitoring the brain while engaged in an activity that is rapid, such as attention, can make it difficult to accurately associate a metabolic change with a particular activity (Cabeza & Nyberg, 2000).

During tasks that involve sustained attention, or vigilance, prefrontal and parietal cortical areas primarily in the right hemisphere are active, suggesting a putative right frontal-parietal circuit for sustained attention. Tasks where participants are imaged while asked to selectively attend to different attributes about a stimulus, show a pattern of activity that suggests that while attending to one particular stimulus modality, e.g., color, activity in neural areas that process information about other sensory modalities are suppressed. During the selective attention tasks there is increased activity in the inferior temporal lobe. Shifts in attention during a task result in a change of activity levels from the parietal to prefrontal regions (Cabeza & Nyberg, 2000).

This review article also discussed findings from imaging studies on working memory activities. During tasks where the participant had to change response in relation to what has previously been presented, a perseveration task, there was increased blood flow to the prefrontal and ventrolateral prefrontal cortical regions. If the task required processing object or spatial information, then predominantly working memory cortical areas in the right hemisphere were active. In tasks that involved verbal or numerical information, the cortical areas of the left hemisphere were active. The authors suggest that this left hemisphere working memory area may indicate the site of the phonological loop for verbal rehearsal suggested by Baddley (Cabeza & Nyberg, 2000).

Patients who have lesions in the prefrontal cortex have revealed a complex pattern of dysfunction. Such patients often show an intact general cognitive capacity, as measured by an IQ test, but often display behavioral and personality changes. As has been discussed, prefrontal cortical damage can result in difficulties with working memory. It has been proposed that working memory is important to operate with the demands of a current stimulus by keeping a representation of the stimulus, and of the plan of action of this stimulus, in mind while performing a task. This helps the individual to maintain an action that is directed at a goal that is not yet achieved (Gazzaniga, 1998).

The dorsolateral prefrontal cortex has been implicated as the primary site for working memory. Patients with lesions in this area often have difficulty with perseveration, which is measured by a cognitive task such as the Wisconsin Card Sorting Task. Such patients find it difficult to change their responses rapidly as the

experimenter changes the “rules” of card sorting and show perseveration type errors while performing this task.

Patients suffering from schizophrenia, Parkinson’s Disease and Huntington’s Disease frequently show patterns of particular attentional deficits on the Wisconsin Card Sorting Task (WCST). Patients with schizophrenia typically display perseveration errors; such patients are unable to disengage or shift from a previously learned rule of sorting when the experimenter changes the sorting criteria. Patients with Parkinson’s Disease often display random errors in the WCST, in that they know when to change the sorting rule when the experimenter does so, but the choice tends to be random rather than influenced by any sorting algorithm. Patients with Huntington’s Disease show both perseveration and random errors in the task.

Models of neurological damage have been developed to explain the types of errors in the WCST frequently seen in patients with schizophrenia, Parkinson’s Disease and Huntington’s Disease. Andrew Amos (2000) has developed a computational model using a neural network approach to information processing to explain the patterns of deficits in the WCST seen in these three neurological disorders. These disorders arise from damage to particular brain areas; the symptoms of schizophrenia are associated with dopamine imbalance in the frontal cortex, Huntington’s Disease symptoms results from neuron damage in the striatum, and Parkinson’s Disease symptoms arise from destruction of neurons in the substantia nigra, which is the major dopamine source to the basal ganglia.

From his review of research into the role of neural structures in information processing and attention, Amos (2000) highlights the importance of processing loops.

These connections between cortical and sub-cortical structures provide a neural pathway for processing information and producing motor responses that are under the direction of cognitive and executive functions. According to Amos, these neural connective pathways can be considered loops, as there is feedback from sub-cortical to cortical sites while information is being processed and while the motor response is being initiated. Such a feedback limits the motor output that is directed through basal ganglia and thalamic structures, while the prefrontal areas coordinate a series of responses that are relevant to the task demands. This would also indicate the importance of working memory in retaining the elements of the task on which a series of actions has to be initiated on.

Amos suggests that there are several of these cortico-basal loops functioning during the cognitive activities that are initiated during the WCST; these are the frontal cortex to striatum; frontal cortex to substantia nigra, globus palladus and thalamus. These cortico-basal loops have both excitatory and inhibitory innervations. The striatum projects to substantia nigra and globus palladus and receives almost all of the afferent fibers from the basal ganglia. The striatum then sends afferent projections to the frontal cortex and receives efferent projections from the frontal cortex. As there are more afferent projections to the striatum than leave from it, it has been suggested that the striatum is important in integrating and processing sensory input. The substantia nigra and globus palladus are the principal output nuclei of the basal ganglia and are important in initiating and maintaining activity. These nuclei also send projections to the thalamus and to the frontal cortex.

When engaging in a motor response the projections from the striatum have an

inhibitory effect on the actions of both substantia nigra and globus palladus; this allows motor responses to come under the direct control of cortical activities. It has been suggested that the patterns of perseveration errors may be caused by the inability of the striatum to inhibit the motor output being generated by the activities of the substantia nigra and globus palladus (Amos, 2000). Using a computer stimulated neural network model Amos was able to replicate the patterns of errors in the WCST exhibited by patients with schizophrenia, Huntington's Disease and Parkinson's Disease. He concluded that the perseveration errors of schizophrenic and Huntington's Disease patients were due to the lack of inhibition of previously learned rules due to frontal cortex dysfunction, while the random errors displayed by Huntington's Disease and Parkinson's Disease patients were due to striatum dysfunction.

Sub-cortical Structures

As was stated earlier, the frontal lobes are innervated from a rich neural network of intercortical and sub-cortical connections. The wide spread CNS involvement in the activities of the frontal lobe has been the subject of recent research. Julie Fiez (1996) has used PET scanning to measure cerebral blood flow during verbal rehearsal tasks. During these tasks a higher blood flow has been measured in the inferior lateral prefrontal cortex and also in the cerebellum. This has led Fiez to postulate that the cerebellum may also be part of the neural network involved in the phonological-articulatory loop in the Baddley and Hitch model of working memory. However, studies that use neuroimaging or blood flow measurement techniques cannot differentiate the type of neural activity that is taking place. It should be remembered that neural activity could be excitatory or inhibitory. These findings of Fiez may

implicate the cerebellum not directly in the working memory system, but rather in an activating system, and that during verbal rehearsal the cerebellum is not directed at maintaining the current information in the working memory from degrading, but is inhibiting any other competing incoming stimulus.

The ventromedial portion of the frontal lobe has an established neural connection with the limbic system. Damasio (1994) proposes that damage to these neural connection results in inappropriate and disinhibited social behavior. Patients with damage to this region of the frontal cortex tend to show a flattened affect to a stimulus, this may also include a flattening of emotions related to motivation that influence decision-making, attention and the resultant responses. Poor control over impulses, and the tendency to seek immediate gratification has also been accredited to damage in this area.

The anterior cingulate cortex has also been of interest to researchers examining the executive functions of the frontal lobe. Using PET scans to study neural activity during a visual attention task Corbetta (1991), monitored changes in cerebral activity when subjects were asked to selectively attend to different components of a visual stimulus. Corbetta suggests that the results indicate that the anterior cingulate cortex is functioning as part of an executive attentional system.

Neural Development

Attentional capacities develop over time and may very well reflect changes in the development and growth of neural structures. It is important when developing a theory of childhood attentional disorders to realize that the patterns of attentional deficit that are apparent in children cannot always be explained by a downward extension of

the models that are applied to explain attentional deficits in adults with damage to neural areas. There is an important difference in the etiology of a disorder that may be caused by the lack of maturation of a brain area as opposed to a disorder caused by damage to an area that was fully developed.

One study of the structural maturation of the brains of children indicates that there is a particular pattern of growth that can be related to the development of various cognitive capacities (Paus, Zijdenbos, Worsely, & Collins, 1999). In this study structural magnetic resonance imaging (sMRI) was gathered on 111 children aged between 4 and 17 years. The authors of this study compared brain weights across the age groups of children in the study. The researchers concluded that changes in brain density and weight were not related to neuron proliferation, but rather due to increase in synaptic density and changes in axonal structures, mainly due to increased myelination. The increase in the diameter and myelination of axons was associated with increase in the speed and sophistication of neural transmission associated with skill development in cognitive and motor activities. The authors of this study suggest that these axon changes indicate the development of putative corticospinal and frontotemporal pathways important in language development, an important cognitive component for the development of executive and attentional functions (Paus, et al., 1999).

Growth patterns in the developing brains of children were also monitored using a within subjects design (Thompson, et al., 2000). In this study children brains were imaged over a prolonged time period to monitor changes in individual growth patterns in different neural areas. The repeated scanning of the children indicated that as well as growth in neural areas associated with language development, there was also neural

density increases in frontal circuits of the corpus callosum that were associated with changes in the child's ability to sustain attention and plan new actions. However, it must be added that research using in-vivo analysis of neural development is a relatively new field, with attendant design limitations.

Barkley has reviewed what imaging and other physical studies on ADHD have revealed about the development of attention in children, and the lack of development in children with ADHD (Barkley, 1998). Imaging studies over the past 10 years have implicated the prefrontal cortex, part of the cerebellum, and the caudate and globus pallidus nuclei of the basal ganglia as possible sites of dysfunction that can explain the behavioral and attentional deficits associated with ADHD. According to Barkley, deficits in these neural areas explain the lack of behavioral self-control to distractions (prefrontal cortex), the lack of inhibition of inappropriate motor activity (basal ganglia nuclei), and difficulties in regulating motivation (cerebellar vermis).

Research into the neural development of attentional capacities in children remains an important area not only for the understanding of what may cause attentional disorders, and a possible source of treating such disorders, but also because there is currently a dearth of research examining the pathways of normal attentional development, particularly in early childhood.

Developmental Issues

As one of the criteria used in the diagnosis of ADHD is the onset of symptoms before the age of 7 years old, it is important to examine the changes that occur in symptom presentation and severity that may be attributed to development. The developmental changes that are associated with the preschool stage (language

development, maturity of motor and behavioral control and the development of peer relationships) may affect the diagnostic accuracy of ADHD for very young children. Alternatively, this may suggest that later developmental sequence have a moderating effect on the persistence and severity of the deficits associated with ADHD.

The results of a number of studies suggest that the deficits associated with the disorder tend to persist from the preschool years into at least middle childhood; however the sub-types of ADHD may present differently depending on the age of the child (Schachtar & Logan, 1990; Markovitz & Campbell, 1998).

In a longitudinal study conducted by Markovitz and Campbell (1998), boys, whom parents and teachers identified as difficult to manage and age-matched controls, were assessed using laboratory-based measures of inattention, impulsivity and hyperactivity. The results of this study suggest that although hyperactive behavior can be identified at age 4 years, cognitive deficits associated with inattention and impulsivity could not be detected until age 9 years, with the measures used in the study.

Many studies have highlighted that ADHD is a disorder where the manifest symptoms are not only present before age 7 years, but persist into adolescence and even adulthood (Barkley, et al., 1990; Lavigne, et al., 1998; Biederman, et al., 1996; Faraone, et al., 1996).

Biederman et al. (1996) reported on predictors of the persistence and remission of ADHD from a four-year follow up of subjects. The study consisted of a group of 140 ADHD boys and 120 control subjects (male) who were aged between 6 and 17 years at the start of the study. The subjects all had contact with at least one biological parent. Psychiatric diagnoses were made on the basis of structured interviews and behavioural

checklists with children, parents and teachers as the informants. Parental history of ADHD was also assessed, and parents were classified as having persistent ADHD if they still met, or did until adulthood, the diagnostic criteria used for diagnosing ADHD for the children in the study. An assessment of intellectual functioning of the members of the study group was carried out using a full-scale standardized IQ test; this was used to exclude any subject with a significant sub-average score. Learning difficulties and school behavior problems were assessed from school records. Indicators of psychosocial adversity were also used, including the length of exposure to paternal and maternal psychopathology, SES, family cohesion and indices of family conflict and adversity. The subjects were assessed twice on all measures, including diagnosis; these were carried out at the beginning of the study and four years later. The results demonstrated that for those subjects who were diagnosed with ADHD 85% still presented with that diagnosis four years later. Of the 15% who showed remission from the diagnosis on the second assessment, approximately half remissions occurred in childhood and the other half occurred in adolescence (Biederman, et al., 1996).

Early onset of ADHD seemed to be a predictor of persistence of the disorder. As has been found in other studies, high scores on family adversity and family patterns of ADHD are most common among subjects whose ADHD symptoms persist. Although it may be hypothesized that family adversity may be as much a consequence of having a child with ADHD, as it is a possible cause of the disorder. As might have been expected, those with persistent ADHD also tended to have more impaired school performance and poorer psychosocial functioning, in comparison with those subjects who never displayed the symptoms of the disorder or those who showed remission.

Those with persistent ADHD were more likely to show inattentive symptoms and have higher rates of comorbid disorders such as conduct disorder and anxiety.

Persistence of ADHD was also predicted by familial patterns of the disorder, and the authors suggested that those with familial patterns of ADHD should be considered as a separate sub-group. Other studies have also shown this increased risk of ADHD with parental histories of the disorder (Biederman, et al., 1996; Lavigne, et al., 1998)).

Temperament

There are other important developmental variables that are known to affect the cognition, emotion, and behavior of children. Carey (1998, 1999) has argued that much of the research that has been conducted into the manifestation of attentional and hyperactive problems in children has failed to make the distinction between pathology and normal variations in temperament and activity levels. Carey has argued that by assessing temperament variables in children with ADHD, a more accurate distinction can be made between what is pathological and what is a normal variant in temperament. Temperament is characterized as differences in the styles of behavior that are present among individuals (Hubert, Wachs, Peters-Martin, & Gandour, 1982). These differences are usually present from the first few weeks of life and influence how an individual performs an activity. Researchers vary as to the degree of influence that they ascribe to genetic or environmental factors on the development of temperament characteristics (Seifer & Sameroff, 1986; Bluss & Plomin, 1984). However, most temperament researchers emphasize the relative stability of temperament characteristics over time (Mathieson & Taubs, 1999).

Buss and Plomin (1984,1986) have suggested that there are three important

characteristics of temperament that underpin the behavior of children. These core temperament characteristics of emotionality (the emotional intensity of behavior, varying from fear to anger), activity (the energy, tempo and vigor of behavior) and sociability (the amount of interpersonal ability), have an inherited basis and are found in young children.

Research conducted using the Bluss and Plomin categorization of temperament has found a relationship between temperament characteristics and cognition. In a study conducted on 56 sets of twins (at age 3, 6, 9, and 48 months), Matheney and Brown found that the twin described by parents as more active was more likely to be emotional and have a shorter attention span (see Mobley & Pullis, 1991).

In a study of preschool children (N = 44, Mean age = 47 months), Mobley and Pullis (1991) examined the relationship between temperament characteristics and the ability of the sample children to attend to a task. The researchers used parental ratings of the Emotionality Activity and Sociability temperament scale (Bluss & Plomin, 1984) to assess the temperament characteristics of the children in the study. They also used preschool teacher assessments of the children's attentional abilities. The researchers concluded that children who could stay on a task, or were vigilant, were likely to be low on the emotionality and activity temperament ratings. The researchers concluded that these results demonstrated a relationship between temperament characteristics and attentional/cognitive abilities that were relevant to a child's task performance in a classroom setting.

In the present research a measure of temperament will be used to determine the relationship, if any, between attentional and temperamental variables.

At present there are no established measures for determining the presence of ADHD symptoms in the preschool age group, nor any research evidence to suggest a possible developmental sequence for this disorder. Despite this the current diagnostic criteria of psychopathology and behavioral disorders still require that the symptoms of inattention and hyperactivity should have been present before a child was 7 years old (DSM- IV, 1994; Markovitz & Campbell, 1998).

Valid and reliable measures of inattention for younger children are necessary to detect and intervene in disorders that have been associated with poor academic, emotional and social development. Such measures of attention and inattention would also allow the development of both normal and abnormal attentional capacities to be studied in young children.

The intention of this thesis research is to develop, pilot and conduct a statistical analysis of a measure of attention in preschool children. Children between the ages of three to six years of age are the focus of this research. The measure of attention under development is referred to as the Preschool Measure of Attention (PMA) throughout this report

Research questions

There are a number of research questions that the research design intends to address.

1. How can attention be measured in a preschool sample of children?
2. What behavioral and cognitive factors emerge from the research measure that best explain the variance in attention in a preschool sample?
3. What theoretical perspectives do the factors that emerge in the PMA support? In

particular do the data gathered from the sample given the PMA suggest that three main factors best represent attention in this sample, in support of the research of Mirsky et al. (1991).

4. Does the analysis of the data from the preschool sample indicate that the attentional factors measured by the PMA are correlated to the temperament constructs measured by the temperament scale used in this study?
5. Does the analysis of the data demonstrate that attentional characteristics differ across the developmental span of the children in the sample?
6. Does the analysis of the data demonstrate any variations in attentional characteristics within the pilot sample that may be validated by an external measure of behavior?

Development of the Preschool Measure of Attention

For the Preschool Measure of Attention, items were developed that measured attention across the age range of the population in which this research is interested. It was considered necessary to show a developmental trend in the responses of children across the age ranges, as the attentional levels of 6 year olds should be greater than that of 3 year olds simply as a function of maturation. Measures of temperament and activity were already available including information on the psychometric properties of such measures.

In developing a pool of items for the PMA, the need to have a relevant focus for the items was important. Currently in assessing attention in school-age children the focus is often in the school behavior of the child, or the responses of the child to activities that demand organizational skills or extended periods of concentration. These situations are not suitable for the preschool child, making attentional problems

more difficult to detect for this age group.

It was hoped to establish that the items that measure attention, the focus of the PMA, do so independently of the temperament and activity constructs that are measured by the temperament scale used in this research.

It was intended that the final developed PMA would contain no more than 30 items and that it would be used as a brief parental report on the attention of children between 3 to 6 years. The final items that were included in the developed PMA measured the constructs of attention that were identified through the exploratory factor analysis of the parental responses from the sample group to the pilot PMA. The pilot PMA contained more items than the final developed measure, as items were eliminated after the statistical analysis of the data gathered from the pilot sample. The pilot version of the PMA was developed to measure at least three constructs associated with attention: shift, vigilance and focus.

Method

The development of the PMA was conducted over three research phases. Phase 1 involved the development of items for the pilot PMA. Phase 2 involved distributing the pilot version of the PMA, the temperament scale and behavior checklist to the parents in the pilot sample. Phase 3 was the statistical analysis of the pilot PMA and other measures to respond to the research questions generated. These phases are explained in more detail in the Method section of this report.

Focus groups- Phase 1

Participants

To facilitate writing of items for the PMA focus groups were formed that consisted

of parents of 3- 6 year olds and teachers of preschool and kindergarten children.

The focus groups were an opportunistic sample that consisted of a group of three teachers and three groups of parents, with 6 parents in each group. These groups were conducted separately. The teachers and parents groups consisted of all female participants. Unfortunately these groups of parents were not representative of the social and cultural mix of parents of young children in Rhode Island, but it was intended that a wider representation of children and parents would be included in later measure development samples for standardization purposes.

Materials

To develop the items that would be used in the pilot PMA, the parents and teachers who participated were asked to read and respond to a number of play and social interaction situations that may be experienced by the children for whom they were responsible. The behaviors of the child in play situations and in parent/adult interactions were used as a means of focusing the items to assess attentional levels in this age group (see appendices A and B of this report). Table 1 indicates the attentional elements that were purported to be measured by the scenarios that were read by the focus group participants.

After the responses of the focus group participants had been analyzed, the items for the pilot PMA were developed.

Table 1. Attentional aspects measured by focus group scenarios.

Scenario 1 (Appendix A and B)	Measures: working memory, focus, shift
Scenario 2 (Appendix A and B)	Measures: working memory, focus, shift, vigilance
Scenario 3 (Appendix A and B)	Measures: working memory, focus, vigilance
Scenario 4 (Appendix A and B)	Measures: working memory, focus, vigilance
Scenario 5 (Appendix A and B)	Measures: working memory, focus, shift, vigilance
Scenario 6 (Appendix A and B)	Measures: working memory, focus, vigilance

Procedure.

Permission to conduct the focus groups was obtained from the participants. While participating in the focus groups each member was treated in accordance with the Ethical Principles of the American Psychological Association (APA, 1992). A consent form was issued to each member of the focus groups; this was signed and returned prior to the groups being run. The confidentiality of each focus group participant was maintained throughout the running of the groups, and when the student researcher analyzed the discussions of the group participants.

Parents and teachers who formed the focus groups were asked to define what the term attention means through their responses with play scenarios and parent/ teacher-child interaction scenario questionnaire (see Appendix A and B for a sample of questions that will be asked of the focus group parents and teachers) . The parents in the focus groups read the scenarios and recorded the typical behavior of her child. Teachers participating in the focus group scenarios and discussions were asked to

respond with a prototype of a child that the teacher would describe as: very attentive, average attention, and poor attention.

The recordings of the parents and teacher focus groups were completed verbally through group discussions, and each participant individually recorded her responses in the space given in the scenario questionnaire. With the permission of the focus group participants, the student researcher took notes during these group discussions. These responses together with information from the research literature on attention were used to develop the items for the PMA. Focus group participants were asked to respond to other participants on a first name basis only, to ensure that no focus group member could be identified by name.

Pilot Group- Phase 2

Participants

The pilot sample consisted of the parents of 148 children who agreed to participate in the research. In total, 550 questionnaire packages, containing all of the research materials were sent home to parents of children between the ages of 3 and 7 years, at the four sites that agreed to participate. The response rate was approximately 27%. The age range of the children was 38 to 85 months ($M = 66.84$ months, $SD = 10.49$ months). Of these, 14 were between 36 and 48 months, 17 were between 49 and 60 months, 84 were between 61 and 72 months, and 33 were between 73-84 months. There were 76 female and 72 male children in the sample of participants. The ethnicity of the children, as rated by their parents, consisted of 140 White Europeans, three African Americans, two other Latino, and, three other ethnic groups. The research material was completed by 143 mothers, four fathers, and, one grandmother.

The children who were rated by their parents came from four child-care settings; 22 were from an elementary school, 94 from a kindergarten, five from a local pre-school group, and 27 from the two child-development centers involved in the study. No incentive was given to the parents for participating in the study.

Missing data were handled by either substituting the mean score, where this was relevant, or by excluding the missing data from the analysis. A fuller discussion of this issue is detailed in the results section of this report.

Materials

In conducting this research the parents of the children who formed the pilot group were asked to rate their children on three measures: 1.the pilot form of the Preschool Measure of Attention, 2.the Emotionality Activity and Sociability temperament scale, and 3. the Behavior Assessment System for Children. (See Appendices C and D for a sample of these measures).

The Emotionality Activity and Sociability temperament scale (EAS) measures three core aspects of temperament; emotionality, activity and sociability. There are 20 questions asked in the scale and it can be used to assess the temperament of children up to 8 years old. Parents are asked to rate their responses to the questions about their children on a 5 point Likert-type scale. The reported internal consistency of the three EAS factors averaged .83, and the test- retest reliability was .72 for Emotionality, .80 for Activity and .58 for Sociability (Bluss & Plomin, 1984). Cronbach Alpha coefficients for this scale ranged from .70 for Emotionality, .76 for Activity and .80 for Sociability.

The Behavior Assessment System for Children (BASC, Reynolds & Kamphaus,

1991,1998) was also given to each parent to rate his or her child. Only the Attention sub-scale of the BASC was used in this study as a measure of the convergent validity of the PMA. Parents are asked to rate their responses to the questions about their children on a 4 point Likert-type scale. The BASC (the parent rating scales form) is a widely used rating scale that is employed to determine the presence of a range of 12 behavioral and emotional problems in children, and it provides an overall and composite problem score.

The paucity of measures of attention for children between the ages of 3-6 years prevents the PMA being compared against any measure with established validity estimates for different attentional dimensions, however the BASC does have an attention problem sub-scale for children between 2-11 years. Although these scales provide no assessment of the factors of attention that will be targeted in the PMA, it could be expected that if children have extreme scores in the attention factors then such children would have higher attention problem score as measured by the BASC.

Two versions of the BASC were used, for children aged 2-5 years and children aged 6-11 years. The BASC has reported internal consistencies estimates for the 12 problem scales with values ranging from .51 to .88, and .82 to .94 for the overall composite problem scores, across the two versions of the scale used. (Reynolds & Kamphaus, 1991; 1998). The test-retest reliability estimates of the BASC have been calculated for testing intervals between two to eight weeks, using parents' ratings. The reported values of the temporal reliability estimates of the BASC ranged from .58 to .92 for the 12 problem scales and .75 to .94 for the overall composite problem scores.

The PMA was given in an initial pilot form to the pilot sample group. This

contained a total of 60 items that were designed to measure the three dimensions of attention previously discussed; the criteria for the decision about the final items that formed the developed version at the end of the research will be discussed in the statistical analysis section of this report. The PMA also comprised of demographic questions that included the age, gender of the rated child, and questions about the family and ethnic composition of the parent(s) and the rated child.

Each item in the PMA was measured on a 5 point Likert-type scale to provide continuous data. The anchors in the items were used to measure differences in each item within and between the age groups of the children used in the pilot sample. To conduct correlational analysis between the PMA, BASC and EAS scores the items used in the pilot version of the PMA were weighted to be interpreted as higher scores indicated that the child displayed the lack of the particular attentional characteristic being measured by the item. To ensure that a response set was not encouraged among the participants, the items were positively and negatively weighted. This was to encourage the participants to read each item fully. The student researcher carried out the appropriate reversal of positively weighted items during the coding of the PMA data.

The research recommendations that the appropriate literacy level for items in a measurement scale should be between a 5th and 7th grade level were adhered to (DeVellis 1991). The reading levels of the PMA items were assessed using Microsoft Windows 2000 readability statistics.

The pilot PMA consisted of 60 items that were designed to measure the core attentional elements of shift, focus, and vigilance. From these 60 items it was purported

that 32 measured focus, 16 measured vigilance, and 12 measured shift. The items were also based on scenario- type situations that reflected typical behavioral interactions of children between 3 to 6 years.

Parents in the pilot group were asked to rate the typical response of their children for each of the items on a Likert-type scale, to allow quasi-interval data to be gathered from the PMA. The parents in the pilot group were be asked to complete the EAS Temperament Scale and the Behavior Assessment System for Children at the same time as completing the PMA. Table 2 details the measures that were given to these parents, and what each was intended to provide data on.

Table 2. Cognitive and behavioral variables of interest and how they were measured.

Cognitive/Behavioral Variable	Measure	Item Number
Shift in attention	PMA	5,9,22,27,34,37,39,40,42,44,52,60
Focus in attention	PMA	1,2,7,8,10,12,13,14,15,17,18,19,20,21,24,30,31,36,38,41,43,45,46,47,48,51,53,54,56,57,58,59
Vigilance in attention	PMA	3,4,6,11,16,23,25,26,28,29,32,33,49,50,55
Temperament/Activity variables- activity levels, emotionality, sociability	EAS	Emotionality: 2,6,11,15,19 Activity: 4,7,9,13,17 Sociability: 3,5,16,18
Attentional problems	BASC	Attention problem sub scale

Procedure

Four child-care settings were approached to give permission for the student researcher to ask the parents of children who used the settings to participate in the

study. The student researcher was given permission by the Superintendent of North Kingstown School District to approach parents whose children attended a kindergarten and the first grade of an elementary school within the school district. Agreement had also been given by two child development centers in Kingston and Providence for the student researcher to approach parents for their active consent to participate in the piloting of the PMA.

At these four settings, research packages were sent out to all the parents who had children between the ages of 3 and 7 years. Thus, all of the children in the kindergarten, child development centers, and first grade of the elementary school were given the packages to take home to their parents. The research packages consisted of a letter of introduction and explanation about the research from the student researcher, a consent form, and the three rating forms that the parents were being asked to complete about their child. (See Appendices E and F).

The parents were fully informed as to their rights not to participate in the research, to omit answers to any questions that they felt uncomfortable with and whom to contact if they had any concerns about the research. It was explained to the parents that although the particular child-care setting had given permission for the student researcher to approach the parents for their consent to participate, the research was not organized by the setting. Parents were reminded to ensure that any responses that they did give should not contain either their name or that of their child.

The parents who consented to participate in the research completed the consent form and the three ratings forms (the PMA, the EAS, and the BASC). The parents were instructed to place the consent forms in an envelope that was to be sealed, and to place

the ratings forms in a separate envelope. Each rating form and the attendant envelope was coded prior to it being distributed to the parents. This code consisted of the first initial of the child-care setting and a sequenced number. No code was put on the consent form or the envelope that it was returned in. The parents were instructed to return the completed rating forms and consent form, in the appropriate envelope, to their child's school or child development center.

Statistical Analysis

Focus groups- Phase 1

The responses of the focus group members were recorded during the discussion of the scenarios that were given in the questionnaires. The discussions and written responses of the focus group members were, with theoretical perspectives on childhood attention, used to form the 60 items that formed the pilot version of the PMA.

Pilot Sample- Phase 2

The statistical analyses of the items on the pilot version of the PMA, including the initial descriptive statistics, the Principal Components Analysis, the multiple regressions and the analysis of variance, were conducted using SPSS for Windows 10.0. The data from the three rating scales used (the PMA, BASC, and EAS) were entered into a Microsoft Access database (Windows 2000) and sorted prior to the statistical analysis conducted. A structural equation model of the identified factor structure of the final version of the PMA was conducted using EQS for Windows (Bentler, 1994).

An initial item analysis was conducted on the responses of the sample group to the items in the PMA (DeVellis 1991). The mean and standard deviation of each item and the overall mean and standard deviation of the PMA was computed. This was used

as a criterion for excluding an item from the measure, as items that have little variance will not be able to discriminate individual differences within a construct. It was expected that the mean of each item would be close to the median of the range of values or choices within the item. The skewness and kurtosis of each item was also analyzed to provide information about the variance of the item, as item variance is desired. Items with significant non-zero kurtosis, and therefore little variance, were eliminated or rewritten for a later version of the developed scale. If an item has a significant positive or negative skew this would suggest that the item could not provide the full range of response options, and the variance of the item (and the item's ability to measure differences in a construct) will be compromised. An item that is skewed either applies to everyone (negative skew) or to no one (positive skew). Item skewness and kurtosis also provided criterion to eliminate or rewrite items.

A Principal components analysis was employed to determine the number of factors that could be statistically identified, and the loadings of items within the factors. Items whose loadings were less than .45, or that were complex were eliminated from further factor analyses (Tabachnick & Fidell, 1996). A table of significant eigenvalues was used to determine an appropriate factor solution, using the number of items in the analysis, the sample size and, the minimum eigenvalues for each factor, as the decision criteria (Lautenschlager, 1989). After an unrotated factor solution was decided on a Varimax rotation was used to maximize the variance within the solution. This technique has the effect of increasing the factor loadings of the items that meet the selection criteria, and minimizing the loadings of those items that do not. This provides a more orthogonal solution than is provided by the unrotated factor solution.

The factor analysis conducted on the Likert type responses of the parents to the items included in this initial version of the PMA, provided information of the item loadings on the underlying constructs identified in the analysis. It was anticipated that these loadings would demonstrate that there were three independent factors being measured, and that these results will provide statistical support for criteria on which to exclude or include items in the final version of the measure. The PCA was employed to identify the individual constructs that are measured by the PMA, and give a total attention score by summing responses across the identified constructs.

The criterion for the exclusion of items was established prior to the statistical analysis being run. Items were excluded from further measure development if they were: a) redundant, b) difficult to understand, or confusing, c) appear to be measuring more than one construct.

The convergent validity of the final version of the PMA was established by correlating the score of the rated children on the attention scale of the BASC with the scores of the children on the constructs of the final PMA. Raw scores on the PMA were used throughout this analysis. It was predicted that children who have elevated attention scale score on the BASC will have higher scores on some of the factors of the PMA, compared to the other children rated in the pilot sample.

The mean and standard deviation scores of the children on the final factor analyzed PMA were compared across 4 age groups (3-4 years, 4-5 years, 5-6 years, and 6<7 years). To determine if it were possible to detect any developmental trends in attentional characteristics, a series of one-way ANOVA's was conducted.

Several multiple regression analyses were conducted with the final PMA

constructs as the dependent variables. The role of temperament characteristics and the child's scores on the BASC as predictors of the PMA constructs was evaluated.

Results

Focus Groups

The responses of the parents and teachers who participated in the focus groups were incorporated with theoretical concepts of attention to formulate items for the PMA. The content validity of the pilot measure of preschool attention was investigated by asking a group of experts in developmental psychology, test construction, and attention to examine these items critically. This procedure generated 60 items to be included in the pilot PMA; 32 items were designed to measure focus, 16 to measure vigilance and 12 to measure shift. The pilot PMA included a number of questions that gathered descriptive information on the children and parents who participated in this study.

Pilot sample

The responses of the 148 participants who completed the three questionnaires used in the study were analyzed. All 148 participants completed the three rating forms that were used in the study. Three of the participants failed to complete all of the items in these forms. An analysis of the missing items revealed no definite pattern of exclusion, and one participant appeared to omit 12 items on the PMA as a result of being unaware that items were on the backside of a page. In most of the statistical analysis used on the collected data, missing values were substituted for an appropriate mean score.

Factor Analysis

In answering research questions 2 and 3, concerning what behavioral and cognitive factors emerge from the analysis of the data from the pilot sample, the responses of the 148 participants to the 60 attention items on the PMA was initially analyzed using SPSS for Windows 10.0 version. Descriptive information on these 60 items was obtained. As the intention was to employ a factor analytical technique to determine the factor composition of the PMA, the need to evaluate the normality of the items was important. Prior to the analysis of the factor structure of the pilot PMA, items that were not normally distributed, had little variance, non-normal skewness and kurtosis, and whose mean score was not close to the median of the response options were excluded from the statistical analysis. As a result, 45 items were used in the factor analysis of the PMA. Of the 15 items that were excluded from factor analysis 10 were Focus items, three were Vigilance items and two were Shift items.

A Principal components analysis, and a later Varimax rotation were employed to determine the number of factors/ components that could be statistically identified, and to estimate the numbers and loadings of items within the factors or components. This analysis also calculated the variance that each identified factor accounted for by the loadings of each variable on the factor. An estimate of the uniqueness of each variable or item was also given. Various factor solutions were tested. Using a table of eigenvalues to determine an appropriate factor solution, one, two, three, and four factor solution models were evaluated (Lautenschlager, 1989). Items that did not have a factor loading of .45 or greater were excluded from subsequent analysis (Tabachnick & Fidell, 1996).

In determining the most parsimonious and theoretically sound solution, two factors were extracted, with eight items loading on the first factor and six on the second. Items were excluded from the tested factor solutions if their loadings on a factor were less than .45, or if the item loaded equally across the factors/ components in the solution. A two and three factor solution model was compared. The number of significant eigenvalues was used as a criterion for deciding on the most appropriate factor solution. Information on the sample size ($N = 148$), the number of items in the solution (14) was compared to a table of statistically significant eigenvalues (Lautenschlager, 1989). Only the eigenvalues for the first two factors (4.18, 1.81) from the principal components analysis were significant. As a third factor referred to the behavior of the rated children in tackling jigsaw puzzles it was decided that this factor made no sense standing alone, when it could be better theoretically accounted for by inclusion of these items on the Vigilance factor.

Loadings of the items on the factors, communalities, and variance accounted for in the final Varimax rotated two-factor solution are shown in Table 3. The items are ordered in relative size of their loadings on a factor.

The factors/components extracted using a principal components analysis, were named as Focus/Distractibility for Factor 1 and Vigilance for Factor 2. The items that loaded on the first factor contained seven items that were originally developed as focus items, and one that was developed as a shift item. All of the items loading on the second factor had been developed as vigilance items. As can be seen from Table 3, Factor 1 accounts for nearly 30% of the variance of the scores generated from the 14 items included in the analysis. The communality estimates for each item give an

estimate of the proportion of variance in the item that can be predicted from the factor that is supposed to underlie it (Tabachnick & Fidell, 1996). The communality estimates given in Table 3, show a range of values, suggesting that there may be some degree of heterogeneity among items that are interpreted as belonging to the same factor.

In response to the research questions 2 and 3 generated by this project, the results of the factor analytical technique suggests that two main factors of attention have been identified from the analysis of the 60 pilot PMA items given to this sample of 148 parents.

The items were used to generate scale scores for the sample. Using the raw scores from the sample three sub-scale scores were calculated, a Focus/Distractibility scale score (summing the eight items), Vigilance scale score (summing the six items) and a Total Attention scale score (summing all 14 items). These scores were used to calculate the reliability of the three scales.

Cronbach's coefficient Alpha was used to calculate the reliability of the PMA and its two sub-scales. Cronbach's coefficient alpha is a widely used measure of reliability that is based on the intercorrelation among the items in a scale. The reliability coefficients for the scale are: .79 for the Focus/Distractibility scale; .72 for the Vigilance scale, and .81 for the Total Attention scale. These represent acceptable levels of reliability (DeVellis, 1991).

Table 3. Factor Loadings, Communalities, Percent of Variance After Varimax Rotation

Item Content and Number	Factor 1 Loading ^a	Factor 2 Loading ^b	h ²
Involved with other things (14)	.80	.12	.66
Easily distracted when tidying (9)	.77	.15	.62
Difficult to sit down (57)	.64	.15	.42
When telling child/walk away (40)	.59	.23	.42
Set routine/remind child (46)	.57	.03	.32
Child loses toys/clothes (56)	.57	.17	.33
Ask what done/says 'forgot' (31)	.55	.16	.33
Child more likely/ asked by other adults (7)	.50	.03	.25
Child frustrated when doing jigsaw (28)	.12	.79	.64
Give up easily/pieces of jigsaw (3)	.03	.74	.55
Going from toy to toy (29)	.12	.65	.44
Complaining of being bored/playing (11)	.02	.59	.35
Asking to get out of activities (25)	.21	.53	.34
Child trips/bumps into things (23)	.30	.46	.31
Percent of Variance Accounted For	29.89	12.88	

Note. Factor 1^a is Focus/Distractibility

Factor 2^b is Vigilance

Table 4 provides information about the performance of the whole sample across the three factor scale scores identified from the factor analysis of the PMA.

Table 4. Mean and Standard Deviations of the Performance of the Sample on the Three Factor Scores

Factor Scale Score	<u>M</u>	<u>SD</u>	<u>N</u>	Range
Focus/Distractibility	20.52	5.18	148	8-33
Vigilance	12.67	3.48	148	6-21
Total Attention	33.23	7.54	148	15-51

Convergent Validity and Temperament Correlations

Research questions 4 and 6, concerned the degree of correlation between the attentional factors from the PMA and the temperament constructs measured by the temperament scale used in this study, and the validation of the PMA factors with an external measure of attention. The responses of 146 participants were included in this analysis, as two participants had failed to fully complete the BASC. The PMA scores were correlated with the three EAS scores to determine if there was any relationship between temperament characteristics and attentional characteristics. It was proposed in the design of the study that temperament and attention were not related constructs. The correlation coefficients between the PMA factor scores and the BASC attention problem scores provide a measure of convergent validity for the PMA.

As was stated in the Method section of this report, the items in the PMA had been written to be interpreted that high scores on an item indicated that the child being rated did not display the attentional construct. This allowed scores on the PMA to be

correlated with scores on the attentional subscale of the BASC, and later with the temperament characteristics on the EAS, as high scores on each of these measures indicates a lack or problem with attention or a temperament characteristic.

Table 5 details the Pearson correlations between the PMA factor scores and the BASC. This shows a significant relationship between PMA factor scores and the attentional problem scores on the BASC, and gives an indication of the convergent validity of the PMA to indicate variations in attentional performance across this sample. There are also significant correlations between the three factor scores from the PMA and the EAS Emotionality and Activity temperament characteristics.

Multiple Regressions

A series of standard multiple regressions were conducted to more fully address research question 4, and to determine how well attentional and temperament factors predict scores on the PMA. See Table 6. In these analyses, the Focus/Distractibility and the Vigilance factor scores were used as the dependent variables, and the BASC attention score, the EAS temperament scores and either the PMA Focus/Distractibility or Vigilance score were used as the predictor variables.

From the results of the regression analysis it can be seen that the BASC attention problem scores and the EAS Emotionality score significantly predict scores on the Focus/Distractibility and Vigilance PMA factor scores. These regression analyses show that the PMA factor scores appear not to predict the other scale score; this will be further analyzed in this section of the report using a structural equation modeling analysis.

Table 5. Correlations Between PMA Factor Scores and BASC Score; and PMA Factor Scores and EAS Factor Scores

	PMA Focus/ Distractibility score	PMA Vigilance score	PMA Total Attention score
BASC Attention score	.52***	.48***	.60***
EAS Emotionality score	.47**	.46**	.55***
EAS Activity score	.39**	NS	.32**
EAS Sociability score	NS	NS	NS

Note. ** $p < .01$. *** $p < .001$. NS = Not Significant

Analysis of Variance

Research question 5 addresses the issue of the influence of development on attention. To answer this question, the scores of the rated children across four age groups were analyzed using three one-way ANOVA's, with each of the PMA factor scores as the dependent variables. Table 6 displays the scores of the four age groups of children on the three PMA factor scores.

Table 6. Summary of Standard Regression Analysis for Variables Predicting Scores on the PMA Factors. (N=146)

Variable	<u>B</u>	<u>SE B</u>	<u>β</u>	<u>R²</u>
1. PMA Focus/Distractibility as outcome.				.39
BASC Attention score	.44	.15	.26**	
EAS Activity score	1.74	.69	.21**	
EAS Emotionality score	1.76	.50	.28**	
PMA Vigilance score	.20	.12	.13	
2. PMA Vigilance score as outcome.				.30
BASC Attention score	.36	.10	.32**	
EAS Activity score	-.07	.51	-.01	
EAS Emotionality score	.78	.37	.18*	
PMA Focus / Distractibility score	.10	.06	.15	

Note. *p < .05 . **p < .01 .

The results of the ANOVA's indicate that there are no significant changes in these factor scores across the age groups in the sample (Focus/Distractibility factor, (F (3, 144) = 0.45, p > .05); the Vigilance factor, (F (3, 144) = 0.73, p > .05); and the Total attention factor, (F (3, 144) = 0.56, p > .05)). An estimate of the variance in the performance across the PMA factor scores accounted for due to the age of the children was obtained by summing the eta squared for each PMA score. The age of the children accounted for 5 percent of the variance across the 3 PMA factor scores.

Table 7. Means and Standard Deviations of the PMA Factor Scores for Children

Across Age groups.

Age Group	n	Focus/Distractibility Score		Vigilance Score		Total Attention Score	
		<u>M</u>	<u>SD</u>	<u>M</u>	<u>SD</u>	<u>M</u>	<u>SD</u>
Group 1 _a	14	19.08	4.13	11.62	3.50	30.69	5.89
Group 2 _b	17	20.88	3.88	12.19	2.95	33.06	5.47
Group 3 _c	84	20.48	5.27	12.99	3.64	33.47	7.87
Group 4 _d	33	21.00	5.92	12.56	3.37	33.23	8.22

Note . Group 1_a = 36-48 months, Group 2_b = 49-60 months, Group 3_c = 61-72 months, Group 4_d = 73-84 months

Structural Modeling

A restricted factor analysis of the 14 items that constituted the final version of the PMA was conducted using EQS for Windows (Bentler, 1994). This technique examines the factor structure of the 14 items from the PMA when the loading of each item is set only to one of the two factors. Table 8 provides information of the fit indices of the proposed factor structure model. As can be seen from these indices the factor model is not fully supported by the data. The significant Chi statistic suggests that the data does not fully fit the model parameters and inspection of the standardized residuals and the variance explained in the standardized solution suggests that some of the items have significant measurement error. The R^2 in Table 8 refers to the percentage of variance in the scores on each item that can be explained by the items association with the latent factor. These values range from a large to a small effect size. Those items with small effects sizes tended to have the most error variances associated with them.

Table 8. Fit Indices and Item Variance Explained for Two-Factor Solution Model

Model/Item	χ^2	DF	CFI	AASR	R^2
Two-factor	136.39***	76	.89	.06	
Item 14 (F1)					.66
Item 9(F1)					.64
Item 57 (F1)					.34
Item 40(F1)					.34
Item 46(F1)					.21
Item 56 (F1)					.22
Item 31 (F1)					.27
Item 7 (F1)					.14
Item 28 (F2)					.84
Item 3 (F2)					.64
Item 29(F2)					.18
Item 11 (F2)					.11
Item 25 (F2)					.11
Item 23 (F2)					.12

Note. *** $p < .001$ F1 is Focus/Distractibility Factor, F2 is Vigilance Factor.

As can be seen in Figure 1, all of the items significantly load on their respective associated factor, and there is a significant correlation between the two factors ($r = .35$, $p < .05$).

Note. *** $P < .001$; ** $P < .01$; * $P < .05$

Figure 1. Factor structure model for the two-factor solution

Discussion

Summary of results

This study was designed to answer six main research questions that addressed issues of what factors of attention could be measured by a parent rated questionnaire and to determine if these attentional factors were influenced by development and temperament characteristics.

The results of this study indicate that two attentional factors have been extracted from the pilot version of the PMA that was given to this sample. The researcher, named these factors as Focus/Distractibility (8items) and Vigilance (6 items). These factors were named because of the perceived constructs being measured by the final items included on each, and also with reference to the theoretical perspectives that influenced the development of the PMA items.

The final version of the PMA has acceptable levels of internal reliability across the three factors scores that were generated from this sample. There was a significant correlation between scores on the PMA and scores on the BASC attentional problem scale, which provided an acceptable level of convergent validity for the PMA. Scores on the EAS Emotional and Activity temperament characteristics also correlated with scores on the PMA.

The restricted factor analysis supported the factor structure of the 14 items that comprised the final version of the PMA. The factor structure of the PMA identified from the principal components analysis of the sample data was compared to a generated model using a structural modeling analysis. The restricted factor structure analysis that was conducted using EQS demonstrated that the loadings of the items on their

respective factors, and the communalities of the items, were similar to those observed when the original Principal Components Analysis and later Varimax rotation was conducted. The reader is asked to compare the values in Table 3 with Table 8, and Figure 1 of the Results section of this report. The restricted factor analysis also demonstrated a significant, but not redundant, correlation between the Focus/Distractibility and Vigilance factor. This may suggest that there is a hierarchically ordered factor that supports this relationship.

However, there proved to be significant differences between the hypothesized factor structure model generated by the EQS program and the model generated through the sample data that can be seen by examining the model fit indices shown in Table 7 of the Results section of this report.

Structural Equation Modeling has been criticized as a statistical technique that can produce significant X^2 and lead to the statistical rejection of a proposed factor structure or path model when the model may indeed have an adequate fit to the data. It is recommended that large samples are needed to produce stable covariance matrices on which the essential statistical comparisons are made. The sample size used in this study was on the lower boundary of what is recommended for both factor analytical and structural modeling techniques (Raykov & Marcoulides, 2000; Tabachnick & Fidell, 1996). The important issue of measurement error will be discussed in a later section of this report that examines the threats to validity that were present in the design of this study.

It was expected that the performance on the PMA factors would show developmental variations across the four age groups of the children who were rated in

this study . However, no significant developmental trends across the three PMA factor scores were obtained from this sample. The selection of the sample used in this study will be discussed later in this section of the report when issues of validity threats to the design of this study are discussed. However, it is perhaps important at this point to look at why the PMA measure may not have allowed any developmental differences in attentional performance to be observed.

The 60 items that were written for the pilot version of the PMA were intended to perform two main tasks: to measure different characteristics of attention, and to show that these attentional characteristics varied according to the age of the rated child. The success of the items in identifying factors of attention shall be discussed throughout this section of the report, but it is unlikely that the items were sensitive enough to determine age differences among the children rated in this sample. Indeed, the characteristics of attention that were possibly measured in this study are either well established by the time a child is age 3 years or the content of the items were not specific enough to any of the age groups of children in this sample. This does not negate the utility of measuring and researching different attentional characteristics, but it does suggest that items need to be more age-specific before conclusions can be made about when these characteristics develop.

Theoretical perspectives

This study was concerned with presenting a model of attentional capacities that was based on different theoretical perspectives about the cognitive nature of attention, the neurological basis of attention and the developmental and temperament changes that may influence attentional factors. This part of the discussion section of the report shall

examine how well the results of the study support the various theoretical perspectives of attention that were examined in the introduction section.

Cognitive Theories

In designing this study it was intended that the PMA would measure three core attentional constructs of attention: *focus*, the selection of a specific target from an array of stimuli; *vigilance*; the maintenance of focus and attention on a stimulus or task over time; and *shift*, the appropriate decrease in vigilance to a particular stimulus and the successful re-focus of attention to a new and appropriate stimulus. These attentional constructs had been based on the work of Mirsky, et al., (1991) and had been identified through research on animals and humans. The factor analysis of the items on the pilot version of the PMA only demonstrated that two factors emerged from the analysis of the sample data.

Although the two factors of focus and vigilance emerged from the factor analysis of the data, there is some evidence with the inclusion of shift items on the focus factor that some aspects of this construct are being measured in the PMA. There were less shift items written for the pilot version of the PMA than vigilance or focus items, and it is possible that the shift items did not well represent this construct domain, but instead these items reflected some aspect of distractibility.

Examining the item content of these factors more closely, it appears that the Focus/ Distractibility factor is comprised of items that reflect a child's difficulty with instigating focus on a task, or a shift in focus when it is not appropriate to do so. This may be related to an increased behavioral activity level that inhibits a child's focus ability.

The Vigilance factor contains items that suggest either that a child is not stimulated by a task or that a child has an extreme negative emotional reaction to the stimulus or task. This emotional reaction may result in an expression of frustration or an inability or unwillingness to maintain focus.

The two factors that were identified in the analysis are to some extent correlated. It would be difficult to support the idea that vigilance on a task or interaction could be demonstrated independently of a child being first able to focus on the task. However, children who can focus on a task do not necessarily demonstrate continued attention to that task or lack of distractibility, when conducting a task.

Working memory is an important cognitive skill that underpins many of the attentional characteristics that were being studied in this sample. Changes in working memory have been associated with changes in neural development (Cabeza & Nyberg, 2000). It is a very dynamic component of the human memory system, and it provides a means by which information related to the order of activities and stimuli actions in goal-directed behavior is maintained in the absence of the component stimuli. Working memory is an important component that is activated during the time a child searches for the stimuli to be focused on and in maintaining the goals of the task during the critical delay period between the presentation of task and the completed response (Barkley, 2000). Both focus and vigilance require the activation of working memory. Although this is implicit in the development of the PMA items, a more specific and independent measure of working memory may have yielded some interesting insight into the range of working memory abilities that may have been related to differences in attentional capacities.

Neuropsychological Theories

Although this study did not attempt to measure any specific type of neural activity, it was of interest to determine if any development differences in attention could be related to what is known about changes in cognitive neural development.

Recent research suggests that the brains of children undergo significant development in neural areas that have been suggested as putative sites for important cognitive capacities including attention (Paus, et al., 1999; Thompson, et al., 2000). Changes in axonal density and myelination in brain areas associated with language functions, including a putative neural circuit for verbal rehearsal associated with working memory, density increases in the frontal circuits of the corpus callosum have been associated with increases in sustained attention or vigilance, provide a neuropsychological model for explaining changes in the attentional capacities of children that are related to physiological maturation.

Developmental Theories

Research on the developmental course of attentional problems has suggested that such disorders may be differentially presented in preschool children, but that when symptoms of inattention are present in early childhood it is often indicative of a pervasive and disruptive disorder (Schachtar & Logan, 1990; Markovitz & Campbell, 1998; Barkley, 1998; Lavigne, et al., 1998; Biederman, et al., 1996; Faraone, et al., 1996).

This study was concerned with attempting to identify attentional characteristics that could show differences between age groups and within members of the same age group. Such differences could demonstrate normal variances in attention associated

with development, and it is posited that extreme PMA scores within an age group may be indicative of attentional difficulties. There were significant correlations between the attention problem sub-scale scores on the BASC and all of the factor scale scores on the PMA. This may suggest that how children were rated on the PMA indicates the perception of the degree of attentional problems that parents rated on the BASC.

As this was not a longitudinal study it is not possible to comment on the predictive validity of the PMA to determine children who have or will develop attention problems, but such a study would clarify this issue. The lack of demonstrated developmental change in the PMA attentional factors makes it difficult to comment on what is normal attentional variance and what is not. The significant correlation between the children's scores on the three PMA factor scores and scores on the attention problem scale of the BASC suggests that lack of ability, or development in the specific attentional constructs, is indicative of elevated scores on a more global measure of attention.

The scores of the majority of children in this study on the BASC attention problem scale were between the 40th and 60th percentile, as reported in the norms provided in the BASC manual (Reynolds & Kamphaus, 1991; 1998). This indicates that the majority of children in this study did not have any extreme problems with attention (as measured by the BASC), and that a more diverse group of children, with reference to global attentional capacity, is needed before the predictive validity of the PMA can be fully discussed.

Temperament Theories

Temperaments are considered relatively stable traits that influence the way in which behaviors are individually expressed (Seifer & Sameroff, 1986; Bluss & Plomin, 1984). Researchers propose that temperament traits have their onset in infancy. Carey (1998,1999) has argued that research into attentional problems has failed to examine the relationship between temperament and attention. According to Carey, examining temperament and attention together would allow for a more precise distinction to be made between normal temperament and activity variance and attentional problems.

In this study, the EAS temperament measure was used to indicate the performance of the rated children across three temperament dimensions: Emotionality, Activity, and Sociability. Research using the EAS has suggested that preschool children who have elevated, or problem scores in these temperament dimensions, are also likely to be rated by teachers as inattentive (Mobley & Pullis, 1991).

The multiple regressions that were conducted on the attention and temperament characteristics in this study do seem to support the findings of Mobley and Pullis. Children who had elevated emotionality and activity temperament scores were also more likely to have elevated focus and vigilance score (elevated scores on these attention characteristics suggests a lacked demonstration of the characteristic). This may suggest that children who have more extremes emotional responses to stimuli and who are more behaviorally active are less able to focus and maintain focus on a stimulus or task.

It is not possible to determine the direction of influence between temperament and attention. There has been a long history of temperament research compared to

research concerning the characteristics and development of attention; therefore measures of temperament are more age sensitive than attention measures. It could be postulated that temperament characteristics influence the degree of attentional capacity of a child or it may be that there are biological differences that influence the attentional sensitivity of a child, which then determines the child's likely temperamental response to stimuli or tasks.

Validity Issues

The validity of a study or test refers to what is being studied/ measured, and how well it is done (Anastasi & Urbina, 1997). Cooke and Stanley further differentiated such research validity into external and internal validity (see Morgan, Gliner, & Harmon, 1999). Each of these will be discussed with reference to the design of this study and the results of the sample data.

Internal Validity

This refers to the soundness of the design of the study, and to the validity and reliability of the measures used in the study. It is not necessarily the case that a sound and valid research design results in valid tools of measurement being used, but certainly lack of such valid measures seriously affects the validity of the research design. (Morgan et al, 1999).

The issue of the validity of the design and purpose of this study relates to the first research question. This posits the question of how attention can be measured in preschool children. If the design of this study is a valid way to measure attention then reliable and valid measures of attention should have resulted from the study and, where possible, the results of the research should have improved on previous research into the

area. Unfortunately, there is a paucity of research into the different dimensions of attention that can be found in preschool children, so the issue of design validity in this study has to be centered on the measurement instruments used and the soundness of the theoretical perspectives that influenced the design.

The study was designed to measure attentional characteristics by using parental reports of preschool children. There has been a substantial body of research indicating some of the difficulties associated with questionnaires that ask for self-report of behavior or parental report of child behavior (Anastasi & Urbina, 1997). Such measures are open to a variety of response factors that can produce substantial error in the results. The parents in this study may have responded to items in the PMA, BASC and EAS in ways that were perceived as being socially desirable, or in ways that suited the perceived objectives of the research. Items in the PMA and BASC were written to be both positive and negative (in relation to the construct being measured) to prevent a response set being established. However, it is not known if all participants fully read the items before responding to them, or if responses were directed by some cognitive response set.

The restricted factor model analysis that was conducted suggests that there was substantial error in some of the items that loaded on the two attention factors. This is an important consideration, as structural modeling analysis assumes an independence of measurement errors. The ratings of parents on the PMA items may have been made with reference to how the child was rated on a previous item, without due reference to what each item was measuring.

Although there was a significant correlation between the PMA and BASC attention problem scores, for the children rated in this sample, the attendant validity problems of a parent report format apply. However, the significant correlations suggest that there is some degree of internal design validity, suggesting that the same construct is being measured.

The Cronbach Alpha statistics on the three factor scales of the PMA suggests that the internal reliability of the measure ranges from acceptable to good (DeVellis, 1991). The validity of a study is reduced when unreliable measures are used (Morgan, et al., 1999).

The type of statistical analysis that is conducted also affects the internal validity of a research study. All of the statistical techniques employed in the data analysis have important underlying assumptions of normality and linearity. Although the items that were used in the factor analysis were screened for normality and linearity, it cannot be assumed that the relationship between the factors in the PMA, BASC and EAS were linear, or that the errors associated with each are independent. However, an analysis of the skewness and kurtosis of the 14 items that were included in the final version of the PMA did not show any significant non-normal deviations.

As this was not a longitudinal study there were no attritional or maturational variables that confounded the results. However, it was presumed that the participants in the study were all equivalent in ways that were considered to influence the study, e.g. when rating a child on the measures there was a common understanding of what the items mean. There is no way of determining if the study participants varied in some dimension that may have influenced the ratings of a child, e.g. a parent who has a

diagnosis of ADHD, or who has a child with a diagnosis of ADHD may rate some of the PMA or BASC items differently.

External Validity

This refers to issues of generalizability of the results from the study (Morgan, et al., 1999). In assessing the external validity of this study it is important to look at the characteristics of the sample used in relation to a wider population, and what real life circumstances the results of the study can be generalized to.

The sample used in this study was not a random sample, but was one that self-selected to participate. A variety of childcare settings were utilized in recruiting participants for the study to increase the social and ethnic diversity of the sample. However, the demographics of the sample show that the participants are from a predominantly two- parent White/ European background, the majority of who have a college education. This does limit who the results of the study can be applied to, and subsequent research would have to address the issue of recruiting participants from more diverse backgrounds before the population validity of these findings can be established.

The sample did not contain the parents of any children with known attentional disorders. This would have allowed the validity and utility of the PMA to a clinical population to be assessed. The low response rate to requests for participation (27%) suggests that those who did participate were very motivated and perhaps had no clear concerns about sharing the behavior of their child with the researcher. It may be that parents who were concerned about the behavior of their children would be less likely to share this.

The correlation of the PMA and the attention problem scores on the BASC does suggest that the PMA may have some degree of ecological validity, in that it may give indications of how children are likely to score on the BASC. A longitudinal study would have to be conducted to determine the predictive validity of the PMA, and items would have to be developed for the PMA that demonstrated more sensitivity across the range of ages of preschool children.

Summary

- A. Two main factors of attention; focus and vigilance, were supported through the factor analysis of the sample data.
- B. There were significant correlations between the PMA factor scores and attention problem scores on the BASC.
- C. There was a significant relationship between the PMA factor scores and the Emotionality and Activity temperament scores.
- D. No significant developmental differences for the PMA factor scores were obtained from this sample data.

Future Research

There are many issues that have to be addressed as a result of this study. The factor structure of the factored version of the PMA has to be confirmed by administering the measure to another sample. Future validation studies of the PMA should include a more ethnically diverse sample, and they should also recruit participants who have known developmental or attentional disorders into future samples.

No direct behavioral or neuropsychological measure was used in this present study, and it suggested that behavioral indicators of task attention and working memory should be included in future research. It is also suggested that any future validation study should include teacher ratings of the children in the study, to examine the degree of parental and teacher concordance in attention and behavioral ratings.

Development work on items for future versions of the PMA should be undertaken before any future validation studies are conducted. From the present sample data it appears that items have to be written to reflect expected age differences in the latent constructs that the measure assesses. There is also a need to better define the construct of attentional shift, and to write items that measure this construct. These changes would alter future studies on the PMA to advanced measure development studies and factor validation and confirmation studies. When the factor structure of the PMA is considered statistically stable, it will be possible to develop norms for children in the target population.

As has been previously stated in this report, attention deficit disorder is one of the most common psychiatric diagnoses that children will receive; however there is a lack of substantive models that describe the normal and variant development of attentional characteristics through childhood. It is important that models of attentional development be proposed and tested in appropriate samples.

Appendix A

Questionnaire for Focus Groups . For parents of children between the ages of 3 to 6 years old.

1. How old is your child / children -----
2. What is the gender of your child? Male Female (circle one)
3. What is this child's position in your family? ----- (e.g. 1st born, middle child, youngest)
4. Does your child attend any programs during the day, such as childcare, preschool or kindergarten? Yes No (circle one)
5. If your child does attend any other program during the day, please state what it is, and how often your child attends. -----

Please think about the usual behavior or activities of your child when you read the following scenarios and answer the questions about each scenario. It would be helpful if you could make notes about each scenario in the space provided. We will discuss each scenario in the group.

1. You have asked your child to go to the closet in his/ her room and bring her/ his shoes to you so that you could put them on her / his feet When the child is reaching the closet you then ask that she/ he brings her/ his gloves.
2. Your child is playing with a puzzle and is trying to make some of the pieces fit.
3. You are reading a story to your child from a new picture storybook. This is a longer story than you have read to your child before.

4. Your child is playing a 'make believe' game with other children. The children are deciding on the rules of the game.
5. Your child is in his or her room (or playroom) playing with his/ her toys, and is looking for a particular toy.
6. Your child is part of a group of similar aged children who are listening to an adult read a story as part of a story-time session at the local library or at the childcare setting.

In the six scenarios that are given above think about how your child would typically behave. If these scenarios are not the types of situation that your child is likely to be in, please note that and suggest a similar situation for your child. Report on his/ her typical behavior in that situation (e.g. your child might not attend story time at the local library, but might be part of a regular gym or tumble tots session).

It would be helpful when you are thinking about your child's typical behavior in the six scenarios to keep the following questions in mind.

- a) If I ask my child to do things for me, how many things can my child remember to do?
- b) If I ask my child to do something for me, how many times do I have to remind my child to do it?
- c) If I read a story to my child does he/ she easily loses interest?
- d) Is my child good at finding a specific toy, or does he/she get easily distracted from the task by the other toys?
- e) If my child is playing with other children at a game, does he/she get involved with the game, or end up playing alone?
- f) How responsive is my child to the directions and questions of other adults? (Note that this is not the other parent)

Appendix B

Questionnaire for Focus Groups . For teachers of children between the ages of 3 to 6 years old.

1. How old are the children that you teach/ take care of? -----
2. Approximately how many children are in your class/group? -----

3. How many children are male and how many are female? (Give approximate numbers)-----
4. Briefly describe the type of program that you offer to the children in your care -----
----- (e.g. kindergarten provided
by a local school district, private childcare, community preschool care)

Please think about the usual behavior or activities of the children that you care for when you read the following scenarios and answer the questions about each scenario. It would be helpful if you could make notes about each scenario in the space provided. We will discuss each scenario in the group. Please try to keep in mind three different types of children, those that are very attentive, those with average attention skills, and those who have poor attentional skills. It may help to have a “typical” child in mind when you think of these three categories. You will not be asked to discuss or name any particular child that you have had in your class or group.

1. You have asked the children in your group/ class to go to their closet/ locker to take out and put on their shoes. When the children are going to the closet/locker you also ask them to bring their gloves as you are going outside.
2. The children are playing with puzzles and trying to make some of the pieces fit.

3. You are reading a story to your class/ group from a new picture storybook. This is a longer story than you have read to your class before.
4. Your class/ group is in the playground during a recess . The children are deciding on the rules of the group game to play
5. You have asked each child in the class/ group to find the painting that he/she had left to dry from the day before.
6. Your class is listening to a presentation on not talking to strangers that is being given by the local community policeman.

In the six scenarios that are given above think about how children in your class would typically behave, and keep in mind the idea of how a very attentive, average attentive, and an inattentive child would behave. If these scenarios are not the types of situation that children in your class/group are likely to be in please note this and suggest a similar situation for your class/group. It would be helpful when you are thinking about your child's typical behavior in the six scenarios to keep the following questions in mind.

- a) If I ask children in my class/ group to do things for me, how many things could I expect a child remember to do?
- b) If I ask a child to do something for me, how many times do I have to remind the child to do it?
- c) If I read a story to children in my class/group do they easily lose interest?
- d) Are the children in my class/group good at locating a specific item, such as a book or toy? Or are the children easily distracted from such a task?
- e) Are the children in my class/group good at getting involved with others when playing

a game?

f) How responsive are the children in my class/group to the directions and questions of other adults?

Appendix C

Preschool Measure of Attention

All the responses that you give will remain confidential.

Please answer the following questions about your child either by writing in the information or checking the appropriate response . If both parents or caregivers want to complete this please use the same form.

Child's date of birth: _____ **Gender:** Male ____ Female ____ .

Birth Order (e.g. first born)

Number of children in the family _____ :

Grade or preschool level the child is at : Preschool ____ Kindergarten

1st grade ____ 2nd grade ____ .

Ethnicity:

White/European descent ____ African American ____

Cape Verdean ____ South/ Central American ____

Puerto Rican ____ Portuguese ____ .

Other Latino ____ Asian/ Pacific Islander ____

American Indian ____ Other ____ .

Please complete the following questions about you as the main caregivers(s) of the child

Relationship to child: Mother ____ Father ____

Relative ____

Other (please give details) _____

Family composition: Single ____ Married

Divorced ____ Other ____

Ethnicity:

White/European descent ____ African American ____

Cape Verdean ____ South/ Central American ____

Puerto Rican ____

Portuguese ____.

Other Latino ____

Asian/ Pacific Islander ____

American Indian ____ Other ____

Education level: High School _____

Advanced study (example, technical college, secretarial college) ____

College degree ____ Graduate degree ____ .

Home Zip Code: _____

1. When I ask my child to go to his/her room to get shoes he/she will do this without being reminded.

2. If I asked my child to find something in a picture book he/she could do this.

3. When putting the pieces of a jigsaw puzzle together my child will give up easily if the pieces do not fit.

4. If I am reading to my child from a picture book, he/she will want to turn over the page before I have finished reading it.

5. If my child is part of a group activity he/she will easily lose interest and wander off to do something else.

6. My child follows the instructions given to him/her by other adults.

7. If I try to explain to my child how to do something new he/she will interrupt me.

8. My child is more responsive to the directions of other adults than to me.

9. My child fidgets or spins around when watching TV or listening to a story.

10. If asked to tidy up his/her toys my child is easily distracted and seldom completes this task.

11. My child has a favorite part of a story that he/she will only want to be read.

12. My child talks out of turn and over other children.

13. I have to remind my child to carry out tasks that I have given to him/her.

1	2	3	4	5
1	2	3	4	5
1	2	3	4	5
1	2	3	4	5
1	2	3	4	5
1	2	3	4	5
1	2	3	4	5
1	2	3	4	5
1	2	3	4	5
1	2	3	4	5
1	2	3	4	5
1	2	3	4	5
1	2	3	4	5
1	2	3	4	5
1	2	3	4	5

	Never / Almost Never	Sometimes	Often	Very Often	Always / Almost Always
14. My child gets frustrated when trying to do a jigsaw puzzle.	1	2	3	4	5
15. My child loses toys or clothes.	1	2	3	4	5
16. My child gets involved in other things when I ask him/her to look for a particular toy or clothes.	1	2	3	4	5
17. My child does not like to get involved in playing with other children	1	2	3	4	5
18. If my child were listening to a story he/she would not know what the story was about if I later asked him/her about it.	1	2	3	4	5
19. My child uses diversions to get out of tasks, such as saying that he/she needs to go the bathroom if I ask him/her to do something.	1	2	3	4	5
20. My child finds the toys or books that he/she is looking for.	1	2	3	4	5
57. If I ask my child to fetch his/her shoes from a closet, and then ask that he/she also bring gloves, my child would be able to bring both things that I asked for.	1	2	3	4	5
22. My child is distracted by what is happening around him/her.	1	2	3	4	5
23. My child trips or bumps into things when he/she is moving around.	1	2	3	4	5
24. If my child is playing a game with other children he/she listens to what the other children are planning to do.	1	2	3	4	5
25. My child asks to get out of activities a lot.	1	2	3	4	5
26. My child can wait his/her turn for playground equipment.	1	2	3	4	5

	Never / Almost Never	Sometimes	Often	Very Often	Always / Almost Always
27. If my child gets distracted I could get him/her to go back to what I asked him/her to do.	1	2	3	4	5
28. My child plays well with other children when he/she has to take part in an organized activity, such as a game.	1	2	3	4	5
30. If I asked my child to do something, such as getting his/ her lunch box, he/she would usually try to get out of doing it.	1	2	3	4	5
31. When I read a story to my child he/she wants to go to a favorite part first.	1	2	3	4	5
32. My child will mess up the toys of other children if he/she is playing in a group.	1	2	3	4	5
33. My child will tidy up his/her toys without me having to tell them how to do it.	1	2	3	4	5
34. If my child is having problems with an activity or in finding a toy, he/she will whine rather than looking or asking for my help.	1	2	3	4	5
35. If my child is having problems with an activity or in finding a toy, he/she will attempt it for a while.	1	2	3	4	5
21. I have to repeat instructions more than twice to get my child to do something.	1	2	3	4	5
36. When I am reading my child a story he/she flips over the pages faster than I can read them.	1	2	3	4	5
37. If my child is playing with a new toy he/she will give up playing with it if he/she cannot get it to work quickly.	1	2	3	4	5
38. If my child is interested in an activity it is very difficult to get him/her to pay attention to anything else.	1	2	3	4	5
39. I have to raise my voice at my child before he/she will do as I ask.	1	2	3	4	5

	Never / Almost Never	Sometimes	Often	Very Often	Always / Almost Always
40. If my child is playing at a friend's house it seems that he/she goes from toy to toy without being interested in any of them.	1	2	3	4	5
41. If my child were playing with other children he/she is likely to complain of being bored with what the children are doing.	1	2	3	4	5
42. When looking at family photographs my child is able to find various family members quickly.	1	2	3	4	5
43. If I ask my child if he/she has done what I asked them to do, he/she says "I forgot"	1	2	3	4	5
44. My child will speak out loud about what he/she is doing during an activity.	1	2	3	4	5
45. My child gets very upset if he/she cannot do something correctly.	1	2	3	4	5
46. If my child likes an activity or a story it seems as if he/she is "stuck in a groove" and it is difficult to get him/her to become involved in something else.	1	2	3	4	5
47. If I am reading a story to my child he/she will wander off and do other things before the story is finished.	1	2	3	4	5
48. If I ask my child to bring me something, he/she is good at listening to directions and will be able to remember to do most of the things asked.	1	2	3	4	5
49. If my child answered the phone he/she would be able to tell me that someone was asking for me.	1	2	3	4	5
36. When my child is having problems with an activity, or in finding a toy, he/she will ask for my help.	1	2	3	4	5
51. When I am giving instructions to my child he/she will walk away or will do something else.	1	2	3	4	5
52. When my child comes back from school or playgroup he/she can tell me what happened if I ask him/her.	1	2	3	4	5

	Never / Almost Never	Sometimes	Often	Very Often	Always / Almost Always
53. My child likes to organize his/her books and toys.	1	2	3	4	5
54. When my child is playing with a group of children he/ she distracts the other children from what they are doing.	1	2	3	4	5
55. When my child is with other children he/she would pick up someone else's shoes before properly looking for his/hers.	1	2	3	4	5
56. If I have a set routine, such as washing hands before a meal, I have to remind my child of the routine.	1	2	3	4	5
57. At an organized program (such as gymboree or a library story time) my child can do what the adult in charge asks him/her to do.	1	2	3	4	5
58. My child is better able to pay attention in a "one-to-one" situation	1	2	3	4	5
59. If my child is putting on new clothes and he/she is having difficulty with buttons or a zip, he/she will keep on trying for a reasonable amount of time before asking for help.	1	2	3	4	5
60. My child would be able to fully do something that involved three different things. For example when getting ready for bed my child could, without being reminded, put on his/her pyjamas, brush his/her teeth and go into bed.	1	2	3	4	5

Appendix D

Participant # -----

EAS TEMPERAMENT SURVEY FOR CHILDREN: PARENTAL RATINGS

Please rate each of the items for your child on a scale of 1 (not characteristic or typical of your child) to 5 (very characteristic of your child). Circle your response.

1 . Child tends to be very shy.	1	2	3	4	5
2. Child cries easily.	1	2	3	4	5
3. Child likes to be with people .	1	2	3	4	5
4. Child is always on the go.	1	2	3	4	5
5. Child prefers playing with others rather than alone.	1	2	3	4	5
6. Child tends to be somewhat emotional.	1	2	3	4	5
7. When child moves about, he/she usually moves slowly.	1	2	3	4	5
8. Child makes friends easily.	1	2	3	4	5
9. Child is off and running as soon as he/she wakes up in the morning.	1	2	3	4	5
10. Child finds people more stimulating than anything else.	1	2	3	4	5
11. Child often fusses and cries.	1	2	3	4	5
12. Child is very sociable.	1	2	3	4	5
13. Child is very energetic.	1	2	3	4	5
14. Child takes a long time to warm up to strangers.	1	2	3	4	5

15. Child gets upset easily.	1	2	3	4	5
16. Child is something of a loner.	1	2	3	4	5
17. Child prefers quiet, inactive games to more active ones .	1	2	3	4	5
18. When alone, child feels isolated.	1	2	3	4	5
19. Child react intensely when upset.	1	2	3	4	5
20. Child is very friendly with strangers.	1	2	3	4	5

Appendix E

Research Instructions

Thank you for agreeing to take part in this research, the purpose of this research has been explained to you in the consent form that you read and signed . The information about the research is being sent home with your child, but the Child Development Center is not requiring that you take part in this research. Although the Child Development Center has given me permission to distribute the research information to parents, it is your decision to complete these forms . All forms are completed in confidence, and you are not asked to put your name, or that of your child on the form . Your answers to the questions will have no effect on your child, the answers given are anonymous and will only be known to the researcher. After you have signed the consent form please put it in the small white envelope and seal the envelope.

There are three forms for you to complete, I hope that this should not take more than 40 minutes to an hour in total to complete . Even if you feel that the questions asked in the forms are similar, please answer it anyway . I will list what you are expected to fill in on each form.

1. **Preschool Measure of Attention** . Please answer all questions, including those on the front page.
2. **Behavior Assessment System for Children.** Please answer all of the indicated questions. Do not put your name or that of your child on this form.
3. **EAS temperament scale.** Please answer all of the questions.

If you have any questions regarding how to complete these forms, please contact Janette Baird, 401-294-9866 . It would be greatly appreciated if you could return these forms in the envelope provided to your child's school by Tuesday January 16th, 2001.

Thank you.

Janette Baird.

Appendix F

The University of Rhode Island

Department of Psychology

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Development of a Preschool Measure of Attention

CONSENT FORM FOR RESEARCH

You have been asked to take part in a research project described below . The researcher will explain the project to you in detail . You should feel free to ask questions . If you have more questions later, Janette Baird, the graduate student mainly responsible for this study (401-294-9866) will discuss them with you . You may also contact Dr. Dominic Valentino (401-874-4223) who is the faculty member at the University of Rhode Island who is supervising the graduate student. You must be at least 18 years old to be in this research project.

Research Project

You have been asked to take part in a study that aims to produce a way of measuring attention in children between 3 and 7 years of age . This study will only involve you as the parents of children between 3 to 7 years of age; your child will not be directly involved in anything to do with this research.

Research Activities

In taking part in this study you will be asked to fill out three different forms that ask you about the typical behavior of your child in different situations or across different activities.

You will be asked to fill out these three forms one after the other . It is hoped that this should not take any more than an hour . Even if you feel that you have already answered a similar question before it would be very helpful if you would answer all of the questions . Your responses will remain totally anonymous, and the numbers on each of the forms are there to allow the researcher to keep track of forms that have been

answered by the same person . Your active consent, which you give by completing this consent form, is needed before you take part in this study.

Risks

Completing these forms should be no more stressful than filling out any other forms about the behavior of your child.

Benefits

The information that you provide in this study will be helpful in finding out how children behave in everyday situations during their early childhood, and in understanding what differences in attention may exist between children of the same age .

Confidentiality

At all times during this study, from when you return the completed questionnaires until I have analyzed and written about the responses of parents like you, no one will be able to know who answered the questionnaires . Confidentiality is a very important issue in studies like this one, and your part in this study will remain confidential at all times . None of the information that you provide will identify you by name.

Taking Part

After reading the information in this consent form, if you agree to take part in the study you will be able to quit at any time . You will not be affected in any way if you do decide to quit the study; your right to make that decision will be respected at all times. Your participation in this study is greatly appreciated but it is entirely voluntary . You may omit your response to any question that you feel uncomfortable with.

Rights and Complaints

At all times you should be treated with respect and your questions about this study should be answered courteously and appropriately . If you are in any way unhappy about how you have been treated you may discuss your concerns at any time with Janette Baird (401-294-9866), or Dr. Valentino (401-874-4223); this may be done anonymously . You may also contact the office of the Vice Provost for Graduate

Studies, Research and Outreach, 70 Lower College Road, Suite 2, University of Rhode Island, Kingston, Rhode Island, telephone: (401) 874-2635.

You have read the Consent Form . Your questions have been answered . Your signature on this form means that you understand the information and that you agree to participate in this study . Please return the consent form in the envelope provided.

Signature of Participant

Signature of Researcher

Typed/printed Name

Typed/printed Name

Date

Date

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