An Investigation of the Clinical Utility of the Sensory Profile

Laura Leigh Pizzano Smith

Seton Hall University

Follow this and additional works at: http://scholarship.shu.edu/dissertations
Part of the Cognitive Psychology Commons

Recommended Citation
http://scholarship.shu.edu/dissertations/223
AN INVESTIGATION OF THE CLINICAL UTILITY OF THE SENSORY PROFILE

BY

LAURA LEIGH PIZZANO SMITH

Dissertation Committee
Cheryl Thompson-Sard, Ph.D., Merzor
Jennis Hanna, Ph.D.
Olivia Lewis-Chang, Ph.D.
Thomas Massarelli, Ph.D.
John Smith, Ed.D

Submitted in partial fulfillment of the requirements
of the Degree of Doctor of Philosophy
Seton Hall University

2007
Abstract

The Sensory Profile is an instrument that was developed by an Occupational Therapist that assesses sensory processing difficulties in children ages 3-10 (Dunn, 1999). It is being utilized by psychologists as part of the evaluation process of children despite a lack of research grounding it in psychological theory. This exploratory study examined the clinical utility of the Sensory Profile. This study attempted to provide a theoretical link between the fields of neuroscience, sensory integration theory, and ego psychology theory. Another purpose was to assess the utility of the measure when used with an inner city population.

The study consisted of an archival data set from sixty child participants, males and females, age 4-10, referred to a mental health clinic. Subjects were predominantly from the inner city, of low socioeconomic status, and of non-white ethnic backgrounds. Instruments included the Sensory Profile and a demographic data sheet.

Scores on three factors of the Sensory Profile from this sample: Sensation Seeking, Emotionally Reactive, and Inattention/Distractibility were hypothesized to be significantly different from the normative sample. The data was analyzed using one-sample, two-tailed t-tests. Results indicated that all three hypotheses were supported. Sensation Seeking scores were significantly different and lower than the normative sample ($t (59) = -8.844, p < .05$). Emotionally reactive scores from this sample were significantly different and lower than the normative sample ($t (59) = -8.393, p < .05$). Inattention/Distractibility scores from this sample was significantly different and lower than the normative sample ($t (59) = p < .05$). Demographic data indicated that nearly 75% of the sample was non-white compared with 9% of the normative sample. Evidence was
provided from the literature linking Sensory Seeking with the developing stimulus barrier ego function; Emotionally Reactive was linked with the developing regulation and control of drives, affects, and impulses ego function; and Inattention/Distractibility was linked with the developing autonomous ego functions (Bellak, Hurvich, & Gediman, 1973).

Future research utilizing the Sensory Profile needs to be conducted in order to assess its clinical utility. An integration of findings across disciplines is needed to better understand the relationship between ego psychological functions and sensory integration development.
Acknowledgements

Completing this dissertation would not have been possible without the support of my family and friends. I wish to thank my husband, Peter, for all he has taught me about life and love, and for all that he has done to support me in completing the program.

I am grateful for my parents, Tom and Linda Pezzano, who taught me never to give up and to my grandmother, for helping to take care of my boys; as well as to the rest of my family and friends who had to endure much sacrifice and gave a great deal of their time and energy in order to make this endeavor possible.

I thank my boys, Austin and Connor, for their smiles and laughter that warms my heart and helped me to keep focused.

I wish to thank my chair, Dr. Cheryl Thompson-Sard, who is incredibly knowledgeable, and was always cheerful and encouraging, even when times were tough. I also wish to thank Dr. Thomas Massarelli, who was incredibly supportive and patient of my progress through the program. I also thank Dr. Olivia Lewis-Chang for being on my committee.

I would also like to thank many of the YCS staff, including Dr. Gerard Costa, for the opportunity to use the Institute data and Dr. Dennis Hama for providing direction and assistance in making my study possible. I also wish to thank Roger Boesch, M.A., L.P.C., who was always available to lend an ear and offer assistance through this process. I also wish to thank my research assistant, Emmanuel Mercedes, who collected the data.
Dedication

To my boys- Pete, Austin, and Conor. You are the sunshine of my life!

In memory of Jack M. Clemente, MD, my mentor, for sharing his wisdom, knowledge, sense of humor, and his love of children.
# TABLE OF CONTENTS

LIST OF TABLES ......................................................................... vii

Chapter

I. INTRODUCTION ......................................................................... 1

Overview ................................................................................. 1
Sensory Profile Overview ......................................................... 2
Theoretical Rationale .............................................................. 4
Statement of the Problem ....................................................... 11
Research Questions ................................................................ 12
Hypotheses ........................................................................... 13
Definition of Terms ................................................................ 14
Sensory Seeking .................................................................... 14
Emotionally Reactive ............................................................ 15
Inattention/Distractibility ....................................................... 15
Significance of the Study ....................................................... 16
Limitations of the Study ......................................................... 17

II. REVIEW OF THE RELATED LITERATURE .............................. 19

Introduction ........................................................................ 19
Ego Psychology/Ego Function Literature .................................. 19
Ego Psychology Theory ......................................................... 19
Ego Functions ..................................................................... 28
Neuroscience Literature ........................................................ 40
Historical Perspective ............................................................ 40
Development of Attentional Systems ...................................... 44
Neurological Development of Regulatory Functions ............... 48
Neurological Development of Affect/Emotional Regulation ...... 50
Neurological Development of Cognitive Processes and
Maturity Systems ................................................................. 53
Neurological Development of Sensory Processing ................. 55
Neuroscience Literature in Relation to Ego Psychology and
Ego Functioning .................................................................. 56
Sensory Integration Literature ............................................... 60
Sensory Integration Theory .................................................... 61
Structure and Function of the Sensory Systems ..................... 62
Sensory Integration Dysfunction .......................................... 64
Sensory Mediation Dysfunction ............................................ 67
Assessments Utilized in the Diagnosis of Sensory Integrative
Dysfunction ....................................................................... 69
Sensory Integration Research ................................................. 82
III. METHODOLOGY .......................................................... 94
  Participants ................................................................. 94
  Procedure ................................................................. 95
  Instruments ................................................................. 95
     Demographic Data Sheet ............................................. 95
     Sensory Profile ....................................................... 95
  Instrument Development ............................................. 97
  Normative Data .......................................................... 101
  Validity ........................................................................ 103
  Reliability ..................................................................... 108
  Data Analysis .................................................................. 108

IV. RESULTS ......................................................................... 110
  Research Variables ....................................................... 110
  Descriptive Statistics for Demographic Variables ............. 110
  Hypothesis Testing ....................................................... 120
  Summary ....................................................................... 122

V. DISCUSSION AND RECOMMENDATIONS ............................. 123
  Discussion of Hypotheses ............................................... 124
  Discussion of Demographic Findings ............................... 129
  Limitations of the Study ............................................... 133
  Clinical Implications .................................................... 136
  Future Research .......................................................... 139

References ........................................................................ 145

Appendices ...................................................................... 157
  A. Permission to Use YCS Archival Data ......................... 158
  B. Demographic Data Sheet ............................................. 159
LIST OF TABLES

1. Frequency Distribution of Age of Subject ........................................ 111
2. Frequency Distribution of Age of Caregiver ..................................... 111
3. Frequency Distribution of Gender of Subjects ................................... 113
4. Frequency Distribution of Caregiver Relationship .............................. 113
5. Frequency of Race ........................................................................... 114
6. Frequency of Educational Level of the Child ..................................... 114
7. Frequency of Educational Levels of Caregivers .................................. 115
8. Frequency of Marital Status of Caregivers ......................................... 115
10. Descriptive Statistics for Psychological Variables .............................. 120
11. Comparison of Sensation Seeking, Emotional Reactivity, and Inattention/Distractibility Factor Values to Normative Values... 121
Chapter 1

INTRODUCTION

Overview

In today’s society, mental health professionals are frequently called upon to evaluate children due to emotional and behavioral regulation difficulties they may be experiencing. In assessing young, pre-school to early school-age children, it is evident that many factors including psychological, physiological/biological, as well as environmental factors, may be impacting the functioning of these children. While many valid scales exist today in the field of psychology to assess emotional and behavioral dysfunction, the Sensory Profile (Dunn, 1999) is one measure in particular that specifically assesses sensory abilities and the impact of one’s sensory system on daily life functioning. Specifically, Yochman, Paresh, and Ormay (2004) stated “The Sensory Profile is a comprehensive instrument that addresses not only sensory processing, but also behaviors considered to be derivatives of sensory processing deficits, such as attention and social-emotional functioning” (p. 299). More and more attention today is being paid to this notion of sensory regulation difficulties as explanations for behavioral dysfunction. The Sensory Profile is another tool that psychologists can utilize to gain an understanding of a child’s development that can assist in planning intervention and treatment strategies when atypical developmental trajectories are noted or when atypical behaviors are being exhibited (Zero to Three, 1997). Atypical developmental trajectories may include developmental delays in certain areas of functioning, such as language or motor delays that may interfere with expected or typical social and/or emotional development throughout childhood, adolescence, and adulthood.
The Sensory Profile is an instrument available to psychologists that assesses sensory processing system difficulties. A psychodynamically oriented psychologist can apply knowledge gained from this measure to clinical case conceptualizations and subsequent work with children. It is widely recognized that a child’s development is impacted by genetic, biological, and environmental experiences. In order to understand a child’s development from a psychodynamic psychological point of view, it is important to look at the development of the ego functions. This study is exploratory in nature and primarily interested in looking at the clinical utility of the Sensory Profile as an assessment tool in order to enhance the understanding of the relationship between sensory processing abilities and psychological theory or the precursors to ego functions. The psychological theory selected for this study is psychodynamic; specifically Bellak, Hurvich, and Gediman’s (1973) theory of the development of ego functions. A review of the current literature indicates there is a lack of information published about this relationship.

**The Sensory Profile: An Overview**

Since this study is an exploratory investigation of the clinical utility of a particular assessment tool, the Sensory Profile, an overview of the profile is provided to gain a general understanding of the measure. (A more comprehensive discussion of the Sensory Profile itself will be provided in Chapter II.) The Sensory Profile was developed by an occupational therapist, Winstle Dunn, in 1999. It is designed as a caregiver questionnaire. It consists of 125 items in which a caregiver rates how each item applies to their child on a Likert scale (always, frequently, occasionally, seldom, and never). These items are grouped under three main headings: Sensory Processing; Modulation; and Behavior and
Emotional Responses. Under the Sensory Processing heading, items that assess auditory processing, visual processing, vestibular processing, touch processing, multi-sensory processing, and oral sensory processing are included. Under the Modulation heading, items that assess sensory processing related to endurance and tone, modulation related to body position and movement, modulation of movement affecting activity level, modulation of sensory input affecting emotional responses, and modulation of visual input affecting emotional responses and activity level are included. Finally, under the behavior and emotional responses, items that assess emotional and social responses, behavioral outcomes of sensory processing, and items indicating thresholds for response are included (Dunn, 1999).

In addition to providing a Section Summary of the child's ability in the areas of Sensory Processing, Modulation and Behavior and Emotional Responsivity, a Factor Summary is also provided. The Factor Summary enables the clinician to look at how a child responds to stimuli in the environment. These factors were determined to account for 47.8% of the variance when researchers looked at how items were clustered in a meaningful way upon design of the Sensory Profile. These nine factors include: Factor 1- Sensory Seeking, Factor 2- Emotionally Reactive, Factor 3- Low Endurance/Tone, Factor 4- Oral Sensitivity, Factor 5- Inattention/Distractibility, Factor 6- Poor Registration, Factor 7- Sensory Sensitivity, Factor 8- Sedentary, and Factor 9- Fine Motor Perceptual (Dunn, 1999).

The Summary Score Sheet for the Sensory Profile utilizes a classification system in which children can receive a score found in either the category of Typical Performance, Probable Difference, or Definite Difference for each of the three sections
and each of the nine factors, which is an estimate of the child's likely performance in those areas (Dunn, 1999). "Typical Performance corresponds to scores at or above the point 1 SD below the mean for children without disabilities, Probable Difference corresponds to scores at or above the point 2 SD below the mean, but lower than 1 SD below the mean, for children without disabilities, and Definite Difference corresponds to scores below the point 2 SD below the mean for children without disabilities," according to Dunn (1999, p. 19).

Dunn also includes a separate summary section in Appendix B of the Sensory Profile manual for items that were found to cluster for children with a diagnosis of ADHD (Attention Deficit Hyperactivity Disorder). This diagnosis appears to cluster with some specific items found in the Visual/Tactile processing systems along with Factors 1 (Sensory Seeking), 2 (Emotionally Reactive), and 5 (Inattention/Distractibility) (Dunn, 1999).

Theoretical Rationale

The ability to regulate one's self states is essential in order to function appropriately in daily life (Dunn, 1999). Knowledge and understanding of this ability can be found across disciplines. Specifically, the fields of neuroscience, occupational therapy, and psychology offer insights into the development of this ability. Further, explanations as to how development can go awry are offered within these disciplines/theories. This study attempted to link neuroscience and sensory integration based theory with ego psychology theory. While the theoretical rationale is provided below, a more comprehensive discussion of ego psychology theory, sensory integration theory, and neuroscience will be provided in Chapter II.
Neuroscience has contributed to the understanding of sensory processing. Recent neuroimaging techniques and an increased understanding of DNA genetic material have enabled researchers to improve the understanding of brain function and central nervous system (CNS) processing (Posner & Rothbart, 2007). Neural pathways have been detected through neuroimaging techniques when subjects are asked to perform certain tasks, which increases knowledge about different brain structures and their functions. Behavior is seen by Posner and Rothbart (2007) as the result of interactions between neural networks and the environment. These researchers describe that both genes and the environment influence one's development. Others have also indicated that the role of the caregiver serves an important function as mediator or regulator for infants and young children (Kraemer, 1992; Posner & Rothbart, 2007; Schore, 1994). Importantly, research has been conducted that examines the development of attentional systems, regulatory functions of affect and emotions, cognitive processes and memory, and sensory processing, which will be discussed further in Chapter II.

According to Dunn (1997, p. 24), "Neuroscience provides a background for understanding how the sensory receptors receive and transmit stimuli, how the CNS codes and interprets the information and how the information gets used to design motor output." The CNS mediates the proprioceptive and kinesthetic channels that affect one's sense of balance, affect, and one's sense of self (Rangell, 1984). The concept of modulation, which is "the ability to monitor and regulate information in the interest of generating an appropriate response to particular stimuli," is central to this process (Dunn, p. 25). Habituation and sensitization are reportedly two important neuro-physiological processes connected with modulation of input. Habituation is a simple form of learning
whereby the CNS and nerve cells recognize stimulation as familiar and therefore decreases transmission along the cellular pathway, as it is perceived that there is no longer a need to keep sending a message to the brain. The process of sensitization is when stimulation is perceived as potentially harmful or important. There is a heightened response by the CNS, which increases the number of neuron connections in the brain in order to help the person remain more alert. It is clear to see then how children’s behavioral responses may be altered due to how the CNS perceives a stimulus (Dunn, 1997).

If there are difficulties in the two areas of habituation and sensitization, a child may over or under respond to his or her surroundings or to a task at hand. In fact, created within the CNS are patterns of interchange between habituation and sensitization known as thresholds. Thresholds are created as the result of a child’s biological capacity as well as through environmental experiences. For example, children with low thresholds experience sensitization and therefore may be hyperactive or act out. Conversely, children with high thresholds who may experience an habituation pattern may appear lethargic, inattentive, or even depressed (Dunn, 1997). If there is a problem with the way in which the CNS is processing sensory information, this may have an impact on how a child behaves. Sensory processing theory postulates that a child’s behavior is a result of the child’s efforts to seek sensory experiences and information that their CNS needs. The resultant behaviors then can either be seen as supportive of growth and learning within the environment or disruptive to the learning process (Dunn, 1997).

The Sensory Profile is a measure that is grounded in neuroscience and sensory integration theory (Dunn, 1999). The assessment tool, through caregiver rating of specific
items that reflect atypical responses to non-noxious stimuli, provides the professional with a wealth of information regarding specific areas in which the child may be presenting with difficulty in any or all of the areas of receiving, processing, and organizing sensory information within the CNS (Ayers, 1972, & Burpee, 2006). The CNS processes visual, vestibular, proprioceptive, tactile, and auditory sensations through the limbic system of the brain (Bundy, Lane, & Murray, 2002). According to Schore (1994), self-regulation occurs through the influence of the infant’s affective interactions within their environment. He reports that the structures within the brain that involve the processing of affect and regulation of affect are found within the limbic system in the right hemisphere of the brain. Emotion is processed neurologically through sensory pathways (Posner & Rothbart, 2007). Therefore, it is hypothesized that ego function psychological development occurs simultaneously and has a relationship with developing brain function and sensory processing abilities. Further, Slipp (2000) argued that neuroimaging studies validate Freud’s theory of the unconscious and conscious. He postulated that the unconscious is located in the right hemisphere, while the conscious process is found in the frontal lobe. Further elaboration and an exploration of the relationship among sensory integration theory, ego function development, and neuroscience are found in Chapter II.

The field of occupational therapy has also contributed a great deal to the literature regarding sensory processing and sensory integration. Jean Ayres is an occupational therapist and educational psychologist who was best known for her contribution of introducing Sensory Integration Theory in the 1970’s. She described sensory integration function as “the neurological process that organizes sensation from one’s own body and
from the environment and makes it possible to use the body effectively" (Ayers, 1979). She further stated that many things in life would be interfered with if the brain does a poor job of integrating sensations (Ayers, 1989). Dunn (1999) discusses that learning happens upon receiving sensory information, processing it, and using it to organize behavior. Dunn (1999) similarly argues that if one does not receive the stimuli input correctly, it is difficult for the information to be processed appropriately to generate appropriate behavior.

Lucy Jane Miller is an occupational therapist that studied with Ayres. She has recently been conducting research to further the sensory integration theory. In addition, she has been instrumental in the classification of terminology related to SI and to the validity of the diagnosis of Regulation Disorders of Sensory Processing in the Diagnostic Classification of Mental Health and Developmental Disorders of Infancy and Early Childhood (Zero to Three, 1997), a diagnostic classification manual for disorders of infancy and early childhood. A Task Force that was established in 1987 by the Zero to Three: National Center for Infants, Toddlers, and Families organization created the DC: 0-3. The Task Force is made up of a multidisciplinary team and includes leading clinicians and researchers from infant centers throughout the United States, Canada, and Europe (Zero to Three, 1997). The classification system was developed due to the "need for a systematic, developmentally based approach to the classification of mental health and developmental difficulties in the first four years of life" (Zero to Three, p. 3). Its purpose is to "complement existing medical and developmental frameworks for understanding mental health and developmental problems in the earliest years" (Zero to Three, p. 3). The Task Force argued that mental health problems often seen in older
children and adults may have had earlier manifestations in infants and young children that were not adequately identified and/or treated. It is believed that if assessment and diagnosis occurs early in development, intervention can ensue and provide a better prognosis for mental health functioning in the future. A revised edition, DC: 0-3R, was published in 2005.

Psychoanalytic theory, generally based on observational research, does discuss the issue of sensory processing in infancy and early childhood development. Pine (1985) discusses Peterfreund's work whereby he challenges the development of psychoanalytic theory in infancy and early childhood. Peterfreund (1978) stated, "I believe that meaningful psychoanalytic theories of infancy will not emerge from the current metapsychology but from different frames of reference-neurophysiological, biological, genetic, evolutionary, informational—of which are basically consistent with one another" (p. 440). Pine argues that this thinking presents a challenge for psychologists to develop a theory of infant development remaining in the language of psychoanalytic theory, however without discounting the contributions of the other frames of reference.

Even Greenspan (1989) notes that much of what has presently been validated empirically about infant and early childhood development in terms of increasing abilities for the infant to organize early experiences coincides with increasing neurophysiologic organization is consistent with Freud's (1895) theoretical hypotheses. The aim of this study is to link and integrate aspects of the literature from the neuroscience, occupational therapy, and psychoanalytic psychology frames of reference. The Sensory Profile is a measure that exists to assess sensory processing abilities and their impact on daily life
functioning. However, theoretically, discussion of its validity with regard to psychoanalytic theory is not found in the literature.

In terms of an overview of the origins of psychoanalytic theory, Freud is credited as being the father of psychoanalytic theory and developing a comprehensive theory of personality, according to Bellak et al. (1973). Freud first introduced the concept of Structural Theory in 1923 when he updated his topographical theory, which included the concepts of the unconscious, preconscious, and conscious, three dynamic systems used to represent the mental apparatus in relation to consciousness. Freud instead began using the terms ego, id and superego to identify structures or systems of psychic functioning and emphasized the role of drives in his theoretical work (Freud, 1895).

In terms of the development of the ego and ego functions in psychoanalytic theory, the ego represents the person or self, including the aspects of the body. The ego is “the part of the mind that involves particular attributes and functions” (Bellak et al., 1973, p.9). Freud’s (1895) work initially discussed that the ego had a permanent cathexis whose main function was to “inhibit psychical primary processes” (p. 324). Its role was to serve as a force that opposed the instinctual drives. The ego grew out of the id and was the part that was modified and influenced by the external world. Pines (1990) argued that infants are born with neurological apparatuses that are mediated by the environment. Bellak et al. (1973) noted that the ego serves a self-regulating function.

The ego was not always the focus of Freud’s writing. It was not until about 1940 that Anna Freud (1966) wrote about ego functions in more detail. Bellak et al. (1973) reviewed the psychoanalytic literature and identified twelve ego functions: reality testing, judgment, sense of reality of the world and of the self, regulation and control of drives,
affects, and impulses, object relations, thought processes, adaptive regression in the
service of the ego, defensive functioning, stimulus barrier, autonomous functioning,
synthetic-integrative function, and mastery-competence. The three ego functions
investigated in this study include stimulus barrier, regulation and control of drives,
affects, and impulses, and autonomous ego function.

Regarding ego function development, the stimulus barrier plays a very important
role in the development of children. The stimulus barrier serves the role of permitting
only a tolerable level of stimulation, in order to prevent overload in the child (Bellak et
al., 1973). It reportedly serves the function as a regulator of stimulation. There is debate
in the literature as to whether or not the stimulus barrier is a structure found in the brain
(Bellak et al., 1973). Regulation and control of drives, affect, and impulses is another ego
function discussed by Bellak et al. (1973). The ability to delay and control impulses and
inhibit motor responses is an important aspect in the development of the self (Bellak et
al., 1973). Autonomous ego function, the final ego function investigated in this study, is
characterized by the ability of the ego to attend, concentrate, remember, learn, perceive,
control motor function, and intend to act in certain ways, without these abilities becoming
impaired (Bellak et al., 1973). A more comprehensive discussion of the ego functions is
found in Chapter II.

Statement of the Problem

The Sensory Profile is an assessment instrument utilized in various clinical
settings by psychologists, among other professionals. However, based on a literature
review, there is a lack of research that discusses how this measure is grounded in
psychological theory or whether it is valid for use by psychologists. The Sensory Profile
was developed in 1999 by an occupational therapist, Winnie Dunn. Dunn was primarily interested in measuring children’s sensory processing abilities and their effects on daily life performance. The rationale provided for its development links neuroscience with sensory-integration theory (Dunn, 1999). While theoretical underpinnings of sensory system development can be found in psychology literature which discusses how the development of sensory processing contributes to the development of ego functions (Bellak et al., 1973; Pine, 1985; & Greenspan, 1985), there is a paucity of research that links sensory-integration theory and psychological theory, specifically ego psychology theory.

Additionally, Dunn (1999) reported normative data that indicate the instrument was designed utilizing a non-disabled, predominantly white, suburban sample. This brings to light the inability to generalize her findings to a multi-racial, inner-city sample referred to a mental health clinic. Thus, despite its use in clinical settings, the clinical utility of the Sensory Profile has yet to be established. Due to these limitations noted, the purpose of this study was two-fold. The first purpose was to theoretically validate the Sensory Profile in terms of ego function theory as reported in the literature. The second purpose was to assess whether or not the Sensory Profile is a valid instrument when used with an inner city population referred to a mental health clinic.

Research Questions

In order for an assessment tool to be valid for use by psychologists, it must be grounded in theory. Research studies are not found in the literature with regard to grounding the Sensory Profile in psychological theory. One of the aims of this study was to provide a theoretical link between sensory processing and ego function development.
through a review of the literature, as no ego function measures to directly assess ego function development are available. A second aim of this study was to examine whether or not the Section Summary Factors on the Sensory Profile that are related to sensory processing and emotional/behavior factors yield significant differences in an inner city clinical population as compared with the normative data.

Hypotheses

The hypotheses of this study involve the validation of the Sensory Profile as a relevant assessment tool in the field of clinical psychology. Specifically, does the Sensory Profile measure what it purports to measure within a multicultural, inner city population referred for mental health treatment and does the Sensory Profile present data consistent with ego psychological theory? The hypotheses are as follows:

1. Sensation Seeking scores from this sample will be significantly different from the normative sample.

2. Emotionally Reactive scores from this sample will be significantly different from the normative sample.

3. Inattention/Distractibility scores from this sample will be significantly different from the normative sample.

For children who are referred to a mental health clinic for an emotional and/or behavioral concern, based on the theoretical rationale, it was hypothesized that their scores in the areas of sensory seeking, emotionally reactive, and inattentive/distractible would not be found in the typical performance range. Psychologically, areas of ego functioning development would be influenced by sensory processing difficulties. In turn, emotional
and/or behavioral problems would be manifested as a result. Data in support of these hypotheses were analyzed using one-sample t-tests.

Definition of Terms

Sensory seeking, emotionally reactive, and inattention/distractibility are the three factors that were being considered in this study. Sensory seeking is conceptually defined as one's behavioral pattern of looking for stimuli or experiences of high intensity or increased duration of sensory stimulation (Mangost, Miller, McIntosh, McGrath-Clark, Simon, & Goldson, 2001). Emotionally reactive is conceptually defined as the degree to which a child displays highly charged affective and/or behavioral responses to stimulation (Dunn, 1997). Inattention and distractibility is conceptually defined as the degree to which a child is able to sustain focus on a task without extraneous environmental or internal factors negatively influencing this ability. Each factor is operationally defined separately below (Dunn, 1997).

Sensory Seeking

Sensory Seeking. Factor 1, will be operationally defined as a Factor Raw Score Total of less than 63 on the Sensory Profile. Seventeen items from the Sensory Profile were found to load on this factor. They include items that correspond to auditory, movement, touch, body position, activity level, and emotional/social sensory processing (Dunn, 1997). With regard to ego functioning, the sensory seeking factor corresponds to the concept of stimulus barrier. Stimulus barrier refers to the “threshold for, sensitivity to, or registration of, external and internal stimuli impinging upon various sensory modalities (corresponds to ‘receptive function’)” (Bellak et al., 1973, p. 78). Stimulus barrier also refers to the “degree of adaptation, organization, and integration of responses to various
levels of sensory stimulation; the effectiveness of 'coping mechanisms' in relation to
degree of sensory stimulation, whether observed in motor behavior, affective response, or
cognition" (Bellak et al., 1973, p. 78).

Emotionally Reactive

Emotionally Reactive, Factor 2, will be operationally defined as a Factor Raw
Score Total of below 27 on the Sensory Profile (Dunn, 1997). This factor is comprised of
16 items from the Sensory Profile that correspond to self-esteem, emotional sensitivity,
maturity level, presence of fears, anxiety, emotional outbursts, tantrum behavior,
frustration tolerance, social difficulties, nightmares, and emotional expression. With
regard to ego functioning, this refers to regulation and control of drives, affects, and
impulses. This is defined as the directness of impulse expression, the effectiveness of
delay and control mechanisms, and the degree of frustration tolerance expressed through
ideation, affect, and manifest behavior (Bellak et al., 1973).

Inattention/Distractibility

Inattention/Distractibility, Factor 5, will be operationally defined as a Factor Raw
Score Total of below 25 on the Sensory Profile. This factor is comprised of seven items
from the sensory processing areas of auditory, visual, and activity level. The auditory
items include the child responding negatively to unexpected or loud noises, covering ears
to protect ears from sound, having difficulty completing tasks or sustaining attention
when another auditory stimulus is present, looking away from tasks and looking around
the room instead, doesn't respond to name being called when it is known that the child
does not have a hearing impairment, and having difficulty paying attention (Dunn, 1997).
With regard to ego functioning, this corresponds to autonomous functioning. Autonomous functioning is defined to include the degree of freedom from impairment of attention, concentration, memory, learning, perception, motor function, and intention (Bellak et al., 1973). This implies that one would be able to engage in these functions with freedom from instinctual emotional demands (Miller, 1998). In fact, Miller believed that autonomous ego functioning is related to cognition or thinking. Specifically, cognitive processes such as symbolization and language are necessary to permit the ego to delay motor discharge by thinking about consequences and anticipating outcomes, rather than by acting on impulse. Hartmann (1939) discussed memory, perception, attention, and intelligence are human cognitive apparatuses that encompass the conflict-free (free of instinctual conflict) ego sphere. In fact, Hartmann argued that the conflict-free ego sphere is responsible for the autonomous ego’s ability to develop and utilize healthy coping mechanisms, rather than defense mechanisms that typically are associated with psychopathology. The autonomous ego then is connected with secondary process thinking (Miller, 1998).

Significance of the Study
This exploratory study can further the field of clinical psychology by demonstrating whether or not the Sensory Profile is a valid instrument that can be used as a clinical tool to assist in assessing and treating children who present with emotional and/or behavioral difficulties. There is an overlap in terminology in occupational therapy, neuroscience and ego psychology regarding ideas that appear quite similar. This study attempted to demonstrate how the development of sensory processing and the development of ego functions have a parallel relationship. Greenspan (1989) stated that
"separating and studying each processing capacity in terms of the sensory pathway involved, in relation to both impersonal and affective stimuli (i.e. the auditory, tactile, vestibular, olfactory, and proprioceptive systems, etc.) is an important research area" (p.10). Recognizing early disturbances in sensory processing/integration can enable a clinician to intervene therapeutically to address ego function development simultaneously. Pinc (1985), among others (Dunn, 1997; Greenspan, 1989), postulated that pathology can stem from sensory processing/biologically based difficulties.

Limitations of the Study

This current exploratory study has several limitations. A randomized sampling procedure was not employed in this study. This study utilized pre-collected archival/aggregate data from a community based inner-city outpatient mental health facility. The sample size was small and limited in age from 4-10 years old. It is important to note that there is a great deal of variation in development among typically developing children as well as among clinical populations. Children with varying diagnoses and developmental levels were included in this study. Therefore, it is necessary to interpret the results with caution. In addition, only one version of the Sensory Profile was examined in this study. There are two other versions available for 0-36 months and for adults age 18 and older. A short form is also available. Therefore, the results from this study using this version of the Sensory Profile cannot be applied to the other versions as they target different populations. There is also a paucity of literature indicating utilization of the Sensory Profile in research. There are also limitations inherent in the Sensory Profile measure itself. For example, the normative data suggests it may not be generalizable to a non-White, non-Suburban population. The Sensory Profile findings
need to be interpreted carefully for four year olds due to varying developmental levels and abilities characteristic of children at this age. Dunn (1999) emphasized that sound clinical reasoning then must be utilized upon interpretation of results. In addition, inherent in the nature of psychodynamic theory, which is generally based on observational studies, there were no assessment tools employed to directly measure ego functions. No observational data of subjects were provided. Therefore, the ability to generalize these findings is limited.
Chapter II

LITERATURE REVIEW

Introduction

The Sensory Profile is an assessment measure of sensory processing functioning used by psychologists although there are concerns about its utility due to its lack of grounding in psychological theory. Minimal research is found in the literature directly linking ego psychology theory with neuroscience and sensory integration theory. Each discipline discusses sensory regulation within its own literature. This review of the literature attempts to enhance the understanding of the relationship between the development of the precursors to the three ego functions (stimulus barrier, regulation and control of drives and affects, autonomous functioning) and the development of sensory processing abilities investigated in this study. This chapter attempts to integrate the current literature across these disciplines in order to provide evidence that supports the use of this assessment tool in psychology.

Ego Psychology/Ego Function Literature

Ego Psychology Theory

In terms of an historical perspective, ego psychology grew out of psychoanalytic theory, a comprehensive theory of personality. Sigmund Freud is credited as being the father of psychoanalytic theory (Bellak et al., 1973). Hartmann (1964) is known for further elaboration of ego psychological theory. His work set the stage for modern thinking about ego psychology. Freud’s original ideas about the structure of the mind involved the topographic theory. The term topography was used because Freud believed that there were mental apparatus or regions of the mind and that the mind was divided
into three dynamic systems that dealt with consciousness. These systems included the unconscious, which contained mental events that could not become conscious without difficulty, the preconscious, which contained mental events that could easily be made conscious, and the conscious, which described mental events that are in one’s awareness. Freud was originally interested in neurotic symptom formation in his patients. He believed that the tension between the unconscious and the conscious was central to the creation and alleviation of neurotic symptoms (Freud, 1895). However, he found that this theory did not adequately explain what he observed in his clinical work.

In 1923, Freud introduced structural theory to replace topographical theory. The terms id, ego, and superego were used to describe psychic structures or systems of psychic functioning. The id was referred to as the structure that represents instinctual drives, which is similar to Freud’s ideas about the unconscious. Freud (1923) stated about the id that its memory traces are sensory – visual, olfactory, auditory, or tactile, not verbal. He based this on clinical observations. Freud found that once repressed wishes and forgotten memories were made conscious and verbally expressed in analysis, symptoms would disappear. The structure of the id is characterized by primary process thinking (non-logical thinking). Primary process thinking is a primitive, undifferentiated mode of functioning. Primary process thinking is found in infants and very young children whereby wishes and impulses are immediately expressed. For adults, primary process mechanisms (displacement, condensation, and symbolization) are found in those with primitive mental functioning, in dreams, and in symptom formation.

The superego was introduced to account for the unconscious sense of guilt Freud observed in his patients. The superego is often described in terms of morality and is
thought of as the conscience. In 1923, Freud outlined four functions of the superego: (a) self-judgment, (b) prohibitions and injunctions, (c) sense of guilt, and (d) social feelings. Later, in 1938, Freud described the superego as consisting of internal mental representations of parental authority and the influences of society from the external world.

The term ego was introduced to describe the person or self, including the body. In fact Freud reportedly stated that he believed the ego is a bodily ego. (Blanck & Blanck, 1974). Freud was originally trained as a neurologist; therefore, he always contended that these mental constructs were neurologically based. Pine (1985) highlights the notion that Freud always intended for his work to be respected as science. Pine (1990) described there are “built-in apparatuses” within the human infant and that “the complex neurological apparatus given to us by evolution is preset to function at least in some important ways in relation to the environment in which it evolved” (pp. 85-86).

Bellak et al. (1973) defined the structures of the ego, id, and superego, as one would traditionally describe bodily organs, by their functions. Blanck and Blanck (1974) propose that Freud defined the ego as a “sense organ for perception, for thought processes, and thus for the reception of external and internal stimuli (p. 20). Bellak et al. also pointed out that, with regard to Freud’s structural theory and early work, there is a distinction between the ego as a structure in the mind versus the concept of the ego as the self that is separate, which came later in Freud’s writings. This literature review of ego functions includes work that has been written under the premise of the ego as a structure in the mind.
According to Pine (1985), psychoanalysis can be thought of as a developmental theory. In terms of one's psychological development, he emphasized the importance of the interaction between the inborn characteristics, or biologically based function, and the person's environment. Pine listed the inborn characteristics as including the capacity for bodily and object-related pleasures at various intensities; aggressive tendencies and their subsequent expression (destructive or assertive); and the ego apparatuses. The ego apparatuses are thought, perception, memory, motility, and affect. Pine (1985) believes these ego apparatuses "form the underpinnings for learning, internal signaling, and adaptation of all kinds (p. 15)."

Spitz (1945) is another theorist who talked about the importance of development and aimed to advance infant psychiatry as a discipline. He noted that the development of judgment, thought processes, and memory coincided with the development of ego functions. Spitz is well known for theories of critical periods in development. He postulated that a stage of development is influenced by the stage that preceded it. In fact, he said that if an aspect of development does not occur during a certain time, it would negatively influence future stages. Spitz is also well known for his study of hospitalism, in which he investigated primarily the effect of institutional care of infants from birth to one year from a psychiatric and developmental point of view. With regard to institutional care, data at the beginning of the 20th century indicated high mortality rates for infants within the first year of life (71.5% in Germany, 90% of infants in various institutions of Baltimore, and reportedly as many as 100% of infants at Randall's Island Hospital in New York). While mortality rates had improved at the time of Spitz study in 1945, it was observed that institutionalized children suffered from psychiatric disturbances including
antisocial behaviors, delinquent behaviors and they appeared of low intelligence. In the United States, this discovery led to the de-institutionalization of infants and the initiation of foster home care (Spitz, 1945).

Spitz’s (1945) study aimed to more clearly specify the factors that led to the deterioration of infant functioning in prolonged institutional care. Two factors already highlighted within the literature of the time included a lack of stimulation and the presence or absence of the infant’s mother. Spitz studied a total of 164 infants. Sixty-nine babies from one institution known as the Nursery, and 61 babies from a second institution, referred to as the Foundling Home, where included in this study. Spitz stated that the two institutions were in different countries of the Western Hemisphere, so he included a group of non-institutionalized children of the same age group living in their parents’ home in both countries in order to compare results. Information was gathered about the mothers of the babies, whenever possible. In addition, the Hetzer-Wolf baby tests were administered. These tests reportedly assessed six aspects of development including the development of perception, body mastery, social relations, memory, relations to inanimate objects and intelligence (capacity to understand relations between and insight into object functions). A profile or personality curve was then developed for each subject. Most of the tests and experiments conducted were recorded on 16 mm film so that action could be studied in slow motion.

In reporting results, Spitz (1945) established Developmental Quotients for the first third of the first year of life and the last third of the first year in order to compare the averages. In the parental home environments, the professional group (from a large city) reported an average of 133 for the first 4 months and an average of 131 for the last 4
months. In the village population (a small isolated fishing village), where conditions of housing, medical care, nutrition and hygiene were poor, an average of 107 was reported for the first 4 months and an average of 108 was reported for the last third of the first year. In the Nursery environment, a penal institution for delinquent girls, the average Developmental Quotient was 101.5 for the first 4 months and 105 for the last 4 months. The children in the Foundling Home, who were children of urban and Latin background who usually had socially well-adjusted, normal mothers who were unable to support themselves and their children, the average score at the end of the first 4 months was 124. The score for the last 4 months was 72.

Importantly, it was noted that the children in the fourth environment, the Foundling Home, started out relatively high but greatly deteriorated (Spitz, 1945). Spitz looked closely at this group and reported that the children suffered emotionally and physically from hospitalism, which he defined as "a vitiated condition of the body due to long confinement in a hospital, or the morbid condition of the atmosphere of a hospital" (p. 53). Specifically, despite excellent hygiene, from the third month on, the infants showed extreme susceptibility to infection and illness of any kind. Spitz compared the institutions in order to help explain how the children's functioning in the Foundling Home deteriorated significantly. In terms of comparisons between the Nursery and the Foundling Home, Spitz found that in contrast to the outcome at 1 year, the children in the Foundling Home started off with an advantage of coming from a background in which the mothers of the children are better adjusted emotionally and socially. In addition, both institutional environments were located outside the city with large gardens. Both have reportedly hygienic conditions. Regarding nutrition, most infants are breast fed until at
least three months. In terms of clothing, the gowns worn by the children and the blankets used are almost the same in both settings. In terms of medical care, it was also adequate with little variation observed between the groups.

More apparent differences were noted among the environments, however in other certain areas (Spitz, 1945). For example, in the Nursery children had at least one toy, while in the Foundling Home, there were initially no toys observed by Spitz. As time went on, more toys appeared and by the end of the yearlong study, each child had at least one toy. Spitz insisted it may have happened due to the presence of the research team. In terms of the children's visual radius, in the Nursery, the setting gave a friendly impression of warmth. The children could reportedly see the outdoors through the windows on both sides of the corridor and could see the bustle of activity at any given time of other infants with their mothers and socialization and play occurring. In addition, while in their cubicles, they could pull themselves up and be able to see the environment around them. When they turned six months, they were put into wards with older babies, where their visual fields were further enlarged and whereby they were able to play with other babies. In contrast, one side of the Foundling Home corridor was bleak, except for feeding time, when 68 nurses were around to feed and tend to the children's needs. There was a lack of activity most of the time. In addition, bed sheets were routinely hung over the cot railings, which did not allow the infants to see anything but the ceiling, giving the impression of solitary confinement, until they were old enough to stand up.

Regarding radius of locomotion, in the Nursery it was determined that the space in the child's cot provided a fairly satisfactory radius (Spitz, 1945). In contrast, in the Foundling Home, as noted above, most babies spent time in the supine position and when
it was time to turn from back to side, the mattresses were worn from their body weight and created a hollow, which confined the babies' activity, and made it difficult for them to move around. Many babies were observed at 10 and 12 months still on their backs playing only with their own hands and feet.

In terms of personnel, in the Nursery, there was a head nurse and three assistants who mainly taught child care skills to the mothers and supervised them (Spitz, 1945). The babies were generally cared for and tended to by their own mothers, a mother of another child, or a pregnant girl who was learn how to care for babies in preparation for the birth of their own child. In contrast, the Foundling Home children were only taken care of by their own mothers or wet nurses for the first couple of months for breast-feeding. After that, nurses cared for the babies where the ratio was one nurse to seven or more children. Spitz noted that these babies lacked human contact then for most of the day. At the third or fourth month when the Foundling Children were weaned and thus began to have less frequent opportunities for human contact, is when their development appeared to fall below normal.

Spitz (1945) concluded that as a result of the lack of progressive emotional development that ensues between mother and infant interactions due to the deprivation of mother or a caregiver substitute, the abilities of the babies in the Foundling Home to learn to walk or talk, or feed themselves were hampered (Spitz, 1945). Spitz further concluded that it was not a lack of perceptual stimulation that contributed to the babies' deterioration. The deterioration was due to the lack of human relationships within the baby's perceptual world that prevented the development of mother representations characteristic of children at the age of one year. Disturbingly, it was noted that by the end
of the second year, the Developmental Quotient fell to 45, which corresponded to a mental age of about 10 months.

Therefore, Spitz (1945) highlighted in his discussion that while institutional care can be destructive in the first year of a child’s life, this study demonstrated that many of the negative factors could be compensated for by the increased intensity of the mother-child relationship, as in the example of the Nursery environment. Spitz also noted that at the end of the first year of life, the babies in the Foundling Home reacted to strangers by exhibiting either extreme friendliness, anxious avoidance of inanimate objects, or a generalized anxiety in which the infants would scream indefinitely. In the Foundling Home children, unusual stereotypic behaviors seen in catatonia were also noted. Spitz concluded that as a result of this investigation it would be necessary to take into consideration the importance of adequate and satisfactory infant-mother relationships during the first year of life, especially due to his concern that neglect during this period could cause irreparable psychic damage. Spitz’s theory indicated that if there were a deficiency in the maturational or psychological processes, or a lack of synchronicity between maturational and developmental factors, a deviant integration would result, creating a developmental imbalance (Spitz, 1945). Thus, ego functions will be out of balance. This clearly has implications for a child’s future development both biologically and psychologically.

A review of the literature of the development of ego functions includes a discussion of Freud’s ideas about the principal characteristics of the ego. These characteristics included “self-preservation; becoming aware of, and dealing with, external stimuli; controlling voluntary movement; and learning to influence the outside world to
our own advantage through activity” (Bellak et al., 1973, pp. 51-52). Other characteristics include the ego’s role as a “barrier against external and internal stimuli” (Bellak et al., 1973, p. 52). As a matter of fact, according to Bellak et al. (1973), “The ego attempts to avoid overly strong stimuli.” (p. 52). The ego does this by using anxiety as a guide to recognizing danger. Bellak et al. discussed that the ego serves a self-regulating function. The ego is also characterized by its ability to organize and control motor actions and perception, test reality, and is responsible for delay in gratification behavior.

**Ego Functions**

The three ego functions utilized in this research study and discussed in this section are based on Bellak, Hurvich, and Gediman’s (1973) theory of ego functions. The first ego function to be discussed is the stimulus barrier. According to Bellak et al. (1973), the stimulus barrier plays a crucial role in the development of children. The role of the stimulus barrier is to mediate the intensity of external stimuli to a more manageable level. Freud believed that the stimulus barrier was responsible for scaling down external stimuli within the nervous system (Freud, 1915). Bellak et al. indicated that brain pathology occurs when satiation experiences of stimuli are lacking, which he refers to as stimulus hunger. The concept of stimulus hunger is important because it theoretically accounts for the behavior of those who seek stimulation. For example, those who have experienced an overload in a system can have a lifelong experience of stimulus hunger. It appears it becomes difficult to contain the hunger and there exists a constant need for discharge. This is similar to the paradox of someone who attempts to reduce the effects of stimulation through sensory seeking behavior. Ideally, the stimulus barrier is
said to function by allowing intake of an optimal amount of stimulation in addition to preventing an overload. In some stimulus-seeking individuals their threshold of sensory seeking behavior is thought of as a psychological defense. For example, an individual may be threatened by the closeness of object relationships but may instead direct this energy elsewhere, to a less threatening stimulus. In these circumstances, overt behavior that appears as a result of overstimulation may not be directly related to or caused by the stimulus at hand.

Much debate is found in the literature, according to Bellak et al. (1973), regarding Freud’s notion of the physical presence of a stimulus barrier found in the brain. They discussed the view that the stimulus barrier is a complex ego function. Some theorists postulate the stimulus barrier is a threshold measure (Bergman & Escalona, 1949; Martin, 1968). However, Bellak et al. (1973) argued that while there may be a genetically endowed predisposition for threshold potentials for stimuli in the various sensory modalities, the ego is responsible for “organizing and integrating” the sensory experiences (p. 220). Freud reportedly described the stimulus barrier as a “potential ego, ego root, or nucleus” (p. 221). Many agree that the neonate is born with an innate stimulus barrier (Blanck & Blanck, 1974). Blanck and Blanck (1974) describe the function of the stimulus barrier (along with a maternal figure) as a regulatory process. They noted that if the infant is unable to adequately internalize the ability to self soothe, the stimulus barrier mechanism fails, ego regression ensues, and the capacity for self-regulation is lost. Therefore, the stimulus barrier also has an integrative, adaptive ego function. “Stimulus barrier determines, in part, how resilient a person is or how he
readapted after the stress and impingements are no longer present” (Bellak et al., p. 226). Thus, the stimulus barrier serves as an adaptive regulator (Bellak et al., 1973).

The role of the ego function of regulation and control of drives and affects is understood to be concerned with one’s ability to delay of gratification, and tolerate disappointment, frustration, anxiety and depression (Bellak et al., 1973). Bellak et al. described the characteristics of impulsivity, acting out, and poor delay versus inhibition and over-control as the main concerns of this ego function. The focus of this ego function is also “on the prositivity-maturity of defenses and their success in terms of the presence of anxiety, depression, and other dysphoric affects” (Bellak et al., 1973, p. 125). Further, theorists have postulated that children with poor control of instinctual drives may display aggressive outbursts (Bellak et al., 1973 & Frosch & Wortis, 1954). Similarly, these children appear to demonstrate superego defects and display antisocial and/or psychopathic clinical profiles.

The concept of delay is a central aspect of the regulation and control of drives, affects, and impulses ego function. In fact, Singer, Wilensky, and McCraven (1956) stated that an ability to delay gratification and inhibit motor responses is a key aspect to establishing an identifiable self. Freud’s theory of delay of gratification includes the pleasure and reality principles. The pleasure principle relates to primary process, which is conceptualized as pressure for immediate discharge. The reality principle is characteristic of secondary process, which is conceptualized by the ability to delay discharge. Emotional disturbance often results from difficulties experienced by the individual during the development of the ego’s ability to delay gratification and move from primary process (primitive) to secondary process (reality) ideation.
In addition to the ability to delay, the ability to control one’s impulses is another important aspect of this ego function. Bellak et al. (1973) discussed how most individuals do react in an impulsive manner at times. However, some psychiatric diagnoses involve impulsivity as a central aspect to the disorder. In individuals with antisocial characteristics and impulse control disorders, there is an inability to delay a response or behavior on the basis of the pleasure principle and primary process thinking. Often this inability is related to an individual’s attempt to escape or deny depression. For example, one may impulsively behave and become depressed when they are not able to receive what they want immediately (Fonichel, 1945). Impulsive behavior is then seen as ego-syntonic. Further, engaging in the behavior is pleasurable so the individual has difficulty resisting the urge to express the impulse.

Some theorists have divided impulse control disorders into different types. Frosch and Wortis (1954) hypothesized that there are two groups of impulse control disorders. They include symptom impulse disorders and character impulse disorders. These authors postulated that these impulse control difficulties are due to an inadequacy of control apparatuses. The control apparatuses referred to can be physiological or psychological. Physiologically, the control apparatus refers to the congenital, constitutional innate potentials and abilities in terms of feelings, motility, and reactability. For example, an aspect of an infant’s control apparatus can be seen in its motility patterns, which are biologically based. Psychologically, the control apparatus “develops out of an undifferentiated state with id and ego potentials” (Frosch & Wortis, 1954, p. 136). The control apparatus develops psychologically through the objects the child interacts with in the environment. The inadequacy of the control apparatus to contain an impulse may be
due to a direct deterioration of the apparatus (encephalitis, brain injury) or due to an increase in the strength of the impulse. Symptom impulse disorders include impulsive neuroses, perversions, and hysterical crises. Character impulse disorders include impulse difficulties epitomizing the whole personality (Frosch & Wortis, 1954).

Bellak et al. (1973) noted that either insufficient or too much frustration during early development can affect one’s capacity for impulse control. Redl and Wineman (1951) described the issue of low frustration tolerance as it relates to impulsiveness and poor regulation and control. These authors found that low frustration tolerance can be seen in the child in two ways. One example is the child who will not be frustrated and insists on immediate gratification. The other way is described by an example in which a child can tolerate some frustration, but is then not able to tolerate the aggressive, anxious feelings that result (Redl & Wineman, 1951). They based these conclusions on a study involving juvenile delinquents. While they did not employ a control group, the authors compared their results with ego development that would typically be seen in normal children (Redl & Wineman, 1951).

Redl and Wineman (1951) conducted a study at a residential facility for 19 months called the Pioneer House, in Detroit, MI. It was intended to be an experimental group therapy home for a small group of male children ages 8-11 that ran from December, 1946 through June, 1948. Children attended school in the neighborhood surrounding the group home. Referrals were obtained through social agencies and local institutions. Six out of 35 children referred were initially admitted to Pioneer House. Three of the initial six children were discharged due to their severe pathology and a need for a more restrictive environment. The other three boys remained at the facility for the
entire 19 months. Another boy lived there for 17 months. Another lived there for 15 months. Five other children were there for 1-3 months prior to the closing of the home. In terms of criteria for participation in the home, all children were of normal intelligence with no significant medical histories or problems. All children selected were described as demonstrating delinquent behavior patterns that included symptoms of destructiveness, hyper-aggression, and anti-social behaviors. The children selected to be part of the program were also described as coming from a similar low, socio-economic level. No ethnic or racial information was provided (Redl & Wineman, 1951).

Redl and Wineman (1951) based their experimental group home study on psychoanalytic theory principles. The main goal was to explore juvenile delinquency from a psychoanalytic perspective. Specifically, the authors were interested in looking at ego function development and the development of impulse control. This was accomplished through analyzing carefully taken notes about individual cases. No statistical analyses were employed. They found that delinquent children did not possess adequate coping techniques to manage fear and anxiety. These children reacted to fear and anxiety by either fleeing or avoiding or by becoming destructive and attacking. In addition, Redl and Wineman found that impulsive children were less able to reduce temptation. These children were unable to recognize or respond to dangerous or guilt producing temptations. They described that these delinquent children presented with superego weaknesses. Due to such serious ego defects, the danger signal function is also usually found to be deficient (Redl & Wineman, 1951).

Acting out is yet another important aspect of the regulation and control of drives, affects, and impulses ego function, according to Bellak et al. (1973), who defined acting
out as more highly organized impulsive behavior. Acting out is reportedly most frequently found in people with impulse neuroses. The goal of acting out involves the avoidance of displeasure rather than gaining pleasure. Fenichel (1945) noted that people, who experience oral fixations, demonstrate high narcissistic needs, who cannot tolerate tension, and have experienced trauma, may be predisposed to acting out.

Bellak et al. (1973) noted that there are various clinical manifestations of acting out. They include: episodic acts that make unconscious statements; acting out due to unrealistic perceptions and impulses; hysterical acting out where there are rapid mood swings in a short period of time; acting out during a dissociative state; psychopathic reactions; character disorders; and excitability in people who inappropriately express affective states. Further, Bellak et al. described acting out as being a complex act that is largely unconscious. It also may serve as a cathartic or abreactive experience in which tension becomes reduced. Often, those who may have been habitually over-stimulated as a child may act out based on the need to discharge the tension. Eckstein (1966) agreed that the precursors of acting out are found in the preverbal period of development. Others who act out may have a low functioning stimulus barrier (Bellak et al., 1973).

Bellak et al. (1973) also discussed the notions of inhibition-overcontrol and the ability to tolerate anxiety and depression as the final key aspects of the regulation and control of drives, affects, and impulses ego function. In general, inhibitions affect the regulation and control of drives, affects, and impulses. There are various forms of inhibitions. One explanation is that there may be a decrease of availability of energy to the ego. One form of inhibition involves self-punishment, according to Anna Freud (1966). Another type of inhibition is seen as a means to avoid pain or an activity that has
taken on the significance of a forbidden impulse (Bellak et al., 1973). When the avoidance becomes extreme and pathological, this type can be seen as an overcontrol of drives, affects, and impulses (Freud, A., 1966). The ability to tolerate anxiety and depression is necessary for successful ego development (Zetzel, 1965). He postulates that if an individual is not able to tolerate these affective states, he/she is predisposed to ego defects and psychopathology.

Autonomous functioning is defined by Bellak et al. (1973) as the “degree of freedom from impairment of apparatuses of primary autonomy (attention, concentration, memory, learning, perception, motor function, intention)” and “the degree of freedom from impairment of apparatuses of secondary autonomy (disturbances in habit patterns, learned complex skills, work routines, hobbies, and interests)” (p. 78). According to Hartmann (1939), primary autonomy refers to the fact that ego development is not only based on instinctual drives and the impact of external reality, but also on inherited characteristics. These characteristics as apparatus are perception, intention, object comprehension, thinking, and language. These characteristics make up what Hartmann called the conflict-free ego sphere. In other words, these characteristics do not develop based on intrapsychic conflicts. Secondary autonomy is described by Hartmann as a continuum of degree of autonomy and includes the ability of the ego to function and not regress when conflict does arise. Zetzel (1969) added that the ability to tolerate affect, including anxiety and depression, is also included in secondary autonomy. Further, secondary autonomy of ego interests, habits, and skills are a result of the process of neutralization. Neutralization is described as the process in which libidinal and aggressive energies are moved from the instinctual to the non-instinctual mode making the energies
available to the ego (Blanck & Blanck, 1974). Hartmann stated that both physical maturation of the perceptual apparatus and learning experiences affect the development of ego autonomy.

Despite Hartmann's notion of a conflict-free ego sphere, disturbances in autonomous functioning can be found. According to Bellak et al. (1973), visual, auditory, motor, and tactile disturbances without a medical cause were often seen as manifestations of hysteria. It is noted that attention and concentration, memory, and speech and language difficulties are found in patients with severe and mild pathology. When the ego functions of habit patterns, skills, routines, hobbies and interests, learning, intentionality, and motility are impaired, one may have difficulty with completing activities of daily life (Bellak et al., 1973). Explanations for this regression include the idea that the energy is coming too close to the instinctual mode or that the impairment is a result of a defensive attempt to protect the self from anxiety and the threat of ego dissolution (Hartmann, 1939). For example, according to Bellak et al. (1973), a healthy autonomous ego in a child is able to establish an inner degree of ego autonomy and a balance between active and passive modes of behavior. A consistent ability to regulate inner and outer states can be observed in this case. However, when a child feels helpless and is not able to manage the impingement of either inner or outer stimuli; his motoric abilities will be affected.

Bellak et al. (1973) and his colleagues were able to identify 12 ego functions, three of which were discussed in detail above and employed in this research study. They accomplished this through theoretical considerations of the time, clinical observations, and limited laboratory studies (Bellak et al., 1973). They provided a review of the development of attempts to measure ego functions in adults in a standardized way.
Through a review of the past and current research literature, no specific scale to measure ego functioning in children was found. Instead, research studies indicated that aspects of ego functions have been studied through the use of various psychological assessments. These assessment batteries have included neuropsychological measures, standardized psychological measures, and projective assessments (Davids, 1969; & Singer et al., 1956). Only one study was found in which an attempt to study ego functions in children was made. In this study, which will be described below, the ego functions of aspiration, inhibition, time estimation, and delayed gratification were examined comparing disturbed and normal children (ages 7-11).

The assessment methods utilized included only one standardized measure, the Minnesota Rate of Manipulation Form Board (Lickert & Quasha, 1955). The researcher used it in order to assess the rate of manipulation and level of aspiration. The other assessment measures included: a mimeographed sheet containing a spiral, in which a child essentially traced a path through a maze and was timed, in order to measure motor inhibition; an opportunity for a child to estimate a 30 second passage of time period, in which the examiner kept a stop-watch from view and recorded the child's response; and a list of questions that assessed delay of gratification. These questions included, "If I gave you 10 cents, what would you do with it?" followed by "If I gave you one dollar, what would you do with it?" (Davids, p.62).

Davids (1969) predicted that "(a) basic ego functions are less well developed in younger children than in older children, and (b) at each developmental level, emotionally disturbed children evidence less adequate ego functioning than do normal children" (p. 61). Following the study, Davids acknowledged that his findings indicate no differences
were found between groups regarding level of aspiration. However, he did find that within the emotionally disturbed group, children who persevered and had better time orientation abilities also had higher IQ scores. He also found that regarding the ability to voluntarily inhibit motor movements; emotionally disturbed children had more difficulty than normal children. He noted these children often experienced difficulty in the classroom complying with classroom rules and expectations. Most of the subjects tended to be at least 2 years behind academically. In addition, the emotionally disturbed subjects were more likely to be diagnosed with Hyperkinetic Impulse Disorder. These children presented with low frustration tolerance, restlessness, and were more active than typical subjects.

In psychoanalytic theory, an important ego function is the ability of the ego to integrate events from the past, present, and future within a person and to be able to delay gratification when necessary to attain long-term goals. Davids' findings confirmed that the development of time estimation, goal planning and the ability to complete tasks, are in keeping with psychoanalytic theory; emotionally disturbed children possess weak ego structure. Therefore, their ability in this area is impaired. Similarly, he found that in regard to the ability to delay gratification for children aged 7-11, children in the emotionally disturbed group were much more likely to seek immediate gratification as compared with the normal group. Importantly, in his discussion section, Davids cautioned that empirical research is needed to increase our understanding of ego functions in children and to improve our ability to intervene with these children prior to adulthood when the damage appears irreversible. Unfortunately, based on a review of the current literature, this empirical research has yet to be conducted.
Additionally, this study by Davids (1969), which attempted to provide empirical evidence, consisted of several limitations. A major limitation included the lack of randomization of the sample and small sample size. Davids used 34 "normal" male subjects from a public school and compared this group with 38 emotionally disturbed male subjects from a residential psychiatric facility. He studied 7, 9, and 11-year-old boys. The normal group consisted of 13 seven year olds, 10 nine year olds, and 11 eleven year olds. The emotionally disturbed group consisted of 11 seven year olds, 13 nine year olds, and 14 eleven year olds. Davids noted that he believed that the smaller number of younger children in the emotionally disturbed group might have limited the ability to generalize the findings. The emotionally disturbed group was made up of 4 subjects diagnosed with schizophrenia, 4 subjects were classified as neurotic and 30 were classified with severe behavior disorders. These types of classifications may have also had an impact on the data. Another limitation included the lack of females in this study. There is also a lack of clarity regarding the definition of ego functions. Davids' study did not assess the same ego functions as defined and outlined by Bellak et al. (1973). Finally, a major limitation noted is noted in the lack of standardized measures included in the study. Only one standardized measure, the Minnesota Rate of Manipulation Form Board, was included in this study. In addition to the need for more empirical research, it is highlighted again that there is a need to identify standardized measures that can be used in empirical studies to further knowledge in this area.

Following the discussion of ego psychology and ego functions literature, a brief review of the history of neuroscience and an overview of the current neuroscience
literature, especially as it relates to the field of ego psychology and sensory regulation, will be presented.

Neuroscience Literature

Historical Perspective

At the beginning of the nineteenth century, brain research in psychology focused on a theory created by Franz Joseph Gall known as phrenology (Posner & Rothbart, 2007). Phrenology postulated that an understanding of the size and importance of the brain tissue underneath bumps on the head could be gained by "reading" the bumps on one's skull. Cognitive abilities and aspects of one's personality could supposedly be predicted. While the theory of phrenology was ultimately disproved, other evidence for localization of function of the human brain was found (Posner & Rothbart, 2007).

According to Posner and Rothbart, Broca, in 1861, studied areas of the brain, which had been damaged. He found that certain specific cognitive functions, such as language, might be found in specific areas of the brain. In addition, in the '960's, Sperry studied "split brains", which referred to brains in which the cerebral hemispheres were separated. It was found that the left hemisphere is dominant for language and the right hemisphere is dominant for spatial processes, attention, and aspects of emotion. Hermann von Helmholtz measured another important contribution, the speed of mental operations, or neural conduction, also in the mid-nineteenth century (Posner & Rothbart, 2007). Brain research continued to progress throughout the following century. However, a discussion of current research that is relevant to this study will now follow.

Two important developments in brain research over the last twenty years have enabled researchers to observe the human brain in action. These developments include
neuroimaging technology and the discovery of the role of DNA as the basis of the gene, which has led to the mapping of the human genome in 2003 by the Human Genome Project coordinated by the U.S. Department of Energy and The National Institutes of Health. Posner and Rothbart (2007) described that:

Genes lay down the basic organization of the brain and the time course for the birth and death of neurons, and influence how people differ. Together with experience, they play a substantial role in determining the organization of neural networks important to attention and memory. (p. 10)

Gene structures vary from person to person. These differences found in gene structures are called polymorphisms, which account for individual differences in attention and temperament, and to how children react in learning environments (Posner & Rothbart, 2007).

Neuroimaging methods that allow direct access to study neural pathways and structures are now available to researchers. Neuroimaging is defined by Posner and Rothbart (2007) as “a wide variety of methods designed to sense activity within large populations of neurons in humans from outside the skull” (p. 30). These methods include the positron emission tomography (PET) and functional magnetic resonance imaging (fMRI), which involve the study of blood circulation changes (Posner & Rothbart, 2007). Reportedly, the local blood supply to neurons changes when they become active. Blood flow changes can be picked up from outside the head and measured through these imaging methods.

In the PET method of neuroimaging, a radionuclide is injected into the bloodstream, which emits positrons, or positively charged particles. These positrons are
discharged through the skull as photons and hit the sensors or detectors surrounding the head. The recorded radioactive events are related to rate of blood flow, since the radioactivity is found within the blood, as the blood flows through the brain (Posner & Rothbart, 2007). Blood flow is most commonly examined with the isotope of oxygen when using the PET neuroimaging method to study perceptual and cognitive processes. Other isotopes that measure glucose utilization or that bind to specific receptors of interest are also used at times.

The fMRI is non-invasive and is conducted by placing an individual in a tube, which is a large magnetic field. The magnetic field picks up changes in oxygen within the blood. The amount of oxygen in the blood changes when neuronal activity occurs. The hemoglobin that carries the oxygen is paramagnetic. Therefore, these changes in oxygen are able to be detected and are recorded as images of local brain activity (Posner & Rothbart, 2007). Most brain research on cognition utilizes the fMRI method. Magnetic resonance imaging (MRI) is used to measure anatomical structures of the brain. Together, the fMRI and the MRI can study and provide information about both the blood oxygenation and the anatomy of an area in the brain while doing during a task, for example.

In addition to studying brain images, the amount of time it takes for areas of the brain to become activated under different experimental conditions has also been studied. Psychologists can measure electrical activity from the scalp through the event related potential method (ERP) (Posner & Rothbart, 2007). These data can reportedly be combined with PET and fMRI data. For example, the visual system had been reportedly mapped out through combining results of these methods (Posner & Rothbart 2007).
While these methods of neuroimaging provide a wealth of information to the researcher to aid in understanding brain function and in diagnosis and treatment of disorders, it is important to note that the PET scans are not used for individuals under 18 year of age due to the use of radioactivity. While fMRI methods are safe to use even with infants, it is often difficult to control for movement during testing. Therefore, the most commonly utilized method of imaging for research with young children is the ERP.

In terms of neuroscience, Posner and Rothbart (2007) described behavior as an interaction between neural networks and the environment. The structure of neural networks depends on genes, which specify the proteins that make up the nervous system, found in chromosomes. While one's genetic makeup will not change, environmental influences can alter how genetic information is expressed within neural networks (Posner & Rothbart, 2007). This research is reported in its infancy. Current research emphasis is on how genetic variations among individuals can influence differences in intelligence and temperament.

Posner and Rothbart (2007) discussed that current temperament research has been focused on specifying biological processes that may link social development of youngsters to later expression in the adult. Temperament appears to develop at different ages along with systems of attention, arousal systems, and motor functioning. In the infant, self-regulatory capacities to manage reactions to the impingement of stimuli emerge. Effortful control is a self-regulatory capacity, which along with the executive attention system, develops in the second year of life. Posner and Rothbart stated that in addition to self-regulatory capacities, other dimensions of temperament include
soothability, perceptual sensitivity, attentional focusing, activity level, extraversion, fear, and anger-frustration.

Regarding the origins of temperament, Posner and Rothbart (2007) reported that temperament comes from "a person's genetic endowment, but it both influences and is influenced by the experience of each individual" (p. 46). Further, they believed that "As experience accumulates, temperament becomes the basis for individual differences in personality in the older child and the adult" (p. 46). Research emphases have been focused on tying dimensions of temperament and personality, some of which have also been the focus of this study, emotional reactivity, sensory seeking, and attention/inattention, to genes. Posner and Rothbart indicated that research conducted has found a dopamine-4 receptor (DRD4) gene that is related to sensation seeking. Posner and Rothbart reported that:

This gene has a polymorphism in which various numbers of 48 base pairs are repeated. The 7-repeat version has been associated both with the childhood disorder of inattention and hyperactivity (ADHD) and with sensation seeking as normal temperamental variation of extraversion. (p. 52)

Further research on individual differences is reportedly being conducted to tie genes, regions in the brain, and behavior together (Posner & Rothbart, 2007). Schore (1994) and Kraemer (1992) noted that within the infant's social environment, the caregiver's behavior is thought to be a mediator that influences genetic predispositions.

Development of Attentional Systems

In terms of brain development, according to Posner and Rothbart (2007), the nervous system continues to develop throughout the life span. While it had previously
been thought that there were critical periods for development, evidence has proven that is not necessarily the case. Infants are born with only the deepest cortical layers developed. The basic formation of the brain continues to develop at a rapid pace post-natally. The most synaptic activity is seen from birth through puberty. Following puberty, it is believed that there is less synaptic activity and density. In addition, the process of myelination also occurs throughout childhood. Myelination is the process by which nerves become covered by myelin (protein) sheaths, which enable faster communication between nerves.

The orienting attention system is said to be the brain system in which the newborn infant begins to control or regulate their behavior and affective states. In this context, researchers and neuroscientists again highlighted the importance of the infant-caregiver relationship in the development of this system. This thinking about the development of the capacity for self-regulation being mediated by a co-regulating maternal figure is in keeping with ego function theorists, as noted above (Greenspan, 1989; Posner & Rothbart, 2007; Schore, 1994). Shonkoff and Phillips (2000) reported that some of the elements of early caregiving regulate brain neurochemistry. An example of an element includes breast-feeding, in which the fats and sugars in breast milk stimulate taste receptors that are linked to opioid pathways, producing a mild analgesic effect. In addition, tactile stimulation of the oral region in infants also affects brain pathways that control distress. Posner and Rothbart reported that although it is not fully known how cell migration, synaptic density, and myelination relate to the development of self-regulatory capacities, there is enough evidence to hypothesize that there are connections between
specific attentional systems and neural activity. Posner and Rothbart (2007) emphasized that continued research in this area will most likely support these hypotheses.

Regarding neural network development of attentional systems, experiments have been conducted utilizing the Attention Network Test (ANT) developed by Posner and Rothbart (2007). On the ANT, subjects are given the task of differentiating as quickly as possible whether or not the stimulus (the middle target arrow) is pointing to the left or right following a cue that the target is about to come into view. The stimulus is either presented alone or with distracters. The ANT reportedly measures three aspects of attention during this task. These aspects include the efficiency of the attention network to resolve a conflict, which is the executive network; the efficiency of the alerting network; and the efficiency of the orienting network. Children have been given the ANT while receiving fMRI studies. Strong findings have indicated that the ANT is indeed a valid measure and that many areas of the brain are activated during the administration of the measure. The active brain areas for the alerting network include the thalamus and areas in the posterior and frontal cortex that are related to the brain's norepinephrine system. The alerting network is specifically found in the area of the midbrain called the locus coeruleus, which is the source of the neurotransmitter, norepinephrine. The role of this network is to perform the function of acquiring the alert state. Areas of the brain activated in the orienting neural network include the superior colliculus, pulvinar, temporal parietal junction, superior parietal lobe, and the frontal eye field. The neurotransmitter acetylcholine is the modulator of this system. The role of this network involves orienting attention to sensory events. The executive neural network is focused on the lateral prefrontal lobe, basal ganglia, and the anterior cingulate gyrus. The neurotransmitter
associated with this network is dopamine. The role of this network is the maintenance of
continuity of behavior when conflicting responses are called for (Posner & Rothbart,
2007).

Executive attentional functioning has been studied in adults and children. In fact,
ADHD studies demonstrated that there is a striking abnormality measured in parts of the
brain of ADHD subjects when subjects are engaged in tasks that require measurement of
reaction times and when they are required to perform a conflict task. Specifically, brain
studies of children with ADHD have shown abnormalities in the right frontal cortex and
in parts of the basal ganglia including the globus pallidus and caudate nucleus (Posner &
Rothbart, 2007). It is interesting to note that much of what is discussed above appears to
be consistent with, and an elaboration of, key concepts discussed regarding the
attention/distractibility factor on the Sensory Profile and the related autonomous ego
function, which is the ability of the self to perform tasks free from distractions, for
example, discussed earlier in this chapter. Researchers describe neurological evidence
that encompasses aspects of these notions.

Posner and Rothbart (2007) explored the notion of effortful control and indicated
that it is related to the ability to monitor for conflict, an executive attentional network
function, and the ability to inhibit responses to stimuli. The former is found to be related
to anterior cingulate functioning. The latter appears to be related to lateral prefrontal
areas. Delay of gratification is an ego function that relates to the factor of emotional
reactivity on the Sensory Profile examined in this research project. Reportedly,
preschoolers were measured on their ability to wait for a preferable treat rather than have
the already accessible treat. The results indicated that those who were better able to delay
gratification were reported as having better self-control and abilities to cope with stress, temptation, and frustration. Further, the ability to delay gratification predicted parent reports of attentiveness, concentration, competence, playfulness and even intelligence as the children became adolescents. Remarkably, follow-up studies were conducted into adulthood and those subjects that could delay gratification as pre-schoolers continued to demonstrate a capacity for goal-setting and self-regulating abilities. Posner and Rothbart stated that they recommend conducting longitudinal research further investigating the developing executive attention network and effortful control.

Posner and Rothbart (2007) posited that effortful control is also connected with the ability to regulate aggression by controlling emotional reactivity, another factor studied in this investigation. Research has demonstrated that 4-6 year old boys with good attentional abilities were better able to deal with anger by using verbal methods rather than becoming aggressive and acting out in a hostile manner. It was also reported by Posner and Rothbart that “Effortful control may support empathy by allowing the individual to attend to the thoughts and feelings of another without becoming overwhelmed by their own distress” (p. 138). Effortful control provides the attentional flexibility needed to recognize the negative affects of the consequences of one’s actions, and to recognize the negative consequences for the other person. Effortful control links negative outcome, action outcomes, and moral principles.

Neurological Development of Regulatory Functions

One of the first ways in which the infant begins to learn to self-regulate is reportedly through the visual system (Kraemer, 1992; Posner & Rothbart, 2007; Schore, 1994). The visual system is reportedly the best understood sensory system by
researchers. The development of the visual system is connected with the development of the attentional system. An infant's growing visual system capacity demonstrates the ability of the infant to voluntarily control their gaze, which is an important aspect of attention. With longer periods of awareness, an infant begins to explore their environment, especially through their visual system. Posner and Rothbart (2007) and Schore (1994) also reminded the reader that this is achieved through the caregiver's involvement. The caregiver helps the infant learn to attend to visual stimuli as a means of quieting a baby who is in distress, especially in Western cultures. Research conducted on infant gaze demonstrates that infants look away to control negative affect. Correlations were found among children who were able to disengage attention in order to decrease negative affect as toddlers and their ability use distraction strategies when in arousing situations to delay gratification as 4-5 year olds.

In addition to the visual system, Schore (1994) found that based on infant research and neurobiology, self-regulation also occurs through the influence of the infant's affective interactions with their social environment. These experiences will have permanent influences on the maturation of the brain structures and the capacities for self-regulation. Scioere reported that the brain structures involved in this process are found in the anterior undersurface and the interior of the cortex found in the right hemisphere. The role of the right hemisphere is said to involve the processing of affect and in the regulation of inner states (Posner & Rothbart, 2007; Schore, 1994). The structural system is mediated by the orbitofrontal cortex, which is the cerebral cortex involved in social, emotional, and self-regulatory processes (Schore, 1994). Further, Schore stated that:
Due to its unique and extensive interconnections with a number of subcortical systems, it represents the hierarchical apex of the limbic system. A critical period for the maturation of this prefrontal structure exactly overlaps the temporal interval extensively investigated by both attachment and psychoanalytic researchers. (p. xxx)

Again, the link between the importance of the infant-caregiver relationship and its influence on the development of the corticolimbic system in the right hemisphere, which is involved in the affect processing of affect and self-regulation, is emphasized (Schore, 1994).

*Neurological Development of Affect/Emotional Regulation*

In terms of the neurological development of affect or emotional regulation, Schore (1994) noted that the connections between the cortical and subcortical areas of the limbic system were of importance. Indeed, Posner and Rothbart (2007) noted that closely connected to the limbic area of the brain is the anterior cingulate, found in the frontal midline of the brain. The anterior cingulate cortex is thought to act as a bridge between attention and emotion and is critical for self-regulation (Davidson, Pizzagalli, Nitschke, & Putnam, 2002). According to research studies, when there is activation of the ventral part of the anterior cingulate, an awareness of emotion is what is reported by subjects rather than the emotion itself. When emotion is processed neurologically, there are simultaneous pathways that route information. Information about object qualities of a stimulus is routed through sensory pathways, while information for an emotional analysis is routed to the limbic system and amygdala. Information from the amygdala initially influences one’s emotional analysis of a situation and subsequent behavior. Further
sensory information gained over time can change the response as needed. Once the amygdala is activated, autonomic reactions through the hypothalamus occur, while motor activation occurs through the corpus striatum (Posner & Rothbart, 2007; Zald, 2003).

The amygdala has received much attention and has been researched in the area of emotionality (Posner & Rothbart, 2007; Zald, 2003). Shonkoff and Phillips (2000) reported that the amygdala appears to be fully mature by the age of 1 year in the human infant. The amygdala is also closely connected to the limbic structure. It responds more strongly to novel stimuli. The amygdala becomes activated when exposed to aversive stimuli and in the processing of negative emotions, which includes fear. Anticipatory anxiety, sadness, frustration, anger, guilt and discomfort are other dimensions of negative emotionality. Neurochemicals that include dopamine and serotonin from the midbrain and gonadal and corticosteroidal hormones that circulate throughout the region regulate these negative affect systems. The amygdala regulates heart rate, behavioral inhibition, facial and vocal expression, heart rate, and startle potentiation. Davidson et al. (2002) reported that structural and functional abnormalities of those with depression have been discovered through neuroimaging techniques. In infants and young children, frequent and/or prolonged periods of stress can negatively affect future development because the stress system function of the amygdala is thought to be become reactive, putting other growth oriented systems of the brain on hold (Shonkoff & Phillips, 2000). While research has not been conducted on human infants, animal studies reviewed indicate that environmental experiences of stress, neglect, and trauma within a caregiving relationship can negatively alter the course of brain development. It is hypothesized that this is the case for human infants as well (Shonkoff & Phillips, 2000).
Posner and Rothbart (2007) discussed further that in the anterior cingulate, an ancient structure within the brain of primates, a unique cell in Layer V has been found only in humans and great apes. The exact function of these cells is unknown, however, based on their proximity to vocalization areas, it is speculated that these cells may link emotional and motor areas and may be responsible for vocalizations that convey emotional meaning. There may also be a connection between the Layer V of the cingulate and attention. Posner and Rothbart stated that dopamine receptors are found in this layer of the cingulate. This finding, along with the recent discovery of the dopamine-4 receptor, found through ADHD genetic studies, indicate that further research in this area is needed in order to better understand the role of this cell and the cingulate in emotional and attentional processing.

Shonkoff and Phillips (2004) also discussed how children's reactions to stress could be affected by their attachment status. These authors reported that the presence of a warm, loving caregiver with whom one is securely attached mediated the effects of environmental distress in infants. For example, cortisol levels were examined in one study in which toddlers, who were accompanied by their caregivers, were exposed to a clown who invited the children to come and play. The toddlers who were more securely attached reportedly showed no increase in cortisol levels, even if they overtly behaved in anxious or fearful way. In contrast, children who were found to be insecurely attached reacted in an anxious and fearful manner also, but demonstrated elevated levels of cortisol. It is important to note that the attachment status of the dyad had been determined at a previous time in the context of the strange situation assessment.
Neurological Development of Cognitive Processes and Memory Systems

Early cognitive development is characterized by a lack of adequately developed brain structures, according to Hutterer and Liss (2006), who compared current psychobiological findings about this area of development with Freud’s notion of primary process thinking. Evidence for primary process thinking involves the lack of executive functions that are controlled by the frontal lobes. In fully developed brains, cognitive functions appear to be located in the dorsal area of the anterior cingulate (Posner & Rothbart, 2007). Neuroimaging has shown that the dorsal part of the anterior cingulate is activated in cognitive tasks and in executive attentional functioning.

Ground breaking work on memory was reported by Joseph LeDoux in 1996. LeDoux is credited with identifying the unconscious as implicit memory. Implicit memory is described as emotional memory that produces immediate responses and serves survival purposes. On the other hand, explicit memory is conscious and declarative. Explicit memory serves the purpose of adaptation to reality. It is slower and more differentiated. During implicit learning, neuroimaging studies demonstrate that the right posterior visual system reduces blood flow when presented with previously presented stimuli rather than novel stimuli (Posner & Rothbart, 2007). The neural structures that are involved in implicit memory are the thalamus and the amygdala. The amygdala sends signals to the hypothalamus, which controls the autonomic nervous system and releases stress hormones. The startle response and the fight or flight phenomenon are examples of this. The conscious, explicit memory travels a longer pathway in the brain and is influenced by perceptions from the thalamus leading through the hippocampus to the neocortex and then to the amygdala. Emotional responses can be regulated with explicit
memories because the perception received by the neocortex is matched against recent and past experiences in the frontal and temporal cortex (Slipp, 2000).

Further, Slipp (2000) argued that these brain studies conducted through neuroimaging validate Freud’s notions of the unconscious and conscious. He postulated that the unconscious is located in the subcortical system of the right hemisphere, which includes the amygdala. He also postulated that the conscious process involves the hippocampus and frontal lobe. There is controversy in the literature regarding the role of the hippocampus in memory formation and storage, according to Hutterer and Liss, (2006).

According to Posner and Rothbart (2007), working memory is closely related to attention. In fact, the executive attention network controls the reorganization and rehearsal of information within working memory. It can be thought of a system that temporarily holds information over a span of a few seconds while the information is manipulated and related to other material (Constantinidis & Poroczyk, 2004; Lacy & Hughes, 2006; Posner & Rothbart, 2007). Working memory is considered a component of higher cognitive functioning. It also tends to be correlated with general intelligence (Posner & Rothbart, 2007). In experiments conducted to assess working memory, neuroimaging studies with adults show activity in the pre-frontal cortex area in and around the Broca’s area, which is involved in rehearsal of information. This same area is also involved in articulatory coding, which involves speech and reading (Posner & Rothbart, 2007). Memory for spatial location is rehearsed in the posterior parietal site, but stored in the frontal areas. Thus, there is evidence of a separation of verbal and spatial functions within the brain.
Neurological Development of Sensory Processing

According to Lacy and Hughes (2006), sensory processing occurs within the nervous system. Understanding the process of how one evaluates, feels, and responds to sensory information is described as complex. The pathways run parallel rather than in a serial manner. When sensory information is received, it is relayed to the hypothalamus, thalamus, and brainstem simultaneously. When sensory input is directed to the hypothalamus, autonomic and motor systems are activated, which affect how one feels and behaves. These responses are seen as being independent from conscious processing and are thought to be similar to Freud’s idea of signal anxiety, as affective and autonomic responses are unconscious. Sensory information is processed through the thalamus in modality specific sensory cortices. Through the association cortex in the parietal and temporal lobes, visual, auditory, and somatosensory percepts are then integrated with previous knowledge, memories, and experiences. Emotional representations or reactions are therefore triggered by the cortical and subcortical connections to the limbic structures. The amygdala receives immediate, direct sensory input from the thalamus as well as information from the association cortices. In parallel, the hippocampus receives the sensory information from the association cortex and assists in encoding this information. These structures are all connected to the frontal lobe. Ultimately, it is the frontal cortex that is responsible for the integration of sensory information. Specifically, the frontal lobe association cortices modify the processing and integration of current sensory input and past experiences, modulate the affect in response, and formulate response plans to manage the impingement of the sensory input. It does so by considering both the affect and the motivational state of the individual and the type of sensory input received. Thus,
in psychodynamic terms, the orbito-frontal cortex is of key importance in the inhibition and regulation of drives and affects (Lacy & Hughes, 2006). In addition, the process by which the central nervous system manages the impingement of the stimuli and the ultimate behavioral/affective response, may be analogous to the functions that Freud believed the structure, the stimulus barrier, was responsible for.

Neuroscience Literature in Relation to Ego Psychology and Ego Functioning

Rangell (1984) noted that the interdependence between the rapid growth of the central nervous system and the psychological aspects of the mind have been described by psychoanalysts, psychologists, and neurologists. Resch and Grand (1984) discussed "The psychological birth of the human infant proceeds, in our view, through a complex set of changes in which primarily biological regulations are gradually transformed into structures and functions that are primarily psychological" (p. 414). Rangell described that analogous to the neurological reflex pathways that regulate neural discharge are the psychological pathways and stimulus thresholds that also serve a function as discharge channels. Rangell compared the unfolding development of the psychic structures with maturational unfolding of somatic structures. For example, the function of sensory apparatuses relate to the capacity for perception and the subsequent images of mental life. Similarly, the central nervous system mediates the proprioceptive and kinesthetic channels that affect one's sense of balance and orientation, affect development, sense of pleasure/displeasure, and an early sense of self. Reportedly, the motor organs enable mastery. Rangell further described the relationship between the psyche and the soma as interdependent. He also noted that pathology could result when there is an overstimulation or deprivation in the child's early life. Structures may develop
prematurely as a defensive strategy to protect the child, which may render an
insufficiently developed ego or superego. Psychological fixations, developmental arrests,
regression, and ego deficits may result.

Schore (1994) has been credited with providing important connections between
the fields of neurobiology and psychoanalysis/psychotherapy. For example, a
contribution of his work includes the recognition that many disorders on the anxiety
spectrum, including anxiety, panic, phobias, affect-regulation disorders (such as bipolar
disorders), and schizophrenia are rooted in neurobiologically induced disorders of
regulation. Schore stated that there is an overlap of terms within the fields and described
that in his studies, the term self-regulation corresponds to neurodynamics. It is reported
that neurodynamics conceptually parallels the term psychodynamics. He supported the
work of ego psychologists and object-relations theory. For example, he connected the
object relations' perspective of the recognition of the primary importance of the maternal
care-giving figure with directly having an impact on the development of the infant's
brain. Schore described how "the vast majority of the development of axons, dendrites,
and synaptic connections that underlie all behavior is known to take place in early and
late human infancy" (p.12). The time period of infancy where there is optimally a close
mother-infant interaction coincides with this period of rapid brain development.
Therefore, Schore (1994) hypothesized that the "organism's postnatal environment acts
as a regulator of brain development and that postnatal stages of brain development may
provide an explanation for how early experience affects later behavior" (p. 12). Schore
(1994) emphasized that the primary caregiver serves as the most important source and
regulator of sensory stimulation for the developing infant.
Kraemer (1992) highlighted the importance of the attachment to a caregiver as a biological requirement for central nervous system functioning. Schore (1994) described how a neurobehaviorally affective social self emerges from the relationship between the infant and caregiver. Further, he identified his belief that in terms of developmental psychology, theories of attachment, especially insecure attachment and the neuropsychological consequences, such as affect dysregulation in the infant, are significant connections that have been made between the two fields. For example, in considering a failed appointment, Schore posited that part of the explanation for the missed appointment involves the evoking of neuronal connections from the past, related to the earlier developmental period, during which the process of the introjection of a good-enough mother figure within the self should have occurred.

In addition to Schore (1994), other theorists have made connections between neuroscience and psychodynamic theory. Earlier, Greenspan (1989) postulated that although there have been many case studies and developmental theories that have arisen to link psychic structures and psychological development with biology, no experimental data existed that link the two. However, Greenspan believed that efforts have been made in the direction of understanding how biology and experience interact and there are improvements in making this interaction amenable to experimental research.

In reviewing Greenspan's work (1989), it is evident that this interaction between psychic structures and biology is taken into account in his theories and research. He discussed that during the course of development, it is difficult to know exactly when myelination and neurochemical changes occur within the brain. However, it is known that as some systems do mature during the life cycle, cognitive shifts also occur. He
further postulated that opportunities are created for increased levels of integration when central nervous system biological shifts occur. Likewise, the opportunity for new cognitive and psychological experiences arises. Greenspan cautioned that if there is vulnerability within the systems, these usually adaptive changes, might pose difficulty and result in affective disturbances and/or mental disorganizations.

Regarding research efforts, Greenspan (1989) described it is possible to infer sensory processing abilities by studying autonomic nervous system functioning utilizing a time-series stimulus interrupt model. Reportedly, this method entails exposing a child to an experience and measuring his/her physiological response as the experience is processed. For example, he reported that a measure has been developed that measures heart-rate variability at the respiratory pathway and evaluates integration at the brain stem level. He also noted that if sensory processing patterns could be identified for children at risk for thought or affective disorders, an emphasis on prevention and intervention research could then ensue. Recently, technological advances have been made that allow direct access to the examination of neural pathways and structures and were discussed earlier in this chapter (Posner & Rothbart, 2007).

In sum, in terms of the variables investigated in this study, evidence that attempts to support the integration of ego-function psychodynamic theories with neuroscience literature was provided. Explorations for and/or evidence for biological structures and/or underpinnings for the variables studied (sensory seeking/stimulus barrier, emotionally reactive/regulation, and control of drives and affects, and inattention/distractions and autonomons ego functioning) were presented.
Support by researchers in the community to integrate the language and theories of neuroscience and psychoanalysis was also found in the literature (Lacy & Hughes, 2006). This is in agreement with an aim of this study, which is to link the findings of the fields of psychology, neuroscience, and occupational therapy. Specifically, regarding education and training, Lacy and Hughes (2006) suggested: “neuroscience should be integrated with psychodynamics, normal development, and psychiatric phenomenology in psychiatry residency programs” (p. 46). They further stated that there needs to be a biologically informed approach to psychotherapy, which they described as integrative psychotherapy. They emphasized their view of this integration as holistic and anti-reductionistic. Lacy and Hughes suggested grounding psychoanalytic education in biology in order to support its legitimacy.

A review of the occupational therapy literature regarding sensory integration theory and sensory processing will be presented next. An integration of the findings with psychodynamic/ego function and neuroscience literature will be provided when possible.

Sensory Integration Literature

Ayers (1972) defined sensory integration as “the neurological process that organizes sensation from one’s own body and from the environment and makes it possible to use the body effectively within the environment” (p. 11). Sensory integration is a vital organization process that enables one to use him or her self to interact with the world. Sensory processing is defined as “the brain’s ability to receive and interpret sensation” (Daniels & Dunn, 2000, p. 865). Sensory information is received, processed, and organized within the central nervous system of the brain (Burpee, 2006). The
integration of the five senses is the main task of the central nervous system, according to Kranowitz (1998).

Sensory integration and sensory processing are terms that are used interchangeably within the literature. Jean Ayers was an occupational therapist, educational psychologist, and a neuroscientist who is credited with creating sensory integration theory. Bundy, Lane, and Murray (2002) stated, "Sensory integration is a theory of brain-behavior relationships" (p. 4). Ayers contended that "when there is a sensory integrative dysfunction-social, emotional, motor, and/or functional problems can result" (Miller, 2006, p. 6). Ayers' primary motivation for devising this theory was to create interventions for children who displayed sensorimotor and learning problems.

**Sensory Integration Theory**

Reportedly, sensory integration theory was derived from the fields of neurology, medicine, and child development in order to explain relationships between behavior and neurological processes (Ayers, 1972). Sensory integration theory is based on three components. The first component involves learning. "Learning is dependent on the ability to take in and process sensation from movement and the environment and use it to plan and organize behavior" (Bundy et al., 2002, p. 5). The second component postulates that "Individuals who have a decreased ability to process sensation also may have difficulty producing appropriate actions, which, in turn, may interfere with learning and behavior" (Bundy et al., 2002, p. 5). Finally, the third component involves sensation. "Enhanced sensation, as a part of meaningful activity that yields an adaptive interaction, improves the ability to process sensation, thereby enhancing learning and behavior" (Bundy et al., 2002, p. 5). Further, according to Bundy et al. (2002), sensory integration theory
describes typical sensory integrative functioning, defines sensory integrative dysfunction, and guides intervention programs to address difficulties in sensory integration through these three components.

According to Bundy et al. (2002), there are five assumptions that underlie sensory integration theory that are related to neural or behavioral bases. The first assumption is the plasticity of the CNS. Originally, Ayers thought there was a critical period for development from 3-7 years. However, current researchers and practitioners in occupational therapy and neuroscience have found that this is not the case (Bundy, et al., 2002; Posner & Rothbart, 2007). The second assumption is that sensory integration develops sequentially, with each stage allowing for more complex behaviors. The third assumption is that the brain functions as an integrated whole. While the theory includes hierarchical development concepts, Ayers believed that there is an interaction between cortical and subcortical structures that contribute to sensory processing. The fourth assumption is that adaptive interactions with the environment promote sensory integration and vice versa. Finally, the fifth assumption that Ayers (1972) believed is that individuals have an inner drive and motivation to develop sensory integration through participation in sensorimotor activities. The use of the term “inner drive” clearly links the theory to language used in psychodynamic literature.

Structure and Function of the Sensory Systems

The sensory systems that are involved in sensory integration processes discussed in the sensory integration literature include the somatosensory system, the vestibular system, the auditory system, and the visual system (Bundy et al., 2002). The somatosensory system receptors gather information and send the information over the
dorsal column medial lemniscal (DCML) and over the anierolateral (AL) system. When any type of force is applied to the receptors on the skin, neuronal transmission of the information ensues. The two pathways work together to help interpret the tactile world and respond appropriately. The DCML is primarily involved in the processing of proprioceptive information. Proprioception involves awareness of spacial orientation of the body or body parts, the amount of force joints exert, and of how much and how fast a muscle is being stretched. The AL mediates temperature and pain. The trigeminothalamic pathway is also part of the somatosensory system. Its role is to transmit sensory input from the face to the brain (Bundy et al., 2002).

The vestibular system involves the structures of the semicircular canals and otolith organs (Bundy et al., 2002). The receptors for this system are hair cells. They are found within the inner ear. The semicircular canals respond to movement of the head in space. The receptors in the otolith organs detect position of the head and body in space and control posture. The auditory system receptors are found in the inner ear as well, in the cochlea. It is located adjacent to the vestibular system. The pathways of the auditory system are more complex and numerous. In general, the auditory system receptors send information to the CNS via the core pathway (well-organized and transmits sound frequency quickly and accurately) or the belt pathway (less organized and sends information relative to the timing and intensity of input). The pathways that are thought to be responsible for controlling the orientation of the head, eyes, and body to sound are the inferior colliculus and auditory cortex, which project their information to the superior colliculus, where the information is then combined with somatosensory inputs (Bundy et al., 2002).
The visual system is the most heavily relied on sensory system for day-to-day function, according to Bundy et al. (2002). The visual system detects edges, contrast, and movement. The visual system, due the vestibular-ocular reflex, enables one to perceive still images best. The visual system adjusts to movement through the optokinetic reflex. The visual system is very complex and consists of at least three parallel pathways that carry information that must be integrated. Photoreceptors at the back of the eye, which include rods and cones, are responsible for the transduction of light energy into electrical energy, which is then transmitted to the CNS. The retina also plays an important role in processing input before the information is transmitted to the CNS via the optic nerve.

The development of the visual system occurs prenatally and continues throughout early childhood. Research conducted indicates that children who have cataracts that are not removed before 10 years of age will suffer permanent damage relative to visual form perception (Bundy et al., 2002).

**Sensory Integration Dysfunction**

Sensory integration dysfunction is a chronic, complex disorder that is caused by the central nervous system’s inability to appropriately process sensory information. As a result, an individual may display inappropriate behaviors and have trouble learning (Bundy et al., 2002; Burpee, 2006). Ayers (1971) noted that it is reasonable to expect that there may be neural system deficits in more than one area, even if only one area is initially identified. The theory is meant to explain childhood-onset deficits, which may persist into adulthood, but not adult-onset deficits. Bundy et al. (2002) cautioned that sensory integrative dysfunction theory is not intended to explain problems associated with difficulties that are attributed to overt CNS damage or abnormalities (e.g. cerebral
palsy, Down syndrome). Instead, it is meant to explain mild to moderate problems that affect learning and behavior.

Bundy et al. (2002) described how the central nervous system (CNS) is responsible for sensory processing. The CNS processes visual, vestibular, proprioceptive, tactile, and auditory sensations through the limbic system (Bundy et al., 2002). Vestibular sense refers to “the sensory system that responds to changes in head position and to body movement through space, and that coordinates movements of the eyes, head, and body” (Kranowitz, 1998, p.294). Proprioceptive sense is “the unconscious awareness of sensations coming from one’s joints, muscles, tendons, and ligaments” (Kranowitz, 1998, p.294). It is also referred to as the position sense (Kranowitz, 1998).

Sensory integration dysfunction results when there is difficulty in CNS processing of sensory information. Typically, sensory integration dysfunction manifests itself through poor praxis or poor modulation (Bundy et al., 2002). Some individuals experience problems in both areas. Praxis is defined by Kranowitz (1998) as the ability to interact successfully in the world through planning, organizing, and carrying out sequences of unfamiliar acts. Dyspraxia, or poor praxis, is defined as difficulty in this ability to plan and sequence actions (poor motor planning) (Kranowitz, 1998). Bundy, Lane, and Murray (2002), described that there are two types of motor planning problems, or dyspraxias: bilateral integration and sequencing (BIS) and somatodyspraxia.

“Individuals with BIS have difficulty using the two sides of their body in a coordinated fashion and sequencing motor actions” (Bundy et al., 2002, p. 8). Deficits in BIS are reportedly associated with proprioceptive and vestibular processing problems. Those who have somatodyspraxia have difficulty with gross and fine motor tasks. Somatodyspraxia
is associated with processing difficulties with vestibular, proprioceptive and tactile sensations (Bundy et al., 2002). Postural deficits are found to be the basis of BIS difficulties and are evident when vestibular and proprioceptive processing is deficient (Bundy et al., 2002).

Williamson and Anzalone (1997) offered a conceptualization of four inter-related components of sensory integration. First, there must be an initial awareness of sensory input or sensory registration. The concept of sensory threshold describes how one registers sensation. Next, selective attention or orientation to the stimulus input occurs. Many children who demonstrate difficulties in relating and communicating have difficulty attending to stimuli and may tend to either over focus on stimuli or avoid it altogether. The ability to interpret or integrate input across all modalities and to understand its meaning is also an important concept in the sensory integration process. Appropriate responding to the stimuli through the cognitive, affective and/or behavioral channels must occur. Finally, Williamson and Anzalone noted that the child must be able to perform the cognitive, affective, and/or behavioral act related to the sensory input. These researchers noted that when there is sensory integration dysfunction, problems could arise in any of the five components. Williamson and Anzalone also stressed the importance of the concept of threshold in the understanding how a child manages the sensory input in their research. Children with hyper-reactivity tend to have a low sensory threshold and sympathetic nervous system responses are evident. In contrast, children who are hypo-reactive tend to have a high sensory threshold and demonstrate parasympathetic nervous system reactions.
Sensory Modulation Dysfunction

Sensory modulation is defined by Bundy et al. (2002) in behavioral terms as “The ability to regulate and organize reactions to sensory input in a graded and adaptive manner” (p. 480). Krahn (1998) described modulation as a mechanism that balances the flow of sensory information coming into the central nervous system. The brain turns on, or turns off, the neural switches of all the sensory systems so that they work in tandem to keep us in sync” (p. 42). In neurophysiological terms, modulation is defined as “The balancing of excitatory and inhibitory inputs, and adapting to environmental changes” (Bundy et al., 2002, p. 480). Previously, sensory modulation or regulation could not be measured in a standardized way. Although Ayers did discuss the concept in her early work, no assessment measures were available until Dunn (1999) began gathering information through factor analysis studies, during the development of the Sensory Profile tool. Bundy et al. (2002) reported that Lucy Jane Miller is currently conducting sensory regulation research using physiologic measures and a shortened form of the Sensory Profile.

According to Bundy et al. (2002), there are four types of modulation disorders: sensory defensiveness, gravitational insecurity, aversive responses to movement, and underresponsiveness to sensation. Sensory defensiveness is characterized by the flight or fight reaction to sensation that others may not find to be noxious. Sensory defensiveness can be found within all of the sensory systems except the vestibular and proprioceptive systems. Similar to the neuroscience findings discussed earlier in this chapter, sensory defensiveness is thought to reflect poor limbic system processing (Bundy et al., 2002).

Gravitational insecurity is described as the fear of movement when one is out of the
upright position or when one’s feet are off the ground. It is associated with poor vestibular processing, aversive responses to movement are described as autonomic nervous system reactions to movements of the body that most would not find as noxious. It is also associated with poor vestibular processing. Under-responsiveness to sensation involves the notion that an individual under-reacts or does not respond to or notice sensation that one would typically notice (Bundy et al., 2002).

Neurologically, sensory modulation dysfunction is a deficit at a cellular level within the CNS in which the CNS has difficulty regulating the intensity of incoming sensory input and in organizing the nature of the behavioral response to that input. Behavioral responses then are either over-responsive or under-responsive, according to Burpee, (2006). In addition, one can behaviorally respond to sensory input by either avoiding (sensory-avoidant) or by demonstrating an apparent constant need for sensory input (sensory seeking) (Burpee, 2006). Dunn (1999, 2000) and others (Burpee, 2006; Miller, 2006) have elaborated extensively on these topics.

Finally, Miller (2006) described three patterns of sensory processing disorders, based on her research. The first one described is sensory modulation disorder (SMD), which she describes “is a problem with turning sensory messages into controlled behaviors that match the nature and intensity of the sensory information” (Miller, 2006, p. 12). The second is sensory-based motor disorder (SBMD), which Miller described as “a problem with stabilizing, moving, or planning a series of movements in response to sensory demands” (p. 12). The third processing disorder is sensory discrimination disorder, which is characterized by difficulty sensing similarities and differences between sensations (Miller, 2006).
Assessments Utilized in the Diagnosis of Sensory Integrative Dysfunction

Following a discussion of sensory integration theory, basic information regarding CNS functioning and the somatosensory functions, the way in which sensory integration dysfunction (SID) and/or sensory modulation dysfunction (SMD) are assessed is now presented. Reportedly, practitioners approach the assessment of sensory processing difficulties from a top-down approach (Bundy et al., 2002). This means that an individual is assessed on the ability to carry out daily life tasks. Only when areas of difficulty are noted, does a practitioner then begin to look more closely at how sensory integration deficits may be impacting functioning.

Ayers (1989) developed an assessment measure to assess sensory integration dysfunction known as the Sensory Integration and Praxis Tests (SIPT). Ayers (1977) began conducting factor analyses clusters of measures of sensory integration long before her final version was published. The final version was developed based on earlier tests developed by Ayers, the Southern California Sensory Integration Test (SCSIT), and the Southern California Postrotary Nystagmus Test (SCPNT) (Bundy et al., 2002). The SIPT is the most “comprehensive and statistically sound means for assessing some important aspects of sensory integration, most notably praxis and tactile discrimination”, according to Bundy et al. (2002, p. 170).

Ayers (1972) was interested in studying the functioning of children with learning disabilities. Therefore, the SIPT was designed to be administered to children 4-8 years of age with mild to moderate learning or motor disabilities. The SIPT consists of 17 subtests. Administration time is reportedly 1.5-2 hours. The 17 subtests are broken down into four domains. The first domain involves form and space and visual motor
coordination. The subtests include space visualization, figure-ground perception, design copying, construction praxis, and motor accuracy. The second domain involves tactile discrimination. The subtests include finger identification, localization of tactile stimuli, manual form perception, and graphesthesia. The third domain is praxis. These subtests include bilateral motor coordination, sequencing praxis, postural praxis, oral praxis, and praxis on verbal command. The fourth domain is vestibular and proprioceptive processing. The subtests include kinesthesia, standing and walking balance, and postrotary nystagmus.

Regarding the standardization process, the SIPT was standardized with a sample of approximately 2000 children (non-disabled) from across North America. Children from Canada were also included. There were significant age and gender differences on all SIPT tests except for two, the manual form perception and postrotary nystagmus tests. The standardized scores reflect an index of how a subject's performance differs compared with the performance of a non-disabled child of the same age and gender.

Regarding the psychometric properties of the SIPT, Ayers (1989) reportedly found that most of the tests had acceptable test-retest reliability. The praxis tests reportedly demonstrated the highest test-retest reliability of all subtests. The lowest reliability coefficients were found for the postrotary nystagmus, kinesthesia, localization of tactile stimuli, and the figure-ground perception tests (Bundy et al., 2002). Evidence of construct validity was demonstrated by factor and cluster analysis comparisons of SIPT scores of children with and without disabilities. Ayers also reportedly conducted similar studies comparing results from her SCIT test with the SIPT test. She reportedly found six patterns that described various types of sensory integrative dysfunction, which included
somatosensory processing deficits, poor BIS, somatodypraxia, poor praxis on verbal command, form and space/visual motor coordination, and generalized sensory integrative dysfunction (extreme cases of the listed patterns). However, Bundy et al. (2002), cautioned that Ayers used data from different tests to demonstrate validity, so no study was ever replicated. Therefore, her studies have been criticized.

A study was found in which the SIPT was used in research. Walker and Burris (1991) investigated the relationship of scores on the SIPT with scores on an academic achievement test, the Metropolitan Achievement Test (Prescott, Balow, Hogan, & Farr, 1978) administered by the school system. Walker and Burris found that there was no significant correlation or predictive relationship between scores on sensory integration tests and academic achievement tests, which is in support of Ayers' contention that sensory integration and academic achievement are separate factors. Further, based on the findings of this study, evidence was provided that supported the notion that sensory integration tests are discrete indicators of sensory and motor functions (Walker & Burris, 1991).

Mulligan (1998) conducted a confirmatory factor analysis with SIPT data from over 10,000 children in order to confirm what she thought was a five factor structure of sensory integration dysfunction. She found evidence for the five-factor structure, which consisted of BIS, postural-ocular movements, somatosensory processing, somatopraxis, and form and space/visual motor integration deficits (Mulligan, 1998). However, she described weaknesses in the data. Further exploratory factor analyses were conducted. It was found that it was best to utilize the label generalized dysfunction as a "higher order" factor and to include visuoperceptual, BIS, somatosensory, and praxis as the four "first-
Dunn (1997) proposed a continuum of neurological threshold (high-habituation or low-sensitization) and a continuum of behavioral responses (that act either in accordance with the threshold or counteracts the threshold) that interact with each other and result in one of these four patterns of responses. In Dunn’s model, if someone has a high neurological threshold and responds in accordance with the threshold, poor registration in the response will be evident. If the individual has a high neurological threshold and responds to counteract the threshold, sensation seeking behavior will result. Similarly, if an individual has a low threshold and responds in accordance with the threshold, he or she will demonstrate sensitivity to stimuli. Finally, if an individual has a low neurological threshold and responds to counteract the threshold, the behavioral response is sensation avoiding. The CNS reportedly modulates the thresholds (Dunn, 1997). In 1997, a 99-item version of the Sensory Profile was in development and took into account the above theory regarding thresholds and behavioral responses. Dunn (2001) reported that physiological support has been found for this model. Individuals with distinct sensory processing patterns as described in Dunn’s model show similar distinct patterns of amplitude and habituation responses in skin conductance measures (Dunn, 2001).

Data from the Sensory Profile studies indicated that these patterns remain the same across the life span. While there is variability in responding, generally, a distinct pattern, overall, will emerge for each infant, child, or adult (Dunn 2001). Dunn (2001) described then that this pattern might not be influenced by environmental experiences. It is noted that only cross-sectional studies are currently available to assess what longitudinal studies in the future will be better able to (Dunn, 2001).
Similar to the discussion of neuroscience literature, Dunn (2001) referenced the importance of connecting research of sensory processing with personality and temperament. Dunn’s model incorporates this research. The research includes Rothbart’s studies of temperament in which she and her colleagues identified four styles of temperament that can be seen in infancy through school age children, which include surgency (positive affect, activity level), fear, irritability/anger, and persistence (Rothbart, Ahadi, & Evans, 2000). Rothbart and Derryberry (1981) posited that these styles underlie and precede self-regulatory processes development. Rothbart et al. linked these styles to personality traits as defined by Costa and McCrae’s (1987) Big Five personality factor structure in their studies. Dunn suggested “the fact that consistent patterns about temperament, personality and sensory processing emerge across studies of children and adults suggests that there is insight to be had in understanding how these constructs interact with each other” (p. 615).

Based on this temperament research, Dunn (2001) proposed that the four patterns of sensory seeking correspond to these four distinct types of temperament in a child. For example, sensory avoiding is associated with children who are fearful. Irritability and anger is the temperament style that corresponds to a sensory pattern of sensory sensitivity. Those who are sensory seeking display positive affect. Those with low registration sensory processing demonstrate a temperament characterized by persistence. Dunn (2001) argued that having this information about sensory processing patterns and related temperaments enables parents and teachers to modify a child’s environment in order to help the child function at his optimal state. Dunn reiterated that it is not the role
of a therapist to change a pattern, necessarily, but to adapt and modify school, work, and living environments to accommodate for their sensory processing abilities and deficits.

In 1994, Dunn reported an item analysis study for her newly developed 99-item questionnaire, the original version of the Sensory Profile. The Sensory Profile was developed due to the need to comprehensively assess sensory processing in daily functioning in the lives of people, rather than assessing responses in clinical settings, for example. In addition, less cumbersome and time-consuming measures were needed (Dunn, 1994). Dunn (1994) was aware that informal checklists were often given to parents and others to fill out in order to obtain a history of the child’s sensory processing abilities. Dunn referenced the notion that sensory histories were often compiled about a subject. After awhile, therapists began to notice face validity in sensory histories, in which patterns of sensory processing could be found. While Dunn discussed the importance of collecting data about a child’s reactions to various sensory experiences via a checklist format, she acknowledged that few studies have reported information on sensory history data or on typical children’s reactions to various sensory experiences in natural environments. This study in 1994 was conducted in order to obtain data about sensory experience from parents of typical children during home activities. The original 99 items were taken from the sensory histories and sensory assessments previously reported throughout the literature (Dunn, 1994).

Dunn (1994) used a convenience sample of 64 typical children (20 girls and 44 boys) ages 3-10 years. Typical was defined as not taking medication regularly and not receiving special services in school. This sample was reportedly part of a larger sample that was also participating in another study. Eight occupational therapists, in addition to
Dunn, participated in the selection of the items on the Sensory Profile. The eight therapists were selected due to their backgrounds and experience with sensory integration in a school-based setting. The 99 items were divided into six sensory categories and two behavioral categories. An item was selected based on its being understandable to parents and on its being a described behavior in typical environments for children. A 5-point Likert scale to rate the items was employed.

In terms of procedure, the researchers explained the study to the parents, left written instructions, and asked the parents to fill out the Sensory Profile at their convenience. Dunn (1994) completed the descriptive analysis of the entire data set. She then completed a MANOVA on each of the data sets to identify differences between boys and girls, and younger and older children, on each item. Dunn reported that if 80% or more of the parents reported that their child displayed a behavior seldom or never, the criterion was met. Dunn noted that previous researchers established this criterion procedure. Altogether, 67 of 99 items (or 67%) met the criterion, which indicated these behaviors were indeed uncommon for typical children. Regarding age comparisons, younger children scored significantly different from older children on the item that involved a visual system, staying in between the lines while coloring. Regarding gender differences, girls were more likely to display stiff body position, display an unusual need for touching certain things, avoid wearing shoes, and always touch people and objects, as compared with boys. Dunn noted that a larger sample was needed to explore gender differences, which could have skewed the data (Dunn, 1994).

Dunn (1994) listed the limitations of this study. One is the use of a convenience sample, which is not representative of the population. Another is that no information
about culture was solicited; therefore, generalizability is compromised. Dunn noted that comparison studies of groups of children with and without sensory processing disabilities were necessary. She also noted that the measure needed to be validated. Groups of items or clusters also needed to be analyzed in addition, according to Dunn (1994). Dunn concluded that the Sensory Profile had the potential to make an important contribution to the overall assessment of children with sensory processing problems, but further research was needed.

Dunn and Westman (1997) continued to work on the measure and conducted a study in order to obtain data about a larger, national sample. The Sensory Profile now consisted of 125 items. The sample of this study included 1,037 children, who were aged 3-10, and who did not present with any disabilities. Data from 78 children were not able to be included in the analysis as they were on medication or receiving special services in school. Dunn and Westman acknowledged care needed to be taken in generalizing results as cultural diversity within sample was still lacking. Twenty-six new items were added in order to include stronger items in categories that performed weakly in her original study of 99 items (Dunn & Westman, 1997). In addition, a total of 166 occupational therapists agreed to take part in this study. The results of this study indicated that 91 of the 125 items were found to be uncommon behaviors for this national sample of children without disabilities. Age and gender differences were significant (p<.001). However, effect sizes were small (below .2) so that differences were not seen as meaningful. Two items in the visual category approached a 1.0 difference when younger and older children were compared. Dunn and Westman concluded from the results of this study that the Sensory
Profile is a useful tool in evaluating and planning intervention for children with disabilities.

Dunn and Brown (1997) utilized the same sample in the study above "to determine whether there was support for the constructs of sensory modulation in the Sensory Profile data on children without disabilities" (p. 491). The factor analysis resulted in the addition of the 9 factors that make up the present version of the Sensory Profile. Through data analysis, it was determined that the nine factor solution accounted for 47.8% of the variance. Items that loaded .40 and above were included in a factor. Further, Dunn and Brown reported that 75% of the items had factor loadings of above .50. Dunn and Brown suggested that "the impact of sensory modulation on the central nervous system" (p. 494) should be considered in future research studies. These results also supported Dunn’s Sensory Modulation Theory. Dunn and Brown concluded their study by recommending future research on the performance of children with various disabilities (including autism and ADHD) to see if specific factors are more closely associated with particular disabilities. It was hoped that information gleaned from these future studies would provide a more detailed assessment of children’s processing abilities (Dunn & Brown, 1997).

Dunn (1999) provided ranges of scores that compared four groups: children without disabilities, children with ADHD, children with autism/PDD, and children with other disabilities. Dunn noted that the children in the latter three groups do not match the variables of the sample without disabilities. Therefore, caution must be taken when interpreting the results of the comparisons drawn. In general, the comparison groups all scored lower than the group of children without disabilities on three of the nine factors.
(Factor 1, Sensory Seeking; Factor 2, Emotionally Reactive; Factor 5, Inattention/Distractibility). For each Factor, the higher the score, the more common the behaviors are of typical children. The lower the score, the more atypical the behaviors are, which may be indicative of sensory difficulties in that particular area. Reportedly, on Factor 1 (Sensory Seeking), 81.1% of the children without disabilities scored 65 or higher out of a possible 85 points. Of the children with ADHD, 81.7% scored below 65. Close to 78% of the children with Autism also scored below 65 points. The cutoff score for Typical Performance is 63. Similarly, for Factor 2 (Emotionally Reactive), 77.1% of the children without disabilities scored 60 or higher out of a possible 80 points. Of children with ADHD, 87.3% of the children scored below 60 points. Of the children with autism, 100% scored below 60 points. The cutoff score for typical performance on this factor is 57. Finally, for Factor 5 (Inattention/Distractibility), 88.8% of the children without disabilities scored 25 or higher out of a possible 35, while 94.4% of children with ADHD and 79.2% of children with autism scored below 25. The cutoff score for this factor is 25.

Additionally, on Factor 4 (Oral Sensitivity) children with autism performed lower on average than children with ADHD. Children with ADHD, in turn, performed lower on average than children without disabilities. The results were similar on Factor 9 (Fine Motor/Perceptual).

Regarding children with ADHD, Dunn (1999) in the Sensory Profile Manual, identified 43 items from the measure that were more common for children diagnosed with ADHD. Dunn reported that 31 of the 43 fell into Factor 1 (Sensory Seeking), Factor 2 (Emotionally Reactive), and Factor 5 (Inattention/Distractibility). In addition, the remaining 12 items found to be more common in children with ADHD involved
behaviors related to difficulties in visual and tactile processing. Reportedly, these items clustered for children with ADHD. As a result, Dunn included a worksheet in Appendix B of the Sensory Profile that enables the examiner to analyze the visual and tactile processing cluster. Dunn believed that this worksheet could be used as part of a comprehensive assessment for diagnosing ADHD. She noted that at a minimum, this worksheet could aid the multidisciplinary team in planning interventions to help a child organize sensory input to help daily functioning at home and school. The next session of this chapter addresses research in the field. Research studies that were conducted using children with varying disabilities are presented. However, there are few studies and no research studies utilizing the Sensory Profile were found outside of the occupational therapy field. Therefore, future research including the Sensory Profile is still needed across disciplines so that its clinical utility can be better assessed.

The Evaluation of Sensory Processing, by Parham and Ecker (as cited in Bundy et al., 2002), is another assessment measure that reportedly provides information about sensory modulation functioning (Bundy et al., 2002). Parham and Ecker's measure is still in its development stage, however. Favorable reviews of the research version are found in Bundy et al. (2002). Additional assessments as noted by Bundy et al. (2002) that are associated with sensory integration constructs include the Bruininks-Oshtetsky Test of Motor Proficiency, which assists in the assessment of praxis; the Motor Assessment Battery for Children, which assesses manual dexterity, ball skills, and balance; the Clinical Test of Sensory Interaction with Balance, which assesses the ability to maintain balance; the Cos, clinical observations of neuromotor performance; and the Touch Inventory for Pre-Schoolers/Touch Inventory for Elementary School-Aged Children.
Royeen and Fortune (1990) emphasized that the Touch Inventory for Elementary School-Aged Children (Royeen & Fortune, 1990) is meant to be a screening instrument, not a diagnostic measure. Dunn (1994) added one more measure to this list, The Functional Assessment of Sensory Integration (Cook, 1991) (FSI). This is an observational checklist measure that records sensory integrative processing observed during the completion of functional tasks, including dressing, eating, bathing, and learning. Parents and teachers also participate in completing parts of the test based on their own observations of the child engaging in various behaviors (Dunn, 1994).

The DeGangi-Berk Test of Sensory Integration (DeGangi, 1988) (TSI) is another standardized test that screens for overall sensory problems in young children. The TSI is useful as an indicator of ability or problems. It is easy to administer and score. Additionally, it emphasizes vestibular and proprioceptive systems (Dunn, 1994). However, according to Dunn (1994), it is not sensitive to tactile functions and does not take into account typical performance in daily life, as it is generally administered in a clinic setting.

In addition to tests for pre-school and young school age children, DeGangi and Greenspan (1989) developed the Test of Sensory Functions in Infants (TSFI), which was designed to measure sensory processing and reactivity in infants. It was administered to 196 normal infants, to 27 infants with a developmental delay, and to 27 infants with difficult temperament. The infant ages ranged from 4 to 18 months. The test consists of 24 items that measure tactile deep-pressure, adaptive motor responses, visual-tactile integration, ocular-motor control, and reactivity to vestibular stimulation. Results indicated that for the two samples, infants with developmental delays and infants with
difficult temperament, tactile defensiveness, poor ocular-motor control, and vestibular
dysfunction occurred in a substantial proportion (DeGangi & Greenspan, 1989). On the
visual-tactile integration and adaptive motor responses tests, difficulties were also noted
for these two groups compared with typically developing infants. The authors cautioned
that this work was preliminary, but believed this tool has the potential to aid in an
objective empirically based manner, in the assessment of developmental difficulties in
infants (DeGangi & Greenspan, 1989).

Sensory Integration Research

Sensory integration is the most studied area in occupational therapy (Bundy et al.,
2002). However, there appears to be consensus that it is not accepted or respected within
the field and by other disciplines (Bundy et al., 2002). Almost 20 years ago, Tickle-
Degnen (1988) published her view that theorists and clinicians in the field of
occupational therapy needed to coordinate research efforts and improve communication
between them. In addition, it was recommended that an effort to provide empirical
evidence rather than theoretical evidence was an important avenue to consider (Tickle-
Degnen, 1988). Similarly, about 10 years ago, Vargas and Camilli (1998) identified that
the concept of sensory integration was the subject of criticism and controversy in the
fields of neuropsychology, medicine, and education. Vargas and Camilli conducted a
meta-analysis of research on sensory integration intervention approaches. Reportedly,
they found that there was a lack of consistent empirical support for the efficacy of
sensory integration treatments. Additionally, sensory integration treatments were found to be as effective as various alternative treatments studied (Vargas & Camilli,
1998).
Within the field, there is no consensus among occupational therapists as to the effectiveness of sensory integration intervention. Further, sensory integration has been criticized throughout the literature in the field of education, especially, and has not attained scientific legitimacy (Bundy et al., 2002). Despite this fact, research efforts have continued. One of the reasons Bundy et al. (2002) gave for why the educational field rejected sensory integration involved the view of sensory integration as a process approach. Bundy et al. described the process approach, in favor until the mid-1970’s-1980’s, as having the main focus be on the remediation of underlying neurological causes of academic problems rather than focusing on solving the problem through direct, on-task instruction. While sensory integration was not directly studied by the educational system, it is thought that it became associated with the other school-based process approach interventions and looked upon negatively as a result.

Miller (2003) argued that sensory integration research is in its infancy and a great deal more rigorous research is needed to provide empirical evidence that sensory integration interventions are valid. Miller noted that there has only been a recent shift within the field of occupational therapy to focus on research and to improve methodology, including adequate power in the statistical analysis of data. In addition, she cited the difficulty inherent in social sciences research in identifying a random sample (Miller, 2003). With regard to sample selection, Miller noted that better methods need to be developed to characterize the population with sensory processing impairments. Miller and her colleagues identified the use of electrodigital reactivity (EDR) provides a marker of sympathetic activity. They have found that the EDR of children with severe sensory processing dysfunction do differ significantly ($p<.01$) as compared with typical children.
(Miller, 2003). Similarly, McIntosh, Miller, Shyu, and Hagerman, (1999) also found that children with sensory modulation disruptions responded differently physiologically to sensory stimuli than did typically developing children. In addition, her research team used vagal tone (VT) to measure parasympathetic nervous system functioning (Miller, 2003). Lower VT is found in children with severe sensory processing impairments as compared with typical children. Therefore, Miller suggested these might have implications for underlying mechanisms that may be disordered in children with sensory processing problems. In addition, Miller and her team reported that they developed a short version of Dunn’s Sensory Profile. Further, these ratings from the Sensory Profile were related to physiologic measures (EDR), (p<.01) of sensory reactivity (Miller, 2003).

It is noted that while sensory integration dysfunction is often associated with disorders classified in the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV), underlying sensory processing problems appear to co-exist with many of the diagnostic categories including Pervasive Developmental Disorder, Attention Deficit-Hyperactivity Disorder, Learning Disorder, developmental disabilities, Fragile X Syndrome, and Developmental Coordination Disorder (Bundy et al., 2002). Further research is needed to assess whether or not the same underlying neurological problems are found in sensory integration dysfunction and perhaps some or all of these disorders, according to Bundy et al. (2002). In fact, Miller et al. (1999) and her colleagues are investigating the relationship that may exist among those who have Fragile X Syndrome and present with sensory integration dysfunction.

With regard to Attention Deficit-Hyperactivity Disorder (ADHD), research has been conducted by occupational therapists. Dunn and Bennett (2002) compared sensory
responses of children who carried a primary diagnosis of ADHD with those of children without disabilities on the Sensory Profile. Parents of 70 children, who ranged in age from 3-15 years, and were matched by age and gender, participated in the study. Through MANOVA statistical analysis and post-hoc testing, it was found that children with ADHD differed significantly from children without disabilities. Dunn and Bennett (2002) analyzed the 14 subtests found within the Sensory Processing, Modulation, and Behavioral Outcomes sections in order to reach that conclusion.

Dunn and Bennett (2002) noted that from a sensory processing perspective, “children with ADHD may not be receiving and processing sensory information properly and therefore, have difficulty producing appropriate responses at school, home, and in the community” (p. 6). Dunn also stated that none of the standard questionnaires used as assessment measures of ADHD, including Conner’s’ Rating Scales, Child Behavioral Profile, Yale Children’s Inventory, Behavior, Behavior Assessment System for Children, Adolescent Behavior Checklist, or the Aggregate Neurobehavioral student Health and Educational Review, assess behaviors related to sensory processing. Dunn emphasized that researchers have identified tactile, visual, and vestibular sensory differences in children with attentional difficulties. She noted that despite the empirical evidence that children with ADHD may have difficulty with sensory processing, instruments that assess ADHD do not investigate this component through current measures (Dunn & Bennett, 2002).

Interestingly, Dunn and Bennett (2002) did report that although this was not the main focus in her study, when she conducted factor analysis groupings of the nine factor scores of the Sensory Profile, the items clustered into 4 of the 9 groups of factors. These
factor groups included: Factor 1, Sensory Seeking; Factor 2, Emotionally Reactive; Factor 5, Inattentiveness/Distractibility; and Factor 9, Fine Motor/Perceptual. Further, it is of interest to note that Factors 1, 2, and 5 were the factors investigated in this study. Dunn and Bennett (2002) highlighted the fact that items assessed on Factor 1 (Sensory Seeking) and Factor 5 (Inattention/Distractibility) are related to the inattention criteria of ADHD, according to the DSM-IV. In addition, Dunn and Bennett (2002) reported that all of the items in Factor 2, Emotional Reactivity, describe criteria that are found in the DSM-IV for ADHD as well. Dunn and Bennett discussed that perhaps sensory processing deficits that include touch processing and emotional/social responses may be unique areas not currently considered in the current DSM-IV criteria of ADHD. In considering Dunn and Bennett’s (2002) conclusions, regarding patterns of sensory processing disorder in children with ADHD, it is important to note that all of the children diagnosed with ADHD were on medication. Dunn and Bennett stressed the importance of considering sensory processing in the context of information gained through neuroscience research, especially with regard to the CNS, when planning interventions for children with ADHD.

In support of this conclusion, Yochman, Ornay, and Parush (2006) conducted a study in Jerusalem with preschool children who were diagnosed with ADHD and exhibited developmental delays. While a detailed summation will not be presented due to cultural limitations and a subsequent lack of generalizability to this population, the findings do indicate that future research is needed to identify developmental pathways, including the sensory neural pathways in order to plan effective intervention strategies (Yochman, et al., 2006). Yochman, Parush, Ornay (2004) also conducted an earlier study that investigated the responses to sensory events in daily life in preschool children with
and without ADHD as measured by the Sensory Profile (Dunn, 1999). Again, due to cultural limitations, the findings may not be generalizable to this population. However, the conclusions drawn noted that young children with ADHD might be at an increased risk for sensory processing deficits, which has implications for early identification and treatment (Yochman, et al., 2004).

Another study found in the literature, which utilized the Short Sensory Profile form, looked at sensory modulation dysfunction in children with ADHD (Mangeot, Miller, McIntosh, McGrath-Clarke, Simon, Hagerman, & Goldson, 2001). Mangeot et al. (2001) compared 26 children with ADHD to 30 typically developing children ages 5-13 years. Assessment measures included the Short Sensory Profile, the Leiter International Performance Scale-Revised, Parent Rating subscales and the Child Behavior Checklist. The children were also tested by means of electrodermal reactivity (EDR). Reportedly, the children with ADHD exhibited greater abnormalities in sensory modulation on parent-report measures and on the neurophysiologic measure. Again, the recommendation of the researchers is to continue future research in order to understand the importance of sensory processing abilities in children with ADHD (Mangeot et al., 2001).

In addition to studies regarding sensory processing utilizing Dunn's (1999) Sensory Profile measure, Mulligan (1996) also conducted a study to identify and describe the score patterns on the SIPT for children with and without ADHD. Mulligan (1996) wanted to conduct this research to increase the understanding of the types of sensory dysfunction seen in children with ADHD. Three hundred and nine children with ADHD and 309 children without ADHD were included in this study. Mulligan concluded that the
areas, in which children with ADHD significantly differed from those without ADHD on
the SIPT, included the areas of praxis (motor planning) and vestibular processing.
Mulligan noted that despite limitations in the study, implications for further research and
intervention strategies are evident in the areas of vestibular processing and praxis, with
regard to those who are diagnosed with ADHD.

Research regarding visuomotor perception in children with ADHD was also
conducted by Raggio (1999). He administered a battery of tests to 26 preadolescents who
were diagnosed with ADHD and without learning disabilities. The measure administered
to assess visuomotor performance was the Bender-Gestalt. The Conner’s’ Parent Rating
Scale and Continuous Performance Test were utilized in the diagnosis of ADHD. The
Wide Range Achievement Test-Third Edition was administered to rule out the presence
of learning disabilities. Raggio found that the sample in his study performed significantly
lower than the normative population. Raggio concluded that children with behavioral
characteristics such as impulsivity and inattention do poorly on tests requiring
visuomotor perception. Raggio suggested that further studies with a larger sample,
increased power, and control groups of typical and learning disabled studies should be
conducted.

Another study that examined ADHD and motor dysfunction was conducted by
Tervo, Azuma, Feugas, and Fiechtner (2002). Tervo et al. (2002) noted that there is an
overlap of symptoms in children who present with ADHD and Developmental
Coordination Disorder (DCD). It is stated that children who have problems with attention
may have difficulties with movement, perception, and memory (Tervo et al. 2002).
Tervo et al. reported that 47% of 7 year olds diagnosed with DCD have ADHD as well. The study investigated the possibility of a subgroup of children who were identified as having both diagnoses labeled under a new classification called neurodevelopmental dysfunction. Tervo et al. also investigated the responsiveness to medication for this group compared with the ADHD only group. The sample for this study consisted of 69 children who met the criteria for ADHD, according to DSM-IV criteria, and did not present with severe motor dysfunction. The Child Behavior Checklist (parent and teacher forms), Conners' Rating Scales (parent and teacher forms), the Home Situations Questionnaire, School Situations Questionnaire, and the Side Effects Rating Scale were the measures administered. Regarding the medication hypothesis, no differences between groups were noted. Thirty-five percent of the children with ADHD were identified as having significant motor dysfunction. These children presented with impaired motor skills (Tervo et al. 2002). Tervo et al. concluded that despite limitations to the study, further studies are needed to replicate this finding and to assess the influence of hyperactivity/impulsivity and inattention on motor functions and the degree to which improvement is noted with medication management.

In addition to studies conducted involving sensory processing and ADHD, studies were found in the literature regarding sensory processing and children with diagnoses on the pervasive developmental disabilities spectrum (Ayers & Tickle, 1980; Baranek, 2002; Dunn, 1997; Kientz & Dunn, 1997; Smith Myles & Orr, 2002; Walling, Deitz, & White, 2001). Baranek (2002) noted that while not all children on the autism spectrum present with sensory processing and motor dysfunction, 42.48% of them do. Ayers and Tickle (1980) studied 10 autistic children who presented with sensory processing disorders and
received sensory integration therapy for 1 year. While there are limitations to this study, including small sample size, the results indicated that therapeutic intervention was more effective with autistic children who are hyper-reactive to sensory input and have trouble modulating responses rather than with children who are hypo-reactive and fail to orient or register sensory input (Ayers & Tickle, 1980).

Ermer and Dunn (1998) designed a study to determine which of the nine factors on the Sensory Profile best discriminate among children on the autism spectrum, children with ADHD, and children without disabilities. Although methodological flaws are noted in this study, including sampling problems, data analysis demonstrated that there were two functions found that enabled the classification of 90% of the subjects. One function was found that differentiated children with disabilities from children without disabilities and the other function found differentiated the two groups of children with disabilities from each other (Ermer & Dunn, 1998). The first discriminant function discriminated children with disabilities from children without disabilities. The significant factor was Factor 5 (Inattention/Distractibility). The second discriminant function discriminated between children on the spectrum from children with ADHD and included Factors 1 (Sensory Seeking); 4, (Oral Sensitivity); and 9 (Fine Motor/Perceptual) (Ermer & Dunn, 1998).

Watling et al. (2001) studied 40 children with autism ages 3-6 years utilizing the Sensory Profile. The results indicated that children with autism performed significantly different than children without autism on 8 out of the 10 factors. The factors found that were different included sensory seeking, emotionally reactive, low endurance/tone, oral
sensitivity, inattention/distractions, poor registration, fine motor/perceptual, and other (Watling et al., 2001). Earlier, Kientz and Dunn (1997) did find evidence that the Sensory Profile does differentiate the sensory processing skills of children with autism from children without autism. Reportedly, 85% of the items on the Sensory Profile were responded to significantly differently by the group with autism (Kientz & Dunn, 1997). To provide further evidence, Dunn et al. (2002) studied the sensory processing patterns of 42 children diagnosed with Asperger's syndrome with 42 children without disabilities on both the section and factor scores of the Sensory Profile. Dunn et al. (2002) found that children with Asperger syndrome differed significantly from children without disabilities on 22 out of 23 items. Interestingly, both groups performed the same on the modulation of visual input affecting emotional responses and activity level sections (Dunn et al., 2002).

Overall, in reviewing the research studies regarding sensory integration, it is clear that there are limitations that prohibit the ability to generalize findings. A recurring limitation in most studies included the lack of a large sample size. While Dunn (1997) initially utilized a large sample, it did not include racially/ethnically diverse subjects, for example. Moreover, as Dunn continued to develop the Sensory Profile and to conduct studies with special populations, she utilized the same data. Other studies, including Dunn’s, had very small sample sizes for the groups with disabilities. Additionally, most studies did not discuss what methods were used in diagnosing these disabilities nor was much demographic information published about these disabilities groups. Therefore, the results of those studies should be interpreted with caution. Further, there appeared to be evidence of a lack of inclusion of control groups in many of the studies reviewed.
Regarding statistical design, Raggio (1999), for example, expressed hope that future studies will include larger samples and control groups that will provide sufficient power in statistical analyses. Replication studies were not found in the literature, which is another limitation of the research that is being conducted in the field.

Due to the emphasis on improving empirical research efforts and the maturing of the field in general, Miller, Cermak, Lane, Anzalone, and Koomar (2006), recently proposed the use of Sensory Processing Disorder (SPD) as a diagnostic term to help avoid confusion among disciplines. SPD would include three primary diagnostic groups: Sensory Modulation Disorder, Sensory Discrimination Disorder, and Sensory Based Motor Disorder. Miller et al., (2006) suggested this change might help differentiate the disorders of sensory integration from the theory and intervention. They further postulated that the assessment terminology should include either the term integration or processing (Miller et al., 2006). Miller et al. and her colleagues discussed they plan to advocate for these changes in terminology when the DSM-IV and the Diagnostic Classification of Mental Health and Developmental Disorders of Infancy and Early Childhood (Zero to Three, 2005) are revised.

While most professionals in the fields of psychology, neuroscience, and occupational therapy are familiar with the DSM-IV, recently, the Diagnostic Classification of Mental Health and Developmental Disorders of Infancy and Early Childhood (DC: 0-3) was published due to concerns by scholars in the field who believe that the DSM-IV provides an adult-oriented, psychopathological model for young children who present with developmental disorders that is inadequate (Lieberman, Wieder, Fenichel, 1997; Neisworth, Bagnato, & Salvia, 1995). In fact, it has since been
revised and is now the DC 0-3R (Zero to Three, 2005). Relevant to this topic, one important change in the revision includes the renaming of the Axis I, clinical disorder "Regulatory Disorders" classification to "Regulation Disorders of Sensory Processing". It was done in hopes that it will call attention to the difficulties in sensory processing that young children experience (Burpee, 2006). In addition to this classification, other relevant classifications to the topic of sensory integration include the ability to specify Hypersensitivity (e.g. Type A - Fearful/Cautious and Type B - Negative/Defiant); Hyposensitivity/Undereactivity; and Sensory Seeking/Impulsive (Burpee, 2006).

It is clear from the research studies reviewed above that there is consensus that more emphasis on generating empirically validated studies in many areas of sensory integration (including the areas of assessment and intervention) is needed in order to establish a more widely accepted position in the scientific community. There is evidence presented that demonstrates much promise and hope for the future for those interested in this field of study and for those children and families that are affected by sensory integration disorders. It appears that the field will continue its struggle in improving research methodology in order to further the knowledge base and understanding of sensory integration (Bundy et al., 2002).
Chapter III
METHODOLOGY

Participants

The present study consisted of an archival data set from 2001-2006 of 60 child participants, females and males, ranging in age from 4-10 years old. The subjects were all children who were referred for mental health treatment to a Youth Consultation Services (YCS) facility in Northern, NJ. This age range was selected due to the nature of the Sensory Profile and the research questions. Further, the study aimed to look at young, early school age children, who are experiencing affective or behavioral difficulties. While the agency primarily treats very young children (birth-6 years of age) often these children remain in treatment beyond their sixth birthday. At times older siblings are also referred for treatment within the Institute, who may be of early school age. YCS is the largest child and family mental health service provider in the state and consists of over 90 different programs.

Only those subjects whose caregivers completed the Sensory Profile upon intake at the Institute were included in this study. The participants were predominantly from the inner city, of low socioeconomic status, and of non-White ethnic backgrounds. All participants were English speaking. All data collected were aggregate or archival. Therefore, there was no direct contact with any subjects. No confidential information regarding the subjects or their caregivers was provided to the researcher. As a result, there was no concern for potential subject distress.
Procedure

The YCS agency provided the data for this convenience sample. Permission from the YCS agency to use this data was obtained by this researcher (see Appendix A). Upon intake, subjects were administered the Sensory Profile as part of the initial assessment phase of treatment. A research assistant collected the data for this study. The staff had already obtained and scored the Sensory Profiles. However, this investigator re-scored the raw data to ensure its accuracy. The research assistant filled out a coded demographic sheet (see Appendix B) that corresponded to each coded Sensory Profile so that no identifying information (such as name or address) was available.

Instruments

Demographic Data Sheet

The Demographic Data Sheet, which was created by the researcher, was used to gather specific information about the participants in the study. The demographic questionnaire sought information such as the subject’s date of birth (age), gender, ethnicity/race, socio-economic status, nature of the referral problem, and diagnostic impression. This information is important as it describes the population.

Sensory Profile

The Sensory Profile is the instrument that is the focus of this study. This investigator attempted to explore the clinical utility of this measure with an inner-city population referred for mental health treatment. Winnie Dunn, PhD, OTR, FAOTA developed the Sensory Profile in 1999. Dunn (1999) is an occupational therapist that designed this measure in order to provide a “standard method for professionals to measure a child’s sensory processing abilities and to profile the effect of sensory
processing on functional performance in the daily life of a child" (p.1). The Sensory Profile results should be utilized in combination with other observations and evaluations in order to aid professionals in diagnostic and treatment intervention planning (Dunn, 1999). Dunn (1999) identified the primary goal behind the development of the Sensory Profile to be the development of an evaluation tool to provide professionals with information about a child’s processing abilities that affect a child’s ability to function in daily life. Dunn (1999) identifies the following important features of the Sensory Profile: captures salient information about a child’s sensory processing; clearly links sensory processing with the child’s daily life performance; provides information for theory-based decision making; includes caregivers as critical members of the team; is applicable for children with all types of disabilities and severity levels; is easy to administer, score, and interpret; and is quick to administer (p. 3).

In the Sensory Profile Manual, Dunn (1999) discussed how psychologists, among other service providers, utilize this measure. She suggested the profile captures how a child performs in daily life activities and identifies areas of strength and weaknesses in a child’s sensory abilities. This information obtained can guide intervention planning.

Dunn noted that while professionals from many different disciplines can administer and score the Sensory Profile, those who are not familiar with sensory processing aspects of children’s performance, should consult with a professional who has a background in sensory processing, such as an occupational therapist, when including interpretations from this measure in reports. It is noted that investigators in the fields of basic science and applied science may also find it a useful tool. Data can be gathered that can link sensory processing abilities to daily life functioning as well as to measure overall sensory
responsivity in children. Other service providers that can benefit from utilizing this measure include teachers, speech/language pathologists, and physicians (Dunn, 1999).

Instrument development. Dunn developed the first version of the Sensory Profile in 1994 as part of research being conducted within a consultation model. Occupational therapists were asked to provide consultative services to assess sensory processing difficulties in children within the classroom. Initial studies found that modifications could be implemented within the context of the daily routines of the classroom with positive outcomes. Therapists demonstrated an interest in the further development of the profile to contribute to comprehensive assessments and for treatment planning and intervention purposes. The present version of the Sensory Profile is the result of research and development that took place from 1993-1999. It is reported that The American Occupational Therapy Foundation, the University of Kansas School of Allied Health, the Kansas Occupational Therapy Association, and the Federal Maternal and Child Health Bureau provided support to graduate students who participated in the research and development of the Sensory Profile (Dunn, 1999).

Regarding item development, the original profile questionnaire contained 99 items written as behavioral statements. These items were developed through a literature review of sensory histories that described atypical responses to various sensory experiences. No further information was provided about the subjects neither from whom these sensory histories were gathered nor from where they were gathered. The manual reported “following pilot testing, 26 more items were added to improve the clarity and range of the behavioral descriptions for caregivers, for a total of 125 items” (Dunn, 1999, p.13). In order to complete the Sensory Profile, caregivers are asked to indicate the
frequency of the child’s response to various stimuli by checking off a box labeled either “Always”, “Frequently”, “Occasionally”, “Seldom”, or “Never”, for all 125 items. The caregiver questionnaire itself and the manual both define these terms for scoring purposes as follows:

**Always:** When presented with the opportunity, your child always responds in this manner, 100% of the time; **Frequently:** When presented with the opportunity, your child frequently responds in this manner, about 75% of the time; **Occasionally:** When presented with the opportunity, your child occasionally responds in this manner, about 50% of the time; **Seldom:** When presented with the opportunity, your child seldom responds in this manner, about 25% of the time; **Never:** When presented with the opportunity, your child never responds in this manner, about 5% of the time (Dunn, 1999, p. 25).

Based on categories generally found in the literature and sensory histories, the items were originally grouped into six sensory systems and two behavior categories for a total of eight categories. The sensory systems included touch (24 items), movement (22 items), body position (11 items), visual (18 items), auditory (16 items), and taste/smell (10 items). The two behavior categories included activity level (6 items) and social/emotional (24 items) (Dunn, 1999).

In 1997, further research was conducted to improve the way in which the items were grouped. Dunn reported that the participants in the study were 155 occupational therapists randomly chosen from the Sensory Integration Special Interest Section of the American Occupational Therapy Association (AOTA). The current version of the Sensory Profile groups the 125 items into three main categories. The three categories
include Sensory Processing, Modulation, and Behavioral and Emotional Responses. Each main category consists of several item sub-groupings (Dunn, 1999).

The Sensory Processing category is comprised of six item groupings that describe different types of sensory processing used in daily life. These items include auditory processing (items 1-8), visual processing (items 9-17), vestibular processing (items 18-28), touch processing (items 29-46), multisensory processing (items 47-53), and oral sensory processing (items 54-65) (Dunn, 1999).

The Modulation category is comprised of five item groupings that describe different types of modulation input used in daily life. These groupings include sensory processing related to endurance/tone (items 66-74), modulation related to body position and movement (items 75-84), modulation of movement affecting activity level (items 85-91), modulation of sensory input affecting emotional responses (items 92-95), and modulation of visual input affecting emotional responses and activity level (items 96-99) (Dunn, 1999).

The Behavioral and Emotional Responses category is comprised of three item groupings that describe various behavioral and emotional responses to sensory stimuli, which reflect a child’s sensory processing abilities. These groupings include emotional/social responses reflecting psychosocial coping strategies (items 100-116), behavioral outcomes of sensory processing (items 117-122), and items indicating thresholds for responses (items 123-125), which reflect a child’s level of modulation (Dunn, 1999).

The Sensory Profile caregiver questionnaire lists all of the 125 items under the item grouping headings in the sequence listed above. To the left of each item, an icon key
and a threshold key is provided for the examiner. The icon key consists of symbols that reflect the initial eight categories (six sensory system and two behavior categories) referenced above. The threshold key is provided as a reminder to the examiner of which type of response to the stimuli the item represents. In other words, an “L” symbolizes a low threshold level item, which indicates it would take little stimuli to meet a neurological threshold to create a response or behavior. Conversely, an “H” symbolizes a high threshold level, which indicates it would take more stimuli to meet a neurological threshold to create a response or behavior. If the green shaded box is empty, it indicates the item is neither low nor high. In addition, a score key is provided for the examiner on the caregiver questionnaire. A score of 1 corresponds to “always”, a 2 to “frequently”, a 3 to “occasionally”, a 4 to “seldom”, and a 5 to “never” (Dunn, 1999).

A summary score sheet is provided for the examiner, which takes 20-30 minutes to complete. The front of the score sheet provides some demographic information, including a section that indicates what types of service(s) the child is receiving. An area to indicate a child’s condition, which refers to any disabilities or disorders already diagnosed, is also provided. The summary score sheet includes a Factor Grid, Factor Summary, and a Section Summary. The Section Summary lists raw scores for the fourteen sub-groupings found under the three main categories of Sensory Processing, Modulation, and Behavior and Emotional Responses as listed above. However, these scores are not the ones of interest in this study. The Factor Grid consists of nine factors that were found to be “the most interpretable” by researchers upon factor analysis (Dunn, 1999, p.18). These factors include Factor 1 (Sensory Seeking), Factor 2 (Emotionally Reactive), Factor 3 (Low Endurance/Tone), Factor 4 (Oral Sensory Sensitivity), Factor 5
(Inattention/Distractibility), Factor 6 (Poor Registration), Factor 7 (Sensory Sensitivity), Factor 8 (Sedentary), and Factor 9 (Fine Motor/Perceptual) (Dunn, 1999). Factor 1 (Sensory Seeking), Factor 2 (Emotionally Reactive), and Factor 5 (Inattention/Distractibility) are the factors of interest in this study.

Normative data. Dunn (1999) reported that in general, research on the Sensory Profile was conducted from 1993-1999. Overall, more than 1,200 children between the ages of 3-14 with and without disabilities in different regions of the nation participated as subjects. There were 166 occupational therapists randomly selected as examiners from the roster of the Sensory Integration Special Interest Section of the AOTA. The sample of children without disabilities consisted of a total of 1,037 children between the ages of 3 and 10 years of age. The sample consisted of 524 girls (50.5% of the sample) and 510 boys (49.2% of the sample). The gender for three of the children was not reported (.3% of the sample). Exclusionary criteria for the sample included receiving special education services and taking regular prescription medication. The original sample of children without disabilities consisted of 1,115 children but 78 were excluded based on the criteria. The smaller sample of children with disabilities was 166.

Regarding the normative sample of children without disabilities, subjects age 3.0-3.11 comprised 13.4% of the sample, n=139. Those age 4.0-4.11 accounted for 13.3% of the sample n=138. Participants age 5.0-5.11 comprised 13.5% of the sample, n=140. Those age 6.0-6.11 accounted for 12.0% of the sample n=124. Subjects age 7.0-7.11 comprised 13.4% of the sample, n=139. Participants age 8.0-8.11 comprised 12.2% of the sample, n=127. Children age 9.0-9.11 accounted for 10.9% of the sample, n=110. Those age 10.0-10.11 comprised 11.6 of the sample, n=120 (Dunn, 1999).
Geographically, Dunn (1999) reported that 29.2% of the sample, n=303, were from the Northeast region of the United States. The North Central region accounted for 29.7% of the sample, n= 308. Participants from the South made up 25.3% of the sample, n=262. While the West accounted for 14.7% of the sample, n=152. Twelve participants, accounting for 1.1% of the sample, did not report their geographic location (Dunn, 1999).

In terms of race/ethnicity, 9.9% of the sample identified as Native American, n=9. Twelve of the children identified as Asian, accounting for 1.2% of the sample. Sixteen participants identified as African American, accounting for 1.5% of the sample. Fifteen of the sample identified as Hispanic, accounting for 1.4% of the sample. Nine hundred forty eight identified as White, which accounted for 91.4% of the sample. Twenty-five subjects reported "other" as race, which accounted for 2.4% of the sample. Twelve subjects did not report their race/ethnicity, accounting for 1.2% of the sample (Dunn, 1999).

Dunn (1999) also reported the distribution of the sample by income. In the $10,000 or less range, 9.1% of the sample was accounted for, n=94. Four hundred and sixty-seven subjects, 45.0% of the sample, reported an income between $11,000-30,000. Two hundred and fifty-nine participants are from households with incomes that range from $31,006-50,000 (25.0%). Ninety-two subjects, 8.9% of the sample, reported income between $51,000-70,000. One hundred twenty-five participants, 12.0%, did not report their income level.

The Sensory Profile manual reported that 631, or 60.9% of the sample lived in suburban communities. One hundred ninety-six, or 18.9% of the sample, were from rural communities.
communities. Urban communities accounted for 16% or 15.5% of the sample. A total of 49 subjects, 4.7% of the sample, did not report their community (Dunn, 1999).

In the Sensory Profile manual, there was mention of a small sample of children with disabilities that were administered the measure. Dunn (1999) provided a more brief description of this sample of children with disabilities. She reported that she conducted studies with smaller samples of children with various disabilities in order to establish validity for the Sensory Profile. Children diagnosed with ADHD (n=61, ages 3-15), autism/pervasive developmental disorder (n=32, ages 3-13), Fragile X disorder (n=24, ages 3-17), or a sensory modulation disorder (n=21, ages 4-9), were included in the studies. It is noted that a smaller group of children with other disabilities such as behavior or learning disabilities were also included in some of the studies, but no further information regarding the normative data for this sample of children with disabilities was reported.

Validity: In order to provide validity evidence for the sample of children without disabilities, Dunn (1999) reported that researchers utilized descriptive statistics, multivariate analysis of variance, and principal component factor analysis. An initial principal component factor analysis was utilized to determine whether or not items clustered into meaningful, independent groupings. Dunn reported that 17 factors were initially found to account for 59.6% of the variance. She explained that these 17 factors account for almost 60% of the variation among the scores of the sample. Dunn reported that when the factors were studied more closely, 9 out of 17 factors were found to be most interpretable. Another analysis was then performed in which items that had a weaker relationship with the factor structure, which the researchers determined to include
those with commonalities of <.40, were eliminated. These 9 factors did account for
47.8% of the variance. Dunn reported that 44 items were eliminated from the final factor
groupings. No further information about the factor analyses was provided.

Researchers utilized the data from the sample of children without disabilities
between the ages of 3-10 years old to create a classification system (Typical
Performance, Probable Difference, and Definite Difference) by establishing a range of
scores for each section and raw score totals. This system gives an estimate of a child’s
performance on a particular section or factor. In general, there was very little difference
reported in the mean raw scores across the various age groups, especially after the age of
5. Developmentally, under the age of 5, different cut scores were determined.
Specifically, three items that form Factor 9 (Fine Motor/Perceptual) and two other
factors, Factor 1 (Sensory Seeking) and Factor 2 (Emotional Reactivity) should be
interpreted carefully with children less than 5 years of age.

Typical Performance scores refer to scores at or above the point 1 standard
deviation below the mean for the children without disabilities. This means that a child in
this area performed like that of a child in the top 84% of the sample. Probable Difference
scores refer to those at or above the point 2 standard deviations below the mean, but
lower than 1 standard deviation below the mean for children without disabilities. This
means that a child performed in between the 2nd and 16th percentile, or as 14% of the
sample performed. Definite Difference refers to scores below the point 2 standard
deviations below the mean for the children without disabilities sample. This means that a
child in this area is performing like a child in the lowest 2% of the sample. Dunn (1999)
argued that this method for determining cut scores was helpful in identifying children
who may be at risk for sensory processing by comparing the score of the child who is being tested to a more homogeneous group (the sample group of children without disabilities).

In terms of content validity, Dunn (1999) argued that this was established during the Sensory Profile's development as the measure sampled a full range of sensory processing items that a child may respond to. This was done through a literature review, expert review, and category analysis. The literature review ensured that items were selected from sensory histories of children and from literature on sensory processing. The criteria for selecting an item was based on how it identified a sensory processing difficulty, discriminated between children with and without disabilities, or the item reported changes in behaviors with intervention. Regarding expert review, eight therapists conducted a pilot study in 1994 to establish whether or not children without disabilities displayed these behaviors selected. Each therapist was experienced in applying sensory integration theory to practice and provided input into which item selection, item placement, and wording of items.

A category analysis was performed nationally by 155 occupational therapists selected from the Sensory Integration Special Interest Section of the American Occupational Therapy Association (AOTA). They received a randomized list of items and were asked to categorize them, based on the earlier version of the Sensory Profile. As a result, two new categories were developed in addition to the original eight. Eighty percent of the therapists agreed on the categories of placement on 63% of the items (Dunn, 1999).
Construct validity, the extent to which the test actually measures what it purports to measure, was demonstrated by Dunn (1999) through the establishment of convergent validity and discriminant validity. Convergent validity is the extent to which a test correlates highly with other measures or variables that it would be expected to correlate highly with. Discriminant validity is defined as the ability of a test to show low to moderate correlations with variables that measure different, but related constructs. Dunn purported that the Sensory Profile researchers provided data that supported the initial hypotheses driven by theory. This was determined by comparing scores obtained on the Sensory Profile with those of the School Function Assessment (SFA). The SFA was reportedly chosen as a measure to determine the convergent and discriminant validity of because it deals with children’s performance in the school setting. No further rationale as to why this measure was selected was provided. The researchers hypothesized that some school tasks, such as learning, would be related to sensory processing abilities while others would not.

When the normative data from the Sensory Profile was compared with that of the SFA, convergent validity was established. As predicted, there were high correlations between the SFA performance items and the items in Factor 9 (Fine Motor/Perceptual) as both measured the same behavior, such as hand use. As predicted, there were also high correlations between the SFA socialization and behavior interaction sections and the modulation sections and factors on the Sensory Profile. This was thought to be due to the nature of the difficulty children exhibit responding in a behaviorally appropriate manner when there is difficulty with regulating sensory input (Dunn, 1999). Specifically, the positive correlations for the three factors of interest in this study will be discussed.
Regarding factors 1 (Sensory Seeking) and 2 (Emotionally Reactive), no correlations were found to be significant when the Sensory Profile was compared to the SFA. However, Factor 5 (Inattention/Distractibility) correlated negatively with the Behavior Regulation section of the SFA. The correlation for Factor 5 and the SFA Behavior Regulation Adaptations scale was -.582, p = .05. The correlation for Factor 5 and the SFA Behavior Regulation Assistance scale was -.584, p = .05. There is a negative correlation because lower scores on the Sensory Profile are undesirable (child exhibits behaviors more often); whereas on the SFA, lower scores are desirable (child needs less support) (Dunn, 1999).

Dunn (1999) described discriminant validity was established for the Sensory Profile when it was compared with the SFA. The Sensory Profile items appeared to reflect a more global sensory processing ability, which is not related to specific tasks included on the SFA. Low correlations then were found between Sensory Profile items and the more specific items on the SFA, as hypothesized.

Dunn (1999) reported descriptive statistics for two clinical groups. As discussed earlier in the chapter, data for a group of children who were diagnosed with autism and for a group of children diagnosed with ADHD was collected. For the autism group, nearly 90% of the items reflected meaningfully different scores than that of the normative sample. These differences were found throughout all sections and factors on the Sensory Profile. For the ADHD group, it was found that on 113 of the 125 items, the behaviors these items represented were exhibited more frequently in ADHD children than compared with the normative sample. Raw scores from 43 of the 125 items demonstrated a difference of more than 1 point on the rating scale. These 43 items also clustered
around a grouping of visual and tactile perception areas and three of the nine factors: Factor 1 (Sensory Seeking), Factor 2 (Emotional Reactivity), and Factor 5 (Inattention/Distractibility). These are the same factors being considered in this study.

Reliability. The reliability of a measure relates to the ability of a test to provide a stable score. The reliability of the Sensory Profile was estimated using an internal consistency measure, Cronbach's Alpha. Internal consistency for each section of the Sensory Profile was reported, which gives the examiner an idea of how well items in each section measured each grouping category. The overall range for all sections and factors was .47 to .91. Regarding the three factors of interest for this study, the range was from .7732 to .9151. The alpha coefficient for Factor 1 (Sensory Seeking) was .8966. For Factor 2, (Emotionally Reactive) the alpha coefficient was .9151. The alpha coefficient for Factor 5 (Inattention/Distractibility) was reported to be .7732 (Hunt, 1999).

The standard error of measurement was also calculated for the section and factor scores. The standard error of measurement for the three factors of interest in this study ranged from 2.89 to 1.65. The standard error of measurement for Factor 1 (Sensory Seeking) was 2.89. For Factor 2, (Emotionally Reactive) the standard error of measurement was 2.47. The standard error of measurement for Factor 5 (Inattention/Distractibility) was reported to be 1.65 (Dunn, 1999).

Data Analysis

The data for this study was analyzed through the method of one-sample, two-tailed t-tests. The one-sample two-tailed t-test is appropriate for this study because all variables are scale variables, where scores reflect differences in amount rather than different categories. The goal of this study is to compare this sample's values to an
established norm. Specifically, the scores for the sample in this study, who are children (age 4-10) referred for mental health treatment in an inner-city setting, was compared to the normative data, the data for the sample of children without disabilities, in order to determine if statistical significance was found for Factor 1 (Sensory Seeking), Factor 2 (Emotionally Reactive), and Factor 5 (Inattention/Distractibility) in this sample. Statistical significance is defined as scores that will be found to be in either the Probable Difference range (scores at or above the point two standard deviations below the mean, but lower than one standard deviation below the mean) or Definite Difference range (score below the point 2 standard deviations below the mean) (Dunn, 1999). Stevens (2001) recommended using 20 participants or more per level of factors, therefore a minimum of 60 subjects will be necessary to employ this design.
Chapter IV
RESULTS
This chapter presents results from the statistical analysis conducted on the data collected in this study. A review of the research variables, descriptive, and demographic information on the participants is provided in addition to a summary of the results of the hypotheses testing.

Research Variables
The variables in the research were the three factors from the Sensory Profile: Sensation Seeking, Emotionally Reactive, and Inattention/Disregardibility. A univariate one-sample, two-tailed t-test was the statistical method used to compare mean scores from this sample to the normative data. Descriptive statistics (frequency distributions) generated by the research are presented in Tables 1-26.

Descriptive Statistics for Demographic Variables
Demographic variables were obtained for each participant in the study. A total of 60 subjects were included in this study. The following tables present the frequency distributions for some of the demographic variables.

Table 1 presents the frequency distribution of the ages of the subjects. The children in this study were slightly older than 5 (M = 5.25) while the average age of caregivers was just over 35 (M = 36.02).
Table 1

Frequency Distribution of Age of Subject

<table>
<thead>
<tr>
<th>Age</th>
<th>Frequency</th>
<th>Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>1</td>
<td>1.7</td>
<td>1.7</td>
</tr>
<tr>
<td>4</td>
<td>22</td>
<td>36.7</td>
<td>38.3</td>
</tr>
<tr>
<td>5</td>
<td>19</td>
<td>31.7</td>
<td>70.0</td>
</tr>
<tr>
<td>6</td>
<td>5</td>
<td>8.3</td>
<td>78.3</td>
</tr>
<tr>
<td>7</td>
<td>7</td>
<td>11.7</td>
<td>90.0</td>
</tr>
<tr>
<td>8</td>
<td>44</td>
<td>6.7</td>
<td>96.7</td>
</tr>
<tr>
<td>9</td>
<td>2</td>
<td>2.3</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>60</td>
<td></td>
<td>100.0</td>
</tr>
</tbody>
</table>

There was a very wide range for the caregiver age. About 1/3 of the sample was age 30 or under. Table 2 outlines the frequency distribution of age of caregiver.

Table 2

Frequency Distribution of Age of Caregiver

<table>
<thead>
<tr>
<th>Age</th>
<th>Frequency</th>
<th>Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>24</td>
<td>4</td>
<td>6.7</td>
<td>6.7</td>
</tr>
<tr>
<td>25</td>
<td>6</td>
<td>10.0</td>
<td>16.7</td>
</tr>
<tr>
<td>26</td>
<td>1</td>
<td>1.7</td>
<td>18.3</td>
</tr>
<tr>
<td>27</td>
<td>3</td>
<td>5.0</td>
<td>23.3</td>
</tr>
<tr>
<td>Age</td>
<td>Frequency</td>
<td>Percent</td>
<td>Cumulative Percent</td>
</tr>
<tr>
<td>-----</td>
<td>-----------</td>
<td>---------</td>
<td>-------------------</td>
</tr>
<tr>
<td>28</td>
<td>2</td>
<td>3.3</td>
<td>26.7</td>
</tr>
<tr>
<td>29</td>
<td>3</td>
<td>5.0</td>
<td>31.7</td>
</tr>
<tr>
<td>30</td>
<td>1</td>
<td>1.7</td>
<td>33.3</td>
</tr>
<tr>
<td>32</td>
<td>2</td>
<td>3.3</td>
<td>36.7</td>
</tr>
<tr>
<td>33</td>
<td>1</td>
<td>1.7</td>
<td>38.3</td>
</tr>
<tr>
<td>34</td>
<td>2</td>
<td>3.3</td>
<td>41.7</td>
</tr>
<tr>
<td>35</td>
<td>6</td>
<td>10.0</td>
<td>51.7</td>
</tr>
<tr>
<td>37</td>
<td>1</td>
<td>1.7</td>
<td>53.3</td>
</tr>
<tr>
<td>38</td>
<td>2</td>
<td>3.3</td>
<td>56.7</td>
</tr>
<tr>
<td>39</td>
<td>2</td>
<td>3.3</td>
<td>60.0</td>
</tr>
<tr>
<td>40</td>
<td>5</td>
<td>8.3</td>
<td>68.3</td>
</tr>
<tr>
<td>41</td>
<td>1</td>
<td>1.7</td>
<td>70.0</td>
</tr>
<tr>
<td>42</td>
<td>4</td>
<td>6.7</td>
<td>76.7</td>
</tr>
<tr>
<td>43</td>
<td>3</td>
<td>5.0</td>
<td>81.7</td>
</tr>
<tr>
<td>45</td>
<td>2</td>
<td>3.3</td>
<td>85.0</td>
</tr>
<tr>
<td>46</td>
<td>3</td>
<td>5.0</td>
<td>90.0</td>
</tr>
<tr>
<td>47</td>
<td>2</td>
<td>3.3</td>
<td>93.3</td>
</tr>
<tr>
<td>48</td>
<td>1</td>
<td>1.7</td>
<td>95.0</td>
</tr>
<tr>
<td>49</td>
<td>1</td>
<td>1.7</td>
<td>95.7</td>
</tr>
<tr>
<td>56</td>
<td>2</td>
<td>3.3</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>60</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>
Table 3 presents the frequency distribution of gender. In this sample, most caregivers were male.

<table>
<thead>
<tr>
<th>Gender</th>
<th>Frequency</th>
<th>Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>46</td>
<td>76.7</td>
<td>76.7</td>
</tr>
<tr>
<td>Female</td>
<td>14</td>
<td>23.3</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>60</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

Table 4 presents the caregiver relationship to the subject. Slightly more than 2/3 of the sample had a caregiver who was a biological parent. The next most frequent caregiver type was foster parent. Other caregiver relationship categories received few responses.

<table>
<thead>
<tr>
<th>Caregiver Relationship</th>
<th>Frequency</th>
<th>Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biological Parent</td>
<td>41</td>
<td>68.3</td>
<td>68.3</td>
</tr>
<tr>
<td>Foster Parent</td>
<td>10</td>
<td>16.7</td>
<td>85.0</td>
</tr>
<tr>
<td>Grandparent</td>
<td>2</td>
<td>3.3</td>
<td>88.3</td>
</tr>
<tr>
<td>Adoptive Parent</td>
<td>4</td>
<td>6.7</td>
<td>95.0</td>
</tr>
<tr>
<td>Aunt/Uncle</td>
<td>3</td>
<td>5.0</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>60</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>
Table 5 outlines the frequency of the racial identity of the subjects in this sample. Nearly ⅔ of the sample were non-White.

Table 5

<table>
<thead>
<tr>
<th>Race</th>
<th>Frequency</th>
<th>Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>African American</td>
<td>30</td>
<td>50.0</td>
<td>50.0</td>
</tr>
<tr>
<td>White</td>
<td>13</td>
<td>21.7</td>
<td>71.7</td>
</tr>
<tr>
<td>Hispanic</td>
<td>14</td>
<td>23.3</td>
<td>95.5</td>
</tr>
<tr>
<td>Asian</td>
<td>2</td>
<td>3.3</td>
<td>98.3</td>
</tr>
<tr>
<td>Other</td>
<td>1</td>
<td>1.7</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>60</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

Table 6 provides the frequency of the educational level of the subjects of the sample. Half of the subjects had an education level of kindergarten or below.

Table 6

<table>
<thead>
<tr>
<th>Educational Level</th>
<th>Frequency</th>
<th>Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-School/Pre-K</td>
<td>21</td>
<td>35.0</td>
<td>35.0</td>
</tr>
<tr>
<td>Kindergarten</td>
<td>10</td>
<td>16.7</td>
<td>51.0</td>
</tr>
<tr>
<td>First Grade</td>
<td>14</td>
<td>23.3</td>
<td>75.0</td>
</tr>
<tr>
<td>Second Grade</td>
<td>5</td>
<td>8.3</td>
<td>83.3</td>
</tr>
<tr>
<td>Other</td>
<td>10</td>
<td>16.7</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>60</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>
Table 7 presents the educational level of the caregivers of this sample. A majority of the sample indicated they are college or vocational/trade school graduates. A very small percentage of the sample reported an educational level of less than high school.

Table 7: Frequency of Educational Level of Caregivers

<table>
<thead>
<tr>
<th>Educational Level</th>
<th>Frequency</th>
<th>Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Did Not Complete High School</td>
<td>2</td>
<td>3.3</td>
<td>3.3</td>
</tr>
<tr>
<td>High School Graduate/GED</td>
<td>28</td>
<td>46.7</td>
<td>50.0</td>
</tr>
<tr>
<td>Vocational/Trade School Graduate</td>
<td>5</td>
<td>8.3</td>
<td>58.3</td>
</tr>
<tr>
<td>College Graduate</td>
<td>25</td>
<td>41.1</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>60</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

Table 8 presents the frequency distribution of the marital status of the caregivers. There were nearly as many married and single adults in this sample. There was a relatively small percentage of divorced caregivers.

Table 8: Frequency of Marital Status of Caregivers

<table>
<thead>
<tr>
<th>Marital Status</th>
<th>Frequency</th>
<th>Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Married</td>
<td>27</td>
<td>45.0</td>
<td>45.0</td>
</tr>
<tr>
<td>Single</td>
<td>26</td>
<td>43.3</td>
<td>88.3</td>
</tr>
<tr>
<td>Divorced</td>
<td>5</td>
<td>8.3</td>
<td>96.7</td>
</tr>
<tr>
<td>Widowed</td>
<td>2</td>
<td>3.3</td>
<td>100.0</td>
</tr>
</tbody>
</table>
Table 8, continued

<table>
<thead>
<tr>
<th>Marital Status</th>
<th>Frequency</th>
<th>Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>60</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

Table 9 displays the employment status of the caregivers. A majority of the adults were employed full time. There was a sizable portion of unemployed adults.

Table 9

<table>
<thead>
<tr>
<th>Employment Status</th>
<th>Frequency</th>
<th>Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Employed Full Time</td>
<td>38</td>
<td>63.3</td>
<td>63.3</td>
</tr>
<tr>
<td>Employment Part Time</td>
<td>2</td>
<td>3.3</td>
<td>66.7</td>
</tr>
<tr>
<td>Unemployed</td>
<td>20</td>
<td>33.3</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>60</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

Regarding the frequency of number of children living in the home variables, the data show that the biological sibling category was the most common type of siblings found at home. Fifty-eight percent of the sample reported having no biological siblings at home. Twenty-two percent of the sample reported having one biological sibling at home. Seventeen percent of the sample had two or more biological siblings at home. Two percent had three biological siblings at home and one percent reported having four siblings in the home.

The half siblings group was the second most common type of siblings found in the home for this sample. Eighty percent of the sample reported living with half siblings in
the home. Ten percent of the sample reported one half sibling at home. Five of the
subjects reported having two half siblings at home and one reported having three half
siblings at home.

No one in the sample reported having stepsiblings at home. The adopted and
"other" categories had very low frequencies. For example, 95 percent of the sample
reported having no adoptive siblings at home. One subject reported having one adopted
sibling at home. Two subjects reported having two adopted siblings at home. Ninety five
percent of the sample reported having no siblings in the "other" category. Three subjects
did report having one sibling at home in the "other" category.

Eighty five percent of the sample reported having no foster siblings at home. Four
subjects reported they had one foster sibling at home. Two subjects indicated they have
two foster siblings at home while none of the subjects reported having three foster
siblings living at home. Five percent of the sample did report that they had four foster
siblings at home.

The frequencies of DSM-IV (Diagnostic and Statistical Manual) diagnoses were
also calculated for this sample. The most common primary DSM-IV diagnosis was PDD
(Pervasive Developmental Disorder) (27%), followed by Disorder of Infancy, Childhood,
or Adolescence NOS (Not Otherwise Specified) (20%). Disruptive Behavior Disorder
NOS (Not Otherwise Specified) (13%) was the third most common primary DSM-IV
diagnosis. Five percent of the sample reportedly had Communication Disorders as the
primary diagnosis. Another five percent of the sample was found to have Oppositional
Defiant Disorder as the next most common diagnosis. Five percent of the sample reported
Adjustment Disorder as a primary diagnosis. Another five percent of the sample reported
Schizophrenia as a primary diagnosis. Three percent of the sample were diagnosed as “other” as a primary diagnosis. Less than two percent of the sample reported Reactive Attachment Disorder of Infancy or Early Childhood, Anxiety Disorders, and/or problems related to abuse or neglect.

While 65 percent of the sample did not present with a secondary DSM-IV diagnoses, for those who did, the most common secondary diagnosis was ADHD (Attention Deficit Hyperactivity Disorder) (10%). The next most frequent category was Relational Problems (8.3%). Three percent of the sample reported Reactive Attachment Disorder of Infancy or Early Childhood as a secondary diagnosis. Pervasive Developmental Disorder, Oppositional Defiant Disorder, Adjustment Disorder, Anxiety Disorders; and the “other” category were all reported by less than two percent of the sample.

There were very few participants with either three or four diagnoses. In fact for 55 of the 60 subjects in the sample, there was no report of a third DSM-IV diagnosis. For two subjects, Communication Disorder was the third diagnosis. For one subject, Disruptive Behavior Disorder NOS was a third DSM-IV diagnosis. For another subject, Disorder of Infancy, Childhood, or Adolescence NOS was the third diagnosis. Finally, for one subject, Anxiety Disorder was reported as the third DSM-IV diagnosis.

For 58 of 60 subjects in the sample, there were no reports of a fourth DSM-IV diagnosis. For one subject, Conduct Disorder was the fourth diagnosis. For another subject, Impulse Control Disorder NOS was the fourth DSM-IV diagnosis.

Demographic information was gathered regarding the four most common presenting problems that led each subject to treatment. The most common presenting problem for
this sample was a developmental disability (30%). This is consistent with Pervasive Developmental Disorder being the most common DSM-IV diagnosis for this sample. The next most common primary problems included school difficulties (15%) and aggression (15%). Hyperactivity was reported to be a primary presenting problem for 12% of the subjects in this sample. Ten percent of the sample indicated that anxiety was the primary presenting problem. Five percent of the sample reported the presenting problem was short attention span. Another five percent indicated that assaultive behavior was the primary presenting problem.

Twenty percent of the subjects in the sample did not report a secondary presenting problem. School problems (18%) and hyperactivity (15%) were the most common secondary problems found. Social/interpersonal problems and short attention span each accounted for eight percent of the sample.

A substantial number of responses in the "Presenting Problems- Third" variable were found (58%). Marital/family (10%), school (10%), and interpersonal problems (10%) were reported. Hyperactivity (7%) and short attention span (7%) were also listed as presenting problems in this category. A strong majority of responses indicated that there was not a fourth presenting problem (82%), although family problems (5%) are the most commonly reported.

Another demographic variable examined was whether or not the subject was on medication at intake. A strong majority (88%) of the responses indicated that the subjects were not on medication. Only 7 of the 60 respondents reported that the subject was on medication.
The type of community the subjects come from was also examined. According to the demographic data gathered in this study, the majority of the subjects (63%) were from an inner city, urban area. Twenty percent of the subjects were from suburban communities.

The payor source for each subject was examined. The majority of the subjects (65%) in this study received Medicaid funding.

Hypothesis Testing

One-sample, two-tailed t-tests were utilized to determine whether or not the means of Dunn's normative values on three factors from the Sensory Profile were statistically different from the normative values examined. Table 10 presents the descriptive statistics for the one-sample t-tests for Sensation Seeking, Emotionally Reactive, and Inattention/Distractibility.

Table 10

<table>
<thead>
<tr>
<th>Psychological Variable</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Number of Subjects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensation Seeking</td>
<td>56.92</td>
<td>13.27</td>
<td>60</td>
</tr>
<tr>
<td>Emotionally Reactive</td>
<td>49.60</td>
<td>14.66</td>
<td>60</td>
</tr>
<tr>
<td>Inattention/Distractibility</td>
<td>21.75</td>
<td>8.38</td>
<td>60</td>
</tr>
</tbody>
</table>

The results of the one-sample, two-tailed t-tests for the three factors examined in this study, Sensation Seeking, Emotionally Reactive, and Inattention/Distractibility, indicated that the mean values obtained in this study were statistically significantly different from the normative values. Table 11 presents the comparison of the factors to normative values. The Sensation Seeking mean score for this sample (M=56.92) was
lower than the normative mean value ($M=72.07$). The Emotionally Reactive mean score for this sample was lower ($M=49.60$) than the normative mean value ($M=65.48$).

Similarly, for Inattention and Distractibility, the mean score for this sample ($M=21.75$) was lower than the normative mean value ($M=23.71$).

Table 11

*Comparison of Sensation Seeking, Emotional Reactivity, and Inattention/Distractibility Factor Values to Normative Values*

<table>
<thead>
<tr>
<th>Factor</th>
<th>Test Value</th>
<th>t</th>
<th>df</th>
<th>p-value</th>
<th>Mean Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensation Seeking</td>
<td>72.07</td>
<td>-8.844</td>
<td>59</td>
<td>.000*</td>
<td>-15.1570</td>
</tr>
<tr>
<td>Emotionally Reactive</td>
<td>65.48</td>
<td>-8.393</td>
<td>59</td>
<td>.000*</td>
<td>-15.8811</td>
</tr>
<tr>
<td>Inattention/Distractibility</td>
<td>28.71</td>
<td>-8.454</td>
<td>39</td>
<td>.000*</td>
<td>-6.9599</td>
</tr>
</tbody>
</table>

Note *p<.05

The one-sample, two-tailed t-test provided the following findings with regard to hypothesis testing:

*Hypothesis 1:*

Sensation Seeking scores from this sample will be significantly different from the normative sample.

This hypothesis was supported by the data ($t(59) = -8.844$, $p<.05$). The Sensation Seeking score from this sample was lower than the normative value (see Table 11).

*Hypothesis 2:*

Emotionally Reactive scores from this sample will be significantly different from the normative sample.
This hypothesis was supported by the data ($t(59) = -8.393, p<.05$). The Emotionally Reactive score from this sample was lower than the normative value (see Table 11).

**Hypothesis 3:**

Inattention/Distractibility scores from this sample will be significantly different from the normative sample.

This hypothesis was supported by the data ($t(55) = -8.454, p<.05$). The Inattention/Distractibility score from this sample was lower than the normative value (see Table 11).

**Summary**

All three of the hypotheses were supported by the one-sample, two-tailed $t$-tests. The results indicate that there is a significant difference between the means found in this sample for the three factors: Sensory Seeking, Emotionally Reactive, and Inattention/Distractibility, and the normative data supplied by Dunn. The subjects in this clinical sample did have lower scores, indicating a higher level of impairment, in the three areas examined. The subjects in this clinical sample were different from the subjects in Dunn's normative population. This clinical sample is primarily composed of subjects who are non-White (78.3%) and from an urban community (63.3%). Dunn's subjects were primarily White (91.4%) and from suburban communities (60.9%). Implications of these findings will be explored and further discussed in Chapter V.
Chapter V
DISCUSSION AND RECOMMENDATIONS

The concept of Sensory Regulation has become a recent topic of interest for those who work with young children, especially those with special needs. Frequently, children are referred for an evaluation to child mental health professionals due to suspected developmental delays and/or behavioral difficulties. It was the purpose of this exploratory study to investigate the clinical utility of the Sensory Profile, an assessment measure that specifically assesses sensory processing abilities in daily functioning, and ground it in psychological theory by comparing a clinical sample to the normative sample. The goal of this chapter is to discuss the statistical results of the comparison of means on three factors on the Sensory Profile from this sample with the normative data, while integrating psychodynamic ego function theory with current literature regarding sensory integration and neuroscience. Limitations of the study, clinical implications, and suggestions for future research will also be presented.

As demonstrated through the literature review (see Chapter II), there is much overlap between the disciplines of psychology, occupational therapy, and neuroscience with regard to their contributions to enhancing the understanding of how sensory processing abilities develop and affect the development of ego functions and emotional and behavioral regulation in young children (Bellak et al., 1973; Greenspan, 1989; Lacy & Hughes, 2006; Posner & Rothbart, 2007; & Schore, 1994). Through statistical analyses, all three hypotheses compared the means of this sample with the normative group on three psychological variables (three factors on the Sensory Profile) were supported. On all three of the factors of the Sensory Profile: Sensory Seeking, Emotional
Reactivity, and Inattention/Distractibility; there was a significant difference between the means of this clinical population and the normative sample. This indicates that in this particular sample, children referred for mental health evaluations exhibited greater difficulty with regulating sensory seeking behaviors, emotional reactions, and their abilities to attend and focus on tasks, than those who were not seeking mental health services (normative population).

Discussion of Hypotheses

Hypothesis 1: indicates that Sensory Seeking scores from this sample will be significantly different from the normative sample. This hypothesis was supported by the data (t (59) = -8.84, p<.000). The following is a more detailed discussion of some of the behaviors that are reported on the Sensory Seeking factor. On this factor, caregivers reported children in this sample enjoy strange noises or seek to make noise for noise’s sake; fidget, seek movement that interferes with daily routines; seek out activities that involve movement; and frequently engage in behavior that involve twirling or spinning. Additionally, caregivers for this group, reported that children in this sample may prefer to be barefoot, touch people and objects, and hang on furniture, people, or objects, even in familiar surroundings. Similarly, these children engage more often in behavior that includes taking excessive risks during play, seek opportunities to fall without regard to personal safety, and appear to enjoy falling. On the Sensory Profile, children who scored low in this section also tend to become overly excitable during movement activity, frequently seem to be on the go, and frequently jump from one activity to another so that it interferes with play. Caregivers report that children in this sample may also tend to be overly affectionate toward others (Dunn, 1999).
Clinically, many of these behaviors overlap with behaviors seen in children typically diagnosed with PDD and ADHD. In other words, sensory seeking behavior appears to include behaviors that are motor driven. The sensory systems that are targeted by these behaviors include auditory processing, vestibular processing, touch processing, multi-sensory processing, modulation related to body position and movement, modulation of movement affecting activity level, and modulation of sensory input affecting emotional responses (Dunn, 1999).

In terms of ego function theory, the concept of stimulus barrier corresponds to this sensory seeking factor. The stimulus barrier plays a crucial role in the development of children (Bellak et al., 1973). The role of the stimulus barrier is to mediate the intensity of external stimuli to a more manageable level. When a child is seeking sensory input, it may be that the developing stimulus barrier is not able to effectively manage the input. Those who seek out stimuli and become over stimulated and dysregulated may be exhibiting behaviors that serve as a defense mechanism (Bellak et al., 1973). Often times there are other conflicts within the child and the sensory seeking behavior can "reduce the effectiveness of other potentially more threatening stimuli, such as those resulting from closeness in object relations" (Bellak et al., 1973, pg. 214). This concept appears to be consistent with the findings of PDD, in which a primary characteristic is an impairment of social functioning.

It is not surprising to find that children, who have the propensity to seek sensory input/experiences that were referred to a mental health clinic, score significantly different than typical children when one considers the notion that sensory regulation is a basic coping task. In fact, the capacity for sensory regulation in children is central for shaping
future coping styles (Bellak et al., 1973). Bellak et al. purports that the stimulus barrier is related to motor thresholds and that when there has been an exposure of a child to an overwhelming stimulation of the senses, the child can become permanently on overload. The child then has difficulty containing the energy and seeks frequent opportunities to discharge it (Bellak et al., 1973). This description is consistent with the demographic data gathered in this study in which behavioral problems in school (15%), aggression (15%), and hyperactivity (12%) were among the most common reasons for referral to the mental health clinic. This finding that clinic referred children scored significantly different than the normative population on the sensory seeking factor ($t(59) = -8.844, p < .000$), which corresponds to the ego function of stimulus barrier, is consistent with ego function theory regarding the development of the stimulus barrier. This indicates that children who scored low on this factor may have the propensity for developing weak ego functioning in this area. Further support of this notion is found when one examines treatment plans that include goals and interventions that encourage the development of coping techniques and that foster resiliency for many children who are referred to mental health clinics for behavioral difficulties.

Hypothesis 2 states that Emotionally Reactive scores from this sample will be significantly different from the normative sample. This hypothesis was also supported by the data ($t(59) = -8.393, p < .000$). Overall, caregivers report that for the children in this sample, many always or frequently need more protection from life than other children; seem to have difficulty liking themselves; have trouble growing up; are sensitive to criticism; have definite fears; seem anxious; display excessive emotional outbursts when unsuccessful at a task; express feelings of failure; are stubborn or uncooperative; have
temper tantrums; poor frustration tolerance; cry easily; are overly serious; have difficulty making friends; and have difficulty tolerating changes in plans and expectations or routines. The sensory systems, from which this factor was derived, include modulation of sensory input affecting emotional responses, emotional/social responses, and behavioral outcomes of sensory processing (Dunn, 1999).

With regard to ego functioning, the concept of emotional reactivity corresponds to regulation and control of drives, affects, and impulses. This ego function involves the child’s ability to tolerate frustration, anxiety, depression, or disappointment and to express inner emotions and urges in a modulated way. It also involves the ability of the child to delay gratification (Bellak et al., 1973). Clinic referred young children in this study who experience behavior characteristics as listed above, clearly demonstrate an inability to regulate and appropriately manage their emotional and behavioral reactions to internal and/or external stimuli. Often these behaviors are described as impulsive and/or acting out behaviors. Again, these findings may indicate that many children who are referred for mental health evaluations and/or treatment exhibit difficulty with this developing ego function.

Hypothesis 3 states that Inattention/Distractibility scores from this sample will be significantly different from the normative sample. This hypothesis was also supported by the data (r(59) = -8.454, p<.000). Caregivers report that children in this sample have trouble completing tasks and become distracted when there is sound or noise (radio) in the background; appear to not hear what you say (appear to ignore you); don’t respond when their name is called (when you know hearing is intact); have difficulty paying attention; and look away from tasks to notice all actions in the room. Auditory processing
and multi-sensory processing are the sensory systems from which this factor was derived (Dunn, 1999).

In terms of ego function, this concept of inattention/distractibility corresponds to autonomous functioning. Autonomous functioning in ego psychology terms refers to the degree of freedom from impairment of attention, concentration, memory, learning, perception, motor function, and intention (Bellak et al., 1973). The strength of the ego in relation to other aspects of mental functioning describes how Hartmann (1939) defined ego autonomy. According to this theory, a child who may not be able to manage drives and urges, may experience difficulty with the development of the ego autonomous function. Children who are having difficulty with their ability to attend to tasks and focus their attention are likely experiencing difficulty in the development of the ego autonomous functioning (Bellak et al., 1973). The implication is that inner drives and/or outer stimuli may be impinging upon their ability to appropriately sustain attention. Therefore, ego function theory supports the findings found for this factor in hypothesis 3.

Children, who have been referred to a mental health clinic and who are experiencing behavioral symptoms described above, may demonstrate problems around the developing autonomous ego function.

In terms of integrating the findings of these three hypotheses, it is important to note that the behavioral descriptions of these factors, especially those found on the sensory seeking behavior and inattention/distractibility factors, appear to reflect many of the characteristics of children diagnosed with behavioral disorders, such as ADHD. For example, the characteristics of sensory seeking children appear similar to those found in the DSM-IV and that describe the criteria for ADHD-Hyperactive/Impulsive type.
Similarly, the behaviors exhibited by those children who scored low on the inattentive, distractible factor appear to be consistent with criteria for ADHD- Inattentive type (APA, 1994). In addition, these symptoms also meet the criteria for both types of ADHD in the DSM-IV-TR, (APA, 2000), which was published following the publication of Dunn’s (1999) Sensory Profile. Likewise, it is important to note that on this measure, many of the behaviors described within the factors are found to be derivatives of overlapping sensory systems, such as multi-sensory processing, modulation, auditory processing, and modulation of sensory input affecting emotional responses. Similarly, in terms of ego functions, each hypothesis was also supported theoretically. These findings highlight the notion that precursors to ego function development and the development of the sensory system/neurological system are interconnected and may affect one another.

Discussion of Demographic Findings

A discussion of important demographic findings from this study is provided. In terms of analyzing the demographic information, while sensory related issues were not the presenting problems that directly brought a child to a mental health clinic, aspects of a child's sensory processing abilities, appear to be impaired. For example, it was found that the primary presenting problem that brought a child to treatment at this facility was a developmental disability (30%); followed by school problems and aggression (15%); and hyperactivity (11.7%).

According to the demographic data, the primary DSM-IV diagnosis given at the time of intake for this sample for 26.7% of this population was Pervasive Developmental Disorder, which is consistent with the primary presenting problem noted above. The next most common primary diagnosis was Disorder of Infancy, Childhood, or Adolescence.
NOS (20%), followed by Disruptive Behavior Disorder NOS (13.3%), and ADHD (10%). It is important to note that the Disorder of Infancy, Childhood, or Adolescence NOS diagnosis is a residual category for disorders with early onset that do not meet criteria for any specific DSM-IV diagnosis, according to the DSM-IV (APA, 1994). Therefore, it is possible to surmise that subjects may have presented with characteristics of developmental disorders or disruptive behavior disorders, including ADHD, but did not fully meet criteria. If there was a second diagnosis present, which only occurred for 21 of the 60 subjects, ADHD was the DSM-IV diagnosis given most frequently (10% of the subjects).

In terms of demographics regarding the subjects themselves, it is important to note that the average age of this sample was 5.25 yrs. Sixty-eight percent of the sample was aged 4-5 years old. Approximately 27% of the normative sample was in that age range. Dunn’s (1999) sample included 1,200 children aged 3-14 years. This sample consisted of 60 children aged 4-10 years. Educational levels were not reported in Dunn’s sample. For this sample, half of the children had an education level of kindergarten or pre-school/pre-k. Dunn (1999) did report that 50% of the sample was girls. Forty-nine percent of the sample was boys. In this sample, the strong majority of the population was male (76.7%). This is consistent with the notion that most often male children are more prone to present with behavioral disorders than female children (Wehmeyer & Schwartz, 2001). In addition, it is well known that there are biological and genetic explanations for this phenomenon as well (Wehmeyer & Schwartz, 2001). It is also important to remind the reader that Dunn did mention that a small sample of children with disabilities was administered the measure in order to establish the validity of the Sensory Profile.
Diagnostic information for this sample is all that is reported. Dunn's studies included children diagnosed with ADHD (n=61, ages 3-15), autism/pervasive developmental disorder (n=32, ages 3-13), Fragile X disorder (n=24, ages 3-17), or a sensory modulation disorder (n=21, ages 4-9).

Further inspection of the demographic information collected during this study yields interesting comparisons. In this study, a strong majority of the participants were ethnic minorities. In fact 78% of the subjects were non-White. Fifty percent of the subjects were African-American. Twenty-three percent were Hispanic. Three percent were of Asian descent. Two percent were described as "other". Dunn (1999) reported that 91.4% of her sample was White. In addition, Dunn reported that 33.5% of the normative sample had income levels above $31,000. While income levels were not obtained for this sample, the payor source was identified. In this sample, Medicaid was the payor source for 65% of the subjects. Medicaid is a state funded health insurance plan for indigent or low-income families. In this study, the distinction between the working class poor and those who are actually at or below the poverty level could not be assessed. Further, there are problems inherent in this practice even if it was assessed, due to the discomfort of the groups in reporting this information. Often low-income groups are fearful to openly report total income for fear of repercussions by the social system, for example. In addition, Dunn reported that in her sample, 60.9% of the subjects lived in suburban communities, while urban communities accounted for 15.5% of the sample. The majority of this sample, however, was from an urban community (65%). Therefore, this may imply that the majority of this sample is low-income and more than likely differs socio-economically from the normative sample. It may also be the case that sensory difficulties
Limitations of the Study

Although the hypotheses were supported, the results may not be generalizable due to limitations of this study. This sample was a convenience sample and assessed through archival data. Subjects were not identified at random for this study. For example, only children aged 4-10 whose caregivers completed the Sensory Profile and whose clinicians filled out demographic information in the subject's charts were included in the study. In this study, there were 425 charts reviewed with 60 subjects meeting the criteria to be included as a subject. There were 95 active (open) cases and 330 inactive (closed) charts reviewed. During data collection and chart review, it was learned that although the Sensory Profile was given as part of an initial assessment package, they were not always returned to the clinician and were therefore missing from the chart. Perhaps in future research, the researcher can interview the caregivers and administer the Sensory Profile directly to them. It is also important to note that the Sensory Profile was added to the intake assessment package for all children from birth to age 5 by the agency in September 2004. Therefore, many of the closed charts did not contain completed Sensory Profile measures. This also indicates that Sensory Profile measures were only generally in the charts of children older than 5 years of age if it was given as part of a psychological assessment or if the child was referred to the developmental pediatrician, who routinely administered the measures to most caregivers. This again emphasizes that caution must be taken when interpreting the results due to the lack of random sampling.

In addition, some of the subjects included in the sample were "assessment only" cases, not on-going treatment cases. From chart reviews, it appeared that many of these "assessment only" evaluations were requested in order to rule out developmental
disabilities. The agency from which this sample was taken is known for its expertise in the DIR (Developmental, Individual-Difference, Relationship-Based) approach to treatment for children on the Autistic spectrum. This may also account for the number of subjects in this sample who had a primary diagnosis of PDD (27%). Therefore, the sample in this study may not be representative of the clinical populations found in most inner-city mental health facilities.

Other limitations of this study that affect one's ability to generalize these results to other populations are noted. Another limitation is the number of subjects who receive medication. For this sample, 11.7% of the subjects indicated they were receiving daily medication. The type of medication taken was not analyzed; therefore it is not clear what type of medication was being administered or for what purpose. It is not known if the medications taken were psychotropic in nature or prescribed due to the presenting mental and/or behavioral health concerns. Further, it is unclear how the children on medication may have affected the data. Perhaps comparing a non-medicated to medicated group may be helpful in the future.

Another limitation that exists is the difficulty inherent in the interpretation of these findings for young children due to varying developmental levels, which is typical for children in this age group. It may be that these scores are reflective of typical development, rather than a mental health concern or a sensory regulatory disorder. A recommendation may be that scores can be weighted based on age in order to account for variability within development. In terms of neuroscience and psychological development, there is tremendous variation between four and ten years old. As a result, a more
thorough and comprehensive evaluation would need to be conducted in order to assess the possibility of pathology. Therefore, caution must be taken in interpreting the results.

Another limitation of this research is that there are more male than female subjects included in study. As mentioned above, it is often the case that more males than females are diagnosed with PDD and ADHD (Mash & Barkley, 2003). It is important to note that female children are underrepresented. Therefore, the results of this investigation should be interpreted with caution when applied to female children.

Importantly, the lack of availability of a measure that assesses ego functions in young children is a limitation of this study. The researcher could not obtain the ego function level of development for each subject. Theoretical implications can be made, but no standardized objective or observational methods to assess ego functions were employed in this present study. In addition, only 3 of 12 ego functions as defined by Bellak (1973) were examined in this study. Therefore, caution must be taken when interpreting the results of the hypotheses as they pertain to ego functions.

A final limitation that exists is inherent in the instrument itself. The Sensory Profile is a self-report measure. Therefore, the responses given by the caregivers may be biased. There are currently no standardized measurements available that objectively assess sensory functioning in daily life. According to the manual, Dunn (1999) notes that occupational therapists were involved in the decision process of which behavioral characteristics would be included in the survey and which factors would be in each behavioral category. Perhaps including professionals across disciplines in the process of designing the measure would have been beneficial in assuring its clinical utility across disciplines.
Clinical Implications

While it is difficult to clinically validate the Sensory Profile based on one exploratory study, perhaps the most important contribution of this study is its attempt to begin to integrate psychological and neurological findings regarding sensory processing. It is evident that an interdisciplinary approach to understanding and evaluating child development and emotional functioning is helpful in planning intervention and treatment strategies. This study provides researchers, occupational therapists, and mental health professionals with information regarding the psychological development of ego functions and the relationship with sensory regulation development. While not being able to completely validate the Sensory Profile, this study makes a concerted effort towards examining the clinical utility of the measure. The significance of this study lies in the demonstration that the disciplines of psychology, occupational therapy, and neuroscience are interrelated. Knowledge of these disciplines can broaden a clinician's understanding and perspective regarding young children's emotional and sensory regulatory development. This study can help integrate the research and literature among the disciplines to best serve the children and families, who are ultimately the ones who will benefit most from this research effort. This study also highlights the need for continued research in this area.

Findings from this study add to the dialogue among the professionals within a multidisciplinary team in conducting assessments and planning treatment interventions. In terms of assessment, a mental health professional that works with children can use the Sensory Profile results to gain a better understanding of how the child is able to manage or regulate him/herself throughout the day and whether or not there are any significant
sensory impairments or areas of concern. Referrals to an occupational therapist and/or neurologist can be made as needed. In addition, it gives a more comprehensive, holistic view of the child and can aid a clinician in making a diagnosis when the Sensory Profile is used as part of a comprehensive assessment.

Another significant need is to develop school-based interventions for young children. While occupational therapy is a service available through early intervention and through most public school districts, often occupational therapists (OT’s) are not well trained in sensory integration theory and intervention. In fact, OT’s can receive post-graduate training for this OT sub-specialty and receive a certificate indicating they are qualified to provide sensory integrative services. This is crucial as many children attend daycare or are in school during the day. It is also important to educate some OT’s and school personnel that while problems with attention and self-regulation can be seen as neurological or medical problems, most likely these difficulties do affect the child educationally. Therefore, it is important for children to receive services in school. The school is an ideal setting in which OT’s can assess and intervene in-vivo to improve a child’s daily functioning.

There are important clinical implications for psychologists and other mental health professionals who work with children either privately or in schools as well. School based psychologists and mental health professionals would benefit from monitoring the child’s progress in OT and planning interventions in conjunction with the OT. The school based mental health professional can monitor the child’s progress in his/her development in the areas that are identified as problematic. For example, if a child with low tone in his upper extremities is not receiving OT to improve this ability, how can a teacher or school
based mental health therapist who is working with that child expect him to "sit up straight in his chair" and "concentrate"? The results of this study may help professionals understand the implications that this child may be using all of his mental and physical effort to keep himself upright, thus exhausting him/herself, leaving little physical or psychic energy left to sustain attention and concentration to attend to a lesson or interact socially with others. In other words, mental health professionals and other school-based professionals, who work with children, can adapt their approaches to better meet a child's needs in order to help him/her improve their abilities in daily functioning. In addition, these same professionals can offer assistance and support to parents who may be struggling with caregiving and behavioral difficulties as a result of their child's sensory regulation difficulties.

In terms of psychotherapeutic intervention, knowing a child's "sensory profile" can enable a therapist to tailor treatment to a child's particular needs. For example, if a child becomes easily overloaded or overwhelmed by auditory stimulation, the therapist may use a non-verbal play approach (without loud toys) when working with the child. As the child works with an occupational therapist on desensitizing him/herself to auditory stimulation and improves the overall integration of this sensory system neurologically, the mental health professional can incorporate toys or strategies that support sensory integration progress. Having the knowledge of a child's sensory profile and ideally working in conjunction with an occupational therapist, the psycho-dynamically oriented mental health professional can structure interventions to best meet the child's needs psychologically. If a child is having difficulty with the auditory channel, it is likely that psychologically, the stimulus barrier function of the ego may be impaired. A child cannot
progress through the stages of psychological development successfully if he or she becomes “stuck” due to ego function difficulties or sensory/neurological issues.

Results of this study suggest that most professionals who work with young children, can benefit from these findings. The professionals from psychology, occupational therapy, and neuroscience have a responsibility to their patients to be up to date with current research and methods of intervention. Being armed with a more comprehensive perspective on sensory regulation can help those who work with children in all fields. Mental health professionals, especially, are often called upon by other disciplines to provide consultation and education regarding psychological development to other professionals or to parents of children with special needs. Knowledge from this study can arm a professional with information that he/she can provide as comprehensive an evaluation as possible. It adds to the professional’s ability to provide developmental guidance to parents, especially in the hopes of remediation and/or preventing any further atypical mental health or behavioral issues from arising in the future. Understanding the interrelated development of ego functions and sensory regulatory development can assist a clinician in effectively intervening with a child and his/her family, guiding the trajectory of the child’s overall development onto a more typical course. Heading off future problems for a child may be accomplished by providing families and other professionals with information regarding ego psychological and sensory development.

Future Research

Future research needs to be conducted in order to further investigate the clinical utility of the Sensory Profile for use by psychologists. Currently, there is no research found in the literature that discusses its usage by mental health professionals. Few studies
that discuss the assessment tool were found in the literature. Following this study, many questions remain regarding its applicability to minority populations. The use of a predominantly low-income minority, or non-White sample, was a strength of this study. However, it is unclear from the results of this study whether or not a non-White sample responds differently to the questionnaire than a predominantly White sample or if the measure is biased against minorities. Therefore, further research replicating Dunn's work and/or utilizing her measures in studies with varying populations is recommended. In addition, further research that compares ethnic differences and socioeconomic status is recommended.

Assessing the utility of the different versions of the Sensory Profile with clinical populations and especially with ethnic minorities is also an important area for future research. A separate infant and toddler version exists for this age group. The field of psychology could benefit from further investigation of this version of the Sensory Profile to see if it is a clinically useful measure for mental health professionals. According to the Sensory Profile website, Dunn is in the process of a confirmatory analysis of the Infant/Toddler Sensory Profile. In addition, Dunn has published an Adolescent/Adult Sensory Profile. The Sensory Profile School Companion has also been recently published. It includes a questionnaire to be filled out by the teacher. Further research to assess the clinical utility of both of these measures would be beneficial. In addition, longitudinal research studies that look at sensory processing across the developmental life span would yield important data and shed light on how psychological and sensory regulatory development are related. This would be helpful in designing preventative interventions.
Another direction for future research may include looking at different psychological disorders or diagnoses to see if there are commonalities in children who have problems with sensory regulation. Results from this study indicate that children with PDD and ADHD diagnoses tend to have difficulties in certain areas of their sensory processing abilities. For example, while children with both of these diagnoses exhibited difficulties in the three factors examined in this study, children on the PDD spectrum exhibited lower scores on Factor 4 (Oral Sensitivity) and Factor 9 (Fine Motor/Perceptual) as compared with children with ADHD and without disabilities samples. It may also be the case that children in the PDD sample may display difficulty (low scores) on Factor 6 (Poor Registration) and Factor 7 (Sensory Sensitivity). Research in this area could increase knowledge in the fields of psychology, occupational therapy, and neuroscience ultimately enhancing the ability for professionals to assess and more effectively treat children who may be experiencing difficulties in these areas.

Utilizing the Sensory Profile as an outcome measure for intervention is another area of future research to be considered. Prior to initiating therapeutic intervention, obtaining a baseline data of a child's sensory functioning abilities and then administering the Sensory Profile as a post test following a treatment protocol may provide valuable knowledge to the professionals who work with children with these types of disabilities. In addition, perhaps utilizing neuropsychological assessments may be important to gauge change in aspects of neurological functioning. Shonkoff and Phillips (2000) noted that the environment could alter neural pathways, which cannot be readily observed, and/or genetic predispositions throughout development, which implies treatment interventions can have an effect on brain functioning. Therefore, from a "best practices" standpoint and
from the point of view of managed care, treatment outcome measures utilizing the Sensory Profile may be beneficial.

Another direction for future research may include the development of an ego function assessment tool in order to study ego functioning in children in a standardized manner. Similarly, a more comprehensive examination of all ego functions and how they may or may not correspond to the factors in the Sensory Profile may be beneficial in helping clinicians better understand the development of ego functions in children and how they relate to sensory processing. Additionally, creating or adding a measure designed to assess the co-regulation abilities of the caregiver may be important, as Bellak et al. (1973) mention in their work that a caregiver capacity to co-regulate or manage their own drives and impulses in an effective, non-pathological manner, can be beneficial in preventing or ameliorating regulatory difficulties in young children.

Future researchers interested in further investigating the clinical utility of the Sensory Profile may want to consider adding other measures to their study in order to look at what psychiatric diagnoses may co-exist with regulatory and sensory seeking problems. This study relied on a psychiatric diagnosis that was not necessarily made in conjunction with standardized measures. For example adding standardized assessment measures, such as the Conners' Rating Scales (Conners, 1997), the Achenbach Pre-School Child Behavior Checklist (Achenbach, 2000), the Achenbach School-Age child Behavior Checklist (Achenbach, 2001), or the Child Depression Inventory (Kovacs, 2003) is recommended. In addition, since no ego function assessment tool was utilized, perhaps adding projective assessments such as the Rorschach (1921/1942) (for the older children) and the Thematic Apperception Test (Murray, 1943) (TAT)/Children's
Thematic Apperception Test (CAT) could further enhance the theoretical knowledge of ego functions and psychological development processes. A comparison of the results of these assessments with standardized diagnostic assessment tools would be interesting.

Finally, another area of future research regarding the Sensory Profile includes examining aspects of the Section Summary portion of the Sensory Profile (see Appendix C). Comparing the mean scores from a multiracial, inner city population referred for mental health treatment with the normative sample on the Factor Summary Sensory Processing heading, which is devised of Auditory Processing, Visual Processing, Vestibular Processing, Touch Processing, Multisensory Processing, and Oral Sensory Processing sections is recommended. The results found may be helpful in extending the knowledge gained from the current research study. Comparing the mean scores of a multiracial, inner city population referred for mental health treatment with the normative sample for the Behavior and Emotional Responses portion of the Section Summary, which includes emotional social responses and behavioral outcomes of sensory processing, would also be an interesting extension of the current study.

In sum, this study has highlighted the notion that research in the areas of sensory processing and its relationship to ego function and psychological development is in its infancy. There is a great deal of further investigation and research to be conducted in order to assess the clinical utility of the Sensory Profile for use by mental health professionals. The three disciplines have a great deal of knowledge to contribute to the study and understanding of sensory regulation development in children. More effort needs to be made in the area of integration of current information and in conducting sound scientific research across the disciplines. For now, it is wise for mental health
professionals who use the Sensory Profile to interpret the results with caution and to integrate the findings carefully in conjunction with results from other well-established and clinically valid assessment tools.
References


Burpee, J.D. (2006, October). *Understanding and responding to regulatory disorders as a function of sensory processing dysfunction*. Symposium conducted at the YCS Fourth Annual Conference, Clifton, NJ.


Appendix A

Permission to Use YCS Subjects
Institute for Infant and Preschool Mental Health

January 3, 2006

Re: Laura Leigh Smith

To Whom It May Concern:

Laura Leigh Smith is completing her psychology doctoral internship at our Institute as part of her requirements for her Ph.D. in Clinical Psychology at Seton Hall University. Her proposed dissertation will examine the potential benefits to clinical psychologists of using measures of sensory processing abilities in children in the assessment and treatment of emotional and behavioral disorders. Ms. Smith has requested use of data contained in our clinical records of children who have been served by our clinical division. Specifically, she is interested in examining the relationships among scores on the Sensory Profile measure to other diagnostic and demographic variables. This data are archival in nature, findings will be reported in the aggregate so that all data will be coded with no identifying information available. There is no contact with subjects, so no harm to subjects can occur.

This letter verifies that Ms. Smith has permission to collect data from our clinical records as outlined above. We will support her efforts in any way we can, and we look forward to asking her to present her findings to our students and staff.

Please contact me if you have any questions. I may be reached by phone at 973-395-5500, Ext. 301 or by email at gcosta@ycs.org.

Thank you.

Sincerely,

Gerard Costa, Ph.D.
Director, YCS Institute
Clinical Assistant Professor, Department of Psychiatry
University of Medicine and Dentistry of New Jersey – New
Appendix B

Demographic Data Sheet
DEMOGRAPHIC DATA SHEET

The investigator will fill out this form as each file containing a completed Sensory Profile at intake is reviewed and data is collected.

1. Age/Date of Birth of the Child
   __/__/__

2. Gender of the Child (Circle one)
   1=Male
   2=Female

3. Age/Date of Birth of the Caregiver
   __/__/__

4. Relationship of Caregiver to the Child (Circle one)
   1=Biological Parent
   2=Foster Parent
   3=Grandparent
   4=Adoptive Parent
   5=Step-Parent
   6=Cousin
   7=God Parent
   8=Sibling
   9=Aunt/Uncle
   10=Other

5. Race/Identity (Circle one)
   1=African American
   2=White
   3=Hispanic
   4=Asian
   5=Other

6. Educational Level of the Child (Circle one)
   1=Pre-school/Pre-K
   2=Kindergarten
   3=1st grade
   4=2nd Grade
   5=3rd Grade
   6=4th grade
   7=Other

Code No.______
7. Child is receiving Special Services in School? (Circle one)
   1=Yes, (please specify) ________________________________
   2=No

8. Educational Level of the Caregiver/Parent (Circle one)
   1=Did not complete High School   2=High School Graduate/GED
   3=Vocational/Trade School Graduate   4=College Graduate

9. Parental Marital Status (Circle one)
   1=Married   2=Single   3=Divorced   4=Widowed

10. Parent Employment Status (Circle one)
    1=Employed (full time)   2=Employed (part time)   3=Unemployed

11. Number of Children Living in the Home
    1=Number of Biological Siblings ______
    2=Number of Half-Siblings ______
    3=Number of Step-Siblings ______
    4=Number of Adoptive Siblings ______
    5=Number of Foster-Siblings ______
    6=Other ______

12. DSM-IV Psychiatric Diagnosis(es) (Circle and number in order of priority)
    1=ADHD
    2=Communication Disorders
    3=Pervasive Developmental Disorder
    4=Conduct Disorder
    5=Oppositional Defiant Disorder
    6=Disruptive Behavior Disorder NOS
    7=Intermittent Explosive Disorder
    8=Impulse Control Disorder NOS
    9=Feeding and Eating Disorders of Infancy or Early Childhood
    10=Tic Disorders
    11=Elimination Disorders
    12=Separation Anxiety Disorder
    13=Selective Mutism
    14=Reactive Attachment Disorder of Infancy or Early Childhood
    15=Stereotype Movement Disorder
    16=Disorder of Infancy, Childhood, or Adolescence NOS
17= Adjustment Disorder  
18= Gender Identity Disorder  
19= Schizophrenia and Other Psychotic Disorders  
20= Mood Disorders  
21= Anxiety Disorders  
22= Relational Problems  
23= Problems Related to Abuse or Neglect  
24= Other  

13. Presenting Problem(s)/Reason(s) for Referral (Circle and number in order of priority)  

1= Anxiety  
2= Assaultive Behavior/Threat  
3= Bizarre Behavior  
4= Daily Living Problems  
5= Depression/Mood Disorder  
6= Destuctive to Property  
7= Developmental Disability  
8= Eating Disorder  
9= Economic Stress  
10= Fire Setting/Ideation  
11= Marital/Family Problem  
12= Medical/Somatic Complaints  
13= No social support resources  
14= Organic Mental Disorder  
15= Physical Abuse/Assault Victim  
16= Physical Neglect  
17= Runaway Behavior  
18= School Problems  
19= Sexual Abuse Victim  
20= Sexual Abuser  
21= Social/Interpersonal (other than family)  
22= Suicidality  
23= Thought Disorder  
24= Hyperactivity  
25= Short Attention Span  
26= Aggression (without assaultive behaviors/threats)  
27= Other  

14. Is the child on any medication? (Circle One)  

1=Yes  
2=No  

If yes, please specify ____________________________
15. Type of Community (Circle one)
   1=Rural  2=Suburban  3=Urban

16. Payor Source (Circle one)
   1=Medicaid  2=Self-pay