SENSORY PROCESSING AND TEMPERAMENT IN PRESCHOOLERS WITH BEHAVIOR PROBLEMS

A Thesis

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By

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ABSTRACT

Objective: This study investigated sensory processing and temperament in children with behavior problems between the ages of 3 and 6 years.

Method: A convenience sample of 26 parents of children with behavior problems participated in this study. Parents of children with behavior problems were identified by school personnel and recruited via letters from the researcher. After obtaining consent, participants then completed two questionnaires: the Short Sensory Profile (SSP) to assess sensory processing, and the Carey Behavioral Style Questionnaire (BSQ), to assess temperament. The evaluation results were analyzed to describe sensory processing patterns and temperament found in the sample, as well as to determine if relationships existed between sensory processing and temperament.

Results: The majority of children with behavior problems in this sample demonstrated significant problems with sensory processing, according to parent report. Specifically, the majority scored greater than 2 SD below the mean for total sensory processing, as well as for tactile processing, auditory filtering and sensory seeking. In general, the majority of parents described their children as non-adaptable, active and non-persistent. Relatively few relationships were found between sensory processing and temperament. Activity was related to sensory seeking as well as to auditory filtering. Adaptability was related to tactile processing. Intensity was related to visual and auditory...
sensitivity. Difficulty with auditory filtering and sensory seeking behaviors were important factors for highly active children.

Conclusion: Preschool children with behavior problems demonstrated sensory processing problems, especially in the areas of auditory filtering, tactile processing and sensory seeking. Overall, the children in this sample demonstrated evidence of Sensory Modulation Disorder. Their sensory processing patterns were similar to patterns in children with ADHD, according to the literature. The children were characteristically non-adaptable, non-persistent and active according to parent report. Few relationships were found between sensory processing and temperament, suggesting that the two constructs are indeed distinct from one another. Problems with auditory filtering and sensory seeking behaviors emerged as clinically relevant problem areas for young children with behavior problems.
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CHAPTER 1

TEMPERAMENT AND SENSORY PROCESSING
IN PRESCHOOLERS WITH BEHAVIOR PROBLEMS

INTRODUCTION

Tommy’s teachers vigilantly supervised his behavior during free play times. He was eager to play, and threw himself into activities with the other children, especially those that involved physical play or special toys. It seemed that things always started out well, but quickly turned sour. If other children touched Tommy one too many times, or tried to take a toy out of his hands, he would hit or bite them. It happened so quickly, it was difficult to prevent. He also had trouble on the playground. Gross motor play in the gym was the worst. The noise, the other kids in his space – you could just watch the irritation build, until he had had enough. During those times, the normal rough and tumble play of preschool boys got out of hand when Tommy was in the mix.

Much time was devoted at team meetings to devising ways to make this troubling experience better for everyone. Why did he react so strongly and so quickly to intrusions from other children? Why did the movement he seemed to crave then over stimulate him and lead to aggressive outbursts? All the while, the question remained: why did Tommy react so extremely to an event that many of the other children relished? Why was he
unable to modulate his behavior despite repeated correction? Was it because the sensory experience was too overwhelming? If so, could we change his experience of the sensory input? On the other hand, was Tommy’s reaction simply an expression of his seemingly defiant disposition? A better understanding of the cause of his behavior would ultimately facilitate better intervention.

Children with behavior problems often receive treatment from a variety of specialists, who likely would posit different perspectives on the cause of troubling behavior. Occupational therapists would likely attribute problem behaviors to a sensory modulation disorder that resulted in overreaction to touch. Other professionals may view problem behaviors as a reflection of temperament. It is important to understand what is behind these behaviors in order to truly design effective intervention. If sensory defensiveness is the reason for the problem behavior, then treatment from a sensory perspective may change a child’s responses to sensory input, which may in turn positively impact behavior. If problem behavior instead reflects temperament, then a behavioral approach may be indicated. A better understanding of the possible relationships between sensory processing and temperament may ultimately help treatment teams decide which approach is helpful for children with behavioral problems.

**BACKGROUND OF THE PROBLEM**

There is increasing evidence to support the perspective that sensory preferences remain relatively stable throughout the lifespan (Dunn, 2001). Although longitudinal studies have not been completed to verify this, case study evidence, anecdotal evidence and professional history and tradition support the use of treatment to modify the
experience of sensation (Ayres, 1972; Miller et al. 2001; Wilbarger, 1995). This dichotomy leaves many therapists unsatisfied in their quest to treat children who demonstrate problem behaviors. It is impossible to develop effective treatment without first fully understanding the phenomena that therapists propose to treat. Furthermore, there has been a steady increase in the prevalence of behavior disorders among preschool age children since the 1970’s, yet little has been published about the best ways to integrate treatment for them (Schmitz & Hilton, 1996).

Many children experience great discomfort from daily events and struggle to regulate their behavior. Occupational therapists, psychologists and psychiatrists, physicians and educators work at alleviating this problem, usually approaching it from different angles. Clinicians and investigators from these fields have studied constructs like temperament, personality, self-regulation and sensory processing in an attempt to explain problem behavior. From these studies, patterns have emerged that suggest possible relationships between temperament and sensory processing. At this point, these relationships are merely hypothesized and poorly understood.

Sensory modulation disorders have been theoretically linked to emotional disorders, regulatory disorders, disorders of behavior, and “difficult” temperament for years. Ayres noted that children with emotional disorders were often described as “colicky” infants who disliked cuddling (Ayres, 1972). Much of Stanley Greenspan’s work revolves around the relationship between early sensory processing and emotional development. Greenspan and Porges’ (1984) model for psychopathology in infancy and early childhood “suggests a relationship between the organization of sensory and affective-thematic experiences. ...[such that] disturbances in affective-thematic
experiences will...be related to disturbances in sensory processing. Similarly, disturbances of sensory processing, if severe enough, will have an impact on thematic and affective organization” (p. 64). DeGangi and Greenspan (1988) found evidence of tactile defensiveness and intolerance of movement in space in infants 7 to 18 months labeled with “difficult temperaments”. In a review of Dunn’s work on the Sensory Profile, Case-Smith (1997) points out that the Sensory Profile factors (Sensory Seeking, Sedentary, Sensory Sensitivity, and Emotionally Reactive) are “remarkably similar to the dimensions of temperament as defined by Chess and Thomas” (p. 497). In fact, nearly all of the current theories regarding temperament include aspects of what occupational therapists would refer to as sensory preference, sensory modulation or sensory processing.

For instance, as Case-Smith pointed out, the longstanding work of Chess and Thomas includes categories such as activity level, sensory threshold, and distractibility. Case-Smith related these temperament categories to the Sensory Profile. For example, she suggested that the temperament domain of activity level might be comparable to the Sensory Profile factors of Sensory Seeking, Low Endurance/Tone, and Sedentary. She coupled other Sensory Profile factors with most of the remaining dimensions of temperament outlined by Chess and Thomas, including adaptability, quality of mood, persistence, approach or withdrawal, and intensity of reaction.

Winnie Dunn (2001) drew similar analogies between Sensory Profile performance patterns and aspects of temperament as identified by Rothbart and colleagues. These investigators formulated four factors of temperament based on research with infants and young children. These four factors are “surgency” or positivity, fear, irritability/anger and...
persistence. Dunn proposes that these four factors are related, respectively, to the Sensory Profile performance patterns of Sensory Seeking, Sensory Avoiding, Sensory Sensitivity and Low Registration (Dunn, 2001). To the author’s knowledge, no work to this date has been published confirming these proposed relationships.

In the 2001 Eleanor Clarke Slagle lecture, Dunn suggests further research into the relationships between sensory processing, temperament and personality, for several reasons. As she states, “different areas of inquiry are getting at some universal truths about being human, but from different points of view. When we have multiple viewpoints, we can inform knowledge development because one way of looking at something can only reveal a portion of the overall truth” (Dunn, 2001: p. 615).

Examining the patterns and relationships between temperament and sensory processing in young children with behavior problems should be fruitful because this population is notoriously difficult to manage and commonly comprises a significant portion of a therapist’s caseload. In fact, teachers often look to occupational therapists, in addition to school psychologists, to help them solve problems of behavior in the classroom. Teachers often hope that suggestions from therapists will result in improved behavior from children like Tommy. Therapists commonly believe that sensory defensiveness is an underlying cause of many behavior problems. Children with sensory defensiveness have been described as fearful, negative, rigid, controlling and prone to aggression in OT literature (Ayres, 1972; Greenspan, 1984; Miller et.al., 2001).
PURPOSE AND SIGNIFICANCE OF STUDY

A better understanding of how these constructs interact with each other may make interdisciplinary discussion and clinical problem solving and planning easier, which in turn should lead to better intervention outcomes. More knowledge is needed regarding the nature of behavior disorders in young children. Greater clarity regarding the nature of the interaction between temperament and sensory preference may, in the long run, make team meetings about children like Tommy more fruitful. A more complete understanding of the relationship between sensory preference and temperament may perhaps lead to the development of a common transdisciplinary vocabulary. Descriptive information about temperament and sensory processing in children already identified with problem behaviors should lead to a better understanding of the nature of behavior problems. Ultimately, exploring these constructs should inform treatment of children with sensory processing disorders, and those labeled with “behavior problems” or a “difficult” or “challenging” temperament.

This study attempts to examine the relationship between sensory preference and temperament in children displaying problem behaviors. The author hopes that the research will lead to a better understanding of both sensory processing and temperament. This information should support the design and development of sensory diets and environments that best support the needs of children with behavior problems.

CONCEPTUAL FRAME OF REFERENCE

Although therapists, educators and physicians approach behavior problems from different points of view, most are familiar with the construct of temperament. This would
provide a common ground for discussion if there existed a consensus regarding what exactly comprised temperament. Unfortunately, researchers have not yet arrived at a consensus regarding this matter. Historically, temperament has been linked with biology since the 2nd century when Greek physician Galen proposed four basic temperaments based upon Hippocrates' medical conceptualization of the four humors or fluids, namely blood, phlegm, black and white bile, or chole. Galen's four basic temperaments - sanguine, phlegmatic, melancholic and choleric - are derived from these four humors (Strelau, 1998). Since then, many studies have been undertaken which examined temperament in light of such biological factors as genetics, central nervous system functions, and cardiac functions, to name a few. Although there are many differences in how current researchers approach the construct of temperament, most concede the following: 1) Temperament refers to individual characteristics of behavior, described as traits by Buss and Plomin, quality by Kagan, dimension by Eysenck, and category by Thomas and Chess (Strelau, 1998). 2) It is relatively stable. 3) Temperament is rooted in biology. 4) Temperament “refers mainly to formal characteristics of behavior or reactions, such as intensity, energy, strength, speed, tempo, fluctuation and mobility” (Strelau, 1998, p. 38).

This study shall derive the concept of temperament from the landmark work of Thomas and Chess (1977). The definition, scope, boundaries and dimensions of temperament outlined in their work will inform the construct of temperament as used in this study. The study shall derive the concept of sensory processing from the work of Winnie Dunn (1997). The concept of sensory processing shall be based upon Dunn’s proposed model of sensory processing, including Dunn’s factors as defined in the
Sensory Profile (1999). The study will attempt to confirm the work of Dunn (2001) and Case-Smith (1997), who have both proposed relationships between sensory preferences and temperament.

RESEARCH QUESTIONS

The purpose of this study is to examine relationships between sensory processing and temperament in children with behavior problems. Specifically, the author attempts to answer the following research questions:

1) Do children with behavior problems have concomitant sensory processing problems?
   a) Do they demonstrate probable or definite differences in tactile sensitivity, taste-smell sensitivity, movement sensitivity, visual and auditory sensitivity, and auditory filtering according to the Short Sensory Profile?
   b) Are children with behavior problems sensory seeking according to the results of the Short Sensory Profile?

2) Describe the behavioral profile of children with behavior problems in terms of temperament. Do children with behavior problems fit the profile of “difficult temperament?” Specifically, can they be described as intense, negative in mood, irregular, non-adaptable, with a tendency to withdraw?

3) In this population, are there significant relationships between the following aspects of temperament as measured by the Carey Behavioral Style questionnaire, and sensory processing as measured by the Short Sensory Profile.
a) Does persistence relate to sensory processing? Do persistent children demonstrate underresponsiveness or low energy? Do nonpersistent children demonstrate probable or definite differences in auditory filtering, tactile sensitivity and/or visual and auditory sensitivity?

b) Does the construct of approach/withdrawal relate to sensory processing? Do children who are hesitant in new environments demonstrate probable or definite differences in tactile sensitivity, auditory filtering, visual and auditory sensitivity, and/or movement sensitivity? Are children who readily approach new places and experiences sensory seeking?

c) Is intensity related to sensory processing? Do children described as intense demonstrate probable or definite differences for tactile sensitivity, movement sensitivity, and/or visual and auditory sensitivity? Do non-intense children demonstrate probable or definite differences for underresponsiveness /sensory seeking or low energy/weak?

DEFINITION OF TERMS

The following definitions are based upon the research and study of temperament by Alexander Thomas and Stella Chess (1977).

Temperament – “Temperament may best be viewed as a general term referring to the how of behavior. It differs from ability, which is concerned with the what and how well of behaving, and from motivation, which accounts for why a person does what he is doing.
Temperament, by contrast, concerns the way in which an individual behaves...Temperament can be equated to the term behavioral style. (Thomas and Chess, 1977, p. 9).

**Activity level** – The amount of motor activity observed throughout daily activities, as well as a comparison of active versus inactive periods of time.

**Approach/Withdrawal** – The characteristic of the child’s response to new situations, including new people, places and events. Positive reactions, such as smiling, laughing, or reaching for a new person or toy, are categorized as approach reaction. Negative reactions, such as crying, grimacing, or moving away, are considered withdrawal reactions.

**Threshold of Responsiveness** – The intensity of sensory stimuli necessary to evoke a response.

**Distractibility** – The degree to which extraneous stimuli disrupts the child’s attention.

**Attention Span and Persistence** – Attention span refers to the duration of time a child engages in a chosen activity. Persistence concerns the child’s ability to remain with a task despite distractions from that task.

**Intensity of Reaction** – the strength of the response

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The following terms and definitions are derived from the work of Winnie Dunn (1997) and the Sensory Profile, a caregiver questionnaire that evaluates sensory processing.

**Vestibular Processing** – How a child responds to movement experiences.

**Auditory Processing** – How a child responds to things he has heard.
**Visual Processing** – How a child responds to things he has seen.

**Multisensory Processing** – How a child responds to experiences involving input from various sensory systems, including the visual, auditory, touch, and movement or vestibular systems.

**Sensation Seeking** – Seeking after intense sensory experiences. Sensory seekers have high sensory thresholds, but act against these thresholds, and therefore seek out and engage in rich sensory experiences. They add movement, touch, visual and auditory stimuli to daily experiences.

**Poor Registration** – A lack of awareness of sensory stimuli. Children with poor registration have high sensory thresholds, but act according to their high thresholds, and therefore appear to be nonreactive to sensory information in the environment. They appear to miss or ignore salient sensory cues in their environments.

**Threshold** – The pattern of interchange between noticing and ignoring sensory stimuli. Persons with high sensory thresholds take longer to notice salient sensory stimuli, or notice it less than others. Persons with low sensory thresholds notice sensory stimuli more readily than others.

**Other key terms:**

**Sensory Processing** – “an encompassing term that refers to the way in which the [central nervous system] and the peripheral nervous system manage incoming sensory information…the reception, modulation, integration, and organization of sensory stimuli, including the behavioral responses to sensory input (Miller & Lane, 2000, p. 2).

**Sensory Modulation Disorder** - “a problem in the capacity to regulate and organize the degree, intensity, and nature of response to sensory input in a graded and adaptive
manner. SMD disrupts a person’s ability to achieve and maintain an optimal range of
performance and to adapt to challenges in daily life” (Lane, Miller & Hanft, 2000, p. 2).

**Sensory Defensiveness** – A type of sensory modulation disorder “involving avoidance or
negative responses to typically nonnoxious sensation in any or all sensory domains”
(Lane, Miller & Hanft, 2000, p. 2)
CHAPTER 2

REVIEW OF THE LITERATURE

INTRODUCTION

Currently there is a new focus on early intervention for children at risk for developing behavior problems. Since the 1970's, increasing poverty and violence have led to a rise in the prevalence of young children with behavioral and emotional problems (Schmitz & Hilton, 1996). Despite governmental mandates to identify and treat these children, little research exists regarding this population, especially concerning toddlers and preschoolers. With a focus on early intervention aimed at the prevention of later problems, more information is needed to develop adequate programming for children displaying early signs of disorders such as ADHD, anxiety disorders and conduct disorders. (Schmitz & Hilton, 1996).

BEHAVIOR PROBLEMS AND TEMPERAMENT

Disorders of behavior exist in very young children. A number of studies have indicated that many elementary age children and adolescents with behavior and conduct disorders demonstrated early evidence of behavioral problems (Schmitz & Hilton, 1996). Kazdin (as cited in Schmitz & Hilton, 1996) studied adolescents with conduct disorders and found that many of them demonstrated oppositional behavior at young ages. Guerin,
Gottfried, Oliver and Thomas (2003) discovered that infants rated as fussy and demanding were at risk for behavior problems at age three. According to their study, preschoolers who were fussy as infants were more frequently distractible, hyperactive and hostile than other children. Many studies suggest links between difficult temperament in infants and young children and later psychopathology. As Bussing (2003) summarizes, “Longitudinal research has established that certain constellations of "difficult temperament" in early childhood are associated with higher rates of behavior problems and psychiatric disorders in later childhood and adolescence, especially when combined with adverse home environments, including high family stress or poor parenting practices” (p. 184).

Thomas and Chess (1977) coined the phrase “difficult child” to refer to children with challenging behavioral profiles. According to these renowned investigators, difficult children are irregular, non-adaptable, intense in mood, frequently in a negative mood, and typically exhibit withdrawal symptoms when introduced to new people, places or things. They demonstrate unpredictable cycles of sleeping and eating, they need a lot of time to adjust to new foods and routines, and they are emotionally intense. Rutter, Birch, Thomas and Chess (as cited in Strelau, 1998) found that children with psychiatric disorders were non-adaptable, irregular, and tended to be emotionally intense and negative, when compared with children who were not being treated for psychiatric disorders. Based on longitudinal studies, Thomas and Chess (as cited in Strelau, 1998) asserted that difficult temperament at age three could predict the development of adjustment disorder in young adulthood.
In support of these findings, other researchers have confirmed the link between difficult temperament and later behavior problems, including Graham, Rutter and George (as cited in Strelau, 1998), who found a predictive relationship between children who demonstrated irregular and rigid behavior as preschoolers and the diagnosis of a psychiatric disorder one year later. Likewise, Maziade and colleagues (as cited in Strelau, 1998) found a predictive relationship between difficult temperament at age 7 and psychiatric disorder at age 16, but only in dysfunctional families.

More evidence suggests that there are links between temperament and the development of behavior problems. Some experts argue that “ADHD may be an extreme variant of underlying temperament or personality traits” (Shiner & Caspi, 2003, p. 17). Difficulty with regulation and self-control are a few temperamental characteristics associated with ADHD. Nigg, Goldsmith, and Schobek (2004) asserted these relationships as well as two subgroups of children with ADHD; those who demonstrate withdrawal symptoms to novel events, and those who approach novel events. Data from longitudinal studies indicates associations between emotional intensity, poor self-control and unruly behavior in early childhood with later identification of antisocial behavior and conduct disorder (Shiner & Caspi, 2003).

Rothbart (as cited in Strelau, 1998) summarized research on the predictive relationships between temperament and later behavioral problems and found that later neurotic and emotional behavior could be predicted by a high degree of social inhibition and emotional intensity at an early age. She also found relationships between later conduct problems and hyperactivity with early evidence of unmanageable behavior, difficulty with self-control as well as emotional intensity (Shiner & Caspi, 2003).
THE CONCEPT OF “GOODNESS OF FIT”

Many theories exist for how temperament influences the development of behavioral disorders. Some suggest that temperament puts children at risk for the development of behavior problems. Thomas and Chess (1977), however, have always emphasized the importance of the environment in determining outcomes, stating that "any temperamental trait or pattern in any individual child could significantly enter into the development of a behavior disorder, if the environmental demands and expectations were sufficiently dissonant with the child’s behavioral style” (p. 37). Thomas and Chess originally suggested that behavior problems might develop when there is a poor fit between the child’s temperamental needs and the environment.

Similarly, occupational therapists treating children from a sensory processing perspective are also interested in the relationship between the child’s needs and the demands of the environment, and agree that environment and interaction style can either exacerbate or minimize behavior problems. The current emphasis on designing environments and sensory diets to meet the needs of children with sensory processing problems operates from the premise that the environment as well as the sensory qualities of activities and the routine in which they are embedded can positively or negatively impact behavior. Furthermore, occupational therapists have always emphasized the importance of a “therapeutic use of self” when treating clients of all ages. For these reasons, occupational therapists often play a key role in collaborating with early childhood educators regarding how to design effective intervention for children with problem behaviors.
SIMILARITIES BETWEEN SENSORY PROCESSING AND TEMPERAMENT THEORY

The natural collaboration between educators, psychologists and occupational therapists is supported by a similar approach to children’s problems, with the difference being the lens through which these problems are examined. Occupational therapists approach problem behaviors through the lens of sensory processing, and other professionals approach problem behaviors through the lens of temperament or behavioral psychological theories. Although different theories and vocabularies form the basis for these two approaches, one wonders if what occupational therapists refer to as “sensory preference”, “sensory processing” or “sensory defensiveness” may conceptually be the same as what investigators studying temperament refer to as “reactivity”, for instance.

The following quote from Stella Chess (1997) describes a child’s temperament:

Six-year-old Larry, who had just entered first grade, was brought for consultation because he did not want to wear the clothing his mother set out for him before school. He said the pants were too tight and scratchy, the seams of his socks hurt his toes, and the shirt label itched. He had one favorite outfit that he wanted to wear every day because, he said, it was the only one that was comfortable. Larry’s parents were convinced that his behavior was meant to annoy and frustrate them. Fortunately, we had full records on Larry’s behavior since birth, and we found that, at least since the age of three months, he had been extremely responsive to almost all sensory stimuli. He had always been exquisitely sensitive to the taste and texture of food and easily startled by noises and bright lights (p. 3).

Occupational therapists reading Chess’s description of an aspect of Larry’s temperament would describe see this as a description of his sensory processing, and would likely label him sensory defensive or sensory sensitive. Interestingly, Chess’ suggestions for treatment involved understanding Larry’s sensory threshold and needs,
and altering expectations and materials to meet those needs. An occupational therapist would do likewise, in addition to prescribing some other forms of treatment meant to decrease Larry’s sensitivity.

Rothbart (1998) describes similar interventions in making recommendations for how teachers can adapt classrooms to the meet the needs of their students’ temperaments. Rothbart describes adapting the environment in ways occupational therapists commonly recommend for children with sensory defensiveness when she says, “For children highly sensitive to overstimulation, loud and boisterous activity can be stressful and fatiguing, and quiet places allowing them recover from excitement are helpful.” She describes a common component that occupational therapists refer to as a sensory diet for hyperactive children when she says, “Children who are very active may require motor outlets in opportunities for exercise and movement. Motor activities (pointing, reaching, moving from one location to another, retrieving objects) also can be used as an adjunct to teaching”.

Like these examples, one finds many instances in the literature where sensory processing and temperament are either treated as the same construct, or where relationships between sensory processing and temperament are assumed. For instance, Case-Smith (1997) pointed out that the Sensory Profile factors (Sensory Seeking, Sedentary, Sensory Sensitivity, and Emotionally Reactive) are “remarkably similar to the dimensions of temperament as defined by Chess and Thomas (p. 497). Case-Smith related Chess and Thomas’ dimensions of activity level, sensory threshold, and distractibility with Dunn’s Sensory Profile factors. For example, she suggested that the temperament domain of activity level might be comparable to the Sensory Profile factors
of Sensory Seeking, Low Endurance/Tone, and Sedentary. She coupled other Sensory Profile factors with most of the remaining dimensions of temperament outlined by Chess and Thomas, including adaptability, quality of mood, persistence, approach or withdrawal, and intensity of reaction.

In fact, nearly all of the current theories regarding temperament include aspects of what occupational therapists would refer to as sensory preference, sensory modulation or sensory processing. For instance, although there is no general consensus as to what dimensions comprise temperament, almost all theories include the dimension of activity level (Goldsmith et. al, 1987). Occupational therapists also consider activity an aspect of sensory processing, and aspects of activity level are measured by the Sensory Profile as well as other sensory questionnaires. Many definitions of temperament also include a dimension related to how the child responds to new places, people or events. Thomas and Chess have labeled this dimension approach/withdrawal, Kagan refers to this phenomenon as inhibited/ uninhibited, it is measured by Rothbart as Fear, and in part by Buss and Plomin as emotionality, of which fear is considered a component (Rothbart, 1995; Strelau, 1998).

Rothbart’s theory of temperament seems especially similar to conceptualizations of sensory processing found in the occupational therapy literature. Rothbart (as cited in Strelau & Angleitner, 1991) defined temperament as “individual differences in reactivity and self regulation”, (p. 61). Rothbart (as cited in Strelau & Angleitner, 1991) defined reactivity as “the arousability of multiple physiological and behavioral systems...as reflected in response parameters of threshold, latency, intensity, rise time and recovery time” (p. 61). She defines self-regulation as “processes that act to modulate reactivity,
including at the behavioral level selective attention and responsiveness to
cues,...behavioral inhibition to novel or intense stimuli, and effortful control” (p. 61).

These components and definitions sound remarkably similar to components and
contacts included in Dunn’s (1997) model of sensory processing. Specifically,
Rothbart’s definition of reactivity is similar to Dunn’s conceptualization of thresholds of
responsiveness, which describe the intensity of sensory stimuli needed for a child’s
nervous system to respond. Dunn describes a neurological threshold continuum from low
to high. Children with low thresholds are sensitive to stimuli, and children with high
thresholds require strong levels of stimulation before their nervous systems respond.
Dunn’s Behavioral Response Continuum responds to Rothbart’s view of self-regulation.
Dunn again proposes a behavioral continuum in which children either act according to
their sensory thresholds, or act to counteract their threshold. Thus, children attempt to
modulate their arousal level either by acting in accordance with their sensory thresholds,
or by acting against their thresholds (Dunn, 1997).

Given the conceptual similarities, Dunn (2001) herself drew similar analogies
between Sensory Profile performance patterns and aspects of temperament as identified
by Rothbart and colleagues. Dunn proposed that Rothbart's factors of “surgency” or
positivity, fear, irritability/anger and persistence are related, respectively, to the Sensory
Profile performance patterns of Sensory Seeking, Sensory Avoiding, Sensory Sensitivity
and Low Registration. To the author’s knowledge, no work to this date has been
published confirming these proposed relationships.

Authors besides Case-Smith and Dunn have postulated relationships between
sensory processing and temperament. Much of Stanley Greenspan’s work revolves
around the relationship between early sensory processing and emotional development. In fact, Greenspan (1984) asserted that early problems of filtering and processing sensory information could interfere first with emotional development, and later with social and cognitive development as the infant matures. In fact, Greenspan and Porges’ (1984) model for psychopathology in infancy and early childhood “suggests a relationship between the organization of sensory and affective-thematic experiences. …[such that] disturbances in affective-thematic experiences will…be related to disturbances in sensory processing. Similarly, disturbances of sensory processing, if severe enough, will have an impact on thematic and affective organization” (p. 64). He refers to early sensory-affective development as the “underbelly of personality” (p.49), and traces childhood psychopathology back to these early difficulties in processing sensory-affective information. Consequently, many of Greenspan’s (1995) suggestions for floor time and intervention for children with difficult temperaments in his book “The Challenging Child” are based upon assumed relationships between temperament and sensory preference. Greenspan describes children who are sensitive to movement, sound, visual stimulation and touch as “highly sensitive”. He explains that these children are often overwhelmed by the sensations of everyday life, both those they receive from their environment, as well as internal experiences like emotions and bodily sensations. He describes their behavior as intense, and explains that they can be difficult to parent for these reasons. Greenspan also links sensory processing with aspects of behavior and temperament for children who underreact to everyday sensations. He describes these children as “self-absorbed”, and difficult to engage because they require more intense
sensory stimulation to react. While these relationships make practical sense and appear valid at face value, they should be further investigated using typical research methods.

Consequently, studies are needed that examine both sensory processing and temperament. These studies may be particularly useful in formulating treatment suggestions for children with problem behaviors, since both temperament and sensory processing have been implicated as causes for problem behaviors.

SENSORY PROCESSING AND BEHAVIOR PROBLEMS

Occupational therapists commonly design intervention based upon the assumption that sensory processing problems underlie many problem behaviors. Sensory modulation disorders have been theoretically linked to emotional disorders, regulatory disorders, disorders of behavior, and “difficult” temperament for years. Ayres noted that children with emotional disorders were often described as ‘colicky’ infants who disliked cuddling (Ayres, 1972). DeGangi and Greenspan (1988) found evidence of tactile defensiveness and intolerance of movement in space in infants 7 to 18 months labeled with “difficult temperaments”. A few studies, in addition to anecdotal evidence, exist to support this notion. Fanchung (1990) found that adolescents with conduct problems performed poorly on tests of postrotary nystagmus, balance, praxis and bilateral coordination when given the Sensory Integration and Praxis Test. Silberzahn (1975) likewise found a high incidence of problems with sensory integration as well as evidence for the existence of bilateral coordination dysfunction in children with problem behaviors between the ages

22
of 5 and 9. In addition, aggressive and hostile behavior, emotionally intense behavior, and withdrawn behavior have been associated with sensory modulation disorder (Miller et al. 2001).

SENSORY PROCESSING AND ADHD

Most of the research conducted on links between sensory processing and behavior problems has been done with children diagnosed with ADHD. Dunn (1997) commented that "Ayres theorized that children with ADHD have decreased sensory processing abilities because they are easily overstimulated and react to stimuli that children without disabilities commonly ignore or tune out" (p. 284). Through a discriminant analysis conducted with children with and without disabilities, Dunn (1997) found clinically significant differences in scores for sensory seeking, emotional reactivity and inattention and distractibility for children with ADHD when compared with typical children. Yochman, Parush, and Ornoy (2004) found similar results. Their study, also using the Sensory Profile, found that children with ADHD demonstrated statistically significant differences in 6 of the 9 factors measured by the Sensory Profile, as well as for areas of sensory processing, modulation, and behavioral and emotional responses.

Mangeot and colleagues (2001) measured electrodermal reactivity in 8 year olds diagnosed with ADHD and found evidence for sensory modulation disorder in this population. Greater variability in response and a greater degree of abnormal responses were found in the children with ADHD when compared with typical children. Results indicative of psychopathology on the Child Behavior Checklist also correlated with levels of Sensory Modulation Disorder. In addition, Parush, Sohmer, Steinburg and Katz (1997)
studied sensory processing in children with ADHD using a similar approach and found evidence of tactile defensiveness, a finding well documented in case studies in the OT literature.

**CONCLUSION**

Research exists on the temperamental profiles of infants, children and adolescents with behavior problems. This research suggests links between dimensions of temperamental "difficulty" and later psychopathology. Children are demonstrating evidence of behavior problems such as inattentiveness, hyperactivity, anxiety, and oppositional behavior at earlier ages. Some studies have been conducted on the characteristics of sensory processing in these children, although mostly with older children with ADHD. More information is needed regarding the sensory processing patterns of young children already identified with behavior problems or at risk for developing behavior problems in order to adequately treat these children with the hopes of the prevention of later problems. Despite this dearth of research, many assumptions exist regarding clinically observed relationships between temperament and sensory processing. As Rothbart (1998) eloquently stated.

Increasing teachers' understanding of children's individual differences and their relation to adaptations or problems can be extremely helpful in shifting the focus from teachers' negative attributions of purposeful misbehavior to active problem-solving. Increasing teachers' awareness of how children's temperament dimensions might contribute to the situation can lead to reduced conflict (Pullis, 1985) and to the development of appropriate strategies specific to the temperament dimensions involved. When children feel accepted and respected as individuals, the focus moves from one of accusation to one of support; children feel less compelled to expend energy defending their positions and they are more inclined to consider alternatives for resolving problems.
Occupational therapists would agree with Rothbart’s conclusions, but would also assert that the full picture of a child’s function should include a critique of how she responds to the sensory aspects of daily environments and events. Consequently, this study will investigate the relationships among aspects of temperament and sensory processing problems in children with behavior problems.
CHAPTER 3
METHODOLOGY

INTRODUCTION

The following chapter describes the methodology used for the study, including research design, population and sample design, data collection procedures, issues related to instrumentation, and data analysis.

RESEARCH DESIGN

The study was both descriptive and relational in nature. First, the investigator gathered sufficient information to describe both the sensory processing characteristics and the temperamental characteristics of children with behavior problems. Second, the study investigated how certain aspects of temperament relate to specific aspects of sensory processing.

RESEARCH QUESTIONS

As previously mentioned, the purpose of this study was two-fold, first, to describe the sensory processing patterns and the temperamental patterns of 3-5 year olds with behavior problems and, second, to examine relationships between sensory processing and
temperament. The author theoretically proposed that sensory processing, a biological and behavioral phenomenon, is related to temperament. Specifically, the investigator hoped to answer the following research questions:

1) Do children with behavior problems have concomitant sensory processing problems?
   
a) Do they demonstrate probable or definite differences in tactile sensitivity, taste-smell sensitivity, movement sensitivity, visual and auditory sensitivity, and auditory filtering according to the Short Sensory Profile?
   
b) Are children with behavior problems sensory seeking according to the results of the Short Sensory Profile?

2) Describe the behavioral profile of children with behavior problems in terms of temperament.
   
a) Do children with behavior problems fit the profile of “difficult temperament?” Specifically, can they be described as intense, negative in mood, irregular, non-adaptable, with a tendency to withdraw?

3) In this population, are there significant relationships between the following aspects of temperament as measured by the Carey Behavioral Style questionnaire, and sensory processing as measured by the Sensory Profile.
   
a) Does persistence relate to sensory processing? Do persistent children demonstrate underresponsiveness or low energy? Do nonpersistent children demonstrate probable or definite differences in auditory filtering, tactile sensitivity and/or visual and auditory sensitivity?
b) Does the construct of approach/withdrawal relate to sensory processing? Do children who withdraw in new environments demonstrate probable or definite differences in tactile sensitivity, auditory filtering, visual and auditory sensitivity, and/or movement sensitivity? Are children who readily approach new places and experiences sensory seeking?

c) Is intensity related to sensory processing? Do children described as intense demonstrate probable or definite differences for tactile sensitivity, movement sensitivity, and/or visual and auditory sensitivity? Do non-intense children demonstrate probable or definite differences for underresponsiveness /sensory seeking or low energy/weak?

d) Is adaptability related to sensory processing? Do children described as non-adaptable demonstrate probable or definite differences for tactile sensitivity, movement sensitivity, and/or visual and auditory sensitivity?

e) Is activity related to sensory seeking? Do children rated as highly active demonstrate probable or definite differences for sensory seeking?

**SAMPLING AND PARTICIPANT CRITERIA**

A convenience sample of 26 parents of children ages 3 through 6 was recruited from programs for preschoolers with special needs within the Columbus area. Parents were selected whose children met the following criteria:

a) Have previously qualified for and been enrolled in programming for children with special needs according to the state requirements for qualification.
b) Have demonstrated behavior problems in the classroom environment within the last six months. This criterion could be met by any of the following:

1) The child has been on a behavior plan within the last 6 months

2) The child’s Individualized Educational Program includes goals related to behavior. Goals related to behavior include those involving social-emotional skills (e.g. will use appropriate means to express anger and frustration), and following the classroom rules and routine (e.g. will keep hands and feet to himself, will follow the teacher’s instructions, will remain seated for group work and circle time)

3) The child demonstrates symptoms of inattentiveness and distractibility which result in any of the following problems: difficulty remaining seated for table or group activities, consistent incompletion of table or play activities requiring adult assistance to complete due to problems of inattentiveness, motor restlessness significant enough to interfere with functional play or task behavior, impulsivity which interferes with functional task or play behavior or results in aggressive behavior.

4) The child has been diagnosed with Attention Deficit Disorder (ADD) or Attention Deficit Hyperactivity Disorder (ADHD), or has been identified as at risk for developing one of these disorders.

5) The child has been referred to a psychologist or behavior specialist within the last 6 months and a system of positive reinforcement, or a system for the use of exclusionary time out, has been established.
c) Does not have a medical diagnosis indicating central nervous system impairment e.g. autism or Down syndrome.

DATA COLLECTION PROCEDURES

To collect the sample, letters were sent to the program directors of local programs for preschoolers with special needs including Nisonger Center Preschool, the Early Childhood Education Center (FCBMR/DD) and The Childhood League Center, asking for their cooperation in carrying out the study. The letters outlined selection criteria. Program directors were then asked to collaborate with teachers and members of intervention teams to choose children who met the above criteria. Once those children were selected, letters explaining the purpose of the study as well as possible risks and benefits to participants were sent to the child’s parents to obtain informed consent and permission from parents. Once consent was obtained, parents received questionnaire packets home from school and were asked to fill out the questionnaires. They were returned to school personnel and then to the researchers. One follow-up phone call was made to parents who returned consent forms, but not evaluations. The investigator gave email and phone number information to participants for assistance completing the questionnaires. A total of fifty-five subjects qualified for the study. Consent forms were sent to fifty-five subjects, of which forty-four consented to participation. A total of twenty-six parents returned questionnaire packets.
INSTRUMENTATION

The Short Sensory Profile by Winnie Dunn and the Behavioral Style Questionnaire by McDevitt and Carey were used. Both questionnaires are well known and commonly used by practitioners and investigators alike.

The Sensory Profile was developed between 1993 and 1999 by Winnie Dunn. After reviewing existing sensory histories, test items were developed that captured atypical responses to daily sensory experiences. Initially, the items were classified into groups according to sensory modality (i.e. touch, visual, auditory, etc.). Therapists from the Sensory Integration Special Interest Section of the American Occupational Therapy Association were recruited to assist in item development. As a result of their participation, the items were grouped according to sensory modality, but also in terms of modulation and behavioral and emotional response (Dunn, 1999).

Examiners were randomly selected from the Sensory Integration Special Interest Section of the American Occupational Therapy Association to participate in research of the profile. The examiners then gave the Profile to clients leading to a sample of 1037 children without disabilities between the ages of 3 and 10 (524 girls and 510 boys. Data were also gathered on a sample of 61 children ages 3-15 with ADHD, 32 children ages 3-13 with Pervasive Developmental Disorder, 24 children ages 3-17 with Fragile X syndrome, and 21 children ages 4-9 with a sensory modulation disorder. A principal-component factor analysis on the children without disabilities was then completed to determine scoring. A classification system and cut scores were then established.

Measures of internal consistency were used to assess the reliability of the Sensory Profile. Cronbach’s Alpha scores ranged from .47 to .91 for the different test sections.
Standard error of measurement values are also included for each section of the assessment so that confidence intervals can be determined to assess how close a score is to the child's true score.

Content validity was established through categorical analysis by experts, literature review and expert review. Convergent and discriminant validity were established via correlations between patterns of scores on the Sensory Profile and the School Function Assessment. Discriminant validity was further established by comparison of scores of typical children on the Sensory Profile with scores of children with ADHD and autism.

The Short Sensory Profile (SSP) is a shorter version of the Sensory Profile developed for screening and research purposes. Development occurred in 3 phases. First, a smaller set of items was identified that were more discriminating for children with and without disabilities from the full Sensory Profile. Then, a principal components factor analysis was conducted using the data on children without disabilities collected for the Sensory Profile, and the scale was evaluated across samples to determine if the new organizational structure would demonstrate generalizability. Finally, item-to-total correlations were calculated for each section for the full sample, the sample of typically developing children, and the sample of children with sensory modulation disorder. The correlations were then examined to determine which items best contributed to each section and further refinement of items was done. As a result, the Short Sensory Profile consists of only 38 items, making it faster and simpler to complete for screening and research purposes.

William Carey and Sean McDevitt began to develop the Behavioral Style Questionnaire in 1975. The test was based on the nine NYLS temperament dimensions
established by Thomas and Chess. Behavioral indicators were developed based upon these 9 dimensions as well as from other Carey Temperament Scales. These items were then given to a panel of judges comprised of faculty and graduate students familiar with the area of research. The judges were then asked to categorize the items according to the appropriate scale. Problem items were rewritten. The items were written in both high and low directions, and the total number of items was balanced for both directions. The placement and order of items within the scale was done according to a block randomization process, using nine blocks of nine items, with each of the nine categories represented in each block.

A pretest phase was conducted in which the questionnaire was given to the parents of 50-75 3-7 year old children, and an item analysis was conducted. Revisions were made based upon this item analysis. The resulting modified scale was used for standardization. The questionnaire was standardized on 200-500 young children with ages spread evenly from lowest to highest. Age and gender were controlled for statistically through correlational analysis. The standardization sample was mainly comprised of Caucasian, middle class participants living in the Eastern United States.

Reliability was measured both by test-retest measures and measures of internal consistency. The median test-retest reliability was .81, and the median alpha reliability was .70. Validity issues of parent questionnaires apply to the Behavioral Style Questionnaire, although “most researchers agree that questionnaire ratings have at least moderate levels of validity” (Carey and McDevitt, 1996, p. 13).
DATA ANALYSIS

Subcategory and total raw scores were used in the data analysis from both the Behavioral Style Questionnaire (BSQ) and the Short Sensory Profile (SSP). Furthermore, BSQ scores were assigned to groups based upon standard deviation from the mean, and further analysis was done. Descriptive statistics were used to describe the overall sensory processing patterns and temperamental patterns of preschool children identified with behavior problems. Correlation coefficients were used to examine relationships between aspects of sensory processing and aspects of temperament, and ANOVA was also used to determine the statistical significance of differences in sensory processing between children categorized by their temperament (e.g. do children who withdraw score differently in tactile sensitivity according to the sensory profile than children who readily approach?).
Suspected missing page 35.
percent were male. All of the children had previously qualified for special needs programming according to the rules for the State of Ohio, and met previously outlined criteria for behavioral problems. All of the children were enrolled in a preschool program for children with special needs, and all received occupational therapy services in the context of that program at the time of the study. Nine of the 25 children also received additional occupational therapy services in an outpatient setting.

SENSORY PROCESSING PATTERNS

In regard to the first research question, “Do children with behavior problems have concomitant sensory processing problems?” the results of this study answer a resounding, “Yes!” Of the 25 children studied, 54.5% received total scores for the Short Sensory Profile that were 2 SD below the mean, indicating definite sensory processing problems. An additional 27.3% of the total scores on the Short Sensory Profile fell between 1 and 2 SD below the mean. Consequently, 81.8% of the subjects were at least 1 SD below the mean for the total score for Sensory Processing on the Short Sensory Profile, indicating that the vast majority of the children have difficulty processing everyday sensations. The mean score for the Short Sensory Profile total (138.23) indicates that on average the children exhibited a definite difference in sensory processing. The children in our sample demonstrated the most difficulty with sensory seeking behaviors, auditory filtering, and tactile processing. They demonstrated tendencies to seek out additional sensory experiences, the inability to efficiently focus in on important sounds while screening out unimportant ones, and overall hypersensitivity to being touched. Results are depicted in Table 1 and Chart 1.
### Chart 1 - Total Score Sensory Processing (SSP)

<table>
<thead>
<tr>
<th></th>
<th>Typical Performance (-1SD and above)</th>
<th>Probable Difference (between-1SD and -2SD)</th>
<th>Definite Difference (at or below – 2SD)</th>
<th>Mean Score</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total score</strong></td>
<td>18.2%</td>
<td>27.3%</td>
<td>54.5%</td>
<td>138.23 (Definite difference)</td>
</tr>
<tr>
<td><strong>Tactile Sensitivity</strong></td>
<td>32%</td>
<td>16%</td>
<td>52%</td>
<td>27 (Probable Difference)</td>
</tr>
<tr>
<td><strong>Movement Sensitivity</strong></td>
<td>61.5%</td>
<td>30.8%</td>
<td>7.7%</td>
<td>13 (typical performance)</td>
</tr>
<tr>
<td><strong>Visual and Auditory Sensitivity</strong></td>
<td>50%</td>
<td>26.9%</td>
<td>23.1%</td>
<td>18 (typical performance)</td>
</tr>
<tr>
<td><strong>Auditory Filtering</strong></td>
<td>19.2%</td>
<td>23.1%</td>
<td>57.7%</td>
<td>19.2 (Definite difference)</td>
</tr>
<tr>
<td><strong>Sensory Seeking</strong></td>
<td>3.8%</td>
<td>11.5%</td>
<td>84.6%</td>
<td>20.2 (Definite difference)</td>
</tr>
<tr>
<td><strong>Taste/Smell Sensitivity</strong></td>
<td>69.6%</td>
<td>8.7%</td>
<td>21.7%</td>
<td>23 (Probable Difference)</td>
</tr>
<tr>
<td><strong>Low Energy/Weak</strong></td>
<td>57.7%</td>
<td>15.4%</td>
<td>26.9%</td>
<td>26 (Typical Performance)</td>
</tr>
</tbody>
</table>

**Table 1. Short Sensory Profile Scores (SSP) and Corresponding Percentages**
The vast majority of the children demonstrated sensory seeking behaviors: 84.6% of the children scored at or below 2 SD below the mean, indicating a definite difference in sensory processing, while 11.5% fell between −1SD and −2SD, indicating a probable difference in sensory processing. Relatively few (3.8%) of the children demonstrated typical processing for this category. This means that, generally speaking, the children in our sample acted to enhance their experience of sensation throughout their daily routines, to the degree that this behavior interfered with daily life.

Auditory filtering likewise emerged as a problem area. Again, a majority (57.7%) of children demonstrated significant difficulty using and screening out sounds: 57.7% of the scores fell at or below 2 SD below the mean, indicating a definite difference in sensory processing, while 23.1% fell between −1SD and −2SD, indicating a probable difference in sensory processing. Only 19.2% of the children scored at or above −1SD, indicating typical performance. The mean score for the entire sample for auditory filtering was 19.2, falling in the definite difference category.

Most of the children with BD in our sample demonstrated a significant degree of tactile sensitivity. A majority (52%) of the scores were equal to or greater than 2 SD below the mean, in the definite difference category. An additional 16% of the scores fell between 1 and 2 SD below the mean, in the probable difference category. The mean score for the entire sample for tactile sensitivity was 27, falling in the probable difference category. This means that most of the children (68%) demonstrated a tendency to overreact to touch sensations experienced during their daily routines.

Although the children appear to be sensitive to tactile experiences, in contrast, they do not appear to be sensitive to movement, sights and sounds, or taste and smells.
For the subcategory of movement sensitivity on the Short Sensory Profile, 61.5% of the scores fell at or above 1 SD below the mean, indicating typical performance. The mean score for the entire sample for movement sensitivity was 13, indicating typical performance. For the subcategory of visual and auditory sensitivity, 50% of the scores fell at or above 1 SD below the mean, indicating typical performance, while 15.4% fell in the probable difference category (between 1SD below the mean and 2SD below the mean), and 26.9% fell in the definite difference category (at or below 2SD below the mean). The mean score for the entire sample for visual and auditory sensitivity was 18, indicating typical performance. The majority (69.6%) of the children likewise demonstrated typical processing of taste and smell. In addition, the majority of children demonstrated typical levels of endurance and strength (57.7% typical performance, 15.4% probable difference, 26.9% definite difference).

**DO CHILDREN WITH BD HAVE “DIFFICULT TEMPERAMENTS”?**

The second research question addressed the issue of temperament. Specifically, our study wanted to find out if the children with behavior problems in our sample had behavioral profiles consistent with a difficult temperament, as previously found in the literature (Bussing, 2003; Thomas & Chess, 1977; Guerin et. al., 2003). Specifically, we wanted to know if these children with behavior problems were emotionally intense, negative, non-adaptable, and if they tended to withdraw in new situations.

Because the Behavioral Style Questionnaire is a Likert-type scale where the end points have opposite meanings (i.e. a high score in persistence category means nonpersistant, while a low score means persistent), the BSQ scores were grouped into 3
different categories for the purpose of data analysis. The scores were grouped according to high scores (at or above 1 SD above the mean), midrange scores (between +1SD and −1SD), and low scores (below −1SD below the mean).

Generally speaking, the children in our sample did not meet the description of “difficult temperament”, with the exception of scores for adaptability. They were generally non-adaptable, but the scores fell in the midrange for intensity, negativity (mood), rhythmicity, and approach. For the most part, the subjects in our study were non-adaptable, active and nonpersistent. (See Chart 5, Temperament Categories by Percentage).

In general, the majority (72%) of children in the sample had difficulty adapting their behavior to socially acceptable standards. Adaptability scores were low for the children: 72% of the subjects demonstrated non-adaptable behavior, and 28% of the scores fell in the midrange. No children in this sample demonstrated adaptable behavior as defined by the BSQ. The average score for adaptability was 3.62, which fell in the non-adaptable category (between+1SD and +2SD). (See chart 2 for percentages, and table 2 for mean scores).
As might be expected, the children in our sample demonstrated moderate to high activity levels during their daily routines. For the subcategory of activity (high/low), 44% of the scores fell at or above +1SD, in the category of high activity level, while 52% of the scores fell in the midrange (between +1SD and −1SD). None of the children in the sample were inactive: zero percent of the scores fell in the “low” range on the activity scale. The average score for activity was 4.02, which fell in the midrange (See chart 3 for percentages, table 2 for mean scores).
The children in the sample had difficulty remaining with a task or activity, generally obtaining scores indicative of non-persistence. For the subcategory of persistence (persistent/nonpersistent), 52% of the scores fell at or above +1SD, meaning high in nonpersistence, while the remaining 48% of the scores fell within the midrange for persistence (between +1SD and −1SD). None of the children in the sample were persistent (at or below −1SD). The average score for the entire sample for persistence was 3.63. This score falls in the nonpersistence category, between +1SD and +2SD (see chart 4 for percentages, table 2 for mean scores).
Chart 4 - Persistence

Chart 5 - Temperament Categories by Percentage

- High = highly active, arrhythmic, tendency to withdraw, high intensity, negative mood, nonpersistence, distractible, low threshold, non-adaptable
Table 2 - Mean scores for BSQ subcategories

<table>
<thead>
<tr>
<th></th>
<th>Activity</th>
<th>Rhythmicity</th>
<th>Approach</th>
<th>Adaptability</th>
<th>Intensity</th>
<th>Mood</th>
<th>Persistence</th>
<th>Distractibility</th>
<th>Threshold</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>(high)</td>
<td>(arrhyth.)</td>
<td>(withd.)</td>
<td>(non-adap.)</td>
<td>(intense)</td>
<td>(neg.)</td>
<td>(non-pers.)</td>
<td>(distr.)</td>
<td>(low)</td>
</tr>
<tr>
<td>+2 SD</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>+1 SD</td>
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<td></td>
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<tr>
<td>-1 SD</td>
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<td>-2 SD</td>
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</tr>
</tbody>
</table>

Table 2 – Mean scores for BSQ subcategories

RELATIONSHIPS BETWEEN SENSORY PROCESSING AND TEMPERAMENT

Since the literature suggests links between sensory processing and temperament (Chess, 1997; Rothbart, 1998; Greenspan, 1984), the third aspect of this study examined the relationships between sensory processing these two constructs. The first question explored relationships between persistence and aspects of sensory processing, including low energy, as well as auditory filtering, tactile sensitivity, and visual/auditory sensitivity. It was hypothesized that persistence would relate to low energy/weak, i.e. that children who were persistent would also demonstrate behaviors indicating that they
had low energy. This hypothesis was not supported. The correlation between persistence and low energy/weak was weak and statistically not significant (r=.246, p=.237, see Table 3). Additional statistical procedures were used (ANOVA) to determine relationships between persistence and sensory processing (Table 4), but there were no significant differences found between persistent and non-persistent kids for auditory filtering, tactile sensitivity, and visual-auditory sensitivity, possibly because the bulk of the scores for persistence fell in the midrange, with no children falling into the category for persistence. Scores for auditory filtering, tactile sensitivity, and visual and auditory sensitivity did not seem to be associated with nonpersistence.
<table>
<thead>
<tr>
<th>SSP SUBCATEGORY</th>
<th>CORRELATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensory</td>
<td>.113 .299 -.176 -.537** -.087 -.156 -.032 -.056 -.130</td>
</tr>
<tr>
<td>Seeking</td>
<td>.246 -.224 .178 .079 .053 -.267 .379 .079 .344</td>
</tr>
<tr>
<td>Low Energy/Weak</td>
<td>.203 -.005 .316 -.239 -.045 -.408* -.300 .221 -.344</td>
</tr>
<tr>
<td>Tactile</td>
<td>.191 -.095 .127 .350 -.427* .210 -.206 .096 .156</td>
</tr>
<tr>
<td>Sensitivity</td>
<td>.022 .044 -.389 -.260 -.053 -.312 -.398* .043 -.307</td>
</tr>
<tr>
<td>Movement</td>
<td>-.179 .286 .052 -.554** .321 -.034 -.009 -.253 -.125</td>
</tr>
<tr>
<td>Sensitivity</td>
<td>.022 .044 -.389 -.260 -.053 -.312 -.398* .043 -.307</td>
</tr>
<tr>
<td>Visual</td>
<td>-.179 .286 .052 -.554** .321 -.034 -.009 -.253 -.125</td>
</tr>
<tr>
<td>Auditory</td>
<td>.022 .044 -.389 -.260 -.053 -.312 -.398* .043 -.307</td>
</tr>
<tr>
<td>Sensitivity</td>
<td>-.179 .286 .052 -.554** .321 -.034 -.009 -.253 -.125</td>
</tr>
<tr>
<td>Auditory</td>
<td>.022 .044 -.389 -.260 -.053 -.312 -.398* .043 -.307</td>
</tr>
<tr>
<td>Filtering</td>
<td>-.179 .286 .052 -.554** .321 -.034 -.009 -.253 -.125</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>BSQ SUBCATEGORY</th>
<th>Persistence Approach Intensity Activity Distractibility Adaptability Threshold Rhythmicity Mood</th>
</tr>
</thead>
<tbody>
<tr>
<td>Persistence</td>
<td>.022 .044 -.389 -.260 -.053 -.312 -.398* .043 -.307</td>
</tr>
<tr>
<td>Approach</td>
<td>-.179 .286 .052 -.554** .321 -.034 -.009 -.253 -.125</td>
</tr>
<tr>
<td>Intensity</td>
<td>.022 .044 -.389 -.260 -.053 -.312 -.398* .043 -.307</td>
</tr>
<tr>
<td>Activity</td>
<td>-.179 .286 .052 -.554** .321 -.034 -.009 -.253 -.125</td>
</tr>
<tr>
<td>Distractibility</td>
<td>.022 .044 -.389 -.260 -.053 -.312 -.398* .043 -.307</td>
</tr>
<tr>
<td>Adaptability</td>
<td>-.179 .286 .052 -.554** .321 -.034 -.009 -.253 -.125</td>
</tr>
<tr>
<td>Threshold</td>
<td>.022 .044 -.389 -.260 -.053 -.312 -.398* .043 -.307</td>
</tr>
<tr>
<td>Rhythmicity</td>
<td>-.179 .286 .052 -.554** .321 -.034 -.009 -.253 -.125</td>
</tr>
<tr>
<td>Mood</td>
<td>.022 .044 -.389 -.260 -.053 -.312 -.398* .043 -.307</td>
</tr>
</tbody>
</table>

* p < .05, ** p < .01

Table 3. Correlations Between Categories of Temperament (BSQ) and Categories of Sensory Processing (SSP)
Table 4 – Sensory Profile scores for Persistent children vs. Non-Persistent children

We also hypothesized that approach would correlate with tactile sensitivity, movement sensitivity, visual and auditory sensitivity, and auditory filtering. Children with high sensitivities would be more likely to withdraw from situations that were stimulating. These hypotheses were not supported by the data. Approach and tactile sensitivity demonstrated no correlation ($r= -.005$, $p= .983$, Table 3). Similarly, approach and movement sensitivity were not related ($r=-.095$, $p = .651$). A low correlation between approach and auditory filtering was found, but was statistically not significant ($r= .286$, $p = .165$). Approach and visual and auditory sensitivity did not correlate ($r = .044$, $p = .835$). For additional analysis, children’s scores were placed into two categories – those who tended to withdraw (scores at or above $+1SD$ on the BSQ for approach) and those who didn’t (scores below $+1SD$ on the BSQ for approach), and ANOVA was calculated to determine if there were group differences in scores for tactile sensitivity, movement...
sensitivity, auditory filtering, and visual and auditory sensitivity (See Table 5). This analysis yielded p values that were not statistically significant for movement sensitivity (F(1,23)= 2.697, p = .115) and auditory filtering (F(1,23)= 2.934, p = .101) for children who withdraw versus children who don’t withdraw in new situations.

<table>
<thead>
<tr>
<th>SSP Subcategory scores</th>
<th>Children who withdraw</th>
<th>Children who Approach</th>
<th>F value</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tactile Sensitivity</td>
<td>25.5</td>
<td>26.9</td>
<td>.377</td>
<td>.546</td>
</tr>
<tr>
<td>Movement Sensitivity</td>
<td>11.7</td>
<td>13.3</td>
<td>2.697</td>
<td>.115</td>
</tr>
<tr>
<td>Auditory Filtering</td>
<td>20.7</td>
<td>18.2</td>
<td>2.934</td>
<td>.101</td>
</tr>
<tr>
<td>Visual/ Auditory Filtering</td>
<td>17.4</td>
<td>18.2</td>
<td>.136</td>
<td>.716</td>
</tr>
</tbody>
</table>

*Approaching significance at p<.05 level

Table 5 – Short Sensory Profile scores for Children who Withdraw vs. Children who Approach

The hypothesis that sensory sensitivity is related to intensity was not supported by the data, with the possible exception of auditory and visual sensitivity. The correlation between intensity and visual and auditory sensitivity was inverse, low but statistically significant (r = -.389, p = .055). Because higher scores indicate more intense behavior on the BSQ, and lower scores indicate greater dysfunction on the SSP, an inverse relationship suggests that as difficulty with visual and auditory sensitivity increases, intensity of reaction also increases. The correlation between intensity and tactile sensitivity was weak and not statistically significant (r = -.316, p = .133), as was the
correlation between intensity and movement sensitivity \((r = .127, p = .544)\). The
correlation between raw scores for intensity and sensory seeking \((r = -.176, p = .401)\).
and between intensity and weak \((r = -.224, p = .282)\) were not statistically significant.

The hypothesis asserted by Case-Smith (1997) and proposed in this study that
sensory seeking is related to activity was supported by the data. The scores for activity on
the BSQ demonstrated a moderate negative correlation with sensory seeking on the SSP
\((r = -.537, p = .006, \text{Table 3})\). Because high scores on the BSQ indicate high activity,
while low scores on the SSP indicate greater difficulty with sensory seeking, a negative
relationship here suggests that children who were rated as highly active also
demonstrated sensory seeking behaviors. The correlation between activity and auditory
filtering was likewise negative, moderate and statistically significant \((r = -.554, p = .004)\).
Again, high scores on the BSQ indicate high activity, while low scores on the SSP
indicate greater difficulty with auditory filtering. Since the relationship is negative, this
suggests that children who were rated as highly active on the BSQ also demonstrated
difficulty with auditory filtering to a moderate degree. Further analysis was conducted
using ANOVA by placing the children into 3 categories of activity – high, midrange and
low activity. Significant differences were found in high versus low activity children for
auditory filtering \((F(1,24) = 5.511, p = .028)\), sensory seeking \((F(1,24) = 12.231, p =
.002, \text{see Table 6})\) and for the total Short Sensory Profile score \((F(1,21)= 6.114, p=.023)\).
Also, the correlation between activity and overall management was moderate and
statistically significant \((r = .492, p = .012)\). This suggests that more active the child, the
more difficult they were to manage.
Table 6 – Short Sensory Profile scores for Active Children vs. Moderately Active Children

The correlation between distractibility and overall management was negative, moderate and statistically significant ($r = -.468, p = .018$). A higher score for overall management indicates easier manageability, while a high score for distractibility indicates greater distractibility. Here, a negative relationship suggests that the more distractible kids were easier to manage. The correlation between adaptability and approach was moderate and statistically significant ($r = .534, p = .006$). The kids who tend to withdraw are also non-adaptable. The correlation between adaptability and tactile sensitivity was moderate and inverse, and statistically significant ($r = -.408, p = .048$). Children rated as non-adaptable also tended to have difficulty with tactile sensitivity.

SUMMARY

Overall, the sample demonstrated problems with sensory processing, but did not demonstrate patterns of “difficult” temperament. The majority demonstrated generalized problems with sensory processing, as well as particular difficulty with tactile
hypersensitivity, auditory filtering and sensory seeking. Generally speaking, the children in our sample did not meet the description of "difficult temperament", with the exception of scores for adaptability. They were generally non-adaptable, but the scores fell in the midrange for intensity, negativity (mood), rhythmicity, and approach. For the most part, the subjects in our study were non-adaptable, active and nonpersistent. Relatively few relationships emerged between sensory processing and temperament. Links were found between activity and sensory seeking, between activity and auditory filtering, between adaptability and tactile sensitivity, and between threshold and visual and auditory sensitivity. Difficulty with auditory filtering and sensory seeking were factors for highly active children.
CHAPTER 5
DISCUSSION

In this chapter, the research findings are related to results already found in the literature on sensory processing and temperament. Next, clinical implications are discussed. Finally, limitations of the study are discussed, and recommendations for further research are made.

SENSORY FINDINGS

Our findings both support and challenge some notions in the field of occupational therapy regarding sensory processing in children with behavior problems. The majority of the participants demonstrated some degree of abnormal sensory processing. It is no surprise that these children with BD demonstrate sensory processing problems. Sensory processing problems have been linked with behavioral problems in many studies of children of all ages, from infants to adolescents. DeGangi and Greenspan (1988) found evidence of sensory processing in difficult infants. Greenspan (1984) suggested that early sensory processing problems contribute to emotional and social problems later in life. Dunn (1999) found significant differences in three factors of sensory processing when children with ADHD were compared with typical peers. Parush, Sohmer, Steinbarger and Katz (1997) also found evidence of tactile defensiveness in children with BD. Fanchung
(1990) found evidence of sensory integration problems in adolescents with conduct problems, and Silberzahn (1975) likewise found a high incidence of sensory integration problems in children ages 5 to 9 with BD. Explosive, hostile and aggressive behaviors have been documented in children with Sensory Modulation Disorder, as well as problems with attention (Miller et al. 2001).

Although these children generally demonstrate sensory processing problems, the longstanding view by occupational therapists that children with behavior problems have hypersensitivity is challenged by our findings. Evidence of tactile sensitivity (a.k.a. tactile defensiveness) was found, but sensitivity did not emerge across the sensory systems. Of the 4 factors on the Short Sensory Profile which measure hypersensitivity (visual and auditory sensitivity, movement sensitivity, taste and smell sensitivity, and tactile sensitivity), the children scored below -1 SD (probable difference) for only taste and smell sensitivity and tactile sensitivity. On average, they scored in the typical range for both visual and auditory sensitivity, and movement sensitivity.

Ayres (1972) and others (Parush et al., 1997) have found evidence of tactile defensiveness in children with emotional and behavioral problems. In fact, it seems to be a longstanding assumption that children with behavior problems have tactile sensitivity (Ayres, 1964). In this study, 50% of the sample scores fell at or below –2SD for tactile sensitivity, and another 15% scored between –1SD and –2 SD. It appears that half of these children with BD demonstrate tactile defensiveness, while half do not. Although these data do not support that in all cases BD is associated with hypersensitivity to touch, many more children with BD demonstrate tactile hypersensitivity than is observed in the
typical population. The data suggest that evaluation of sensory processing is important in children with BD to determine whether or not sensory processing problems are present.

It is also surprising that 61.5% of the sample score s fell in the typical range for taste and smell sensitivity as well as movement sensitivity, and 50% of the scores fell in the typical range for visual and auditory sensitivity. These findings support the notion that a percentage of children with behavior problems are hypersensitive.

In this study, 84.6% of the sample fell at or below −2SD for sensory seeking, and 80.8% fell at or below −1SD for auditory filtering (57.7% at or below −2SD). Dunn (1999) suggested that children who demonstrate problems with sensory seeking and auditory filtering as measured by the Short Sensory Profile might have problems with sensory modulation, thus suggesting that this sample demonstrates symptoms of sensory modulation disorder.

This finding is supported by the existing literature. Sensory Modulation disorders have been found in children with ADHD and behavioral problems. Mangeot and colleagues (2001) measured electrodermal reactivity in 8 year olds diagnosed with ADHD and found evidence for sensory modulation disorder in this population. Greater variability in response and a greater degree of abnormal responses were found in the children with ADHD when compared with typical children. Yochman, Parush and Ornoy (2004) likewise found evidence of sensory modulation problems in preschoolers diagnosed with ADHD. These findings suggest that children with sensory modulation problems demonstrate both hyper responsive and hypo responsive behavior. Because they appear to both under react, and overreact to sensations, their behavior appears quite unpredictable and may be interpreted as difficult or problematic by teachers or parents.
The results of this study also challenge the notion suggested by Ayres that children who exhibit behaviors indicative of ADHD are easily over stimulated and therefore sensitive to sensory stimuli. One would expect to find a larger percentage of children who demonstrated difficulty with visual and auditory sensitivity, taste and smell sensitivity, movement sensitivity, and tactile sensitivity to support this claim.

The findings do parallel other research that examined the sensory processing patterns of children with ADHD. In general, the children in the sample were sensory seeking and had difficulty with auditory filtering. Yochman, et al. (2004) found that preschool children with ADHD scored significantly different than their typical peers for items related to sensory seeking and inattention/ distractibility, as well as several other factors, on the Sensory Profile. Dunn (1999) likewise found significant differences in sensory seeking and inattention and distractibility in children ages 3 – 17 with ADHD for scores on the Sensory Profile. Because the questions for inattention and distractibility on the Sensory Profile match well with the questions for auditory filtering on the Short Sensory Profile, our results support Dunn’s findings. Although it is unknown if the children in this sample have been diagnosed with ADHD, some of the criteria for inclusion in this study parallel diagnostic criteria for ADHD, (i.e. inattention and distractibility), suggesting similarities between this sample and the samples used in the above studies.

TEMPERAMENT

Our descriptive findings as they relate to temperament both support and contradict results previously described in the literature about children with behavior problems.
Generally speaking, the children in our sample did not display all of the temperamental characteristics typical of children with behavior problems, although they did display some of these characteristics. We did not find evidence that our children displayed "difficult temperaments" as defined by Thomas and Chess (1977), although they did demonstrate a few aspects of challenging temperament as defined by Thomas and Chess and others.

As previously stated, Thomas and Chess (1977) coined the phrase "difficult child" to describe a type of child with a challenging behavioral profile, that included irregularity, non-adaptability, intensity, negativity, with a tendency to withdraw when introduced to new people, places or things. Rutter, Birch, Thomas and Chess (as cited in Strelau, 1998) likewise found that children with psychiatric disorders were non-adaptable, emotionally intense and negative. Rigid, controlling and non-adaptable behavior has been associated with difficult children by others, as well (Ayres, 1972: Graham, Rutter and George (as cited in Strelau, 1998). Our study supports this finding, since 72% of the participants demonstrated non-adaptable behavior. It did not support other findings that define the temperamental characteristics of children with BD. Overall, the participants in our study were non-adaptable, active and nonpersistent: however, scores fell in the midrange for intensity, negativity (mood), rhythmicity, and approach. According to the BSQ, (Carey, 1996), adaptability is defined as, “the ease or difficulty with which your child can change to socially acceptable behavior.” Given this definition, it is not surprising the children with BD would demonstrate difficulty with adaptability.

It is somewhat surprising, however that our subjects scores did not cluster for irregularity, high intensity, negativity and withdrawal symptoms, given so many studies
that point to these as typical of children with BD. Irregularity (or arhythmicity, as defined by the BSQ) has been identified as a factor for difficult children by Thomas and Chess (1977), as well as Graham, et al., (as cited in Strelau, 1998), who found a predictive relationship between children who demonstrated irregular behavior as preschoolers and the diagnosis of a psychiatric disorder one year later. Our study does not support this finding, since only 24% of the children in this sample were identified as arrhythmic; the majority (65%) of scores for this category fell within the midrange.

It is especially surprising that the children with BD were not high on emotional intensity. Thomas and Chess’ (1977) study as well as data from longitudinal studies indicates associations between emotional intensity in early childhood and behavior problems (Shiner & Caspi, 2003). Rothbart (as cited in Strelau, 1998) found that later neurotic and emotional behavior could be predicted by emotional intensity at an early age. In contrast to these studies, only 12% of the children with BD in this sample were identified as intense, while the majority (64%) fell in the midrange.

Negativity has also been associated with behavior problems by many investigators. Guerin, Gottfried, Oliver and Thomas (2003) described preschoolers with behavior problems as “hostile” and fussy and demanding as infants. Thomas and Chess (1977) found negativity in difficult children, and Rutter, Birch, Thomas and Chess (as cited in Strelau, 1998) found negativity in children with psychiatric disorders. Only 4% of the children in this sample were labeled with a positive mood: the majority (64%) fell in the midrange, with 32% were identified as having a predominantly negative mood.

Most of the studies (Strelau, 1998; Thomas & Chess, 1977) suggest that children with BD tend to withdraw in new situations. Rothbart (as cited in Strelau, 1998)
summarized research on the predictive relationships between temperament and later behavioral problems and found that later neurotic and emotional behavior could be predicted by a high degree of social inhibition. Again, while only 4% of the children in this sample readily approached new situations, the majority (68%) of scores fell in the midrange, and 28% of the children were identified as likely to withdraw in new situations. Generally, children who withdrew in new situations had more difficulty screening out irrelevant sounds and focusing in on important sounds, and likewise demonstrated greater sensitivity to everyday movement than the children who approached new situations more readily. Problems with auditory filtering might lead to confusion or apprehension in these children, which then leads them to be more cautious when approaching new situations. Sensitivity to movement may also affect the degree to which they move around exploring new environments, as well as their willingness to engage in new movement experiences.

It is interesting to examine the results for this construct of temperament in comparison with a study by Nigg, Goldsmith, and Schobek (2004), in which approach/withdrawal was studied in children diagnosed with ADHD. These researchers discovered two subgroups of children with ADHD: those who demonstrated withdrawal symptoms to novel events, and those who approached novel events. This study suggests that among children with ADHD (and our subjects appear to demonstrate symptoms associated with this disorder), some children might readily approach, while others will tend to withdraw. Perhaps this phenomenon may explain why many of the scores for our sample fell in the midrange, since apparently this aspect of temperament is variable in children with behavior disorder such as ADHD.
Although activity level did not emerge as a component of difficult temperament in Thomas and Chess’ study, the children with BD in this study did demonstrate high activity levels, as well as sensory seeking behaviors and difficulty with auditory filtering. Consequently, the data do parallel Greenspan’s (1995) description of active/aggressive children, who tend to “crave input… and under react to sensations: they seem to need a lot of noise, sound, touch or other sensations” (p. 240) and may have “difficulties with auditory processing” (p. 240). High activity is also implicated in other studies. Guerin, Gottfried, Oliver and Thomas (2003) described three-year-old children with behavior problems as hyperactive. Others have found relationships between conduct problems in later childhood and adolescence with early hyperactivity (Shiner & Caspi, 2003).

RELATIONSHIPS BETWEEN SENSORY PROCESSING AND TEMPERAMENT

Relatively few substantial and significant correlations were found between sensory processing and temperament. Moderate, negative correlations were found between sensory seeking and activity, auditory filtering and activity, tactile sensitivity and adaptability, movement sensitivity and distractibility, as well as between visual and auditory sensitivity and threshold. The overall lack of many strong, significant correlations between temperament and sensory processing is puzzling, given so many theoretical similarities. Chess’ (1997) conceptualizations of temperament sound strikingly similar to an occupational therapist’s description of sensory sensitivity. Rothbart’s (1998) conceptualization of temperament includes constructs typically thought of as aspects of sensory processing by occupational therapists, including reactivity. In fact, the similarity between Rothbart’s conceptualization of temperament, and Dunn’s
model of sensory processing is striking. Dunn (2001) herself drew similar analogies between Sensory Profile performance patterns and aspects of temperament as identified by Rothbart and colleagues. Dunn proposed that Rothbart's factors of "surgency" or positivity, fear, irritability/anger and persistence are related, respectively, to the Sensory Profile performance patterns of Sensory Seeking, Sensory Avoiding, Sensory Sensitivity and Low Registration.

In addition, Case-Smith (1997) proposed relationships between Thomas and Chess' dimensions of temperament and Dunn's Sensory Profile factors, suggesting that activity level might be related to sensory seeking, low endurance/tone, and sedentary. Our finding of a moderate, significant correlation between activity and sensory seeking supports Case-Smith's proposition. Relationships were not found, however, between activity and low energy/weak, suggesting that two different constructs are being measured.

We attempted to investigate Dunn's proposition that persistence would be related to low registration by examining relationships between persistence and low/energy weak. According to Dunn (1999), children with poor registration have high neurological thresholds for detecting sensory stimuli. They do not easily notice incoming stimuli, and consequently can appear self-absorbed and seem unaware of sensory information in their environments. Because they may miss salient cues in their environment, it is possible that their sensory processing characteristics might enable greater task persistence, since by nature they are not easily distracted by incoming stimuli since they do not notice stimuli as readily as others. Upon further evaluation of the SSP, it appears that the questions for low energy/weak do not correspond with the low registration factor on the Sensory
Profile. Because of this oversight, we cannot really say if Dunn's proposition is supported or not since we did not actually measure poor registration. Given this, it is not surprising that we did not find correlations between these two constructs.

Given the apparent similarities between the constructs of temperament and sensory processing, one would expect to find correlations between the two for several categories. In contrast, our study found very few relationships between aspects of temperament and aspects of sensory processing. A moderate, negative correlation was found between sensory seeking and activity, indicating that high activity level was associated with sensory seeking behaviors. This suggests, as Case-Smith (1997) proposed, that activity level as defined by Thomas and Chess (1977), and sensory seeking as defined by Dunn (1999) are similar constructs.

A moderate, negative correlation was also found between tactile sensitivity and adaptability, indicating that low adaptability was associated with tactile sensitivity. Again, this finding is interesting clinically, but does not support the notion that sensory processing and temperament are theoretically similar constructs. Children with tactile sensitivity have long been regarded as "difficult" and "rigid" by occupational therapists (Ayres, 1972; Greenspan, 1984). This notion is consistent with this finding.

A moderate, negative correlation was also found between visual and auditory sensitivity and threshold, indicating that low thresholds, or in other words hypersensitivity, was associated with visual and auditory sensitivity. Upon closer inspection, eight of the eleven questions for the threshold category on the BSQ seemed to require a degree of auditory or visual processing. This could explain the relationship found between these two constructs.
One must ask why more associations between sensory processing and temperament were not discovered in this study. One strong explanation lies in the methodology of the study. First, a relatively small sample size (n = 25) was obtained. This presented a problem because we did not have sufficient numbers for good statistical power. Potential correlations were not expressed because the sample lacked variability. In addition, the analyses that separated the children into groups representing the range of temperament lacked power because the number representing extreme temperament types were low. One wonders if the sample had been larger with greater variability represented if more relationships would have been revealed. Of course, it's possible that we did not find relationships because the two constructs indeed are not related. Perhaps relationships did not emerge because temperament and sensory processing refer to different characteristics and different aspects of personality and behavior.

**CLINICAL IMPLICATIONS**

Our study has revealed some information that might be helpful when designing intervention for young children with behavior problems. First, since a significant portion of the children demonstrated problems with sensory processing, our findings reinforce the common practice of including sensory processing evaluation and treatment as part of the piece of the puzzle for understanding these children and helping them reach their potential. In particular, occupational therapists should look for patterns suggesting sensory modulation problems. Therapists are urged to do thorough evaluation of sensory processing patterns. Rather than assuming that the child has sensitivities across all sensory systems, careful observation and evaluation of areas of hypo and
hyperresponsiveness should be conducted to facilitate understanding of the child’s sensory needs. By discerning a child’s pattern of sensory processing, occupational therapists can enhance teachers’ and parents’ understanding of the children’s unpredictable or disruptive behaviors when these relate to a sensory modulation disorder. Because the hallmark of a modulation disorder is both over and underresponsiveness to sensory stimuli, children with these disorders can be quite frustrating and puzzling to caregivers and teachers. It is even easy to interpret disruptive and erratic behaviors as purposeful, particularly when children are non-compliant. These two issues compounded can lead to problems between caregiver and child where the adult might begin to assume that the child is complaining about sensations or overreacting in order to manipulate or get his or her way. The occupational therapist can enhance understanding of the child, and provide suggestions for meeting sensory needs to both teachers and parents. By doing this, occupational therapist can strengthen positive relationships between caregiver and child, which hopefully would support compliance with behavioral standards in the long-term.

Also, since the children in this study demonstrated both sensory seeking and sensory sensitive behaviors, proper evaluations will help therapists to alter tasks demands to compensate for sensory sensitivities, to provide adaptations for calming, as well as to provide additional sensory input as needed. Children should be provided with flexibility in accessing these interventions since they are naturally unpredictable in their reactions and needs. This finding reinforces the need for occupational therapists to be centrally involved in the programming for children with behavior problems, since these children do appear to demonstrate difficulty using and screening out sounds from their
environments, and an unusual need for sensory input. A well-designed sensory diet with these needs in mind, as well as environmental modifications might make a significantly positive impact on the behavior of these children.

Although sensory processing did emerge as a factor for children with BD in this study, it is important to recognize that sensory processing accounts for only a small portion of the behavior problems. This finding supports the inclusion of behavioral as well and social-emotional interventions alongside sensory diet strategies for the optimum benefit to the children.

Since the vast majority of these children demonstrated sensory seeking behaviors, providing additional sensory input might prove helpful for managing behavior problems. Providing ample opportunity for movement before demanding performance and compliance is recommended. Providing the opportunity to move during task performance through the use of dynamic seating and fidget tools may also be helpful to the child who is sensory seeking. Also, adding novelty to activities that require performance and compliance may also help the sensory seeker to engage meaningfully and without defiance. Teams are encouraged to brainstorm ways to view a child’s sensory seeking behaviors as strengths, and then teach or program to those strengths in order to promote compliance and performance. For instance, sensory seekers can lead in movement activities, being the first to demonstrate how to hop on one foot to the song at circle time. Since they crave movement, they could have a special job of retrieving needed materials for the teacher during story and craft times to allow for move opportunities to move. Multisensory activities might also be enticing to sensory seeking children.
Since problems with auditory filtering also emerged, it might be useful for teams to further investigate auditory processing as perhaps a factor for misbehavior. Perhaps these children appear non-compliant at times when they are in fact confused by verbal commands. Again, adding additional input to support verbal directions might be helpful, especially in the visual mode, since this did not emerge as a problem area for this sample. One might still be cautious with physical redirection, however, since tactile sensitivity did appear to be problematic for many of these children. In fact, the findings support the need to evaluate for and rule out tactile sensitivity as a factor in aggressive or problematic behavior.

It is interesting that our study revealed difficulties with sensory seeking and auditory filtering in children with behavior problems. At least two other studies by occupational therapy researchers have found similar symptoms in children diagnosed with ADHD. It is interesting that these factors emerged in preschoolers labeled with behavior problems, most who have not yet been diagnosed with ADHD. Further research into this phenomenon is recommended. A longitudinal study that examined sensory processing patterns and behavioral profiles beginning in early childhood and throughout middle childhood, when ADHD is most typically diagnosed, might reveal if problems with auditory filtering and sensory seeking behaviors might be risk factors or indicators of ADHD. This information could be helpful in supporting these children when they first enter school, and in identifying children with ADHD much earlier.
LIMITATIONS

Implications and conclusions of this study are quite limited due to the use of convenience sampling, the small sample size \((n = 25)\), and the reliance on parent questionnaires that measure the parents’ perceptions of their children’s behavior. Convenience sampling is generally considered a last resort, and it does not allow for any kind of generalization to the larger population. Furthermore, demographics on families who participated were not collected, limiting the generalizability. Perhaps their qualities could help to explain some of the findings – i.e. why the children did not appear to be behaviorally as “difficult” as expected. Perhaps the parents who participated were more involved with their children and thus more likely to have a more positive view of them. On the other hand, perhaps more involvement with them actually had a positive impact on their temperament and behavior at home, and this could explain why the sample children weren’t as “difficult” as expected. Since no information was collected on the parents, these are only speculations. This aspect of the study was poorly controlled, and so the validity of the results has been seriously compromised. The small sample size likewise decreases generalizability to the population, since very little true variability can be represented in only 25 subjects.

The use of parent questionnaires as evaluation tools without concomitant use of objective assessment also limits the validity of the study. One must assume that we examined parent perception of temperament and parent perception of sensory processing, and one cannot assume that these are indeed accurate assessments of either of these constructs. The external validity of parent questionnaires to measure child temperament is an issue of controversy. This controversy exists for several reasons. First, research on this
problem has shown only moderate agreement between mothers and fathers, and even less agreement between parents and teachers, for temperament questionnaires (Strelau, 1998). This has raised a question of validity such that some in the field assert that parent questionnaires do not really measure child temperament, but rather the parent’s perception of the child’s temperament (Bates, 1980). The inclusion of questionnaires filled out by teachers and therapists for temperament and sensory processing could have helped to correct this problem, and would have been useful in discerning true validity and possible implications of the research. It is interesting to note that children perceived and identified as behaviorally challenging by teachers did not score as difficult as expected on temperament questionnaires. Perhaps this could be related to discrepancies between parent and teacher perceptions of behavior problems. This certainly is a mitigating factor in this study that limits the usefulness of the results.

RECOMMENDATIONS FOR FURTHER RESEARCH

In general, it is recommended that further research be conducted which would examine possible relationships between sensory processing and temperament. Specifically, a larger scale study using random sampling and using Rothbart’s questionnaire on temperament which would address Dunn’s theorized relationships between Rothbart’s factors of temperament and Dunn’s factors of sensory processing might be revealing. In addition, a larger scale study using the BSQ and the original SP would allow the exploration of relationships between all aspects of temperament and sensory processing to determine if we are dealing with similar constructs. One could base this study on Case-Smith’s suggested relationships. Studies that examine children’s
electrodermal response and also use Rothbart’s questionnaire may further reveal the relationship between temperament and sensory reactivity. Large scale studies are needed to investigate the possibility suggested by Greenspan that sensory processing is a precursor to temperament. A better understanding of the relationships between sensory processing and temperament could enhance our overall understanding of these two constructs, but might also be helpful when designing treatment. Links between sensory processing and temperament might support the current thought that sensory processing patterns remain fairly constant over time, since research has shown that temperament tends to be fairly constant over time as well.

CONCLUSIONS

In conclusion, our study revealed that young children with special needs and behavior problems demonstrated problems with sensory processing, including difficulty with auditory filtering, tactile defensiveness, and problems with sensory seeking. Overall, they demonstrated symptoms typical of Sensory Modulation Disorder, but did not demonstrate sensory sensitivity across all modalities. With regard to temperament, they were highly active, non-adaptable and non-persistent. They did not fit the mold for “difficult temperament”. To our surprise, few relationships were found between sensory processing and temperament. Relationships were found between activity and sensory seeking, such that active children were also sensory seeking, as well as between activity and auditory filtering. Adaptability and tactile sensitivity also correlated, suggesting that children with tactile sensitivity tended to be non-adaptable. Relationships between movement sensitivity and distractibility, as well as between visual and auditory
sensitivity and threshold, were also discovered. Due to the methods used for sampling, sample size, and the nature of the questionnaires used, the study has very limited validity and generalizibility. Further research is indicated using random sampling, larger sample sizes, and better control for mitigating factors.
REFERENCES


Ms. Kathy Mortimer  
FCBMR/DD

April 24, 2005

Dear Ms. Mortimer,

My name is Jennifer Wolverton, I am an occupational therapist and a graduate student in the Ohio State University School of Allied Medical Professions completing my master's degree. I am currently working on my thesis research, and would appreciate your cooperation in completing my study. The purpose of my study is to examine the relationship between sensory preference and temperament in preschool children displaying problem behaviors. I hope that the research will lead to a better understanding of both sensory processing and temperament. This information should support the design of interventions that best support the needs of children with behavior problems.

In general, this study attempts to examine the sensory processing patterns of young children with behavior problems and to discover relationships between sensory processing and temperament in children with behavior problems. Aspects of temperament will be examined including approach/withdrawal, persistence, and behavioral intensity. Aspects of sensory processing will be examined including auditory, touch, visual and multisensory processing as well as specific sensory processing patterns including poor registration, sensory sensitivity and sensory seeking.

In order to help me complete my study, I am asking that your treatment teams or teachers identify children who meet the following criteria;

- Have previously qualified for and been enrolled in programming for children with special needs according to the state requirements for qualification.
- Have demonstrated behavior problems in the classroom environment within the last six months. This criteria can be met by any of the following:
  1) The child has been on a behavior plan within the last 6 months
  2) The child’s IEP includes goals related to behavior. Goals related to behavior include those involving social-emotional skills (i.e. will use appropriate means to express anger and frustration), and following the classroom rules and routine (i.e. will keep hands and feet to himself, will follow the teacher’s instructions, will remain seated for group work and circle time, etc.)
  3) The child demonstrates symptoms of inattentiveness and distractibility which result in any of the following problems: difficulty remaining seated for table or group activities, consistent incompletion of table or play activities requiring adult assistance to complete due to problems of inattentiveness, motor restlessness significant enough to interfere with
functional play or task behavior, impulsivity which interferes with functional task or play behavior or results in aggressive behavior.

4) The child has been diagnosed with Attention Deficit Disorder (ADD) or Attention Deficit Hyperactivity Disorder (ADHD), or has been identified as at risk for developing one of these disorders.

5) The child has been referred to a psychologist or behavior specialist and a behavioral program such as a system of positive reinforcement, or a system for the use of exclusionary time out, has been established.

Has never been diagnosed with Autism or Downs Syndrome.

The parents of participating children will complete two assessments – the Short Sensory Profile, and the Carey Behavioral Style Questionnaire.

If your facility is interested in participating, please contact me at 614-261-6489. I also check my email regularly (Wolverton.16@osu.edu). Thank you for your consideration.

Sincerely,

Jennifer Wolverton, OTR/L
Dear Parent,

My name is Jennifer Wolverton, I am an occupational therapist, and most of my career has been spent serving children with special needs. I am also the mother of a 14-month-old daughter, and a graduate student in the Ohio State University School of Allied Medical Professions completing my master’s degree. I am currently working on my thesis research, and would appreciate your participation in my study. You and your child meet the criteria for participating in my study. The purpose of my study is to find out how a child’s emerging personality relates to how he or she experiences everyday sensations like touch, sound and movement. Specifically, I am studying these relationships in preschool children who demonstrate behavioral problems. I hope that the research will lead to a better understanding of the needs of children with behavior problems. This information should support the design of interventions that best support the needs of children with behavior problems.

In general, this study attempts to examine how young children with behavior problems respond to everyday sensations, and to discover relationships between temperament, or emerging personality, and sensation in children with behavior problems. Aspects of temperament will be examined including a child’s tendency to approach or withdraw from new environments, how long the child remains with a task, and how intensely she responds to everyday events. Specific aspects of sensation will also be studied included how the child typically responds to sights, sounds, and movement.

Possible risks for participating in this study include the following:

- The identification of your child as having “behavioral problems.” Although this is already known to you, and to the child’s treatment team, your name and your child’s name will remain confidential as the research is conducted and the results are reported.
- Possible negative emotional reactions experienced from the above.
- Possible negative emotional reactions experienced while filling out the questionnaires.
- The inconvenience of filling out two questionnaires.

Thank you for your consideration. If you have any questions please feel free to email me (my email address is listed at the top of the page), or you may reach me at home at 614-261-6489. If you are interested in participating, please fill out the included permission slip and return it in the stamped envelope provided.

Sincerely,

Jennifer Wolverton, OTR/L

Dr. Jane Case-Smith, Ed.D, OTR/L