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ASSESSMENT OF COGNITIVE ABILITIES IN CHILDREN WITH A PERVASIVE DEVELOPMENTAL DISORDER USING THE UNIVERSAL NONVERBAL INTELLIGENCE TEST

A Dissertation

Presented for the

Doctor of Philosophy Degree

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Bobbie Ann Burton

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DEDICATION

This dissertation is dedicated to my parents, Bill Burton and the late Barbara Burton. They have always believed in me and encouraged me to achieve my goals. Their unconditional support and the examples that they have set have influenced my life in so many ways.

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ABSTRACT

This study was designed to examine the utility of the Universal Nonverbal Intelligence Test (UNIT; Bracken & McCallum, 1998) for use with children who have been diagnosed with a pervasive developmental disorder (e.g., autistic disorder, asperger's disorder, pervasive developmental disorder-not otherwise specified). The goal was to determine whether distinct cognitive profiles on the UNIT exist within this population and between those with and without a pervasive developmental disorder: a) Do children with a pervasive developmental disorder earn significantly lower mean scores than a demographically matched control group on the UNIT Full Scale Intelligence quotient? b) Do children with a pervasive developmental disorder earn a significantly higher mean score on the UNIT Nonsymbolic quotient versus the Symbolic quotient? c) Do children with a pervasive developmental disorder earn significantly different mean scores on the UNIT Reasoning and Memory quotients?

Examiners administered the UNIT to 43 children with a pervasive developmental disorder. Data from 31 children who received raw scores of at least 1 on every subtest were used for statistical analyses. Data from an additional 31 children who participated in the UNIT standardization process were also included as the control group. The group with a pervasive developmental disorder had significantly lower scores ($p<.001$) on every quotient of the UNIT when compared to the control group. When the mean Full Scale Intelligence quotients were compared, the difference of approximately 22 points was significant, $t(26) = 4.46$, $p = .000$. Within the group with a pervasive developmental

disorder, the mean score of the Nonsymbolic quotient was approximately 4 points higher than the Symbolic quotient; this difference was not significant, $t(30) = 1.59$, $p > .05$ (one-tailed). When the Memory and Reasoning quotients were compared, the mean difference of .19 was not significant, $t(30) = .068$, $p = .947$. Based on mean difference analysis of this sample, there does not seem to be a unique cognitive profile for this population on the UNIT.

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CHAPTER 1

Introduction

Purpose

This study is designed to examine the utility of the Universal Nonverbal Intelligence Test (UNIT; Bracken & McCallum, 1998) for use with children who have been diagnosed with a pervasive developmental disorder (e.g., autistic disorder, asperger's disorder, pervasive developmental disorder-not otherwise specified) based on DSM-IV-TR (American Psychiatric Association, 2000) criteria. More specifically, the goal is to examine whether distinct cognitive profiles on the UNIT exist within this population and between those with and without pervasive developmental disorders: a) Do children with pervasive developmental disorders earn significantly lower mean scores than a demographically matched control group on the UNIT Full Scale Intelligence quotient? b) Do children with pervasive developmental disorders earn a significantly higher mean score on the UNIT Nonsymbolic quotient versus the Symbolic quotient? c) Do children with pervasive developmental disorders have unevenly developed reasoning and memory skills as evidenced by mean difference analysis of the UNIT Reasoning and Memory quotient scores?

Rationale

Psychologists are often hired to assess children to determine if they meet certain diagnostic criteria or to learn more about their ability and achievement levels. Some special needs populations provide unique challenges for those conducting assessments.

Children with pervasive developmental disorders may be particularly difficult to assess because of their verbal and nonverbal communication problems (Shah & Holmes, 1985). Due to their poor verbal comprehension skills, examiners may have trouble explaining the test procedures to them. It may be necessary for the examiner to use gestures, exaggerated affect, prompts, or other visual aids to communicate about the test (Marcus, Flager, & Robinson, 2001). Social interaction impairments may make it difficult to establish rapport, and timed tests may be spoiled by lack of motivation, fixation with stereotyped activities, and attention problems (Koegel, Koegel, & Smith, 1997; Shah & Holmes). Disruptive behaviors such as self-stimulation and task avoidance may also interfere with the assessment process (Koegel, et al.). In addition, "the skills of autistic children are often difficult to assess reliably because their readiness to perform varies widely" (Sigman & Ungerer, 1984, p. 295). Standardized intelligence tests often include tasks in areas that are known to be problematic for this population (Carothers & Taylor, 2007). Because of these problems, standardized test scores may be heavily influenced by the child's test-taking skills and symptoms, which may lead to results that are not indicative of actual ability levels (Edelson, Schubert, & Edelson, 1998; Koegel, et al.). These assessment results may lead to underestimates of the child's abilities, which may adversely affect placement decisions (Koegel, et al.).

Despite the potential assessment problems, it is important to document each child's unique strengths and weaknesses in order to plan appropriate interventions (National Research Council, 2001). There is not a "cure" for autistic disorder (Graziano,

2002). However, a variety of treatments and interventions are available for individuals with pervasive developmental disorders. Standard treatments include special education, speech and language therapy, physical therapy, occupational therapy, and behavior modification. Other treatments available include social skills training, alternative communication procedures, art therapy, holding therapy, music therapy, scotopic sensitivity training, pet therapy, sensory integration therapy, auditory integration, drug and vitamin therapies, and facilitated communication (Bilken, 1990; Graziano; Howlin, 1997). It is important to properly assess these children in order to understand their individual abilities, establish baselines of functioning, and choose appropriate interventions.

In order to obtain accurate estimates of the individual's abilities, it is helpful to identify and eliminate possible problems with test administration that may interfere with assessment. For example, Koegel, et al. (1997) manipulated testing variables related to motivation and attention (e.g., allowed certain interfering behaviors during predictable breaks contingent upon appropriate test behavior) and found that the children's performance improved in comparison to standard testing conditions. Test administrators should establish a structured setting and be flexible to the child's unique symptoms (Marcus, Flagler, & Robinson, 2001). Children with pervasive developmental disorders often perform best on assessment instruments that require little social interaction and verbal mediation. Therefore, a nonverbal test like the UNIT is a promising instrument for use with children with pervasive developmental disorders.

Pervasive Developmental Disorders

The Diagnostic and Statistical Manual of Mental Disorders (DSM-IV-TR, 2000) describes five different pervasive developmental disorders (i.e., autistic disorder, rett's disorder, childhood disintegrative disorder, asperger's disorder, and pervasive developmental disorder not otherwise specified). In clinical settings, these disorders are often referred to as autism spectrum disorders. Individuals with these disorders have impaired social or communication skills and may have stereotyped behaviors, interests, and activities. These disorders are typically noticed early in life and often occur with mental retardation. Autistic disorder will be described in more depth in the following section because much previous research has focused on it.

Rett's disorder only occurs in females and is associated with normal development through the first 5 months of life (DSM-IV-TR, 2000). Around the fifth month, head growth decelerates (between 5 and 48 months old); purposeful hand skills are replaced with stereotyped hand movements (between 5 and 30 months old), and interest in the social environment decreases. They may develop more interest in social interactions as they mature. Individuals with this disorder exhibit poor gait or trunk coordination, and their expressive and receptive language development is impaired. Severe to profound mental retardation also occurs with rett's disorder (Graziano, 2002).

Childhood disintegrative disorder (DSM-IV-TR, 2000) is characterized by regression in functioning following at least two years of normal development. Between the ages of 2 and 10, the individual loses previously acquired skills in at least two areas

(i.e., expressive or receptive language, social skills or adaptive behavior, bowel or bladder control, play, or motor skills). These individuals also have abnormal functioning in at least two areas (i.e., social interaction, communication, or restricted, repetitive, and stereotyped behaviors, interests, and activities). Severe mental retardation is associated with childhood disintegrative disorder (Graziano, 2002)

Asperger's disorder (DSM-IV-TR, 2000) is characterized by clinically significant impairment in functioning related to social interaction and restricted, repetitive patterns of behaviors, interests, and activities. Language acquisition is not affected by asperger's disorder; however, social communication may be affected. Development occurs normally in areas such as cognition, self-help skills, adaptive behavior, and curiosity. Asperger's disorder is often not diagnosed until the child is in school (Grazziano, 2002).

Pervasive developmental disorder not otherwise specified (DSM-IV-TR, 2000) is reserved for individuals that have severe impairments related to social interaction, communication, or stereotyped behaviors, interests, and activities but do not meet all of the criteria for the other pervasive developmental disorders.

Autistic Disorder

History. Jean-Marc-Gaspard Itard was one of the first clinicians to describe autistic disorder, which he called intellectual mutism (Carrey, 1995). In 1828, he wrote a memoire titled "Mutism as produced by a lesion of the intellectual functions", and he attempted to distinguish between mental retardation and what would presently be considered autistic disorder. He described these children as being fixated on their

childhood habits, unable to express their ideas, aversive to mechanical work, giving superficial attention, being unable to focus, having difficulty with certain aspects of memory, being socially awkward and aloof, not being very loving and affectionate with their caretakers, and having poor imitative capacity.

In 1911, Bleuler first used the term "autism" to describe those with schizophrenia who were no longer in touch with reality (Klinger, Dawson, & Renner, 2003). In 1943, Kanner described 8 boys and 3 girls who had cognitive and communication delays and deficits, peculiar social and behavioral characteristics, and an inability to form emotional connections with others (Siegel, 1998). These children did not relate to people and situations in ordinary ways; they were attached to objects, socially inaccessible, and socially unaware. They disregarded people or recognized them as objects who intruded on their routines, aloneness, and preoccupations. Their parents described them as being unaware of their surroundings, seeming hypnotized, and preferring aloneness. These children exhibited communication problems including monotonous speech, repetitive speech patterns, literal word interpretations, mechanical use of phrases, personal pronoun reversals, purposeless communication through speech, and lack of gestures. They also demonstrated odd behaviors, such as spinning objects, reflecting light, stereotyped movements, ritualistic play, insisting on sameness, and unusual responses to touch, motion, and sound. In addition, these children had unique fears. They demonstrated intact memory for rote facts, and Kanner believed that they were capable of attaining average cognitive abilities.

Prevalence. Based on the median rate cited in epidemiological studies, autistic disorder occurs in 5 per 10,000 individuals (DSM-IV-TR, 2000). This rate has increased in the past 30 years (National Research Council, 2001). Approximately 5% of the siblings of those affected also have autistic disorder (DSM-IV-TR). It occurs four to five times more often in males than females.

Characteristics. The most definitive diagnostic criteria for autistic disorder is provided in the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV-TR, 2000) (See Figure 1, Appendix A). According to the DSM-IV-TR, autistic disorder is associated with three main areas of abnormal functioning. Social interaction, communication, and behaviors and interests are all affected by autistic disorder. However, levels of functioning vary within the autistic population and within individuals over time (National Research Council, 2001; DSM-IV-TR).

For those with autistic disorder, there is marked impairment in social interaction. These impairments may result from a general deficit in orienting ability, which is worse with social stimuli (Dawson, Meltzoff, Osterling, Rinaldi, & Brown, 1998). This deficit may lead to problems with joint attention, which typically appears when children are about 9 months old (Dawson, et al.; Morgan, Mayberry, & Durkin, 2003). Joint attention deficits involve difficulty managing attention between people and objects. It is evidenced by difficulty attending to others socially, shifting gaze, sharing emotions with others, following the gaze and point of others, and sharing experiences with others (National Research Council, 2001). Levels of joint attention may vary across developmental levels

(i.e., intelligence and mental age) (Mundy, Sigman, & Kasari, 1994). Individuals with autistic disorder may not spontaneously seek to share enjoyment, interests, or achievements with others (DSM-IV-TR, 2000). For example, they may not point out objects they find interesting. They may not have social or emotional reciprocity (Sattler, 2002). In addition, they may exhibit impaired nonverbal behaviors during social interaction in areas such as eye contact, facial expression, body posture, and gestures (DSM-IV-TR).

Children with autistic disorder may have difficulty relating spontaneously with peers and may not develop appropriate peer relationships (Sattler, 2002). They may prefer to spend time with adults or older peers. Younger children may not be interested in friendships, while older individuals may be interested but lack an understanding of social norms (DSM-IV-TR, 2000). Although these children may not develop appropriate peer relationships, they seem to have the ability to form attachment relationships with their caregivers (Klinger, et al., 2003). Individuals with autistic disorder may have face recognition impairments (prosopagnosia) compared to normally developing individuals. They may not pay attention to people and may even avoid people, preferring to play alone. However, they may use others as tools when needed (DSM-IV-TR).

For individuals with autistic disorder, both verbal and nonverbal communication skills are impaired (DSM-IV-TR, 2000). Development of spoken language may be delayed or missing. Children who use gestures, eye contact, and other behaviors related to joint attention are more likely to develop verbal language (Sigman & Ruskin, 1997 as

cited in Klinger, et al., 2003). Those who have not developed verbal language by age 6 do not typically acquire it (Sattler, 2002). If verbal language develops, they may exhibit abnormal pitch, intonation, rate, rhythm, or stress (DSM-IV-TR). They may use stereotyped, repetitive, or idiosyncratic language, and they may use deficient grammatical structures (e.g., pronoun reversals), and repeat words, phrases, jingles or commercials. About 85% of those who develop speech use immediate or postponed echolalia (Schuler & Prizant, 1985 as cited in Klinger, et al.). Although they often use language that is not meaningful to others around them, echolalia may be viewed as effortful communication (DSM-IV-TR; Tager-Flusberg, 2001). Their ability to initiate or sustain a conversation may be impaired, and they may not use language in a social manner (Sattler). Social aspects of language may be most impaired; they may provide irrelevant details, perseverate, teach about a particular topic, abruptly shift topics, and ignore conversational initiatives of others (Tager-Flusberg, 1999, 2001).

Children with autistic disorder may lack developmentally appropriate pretend, symbolic, or social imitative play (DSM-IV-TR, 2000; Klinger, et al., 2003). They have poor motor imitation skills, compared to matched controls (Stone, Ousley, & Littleford, 1997). Sigman and Ungerer (1984) found that children with autistic disorder imitated both gestures and vocalizations significantly less well than children with and without mental retardation. In addition, these children with autistic disorder exhibited less spontaneous, functional play with dolls and were deficient in symbolic play compared to the control groups. Lack of social imitation, specifically imitation of body movements,

has been linked to expressive language impairments in young children with autistic disorder, while imitation of actions with objects has been linked to play skills (Stone, et al., 1997). These children may have deficits in symbol use, which involves difficulty learning and using meanings for symbols and gestures; it is reflected in deficits regarding conventional meanings for words and in symbolic play (National Research Council, 2001). Children with autistic disorder typically do not use many gestures (e.g., pointing, showing objects), and the gestures that they use are primitive (e.g., manipulating another's hand). (National Research Council; Stone, Ousley, Yoder, Hogan, & Hepburn, 1997). However, when communication interventions are reviewed, sign-language training or total communication (speech and sign) training consistently produces quicker vocabulary learning than speech training alone (Goldstein, 2002). Individuals with poor verbal skills especially benefit from learning sign language.

The communication impairment of children with autistic disorder is also evident in their receptive language (DSM-IV-TR, 2000). They may not understand questions, directions, humor, or other non-literal features of speech. Paul, Fischer, and Cohen (1988) found that these children had a better comprehension of sentence structure than sentence meaning.

Autistic disorder is also manifested by repetitive and stereotyped patterns of behaviors, interests, and activities (DSM-IV-TR, 2000). Individuals with this disorder may be abnormally preoccupied with one or more stereotyped and restricted areas of interest (e.g., dates, telephone numbers), which may be evidenced by intensity or focus.

Individuals with autistic disorder may adhere to specific, nonfunctional routines and rituals. They may line up toys in specific ways, and they may become distressed over environmental changes. They may insist on following routines, such as taking a specific route to certain locations. Focused interest and insistence on sameness occurs more often in higher-functioning individuals (Klinger, et al., 2003). Those with autistic disorder may have stereotyped and repetitive motor mannerisms such as hand or finger flapping (DSM-IV-TR, 2000). They may also use their whole body to rock, dip, or sway. In addition, they may exhibit abnormal body posture (e.g., walking on tip toe). These repetitive movements, particularly in the orofacial area, occur more often in lower-functioning individuals with autistic disorder (Campbell, et al., 1990). These individuals may exhibit persistent preoccupation with parts of objects, moving objects (e.g., toys, fans, doors, etc.), or specific objects and may use these items in repetitive actions (DSM-IV-TR; Sattler, 2002). Over time, high-functioning individuals may become more focused on specific interests and may show decreases in object use, motor movements, and rigid routines; gains in areas such as communication often make these restricted interests more noticeable (South, Ozonoff, & McMahon, 2005).

A variety of other behavioral problems may also be present in individuals with autistic disorder. For example, they may exhibit hyperactivity, attention deficits, impulsivity, aggression, self-injurious behavior (e.g., head banging or finger biting), and temper tantrums (DSM-IV-TR, 2000). They may have abnormal responses to sensory stimuli. For example, they may have a high pain threshold or exhibit oversensitivity to

sounds, lights, odors, or touch. Their levels of fearfulness may not be congruent with actual levels of harm. They may have restricted diets or engage in pica, and they may have abnormal sleeping patterns. These individuals may exhibit abnormalities in mood or affect, such as laughing for no apparent reason. Additionally, those with higher cognitive abilities may become depressed when they realize their level of impairment.

Cognitive functioning. Individuals with autistic disorder typically receive a diagnosis of mild to profound mental retardation (DSM-IV-TR, 2000). Females are more likely to have severe mental retardation. The cognitive skills of individuals with autistic disorder are typically unevenly developed, with verbal skills being weaker than nonverbal skills. Their language abilities may actually be overestimated by single word vocabulary measures. In a study by Minshew, Goldstein, Taylor, and Siegel (1994), high-functioning individuals with autistic disorder performed significantly worse than a control group on achievement related comprehension tasks but not on procedural and mechanical tasks. Their ability to identify letters, words, and nonsense words, complete numerical computations, and define words was similar to controls; however, their ability to follow complex oral directions, repeat lists of verbal material, and comprehend passages was worse than controls. Children with autistic disorder typically have problems combining different kinds of information (National Research Council, 2001). About 10% of individuals with autistic disorder have focused areas of unusually high ability (e.g., drawing, music, calendar calculation, etc.); these individuals are often described as savants.

On intelligence tests, individuals with autistic disorder often do worse on items involving information processing, acquired knowledge, verbal mediation, abstraction, skilled motor, complex language, complex memory, and reasoning abilities (Maltz, 1981; National Research Council, 2001; Siegel, 1998). They typically do better on tasks involving spatial understanding, perceptual organization, short-term memory, concrete information, sensory perception, simple memory, simple language, and visual-spatial abilities (Hermelin & O'Connor, 1970 as cited in National Research Council; Maltz; Siegel). They may be better at activities involving rote memorization compared to activities involving mental manipulation (Klin & Shepard, 1994 as cited in National Research Council).

Models of cognitive/ behavioral functioning. Several theoretical models have been developed to explain the difficulties related to autistic disorder. The theory of mind hypothesis suggests that these individuals are unable to perceive or comprehend the cognitions, feelings, or intentions of others (National Research Council, 2001). They are unable to identify mental states in themselves and others, which leads to difficulty distinguishing between the worlds of objects and people (Frith, 1996). Although research has not consistently supported the theory of mind hypothesis (Aldridge, Stone, Sweeney, & Bower, 2000; Baron-Cohen, Leslie, & Frith, 1985; Bauminger & Kasari, 1999; Morgan, Mayberry, & Durkin, 2003), many studies have confirmed the theory of mind deficit (Baron-Cohen, Tager-Flusberg, & Cohen, 1993 as cited in Frith). The theory of mind hypothesis related to autistic disorder was developed by Leslie in 1984 and

originally tested by Baron-Cohen, Leslie, and Frith (1985) (Frith). Baron-Cohen, et al. compared the performance of children with autistic disorder, down's syndrome, and a control group on a task involving two dolls named Sally and Anne. The children were shown a scenario where Anne moved Sally's marble without her knowledge; then they were asked questions about the location of Sally's marble. They were also asked how Sally would respond to a similar question about the location of her marble. The majority of the control group and children with down's syndrome correctly answered the question, while the majority of children with autistic disorder thought that Sally would know the location of her marble. They concluded that the children with autistic disorder did not understand the difference between their knowledge and the doll's knowledge. This theory suggests that individuals with autistic disorder have difficulty comprehending the mind (Frith) and behavior of others, leading to a complex, unpredictable social world (Tager-Flusberg, 1999). Infants usually begin viewing people's behavior as intentional by the end of their first year (Tager-Flusberg), and children typically develop a theory of mind between the ages of 3 and 5 years (Morgan, et al.).

Other researchers have focused on executive-functioning deficits, which involve planning, impulse control, working memory, flexibility, and inhibition of unrelated responses; these functions are important in problem solving (Klinger, Dawson, & Renner, 2003; Ozonoff, Strayer, McMahon, & Filloux, 1994). Individuals with autistic disorder are more likely to have problems switching cognitive sets on difficult tasks, and they are likely to make perseverative errors (Liss, et al., 2001). Liss, et al. found that high-

functioning children with autistic disorder were more likely than a comparative sample to make perseverative errors on the Wisconsin Card Sorting Test, but their actual performance during the task was not impaired. They also found that executive-functioning abilities correlated higher with verbal and nonverbal IQ scores for children with autistic disorder than the comparison group. However, they did not find evidence for the universality of executive-functioning deficits in autistic disorder. Ozonoff, et al. found that children with autistic disorder were more likely to respond impulsively instead of inhibiting a response relative to a comparison sample on a task that required cognitive flexibility (i.e., shifting response patterns). Goldberg, et al. (2005) did not find abnormalities in inhibition, planning, or set-shifting; however, they found that spatial working memory was impaired in high-functioning children with autistic disorder compared to a control group.

The central-coherence theory posits that difficulties in autistic disorder arise from impairment in noticing meaning in whole contexts; individuals with autistic disorder may focus more on the parts (Jarrold, Butler, Cottington, & Jimenez, 2000). They may have impairments related to abstracting information from the environment, which may cause generalization problems (Klinger, et al., 2003). However, these difficulties may lead to significantly better performance compared to individuals without autistic disorder on tasks that use local processing, such as pattern construction, block design, and embedded figures tasks (Jarrold, et al.; Morgan, et al., 2003). However, Ozonoff, et al. (1994) did not find support for this theory when a global-local processing task was performed by a

group of high-functioning individuals with autistic disorder; they did not perform significantly different from the comparison samples.

Others have focused on issues related to attention (Klinger, et al., 2003). Individuals with autistic disorder may be unresponsive to stimuli aimed at getting their attention and may be too focused on other stimuli; they may have trouble shifting their attention. Data related to areas of attention such as arousal deficits, over-focusing, over-selective gaze, poor filtering, and orienting deficits have been inconclusive (Goldstein, Johnson, & Minshew, 2001). However, Goldstein, et al. found that individuals with autistic disorder had deficits relative to a control group in measures of attention that utilized cognitive flexibility or psychomotor speed. These individuals were deficient on tasks requiring focus, execution, and shifting. Differences were not found for tasks measuring vigilance or encoding. Leekam, Lopez, and Moore (2000) did not find evidence for problems with exogenous attention shifts in preschool children with autistic disorder, but they did find problems with endogenous attention. Others have suggested that children with autistic disorder have difficulty with motivation instead of sustained attention; their performance may improve with proper reinforcement (Garretson, Fein & Waterhouse, 1990).

Although memory may be a relative strength, it is still a key deficit for these children. Tasks that assess recognition memory may be particularly difficult for young children with autistic disorder, as well as those individuals with autistic disorder and mental retardation (Klinger, et al.). It has been suggested that the memory problems of

individuals with autistic disorder are related to ineffective use of organizational strategies to encode and retrieve information. Williams, Goldstein, and Minshew (2006) found that children with autistic disorder had worse memory for complex visual and verbal information than associative learning ability, verbal working memory, and recognition memory. Compared to the control group, the spatial working memory of these children was also impaired; however, spatial memory for location was not impaired. Frith (1970) found that children with autistic disorder and low digit spans recalled random word patterns in a similar manner to a control group; however, the control group was significantly better than those with autistic disorder when more meaningful word patterns were used. This suggests that those with autistic disorder did not process the material like the control group. Similarly, Hermelin and Frith (1971) found that children with autistic disorder performed as good as or better than a control group when repeating random words; however, they performed significantly worse when repeating sentences. Children with autistic disorder tended to recall the last words better than the first, regardless of sentence meaningfulness. Thus, children with autistic disorder may use their memory as an echo instead of finding meaning and organizing material. Hermelin and Frith also found that children with autistic disorder failed to use structure when repeating random word lists; the control group performed significantly better than those with autistic disorder when the word lists were redundant.

Course of autistic disorder. Abnormal functioning in social interaction, social language, or imaginative play is evident prior to age 3; normal development does not

extend past age 3 (DSM-IV-TR, 2000). Approximately 20% of parents report normal development for the first year or two, followed by losses or lack of gains. Infants may exhibit a failure to cuddle, aversion or indifference to affection, lack of eye contact, lack of social responsiveness, and may fail to respond to their parents' voices. Children with autistic disorder may cling to a specific person or may use their parent's hands to obtain objects. During elementary school and adolescence, they may make some developmental gains, such as increased interest in social functioning; however, they may still treat others unusually. Some individuals may continue to have behavioral problems during adolescence, while others may improve. Older individuals may have excellent long-term memory, but they may repeat material inappropriately. Language skills and intelligence are the areas most related to outcomes in autistic disorder. Those with higher intelligence who have developed functional, spontaneous language before age 6 are likely to have better outcomes (Szatmari, Bryson, Boyle, Streiner, & Duku, 2003). Early language and nonverbal skills are predictive of outcomes through the pre-adolescent years for adaptive behavior in communication, socialization, and to a lesser degree in autistic symptoms. Only a small percentage of individuals with autistic disorder live and work independently as adults (DSM-IV-TR). Approximately one-third have partial independence. Even the highest functioning individuals with autistic disorder tend to continue having problems in the areas of social interaction and communication, and they may continue having restricted interests and activities.

Etiology and related medical features. No consistent etiology has been discovered for autistic disorder. Family and twin studies suggest that it is related to genetic and chromosomal factors; although, no specific genes have been consistently identified (Graziano, 2002). Prenatal and perinatal risk factors and immunizations have also been studied as possible causes of autistic disorder; research does not support the link between MMR vaccinations and autistic disorder (Klinger, et. al., 2003). Group differences have been noted in some measures of serotonergic activity, with individuals with autistic disorder having elevated levels of serotonin. (DSM-IV-TR, 2000; Klinger, et al.). Abnormalities in EEG results are common; however, no specific pattern has emerged from imaging studies (DSM-IV-TR). Research on the brain development of individuals with autistic disorder has focused on abnormalities in the brain volume, cerebral cortex, cerebellum, limbic system, and corpus collosum (Klinger, et al.). The findings related to brain development suggest that autistic disorder may be related to abnormal cell growth during early brain development which leads to enlargement or reduction of certain areas of the brain. Both microcephaly and macrocephaly are often observed; a study by Deutsch and Joseph (2003) found that macrocephaly occurred at a significantly higher frequency in individuals with autistic disorder than in a reference group. They also found that head circumference correlated with discrepantly high nonverbal abilities compared to verbal abilities; head circumference was not related to language, executive functioning, or verbal or nonverbal IQ scores. Autistic disorder may also be associated with other medical conditions, such as fragile x syndrome or tuberous sclerosis (DSM-IV-TR).

Seizures occur in approximately 25% of cases. Although a specific etiology has not been found, much research has focused on the various symptoms and characteristics of autistic disorder, including intelligence.

Assessing the Intelligence of Children with Autistic Disorder

Tests of intellectual ability are important because they can predict academic and vocational outcomes. They can also be used by psychologists and other helping professionals to make diagnoses and develop interventions (McCallum, Bracken, & Wasserman, 2001). Scores on nonverbal and verbal intelligence tests have consistently predicted future independence and functioning for individuals with autistic disorder (Howlin & Goode, 1998; Venter, Lord, & Schopler, 1992).

A variety of verbal intelligence tests have been given to individuals with autistic disorder. Allen, Lincoln, and Kaufman (1991) studied the sequential and simultaneous processing abilities of high-functioning children with autistic disorder. They administered the Kaufman-Assessment Battery for Children (K-ABC) (M = 81.30) and subtests from the Wechsler Intelligence Scale for Children-Revised (WISC-R) (M = 68.40). For these individuals, WISC-R Performance IQ scores were higher than Verbal IQ scores; K-ABC Simultaneous Processing scores were higher than Sequential Processing scores.

The Wechsler Intelligence Scales have frequently been used in studies related to the intellectual abilities of those with autistic disorder. Siegel, Minshew, and Goldstein (1996) found 16 studies that focused on Wechsler profiles of high-functioning individuals. The mean Full Scale IQ scores for those studies ranged from 66 to 104.

Verbal Intelligence scores were typically lower than Performance Intelligence scores; differences ranged from 1 to 29 points. However, they also found studies with either no difference or reverse profiles with Verbal Intelligence scores 4 to 9 points higher than Performance Intelligence scores. Within these scales, there is also a distinct pattern. Comprehension is typically the lowest Verbal score, and Digit Span is typically the highest Verbal score. On the Performance scale, lowest scores are often found on the Picture Arrangement or Coding/Digit Symbol subtests (Siegel, et al.), and highest scores are typically found on the Block Design subtest (Ehlers, et al., 1997; Siegel, et al.). Ottem (1999) noted that individuals with autistic disorder performed better on nonverbal tasks and were better at preserving than transforming data based on WISC-R results.

Siegel, et al. (1996) found non-significant differences between Verbal IQ and Performance IQ scores when the WISC-R was given to a group of 45 children with autistic disorder who had IQs above 70; however, 58% of their sample had higher Verbal Intelligence scores. This may be due to the higher general ability level of this sample. Only 16% of the children had significantly higher Verbal scores, while 20% had significantly higher Performance scores. The typical subtest profile for the sample was similar to that found in the literature. On the Verbal scale the highest score was on Information, and the lowest was on Comprehension. On the Performance Scale, Block Design was highest, and Coding was lowest. Mean Block Design scores were significantly higher than mean Comprehension scores. They noted that Verbal/Performance differences and subtest scatter occur in the general population and

are not unique to individuals with autistic disorder; they suggested that there is not a unique cognitive profile for those with autistic disorder.

Bolte and Poustka (2004) used the Wechsler Adult Intelligence Scale-Revised (WAIS-R) to compare the cognitive profiles of savant and nonsavant individuals with autistic disorder. They did not differ significantly in their general intelligence levels. Savants performed significantly better than nonsavants on the Digit Span subtest. Savants performed best on Information, Block Design, Object Assembly, and Digit Span; nonsavants performed best on Object Assembly, Similarities, and Information. Both groups performed worst on Comprehension and Picture Arrangement.

Other intelligence scales have also been administered to individuals with autistic disorder. Mayes and Calhoun (2003) administered the Stanford-Binet IV to children between the ages of 3 and 6, and they gave the Wechsler Intelligence Scale for Children-III (WISC-III) to children between the ages of 6 and 15. Their sample included individuals with both low (IQ below 80) and high (IQ above 80) intelligence scores. Mean IQ scores on the Stanford-Binet IV were 66 for the low IQ group and 99 for those in the high IQ group. On the WISC-III, mean IQ scores were 67 for those in the low IQ group and 103 for the high IQ group. On the Stanford-Binet IV, Nonverbal IQ scores were significantly higher than Verbal IQ scores; however, a significant difference was not found between Verbal and Nonverbal IQ scores for the children who were administered the WISC-III. Based on their results, younger and lower-functioning individuals were more likely to have nonverbal strengths. Only 40% of those who took

the WISC-III had higher Nonverbal IQs. On the Stanford-Binet-IV, Quantitative Reasoning was significantly higher than other scores for those with both low and high IQ scores. Bead Memory was the highest mean subtest score, while Memory for Sentences was the lowest mean score for both groups. The researchers interpreted their results to mean that the low IQ group had high visual skills and rote learning and low verbal ability, while the high IQ group had high visual skills and rote learning and low verbal ability, short-term memory, and attention. On the WISC-III, children with low IQs did not have significant differences between their index scores; however, those with high IQs scored significantly better on Verbal Comprehension and Perceptual Organization compared to Freedom from Distractibility and Processing Speed. The highest mean subtest score was Object Assembly for those with low IQ, while the lowest scores were Comprehension and Arithmetic. The high IQ group scored highest on Similarities and lowest on Coding. The researchers interpreted the most common WISC-III profiles to mean that those with low IQ had high visuospatial and visuomotor manipulative skills, high lexical knowledge and recall of facts, definitions, and categorical terms, and low language comprehension and social reasoning. They decided that those with high IQ had high ability to recall facts and categorical terms; however, they had low ability for language comprehension, social reasoning, auditory attention, short-term memory, and graphomotor skills.

Mayes and Calhoun (2004) also found that the majority of individuals with autistic disorder (IQ > 80) exhibited a WISC-III profile of a low Coding score or low

Freedom from Distractibility Index (FDI) combined with a low Comprehension score. When compared to other exceptional groups (i.e., brain injury, attention deficit hyperactivity disorder (ADHD), learning disability, mood/behavior disorder), children with autistic disorder were twice as likely to have the low Comprehension profile. The high Block Design profile was also more common in individuals with autistic disorder when compared to the other exceptional groups; however, the majority of participants with autistic disorder did not have a high Block Design profile. The low Coding or FDI with low Comprehension profile correctly classified children with autistic disorder with 73% accuracy. Calhoun and Mayes (2005) found that children with autistic disorder scored lower on the WISC-III Processing Speed index and Freedom from Distractibility index, compared to the Verbal Comprehension and Perceptual Organization indexes; this profile was shared with children with ADHD, bipolar disorder, and learning disabilities. Such a profile may lead to difficulty with processing speed, attention, and writing.

Joseph, Tager-Flusberg, and Lord (2002) administered the Differential Ability Scales (DAS) to children with autistic disorder between the ages of 3 and 13. When the preschool (M = 76.7) and school-age children (M = 84.5) were compared, they found that the groups performed at similar levels of nonverbal ability; however, the preschool children had significantly lower levels of verbal abilities. They suggested that this was the result of developmental delays that lessened with time. Both younger (56%) and older (62%) individuals had a higher frequency of verbal-nonverbal differences than the DAS normative sample (30%). In the younger sample, those with higher nonverbal abilities

(85%) tended to have higher levels of general ability than those without discrepant profiles. In the older group, 28% had higher verbal abilities, while 34% had higher nonverbal abilities; this did not vary with level of intelligence. They also found that communicative competence was positively related to verbal ability.

The above studies suggest that individuals with autistic disorder often have lower verbal scores than nonverbal or performance scores. They may perform better at tasks that do not require a high level of social comprehension (e.g., Object Assembly, Block Design and Digit Span) and may perform worse on tasks requiring writing skills, attention, and social reasoning (e.g., Coding, Picture Arrangement, and Comprehension). Although individual cognitive profiles may be related to general intellectual and verbal abilities, these studies suggest that nonverbal intelligence tests may provide a good estimate of the cognitive abilities of children with autistic disorder because of the lack of language and social reasoning based tasks.

Nonverbal Assessment of Intelligence and Autistic Disorder

Although the phrase "nonverbal assessment" has various meanings, McCallum (2003) describes it as a test administration process that does not require receptive or expressive language by the examiner or examinee. A variety of nonverbal intelligence tests have been administered to children with autistic disorder. Early nonverbal intelligence scores were significant predictors of performance on later measures of adaptive functioning and academic achievement in those with autistic disorder (Venter, Lord, & Schopler, 1992). A study by Shah and Holmes (1985) compared the performance

of children with autistic disorder on the Wechsler Intelligence Scale for Children-Revised and the Leiter International Performance Scale. They found that the mean Leiter IQ (M = 69) was significantly higher than the mean full scale IQ on the WISC-R (M = 56). The Leiter IQ scores were directly comparable to the Performance IQ scores from the WISC-R (M = 65); however, there was a low correlation between the Leiter IQ scores and the Verbal IQ scores from the WISC-R. The Leiter focuses more on items measuring perceptual and visual-spatial abilities, while the WISC-R weighs verbal and performance items equally.

Tsatsanis, et al. (2003) studied the concurrent validity of the Leiter and Leiter-R in low-functioning children with autistic disorder. They focused on children between the ages of 4 and 16 who had significant language impairments. For the autistic population, they developed a set of verbal cues that were designed to be a direct translation of the standardized gestures for the Leiter-R, and hand over hand guidance was used on some of the teaching tasks. They found that the Leiter (M = 72.5) and Leiter-R Full IQ (M = 68.8) correlated highly (r = .87) without a significant difference between mean scores. However, there were significant intra-individual differences between the two instruments for a number of individuals, with the Leiter typically giving a higher score; these children also had variable abilities on the Leiter-R. The highest scores were obtained on subtests that used visualization skills, and the Paper Folding subtest, which uses spatial reasoning, was the most frequent significant strength. The authors suggested that the Leiter might be a better instrument for low-functioning individuals because of its uniform response

format, while the Leiter-R would typically be the best choice because of its updated norms and varied tasks (Tsatsanis, et al.). Hanzel (2003) administered the Leiter-R, Wechsler Intelligence Scale for Children-III, and parts of the Differential Ability Scales and Woodcock-Johnson-Revised and concluded that the Leiter-R is a valid instrument for use with high-functioning children with autistic disorder. She found no significant difference between the fluid reasoning and visualization abilities of high-functioning children with autistic disorder (i.e., relatively evenly developed abstract, nonverbal reasoning skills and visual-spatial functioning). In addition, she found that language and comprehension deficits affected measures requiring verbal mediation.

The Test of Nonverbal Intelligence-Second Edition (TONI-2) has also been used with individuals with autistic disorder. Edelson, Schubert, and Edelson (1998) provided support for using the TONI-2 with this population. Although the TONI-2 is a nonverbal test, the directions were administered orally in a manner that would lead to maximum comprehension of the task. The majority of their sample (66%) was testable with the TONI-2; testability was determined by successful completion of training items and the first few test items. Those who were not testable had attention deficits and a moderate number of autistic symptoms. They found that younger age, higher verbal ability, and lack of attention deficits predicted higher TONI-2 scores. Nonverbal individuals scored significantly lower. The average TONI-2 scores (M = 88.99) in their sample were more similar to those obtained by non-English speakers, those with head injuries, and those with dyslexia than those with mental retardation (Edelson, Schubert, & Edelson, 1998).

Similar results were found when the TONI-2 was administered to a sample of individuals with autistic disorder in Taiwan (Edelson, Edelson, & Jung, 1998). Their sample was only 37% testable; however, the mean IQ score for the testable group was 90.10. They were less verbal than the comparative United States sample, but their scores were similar (Edelson, Edelson, & Jung, 1998). These results may not have been as similar if the entire samples had been testable.

More recently, the Test of Nonverbal Intelligence-3rd Edition (TONI-3) and the Analogic Reasoning (AR) subtest of the Universal Nonverbal Intelligence Test (UNIT) have been administered to individuals with autistic disorder (Edelson, 2005). These tests present analogies in a matrix format. The main difference is that over half the items on the AR subtest of the UNIT involve concrete, real-world knowledge. The number of real world items attempted on the UNIT varies according to the age start points and ceiling items. The TONI-3 relies solely on abstract knowledge. Individuals between the ages of 4 and 18 were administered these tests. Although both tests are designed to be administered nonverbally, the instructions were presented orally to the examinees because individuals with autistic disorder have difficulty following nonverbal directions. Edelson found no significant difference in overall scores between the TONI-3 (M = 95.49) and the AR subtest of the UNIT (M = 91.43). However, when age was controlled for, those individuals who completed more concrete, real-world knowledge items on the AR subtest of the UNIT scored significantly better on the TONI-3; those who completed fewer concrete, real-world knowledge items on the AR subtest scored slightly better on the

UNIT compared to the TONI-3. These results suggest that social deficits may have interfered with test scores on the AR subtest of the UNIT; thus, more abstract tasks might provide better estimates of intelligence with this population.

The UNIT measures memory and reasoning abilities; some of the tasks lend themselves to verbal mediation (Symbolic quotient), while others do not (Nonsymbolic quotient) (Bracken & McCallum, 1998). The memory subtests (Memory quotient) measure the individual's ability to recall content, location, and sequence of material, while the reasoning subtests (Reasoning quotient) measure pattern processing, problem solving, relationship comprehension, and planning abilities. Previous research suggests that children with autistic disorder perform worse on test items involving verbal mediation (Hanzel, 2003; National Research Council, 2001); therefore, it is predicted that the children in the current study will perform better on the Nonsymbolic quotient compared to the Symbolic quotient. Research supports the view that children with autistic disorder have relatively good short-term memory, rote memory, and spatial memory for location (Siegel, 1998; Williams, et al., 2006). They are typically better at preserving data than transforming it (Ottem, 1999). Therefore, it is predicted that the current sample will perform better on the Memory quotient relative to the Reasoning quotient. This is the case even though the Reasoning quotient includes a block design task, and children with autistic disorder often perform relatively better on such tasks (Siegel, et al., 1996). Neutralizing this potential advantage is inclusion on the Reasoning quotient of the

Analogic Reasoning subtest, which requires some social reasoning skills that may be difficult for children with autistic disorder (Edelson, 2005).

Statement of the Problem

The current study will address the utility of the UNIT for assessing the cognitive abilities of individuals with pervasive developmental disorders. The UNIT manual (Bracken & McCallum, 1998) suggests that it can be used with this population. Although several exceptional samples were assessed in the developmental stages of the UNIT, individuals with pervasive developmental disorders were not included. The current study will also examine whether a distinct UNIT cognitive profile exists for this population. Researchers have studied cognitive profiles on a variety of instruments (e.g., WISC-III, Leiter-R). However, this question has not been addressed for the UNIT.

Research Questions

The following research questions will be addressed.

1). Do children with pervasive developmental disorders earn significantly lower mean scores than a demographically matched control group on the UNIT Full Scale Intelligence quotient?

2) Do children with pervasive developmental disorders earn a significantly higher mean score on the UNIT Nonsymbolic quotient versus the Symbolic quotient?

3) Do children with pervasive developmental disorders have unevenly developed reasoning and memory skills as evidenced by mean difference analysis of the UNIT Reasoning and Memory quotients?

CHAPTER 2

Method

Participants

The research sample included 43 individuals with previous diagnoses of autistic disorder, asperger's disorder, or pervasive developmental disorder-not otherwise specified (PDD-NOS) based on criteria from the DSM-IV-TR (American Psychiatric Association, 2000) or previous versions. Twenty-six individuals were diagnosed with autistic disorder. Nine individuals were diagnosed with asperger's disorder, and 3 individuals were diagnosed with PDD-NOS. When asked for the specific diagnosis, four parents responded that their child was diagnosed with autism spectrum disorder. The specific diagnosis of one participant was unknown. Their mean age of diagnosis was 39.95 months (SD = 18.38); this information was unavailable for one individual. Only 31 individuals, who received raw scores of at least 1 on every subtest, were included in analyses.

Participants were recruited through local mental health providers, parent groups, and acquaintances of the researcher in the southeastern United States. Of those included in the analyses, 19 were diagnosed with autistic disorder. Seven were diagnosed with asperger's disorder, and two were diagnosed with PDD-NOS. Two parents noted that their child was diagnosed with autism spectrum disorder. This information was unknown for 1 participant. All participants were between the ages of 5 and 17 years. The average age of the sample was 10 years 2 months (SD = 3 years 6 months). Seventy-four percent

were male (n = 23), and 26% were female (n = 8). The sample was 3.2% Asian American (n = 1) and 96.8% European American (n = 30). The ethnicity of 6.5% was Hispanic (n = 2). If Hispanic origin was not noted on the demographic questionnaire, it was assumed that they were non-Hispanic for matching purposes. They were in grades Kindergarten through eleven. Thirty-nine percent were in a full-time general-education classroom. Ten percent were in a full-time self-contained classroom. Thirty-nine percent received part-time special education/resource, and 9.7% received other accommodations. The classroom placement of 3.2% of the sample was unknown. The educational attainment of the mothers was less than high-school diploma (3.2%), high-school diploma (9.7%), some college (45.2%), and college degree or higher (41.9%). The educational attainment of the fathers was less than high-school diploma (6.5%), high-school diploma (22.6%), some college (29.0%), college degree or higher (35.5%), and unknown (6.5%). Their community settings were 45.2% rural, 19.4% urban, 29.0% suburban, and 6.5% unknown. When parents were asked to rate their child's verbal ability on a likert-type scale from 0 (completely nonverbal) to 5 (uses sentences), the mean rating was 4.47 (SD = .96).

In addition, existing data from 31 individuals who participated in the UNIT standardization process with Riverside Publishing Company were included as a control group. This comparative sample was matched based on age, sex, race, ethnicity, and parental educational attainment. Parental educational attainment was determined by using the highest level of education obtained between the two parents. This was done to

replicate how the clinical and exceptional studies were matched in the UNIT standardization process. Exact matches were found for 27 children. If an exact match was not possible, the closest available match was found. The average age of the control group was 10 years 2 months. Seventy-four percent were male (n = 23) and 26 % were female (n = 8). The control group was 100 % European American, and 3.2% were Hispanic (n = 1). The educational attainment of the mothers was less than high-school diploma (3.2%), high-school diploma (12.9%), some college (38.7%), and college degree or higher (45.2%). The educational attainment of the fathers was less than high-school diploma (6.5%), high-school diploma (22.6%), some college (25.8%), college degree or higher (38.7%), and unknown (6.5%). Table 1 displays the demographic characteristics of both the group with a pervasive developmental disorder and the control group.

Universal Nonverbal Intelligence Test

The *Universal Nonverbal Intelligence Test* (UNIT) is an individually administered test designed to measure the general intelligence and cognitive abilities of individuals between the ages of 5 and 17 years (Bracken & McCallum, 1998). It is published by Riverside Publishing Company and is specifically designed for those who may be disadvantaged by traditional verbal and language-loaded tests, such as those with speech, language, or hearing impairments, color-vision problems, various cultural backgrounds, or those who are verbally uncommunicative. Its administration and response formats are completely nonverbal.

Table 1

Matched Demographics for the Individuals with a Pervasive Developmental Disorder and the Control Group

	Individuals with a Pervasive Developmental Disorder	Control Group
Average Age	10 years 2 months	10 years 2 months
Sex	74% Male	74% Male
	26% Female	26% Female
Race	3.2% Asian American	100% European American
	96.8 % European American	
Ethnicity	6.5% Hispanic	3.2% Hispanic
Mother's Educational	3.2% Less than High School	3.2% Less than High School
Attainment	9.7% High School Diploma	12.9% High School Diploma
	45.2% Some College	38.7% Some College
	41.9% College Degree	45.2% College Degree
Father's Educational	6.5 % Less than High School	6.5% Less than High School
Attainment	22.6% High School Diploma	22.6% High School Diploma
	29.0% Some College	25.8% Some College
	35.5% College Degree	38.7% College Degree
	6.5% Unknown	6.5% Unknown

Eight universal hand and body gestures are used to communicate with the examinee. These include head nodding (approval), head shaking (disapproval), open-handed shrugging ("What is the answer?"), palm rolling ("Go ahead."), pointing to the examiner ("You do it now."), hand waving over the materials (materials should be considered as a group of choices), hand in vertical position with palm up ("Stop"), and thumbs up (approval). To ensure understanding, demonstration items, sample items, and checkpoint items are included in each subtest.

The Standard Battery subtests include Symbolic Memory, Cube Design, Spatial Memory, and Analogic Reasoning. These subtests are combined to form scores for the Memory, Reasoning, Symbolic, and Nonsymbolic quotients. The Memory quotient provides a measure of the individual's ability to recall content, location, and sequence of material, while the Reasoning quotient provides a measure of pattern processing, problem solving, relationship comprehension, and planning abilities. The Symbolic quotient utilizes verbal mediation, while the Nonsymbolic quotient does not.

Symbolic memory subtest. This subtest requires examinees to view a sequence of symbols for 5 seconds and then re-create the sequence once the stimulus is removed. The sequences consist of green or black representations of a baby, girl, boy, woman, and man. This subtest measures short-term visual memory and complex sequential memory. It is part of the Symbolic and Memory quotients.

Cube design subtest. This subtest requires the examinee to reproduce two-color, geometric designs using 1 inch cubes that are white, green, or half white and half green.

This task is completed while viewing the design in the stimulus book. It measures visual-spatial reasoning and contributes to the Nonsymbolic and Reasoning quotients.

Spatial memory subtest. This subtest requires the examinee to view a random pattern of green, black, or green and black dots for 5 seconds and then recreate the pattern on a response grid once the stimulus is removed. It measures short-term visual memory for abstract material and contributes to the Nonsymbolic and Memory quotients.

Analogic reasoning subtest. Examinees are presented with incomplete conceptual or geometric matrix analogies and are required to point to the response option that best completes the matrix. This subtest measures symbolic reasoning and contributes to the Symbolic and Reasoning quotients.

UNIT normative data. The UNIT is a standardized, norm-referenced test. The standardization sample was representative of the United States population based on the 1995 census, and it consisted of 2,100 children and adolescents between the ages of 5 years 0 months and 17 years 11 months. These individuals were assessed at 108 sites in 38 states. The sample was stratified and proportionately representative according to sex, race, Hispanic origin, region, community setting, classroom placement, special education services, and parental educational attainment. It included a representative sample of children with special needs, such as those receiving special education and those in English as a second language (ESL) classes. An additional 1,765 children participated in reliability, validity, and fairness studies.

UNIT reliability. The UNIT manual reports high measurement precision for both internal consistency and stability over time; these values approach or exceed standards for reliability (Bracken & McCallum, 1998). The manual provides internal consistency reliability figures for subtests and quotients. The standardization subtest average reliability across ages was as follows: Symbolic Memory .85, Cube Design .91, Spatial Memory .81, and Analogic Reasoning .79. For the clinical/exceptional sample, subtest reliability averages across ages were as follows: Symbolic Memory .92, Cube Design .96, Spatial Memory .92, and Analogic Reasoning .91. For the Standard Battery average quotient reliabilities across ages were as follows: Memory .88, Reasoning .90, Symbolic .87, Nonsymbolic .91, and Full Scale .93. The clinical/exceptional sample had the following mean quotient reliabilities across ages for the Standard Battery: Memory .95, Reasoning .96, Symbolic .95, Nonsymbolic .97, and Full Scale .98.

Test-retest reliability values for the Standard Battery subtests ranged from .68 on Spatial Memory to .85 on Cube Design. These values were corrected for restriction or expansion of range. For the Standard Battery, the reliability values for the quotients were as follows: Memory .81, Reasoning .87, Symbolic .78, Nonsymbolic .84, and Full Scale .88.

UNIT validity. The UNIT manual also provides evidence of validity. “In terms of content validity, the UNIT items and tasks were designed to be relevant to and representative of cognitive and intellectual abilities, with an emphasis on abilities and aptitudes rather than on achievement, previously acquired knowledge, or cultural

experiences" (Bracken & McCallum, 1998, p.123). Structural validity was verified using fit of individual items within a subtest, subtest inter-correlation studies, and factor analyses. Factor analysis demonstrated that the UNIT is a solid measure of general intellectual ability.

The UNIT manual provides concurrent validity studies with a number of measures of intelligence. For individuals with mental retardation, the UNIT Standard Battery and the Wechsler Intelligence Scale for Children-III corrected correlations ranged from .60 (WISC-III Processing Speed and UNIT Symbolic quotient) to .87 (WISC-III Perceptual Organization index and UNIT Reasoning quotient). The corrected correlation for the Full Scale Intelligence quotients from these measures was .84. For students in general education classrooms, corrected correlations for the UNIT Standard Battery and the Woodcock Johnson-Revised ranged from .24 (WJ-R Visual Closure and UNIT Memory quotient) to .72 (WJ-R Analysis Synthesis and UNIT Memory quotient; Analysis Synthesis and UNIT Symbolic quotient). The general cognitive ability estimates for these measures correlated at .83 when corrected for range.

Test performance by examinees in various diagnostic and exceptional groups was used to determine validity for clinical and educational decision making. These individuals were previously diagnosed with specific learning disabilities, speech or language impairments, mental retardation, or serious emotional disturbance. Individuals with speech and language impairments received the following mean scores on the Standard Battery of the UNIT: Memory quotient 94.81, Reasoning quotient 91.42, Symbolic

quotient 93.67, Nonsymbolic quotient 92.40, and FSIQ 91.98. Individuals with mental retardation achieved the following mean scores on the Standard Battery of the UNIT: Memory quotient 67.56, Reasoning quotient 66.88, Symbolic quotient 66.52, Nonsymbolic quotient 67.17, and FSIQ 62.40.

Assessment Procedures

Five examiners assisted with assessment procedures; however, the principal investigator conducted the majority of the assessments. All examiners were trained to administer and score the Universal Nonverbal Intelligence Test (UNIT, Bracken & McCallum, 1998) in an assessment practicum course that is part of the curriculum for a graduate program in school psychology. As part of that course, they were observed administering the UNIT and demonstrated competency on it. The UNIT manual suggests that examiners should have previous training in measurement, assessment, and psychology. In addition, examiners are instructed to read the manual, watch the training video, administer the UNIT to a student without a referral problem, and reexamine administration guidelines following the practice administration. All examiners for this study had also been involved in a practicum experience where they interacted with children with a pervasive developmental disorder and observed assessments by an experienced clinician within a clinical setting.

Written informed consent was obtained from each participant's parent or legal guardian prior to inclusion in the study. Assent was obtained from each child if possible. If the child agreed to participate but was unable to sign his or her name, the examiner

wrote the child's name. The Standard Battery of the UNIT (e.g., Symbolic Memory, Cube Design, Spatial Memory, and Analogic Reasoning subtests) was administered. Participants were assessed in their homes, schools, or in the school psychology clinic at a southeastern university. The reported administration time for the standard battery is 30 minutes (Bracken & McCallum, 1998). Parents were told that the test would take approximately 1 hour.

Participants were provided a small reward (e.g., stickers, pencils, small toys) immediately following the assessment. They were not informed about the reward unless it was necessary to keep their interest in the activity. Parents or legal guardians received a typed summary of their child's performance on the UNIT within 1 month of the testing session.

All protocols were initially scored with the UNIT examiner's manual (Bracken & McCallum, 1998). They were later checked with the UNIT compuscore program to ensure accuracy.

Statistical Procedures

Descriptive statistics (i.e., means and standard deviations) were calculated. Between and within group mean difference analyses were also conducted. When appropriate, one-tailed t-tests were applied. For this study, the level of significance sought was at least $p < .05$.

CHAPTER 3

Results

This study addressed the utility of the UNIT for assessing the cognitive abilities of individuals with pervasive developmental disorders. Scores of children with autistic disorder and related pervasive developmental disorders obtained via administration of the standard battery of the UNIT were compared to a matched sample from the UNIT standardization data set. Table 2 and Figure 2 display the descriptive statistics for both groups. The means and standard deviations are displayed for the UNIT Full Scale IQ, Memory quotient, Reasoning quotient, Symbolic quotient, and Nonsymbolic quotient.

This study also addressed whether a distinct cognitive profile exists for individuals with pervasive developmental disorders on the UNIT. Table 3 displays the descriptive statistics for this group; means and standard deviations for all subtests and quotients are displayed. Some of these means and standard deviations are slightly different from those used in the matched control group comparisons (shown in Table 2); because all of the quotient scores were not available for every individual in the control group, all 31 individuals from the group with pervasive developmental disorders were not always included in the comparisons. The mean Full Scale IQ score for this group was 81.42 (SD = 20.49). Their Full Scale IQ scores were descriptively classified in the High Average range (9.7%), Average range (32.3%), Low Average range (9.7%), Delayed range (12.9%), and Very Delayed range (35.5%). Large standard deviations were present for all of the quotients for those with pervasive developmental disorders.

Table 2

Descriptive Statistics for the Universal Nonverbal Intelligence Test Full Scale Quotients for the Individuals with a Pervasive Developmental Disorder and the Control Group

Quotient	Individuals with a pervasive developmental disorder		Control group	
	Mean	Standard deviation	Mean	Standard deviation
Full Scale Intelligence Quotient	81.85	19.55	103.89	12.70
Memory Quotient	82.66	18.51	101.90	15.16
Reasoning Quotient	84.76	18.44	104.93	13.22
Symbolic Quotient	83.21	16.43	102.57	13.57
Nonsymbolic Quotient	84.55	21.52	103.93	12.83

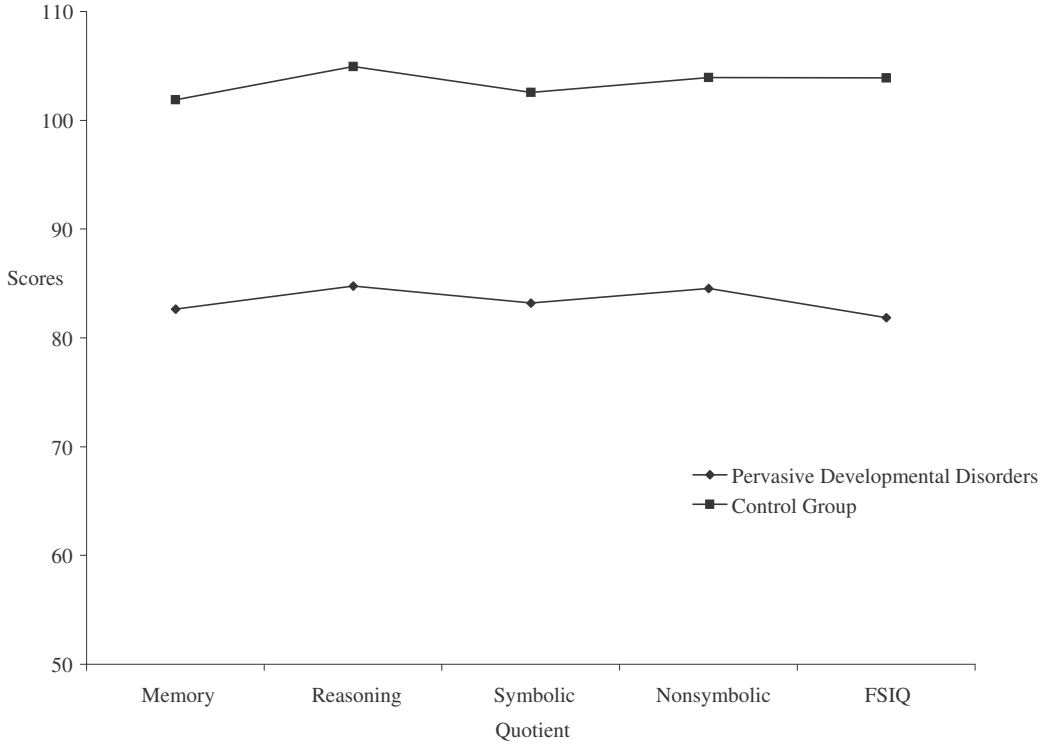


Figure 2. Mean quotient scores for the group of children with a pervasive developmental disorder and the control group

Table 3

Descriptive Statistics for the Individuals with a Pervasive Developmental Disorder

	Mean	Standard deviation
UNIT subtests		
Symbolic Memory	7.55	3.20
Cube Design	8.10	3.84
Spatial Memory	6.97	4.28
Analogic Reasoning	6.16	3.55
UNIT quotients		
Memory	83.84	20.33
Reasoning	83.65	18.88
Symbolic	81.74	16.79
NonSymbolic	85.42	21.46
Full Scale IQ	81.42	20.49

Comparison of the UNIT Full Scale Intelligence Quotient Scores of Children with a Pervasive Developmental Disorder and a Demographically Matched Control Group

To determine whether significant mean score differences exist between a sample of children with a pervasive developmental disorder and a demographically matched control group from the UNIT standardization sample, paired t tests were calculated. The mean Full Scale IQ score of the group of children with a pervasive developmental disorder was 81.85 (SD = 19.55), and it was compared to the control group's FSIQ mean of 103.89 (SD = 12.70). The difference of 22.04 was statistically significant, $t(26) = 4.46$, $p = .000$. The effect size of 1.34 is considered large using Cohen's (1988) criteria.

When the mean Memory quotient score of the group of children with a pervasive developmental disorder (M = 82.66, SD = 18.51) was compared to that of the control group (M = 101.90, SD = 15. 16), the difference of 19.24 was statistically significant, $t(28) = 3.61$, $p < .001$. The effect size of 1.14 is considered large (Cohen, 1988). The mean Reasoning quotient score of the group of children with a pervasive developmental disorder (M = 84.76, SD = 18.44) was compared to the control group (M = 104.93, SD = 13.22); the difference of 20.17 was statistically significant, $t(28) = 4.59$, $p = .000$. The effect size of 1.26 is considered large (Cohen). When the mean Symbolic quotient of the group of children with a pervasive developmental disorder (M = 83.21, SD = 16.43) was compared to the control group (M = 102.57, SD = 13.57), the difference of 19.36 was statistically significant, $t(27) = 4.16$, $p = .000$. The effect size of 1.28 is considered large (Cohen). The mean Nonsymbolic quotient score of the group of children with a pervasive

developmental disorder (M = 84.55, SD = 21.52) was compared to the control group (M = 103.93, SD = 12.83); the difference of 19.38 was statistically significant, t(28) = 3.98, p = .000. The effect size of 1.09 is considered large (Cohen).

Comparison of Mean Scores on the UNIT Symbolic and Nonsymbolic Quotients for Children with a Pervasive Developmental Disorder

To determine whether the UNIT Nonsymbolic quotient scores were significantly higher than the Symbolic quotient scores for a sample of children with a pervasive developmental disorder, their mean scores were compared using a paired one-tailed t test. See Table 3 for these descriptive statistics. When the Nonsymbolic quotient (M = 85.42, SD = 21.46) was compared to the Symbolic quotient (M = 81.74, SD = 16.79), the difference of 3.68 was not significant, t(30) = 1.59, $p > .05$. Although the one-tailed t value approached significance ($t < 1.70$), the Nonsymbolic quotient scores were not significantly higher than the Symbolic quotient scores. The effect size of .19 is considered small (Cohen, 1988).

Comparison of Mean Scores on the UNIT Memory and Reasoning Quotients for Children with a Pervasive Developmental Disorder

To determine whether significant differences exist between the UNIT Memory and Reasoning quotients for a sample of children with a pervasive developmental disorder, their mean scores were compared using a paired t test. See Table 3 for these descriptive statistics. When the Memory quotient (M = 83.84, SD = 20.33) was compared to the Reasoning quotient (M = 83.65, SD = 18.88), the difference of .19 was not

significant, $t(30) = .068$, $p = .947$. The effect size of .01 is considered small (Cohen, 1988).

CHAPTER 4

Discussion

The results of the current study supported one of the three hypotheses that were posed. The group of children with a pervasive developmental disorder produced mean quotient scores that were significantly less than those of the control group for the Full Scale Intelligence quotient, Memory quotient, Reasoning quotient, Symbolic quotient, and Nonsymbolic quotient. The hypotheses that were made in relation to the cognitive profile of the group of children with a pervasive developmental disorder were not supported by the current study. Although the group had higher mean scores on the Nonsymbolic quotient compared to the Symbolic quotient, the difference was not significant. In addition, the group of children with a pervasive developmental disorder did not have significantly different mean scores on the Memory quotient and Reasoning quotient.

How do Those with a Pervasive Developmental Disorder Perform on the Universal Nonverbal Intelligence Test?

One of the purposes of this study was to evaluate the utility of the UNIT for individuals with a pervasive developmental disorder since they were not included as one of the clinical samples during the test's development. Similar to previous research (Edelson, Schubert, & Edelson, 1998; Edelson, Edelson, & Jung, 1998), the entire sample selected was not testable (27.9%). A large percentage (35.5%) of the current sample had low Full Scale IQ scores, similar to those diagnosed with mild to profound mental

retardation (below 70); this is similar to previous research related to this population (DSM-IV-TR, 2000). Those with a pervasive developmental disorder earned average UNIT Standard Battery FSIQs well below the average of a matched control group. The average Full Scale IQ score of those with a pervasive developmental disorder in the current study was 81.42 (SD = 20.49). Previous researchers have used both verbal and nonverbal intelligence tests with this population. Due to the variety of ability levels, a wide range of mean IQ scores have been found. Mean full scale intelligence scores on Wechsler Intelligence Scales have ranged from 66 to 104 (Siegel, et al., 1996). Researchers have also found mean scores of 81.30 on the Kaufman-Assessment Battery for Children (K-ABC) (Allen, et al., 1991), 66 for a low-functioning group on the Stanford-Binet IV (Mayes & Calhoun, 2003), 99 for a high-functioning group on the Stanford-Binet IV (Mayes & Calhoun), 76.7 on the Preschool Differential Ability Scales (Joseph, et al., 2002), and 84.5 on the School-Age Differential Ability Scales (Jospeph, et al.).

In a study comparing scores across tests, Shah and Holmes (1985) found that Leiter IQ scores (M = 69) were significantly higher than Wechsler Intelligence Scale for Children-Revised (WISC-R) IQ scores (M = 56); they were comparable to the WISC-R Performance IQ score (M = 65). Since individuals with a pervasive developmental disorder often perform better on the Performance Intelligence scale of the Wechsler tests, these results suggest that nonverbal tests may be more appropriate with this population. A variety of nonverbal tests have previously been used with individuals with a pervasive

developmental disorder; researchers have found mean full scale intelligence scores of 72.5 on the Leiter (Tsatsanis, et al., 2003), 68.8 on the Leiter-R (Tsatsanis, et al.), 88.99 on the Test of Nonverbal Intelligence, Second Edition (TONI-2) (Edelson, et al., 1998), and 95.49 on the Test of Nonverbal Intelligence, Third Edition (TONI-3) (Edelson, 2005). The mean FSIQ on the UNIT (81.42) in the current sample fits with previous research of both verbal and nonverbal tests, especially considering that many of the other studies have focused on high-functioning individuals.

Those with a pervasive developmental disorder may have had some difficulty with the UNIT due to their limited ability to make eye contact and to use gestures (DSM-IV-TR, 2000). Since some may not use many gestures freely, (National Research Council, 2001) they may not thoroughly understand them in the testing setting, required by the UNIT. In addition, deficits in motor imitation (Sigman & Ungerer, 1984; Stone, Ousley, & Littleford, 1997) may have affected their ability to learn from the demonstration items. Attention problems (Klinger et al., 2003) may have also affected their performance on timed items (e.g., cube design) and memory items. Previous researchers using nonverbal tests with this population created verbal directions to accompany the nonverbal directions to ensure maximum comprehension (Edelson, Schubert, & Edelson, 1998; Edelson, 2005; Tsatsanis, et al., 2003). Perhaps a larger percentage of the sample in the current study would have understood the tasks if short, verbal directions were added. The mean scores of this sample were significantly lower than the matched control group for every quotient score, including the FSIQ. Considering

all of the testing related issues of this population (e.g., attention, motivation, sensory issues, difficulty developing rapport, and comprehension problems) and deficits in various ability areas, it is not surprising that this sample had lower mean scores.

Many of the problems inherent in the administration of the UNIT are part of every standardized testing situation. Some have even questioned whether standardized testing is justifiable with this population given their unique deficits in areas such as shared attention, verbal expression, and auditory processing (Carothers & Taylor, 2007). The lack of expressive and receptive verbal skills needed on the UNIT makes it a useful test for this population. Even though the entire current sample did not receive at least 1 raw score point on every subtest, the majority of the sample (72.1%) was able to complete all four subtests that were administered.

Do Children with a Pervasive Developmental Disorder Demonstrate a Unique UNIT Cognitive Profile?

Another purpose of this study was to determine if a distinct cognitive profile exists on the UNIT for this population by comparing the mean quotient scores of individuals with a pervasive developmental disorder. Based on the results of the current study, it does not seem that a distinct cognitive profile exists for individuals with a pervasive developmental disorder within the quotient scores. These results imply that the unevenly developed cognitive profile of individuals with a pervasive developmental disorder may not be as apparent when tasks are not verbally laden.

Previous studies have noted a unique profile of cognitive abilities for individuals with autistic disorder including the tendency to do worse on items involving verbal mediation, abstraction, comprehension, information processing, acquired knowledge, and spatial working memory (Goldberg et al., 2005; Maltz, 1981; Minshew, et al., 1994; National Research Council, 2001) and do better on tasks involving spatial understanding, perceptual organization, short-term memory, concrete information, and memory for location (Hermelin & O'Connor, 1970 as cited in National Research Council; Maltz; Williams et al., 2006). However, the mean difference analyses of the UNIT quotients did not reveal significant differences in the ability levels of the areas tested by the UNIT. Although the mean Nonsymbolic quotient scores were higher than the Symbolic quotient scores, the difference approached but was not statistically significant despite the existence of meaningful material that could be verbally mediated on the Symbolic quotient. Nor was the Memory quotient significantly different from the Reasoning quotient, though the difference was in the expected direction (The mean scores on the Memory quotient were higher than those on the Reasoning quotient). This was the case despite the tendency for this population to do well on tasks involving short-term memory (Heremelin & O'Connor).

Previous research related to specific intelligence tests has found certain patterns of performance. Verbal Intelligence scores are typically lower than Performance Intelligence scores on the Wechsler scales (Siegel, et al., 1996). On the Verbal scale, scores typically range from a low on the Comprehension subtest to a high on the Digit

Span or Information subtests; on the Performance scale, scores typically range from a low on the Picture Arrangement or Coding/Digit Symbol subtests to a high on the Block Design or Object Assembly subtests (Ehlers, et al., 1997; Mayes & Calhoun, 2003; Siegel, et al.). Verbal-Nonverbal differences have also been noted on the Stanford-Binet IV and the Differential Ability Scales (Joseph, et al., 2002; Mayes & Calhoun, 2003). Although this profile is somewhat common, it is not universal; non-significant differences between Verbal and Performance scores have also been found on the Wechsler Intelligence Scale for Children-Revised (Siegel, et al, 1996) and the Wechsler Intelligence Scale for Children-III (Mayes & Calhoun, 2003). On the Leiter-R, Tsatsanis, et al. (2003) found that the highest scores were obtained on subtests that used visualization skills and spatial reasoning, and Hanzel (2003) reported that language and comprehension deficits affected tasks involving verbal mediation.

Similar to the findings above regarding high scores on the Block Design subtest of the Wechsler scales and high scores on subtests that used spatial reasoning on the Leiter-R, the highest mean subtest score for the current sample was the Cube Design subtest of the UNIT ($M = 8.1$, $SD = 3.84$). It was significantly higher than the lowest mean subtest score, the Analogic Reasoning subtest ($M = 6.16$, $SD = 3.55$) ($p = .002$). Both subtests contribute to the Reasoning quotient of the UNIT and may have neutralized each other when determining the Reasoning quotient scores. The Symbolic Memory subtest ($M = 7.55$, $SD = 3.2$) was also significantly higher than the Analogic Reasoning subtest ($p = .027$). Perhaps the concrete, real-world knowledge items that are part of the

Analogic Reasoning subtest contributed to the lower scores; Edelson (2005) found that the real-world items on the Analogic Reasoning subtest led to lower scores when compared to the Test of Nonverbal Intelligence-3rd Edition (TONI-3).

Clinical Implications of the Study

Based on the results of this study, it seems that the UNIT is not necessarily the best intelligence test for every child with a pervasive developmental disorder. Based on the percentage of participants that did not receive raw scores of at least one on every subtest, the UNIT is probably better for higher functioning individuals diagnosed with a pervasive developmental disorder. However, the variety of ability levels and symptoms within this population makes it difficult to predict who would be able to complete this or any other standardized test.

As the UNIT is a completely nonverbal test, it does not measure verbal ability, which may actually be a strength for some children with a pervasive developmental disorder. In order to understand each child's unique strengths and weaknesses, it may be necessary to supplement the UNIT with some verbal subtests, such as measures of vocabulary or comprehension. A verbal intelligence test might even be better for certain children.

Some of the difficulties that children with a pervasive developmental disorder have related to understanding gestures may be reduced by meeting before the testing session to teach the gestures to the child. The UNIT manual encourages examiners to explain and demonstrate the gestures prior to test administration if necessary (Bracken &

McCallum, 1998). This may eliminate some of the confusion associated with understanding the test directions that are presented using gestures.

It may also be necessary to test the child's limits after the standardized testing session by adding verbal directions to the gestures, using hand over hand guidance for sample items, or giving the child unlimited time to complete timed items. Since motivation is often a problem with this population, it might also be helpful to reinforce the child for participating with a favored activity or prize. This will allow the examiner to see if these variables were deterring the child from performing to his/her true potential.

Limitations of the Study

There are a number of limitations associated with the current study. There was a small sample size. Because participation was based on parental consent, it may not be a representative sample; the parents who volunteered their children to participate in this study were interested in supporting research related to pervasive developmental disorders. All of the participants were from the southeast United States, and most of them were males (72.4%). (Of note, however, males are 4 to 5 times more likely to be diagnosed with autistic disorder (DSM-IV-TR, 2000)). The participants represented a variety of diagnoses, ability levels, and ages. This variability makes it difficult to generalize the results of this study to a specific group within the population of individuals with a pervasive developmental disorder. Most of the tests were administered in the children's homes; although this setting was convenient for the parents and the children were comfortable in the setting, the children may have been distracted by items in their

homes (e.g., toys, family, television, pets, etc.). In addition, the examiners had little, if any, previous experience assessing children with pervasive developmental disorders, though they did have training administering the UNIT. Different results might have been obtained from more experienced examiners.

Future Research

The findings of this study are important because they contribute to the growing body of research related to understanding the cognitive abilities of individuals with a pervasive developmental disorder. This study lays groundwork for future research related to this population and the Universal Nonverbal Intelligence Test. Researchers could create simple, verbal directions to accompany the gestures that are used to explain the tasks on the UNIT subtests. Individual profiles could be analyzed for significant differences instead of focusing on mean group scores. In addition, scores on the UNIT could be compared to scores on verbal IQ tests.

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APPENDICES

Appendix A

Figure 1. Diagnostic Criteria for Autistic Disorder

Note. From *Diagnostic and statistical manual of mental disorders* (4th ed.) text revision. (p.75), by American Psychiatric Association, 2000, Washington, DC: American Psychiatric Association. Copyright 2000 by American Psychiatric Association.

Diagnostic Criteria for Autistic Disorder

A. A total of six (or more) items from (1), (2), and (3), with at least two from (1), and one each from (2) and (3):

(1) Qualitative impairment in social interaction, as manifested by at least two of the following:

(a) Marked impairment in the use of multiple nonverbal behaviors such as eye-to-eye gaze, facial expression, body postures, and gestures to regulate social interaction
(b) Failure to develop peer relationships appropriate to developmental level
(c) A lack of spontaneous seeking to share enjoyment, interests, or achievements with other people (e.g., by a lack of showing, bringing, or pointing out objects of interest)
(d) Lack of social or emotional reciprocity

(2) Qualitative impairments in communication as manifested by at least one of the following:

(a) Delay in, or total lack of, the development of spoken language (not accompanied by an attempt to compensate through alternative modes of communication such as gesture or mime)
(b) In individuals with adequate speech, marked impairment in the ability to initiate or sustain a conversation with others
(c) Stereotyped and repetitive use of language or idiosyncratic language
(d) Lack of varied, spontaneous make-believe play or social imitative play appropriate to developmental level

(3) Restricted repetitive and stereotyped patterns of behavior, interests, and activities, as manifested by at least one of the following:

(a) Encompassing preoccupation with one or more stereotyped and restricted patterns of interest that is abnormal either in intensity or focus
(b) Apparently inflexible adherence to specific, nonfunctional routines or rituals
(c) Stereotyped and repetitive motor mannerisms (e.g., hand or finger flapping or twisting, or complex whole-body movements)
(d) Persistent preoccupation with parts of objects

B. Delays or abnormal functioning in at least one of the following areas, with onset prior to age 3 years: (1) social interaction, (2) language as used in social communication, or (3) symbolic or imaginative play.

C. The disturbance is not better accounted for by Rett's Disorder or Childhood Disintegrative Disorder.

Appendix B

Parental Consent Form

Parental Consent Form

Dear Parents/Guardians:

My name is Bobbie Burton, and I am a doctoral student at the University of Tennessee. As part of my dissertation, I am giving a nonverbal intelligence test to children with autistic disorder. Because of the language problems related to autistic disorder, nonverbal assessment may be a helpful way to identify cognitive abilities. This study will examine the usefulness of the Universal Nonverbal Intelligence Test (UNIT; Bracken & McCallum, 1998) for children with autistic disorder. Your child is invited to participate.

If you give permission, your child will be asked to take the Universal Nonverbal Intelligence Test (UNIT) at a time and place that you choose. The UNIT is administered without spoken language. Gestures are used during the test. It should take about one hour. Your child will be given breaks as needed. The UNIT will be given by trained graduate students. You will also be asked to fill out a questionnaire, which should take about five minutes.

You may decide if you want your child to participate. You or your child may withdraw from the study at any time without penalty. Before testing, the examiner will read an assent form to your child explaining what will take place. No testing will occur if your child does not want to participate. There are no apparent risks. If your child takes the test, he/she will get a small prize (e.g., stickers, pencils, etc.). A summary of your child's results will be mailed to you within three months of testing upon your request. These results can only be used for research purposes and will only provide an estimate of cognitive abilities. Results cannot be used for special education decisions. Your participation may lead to a better understanding of autistic disorder.

All test results will be confidential. Testing materials will be coded without names. The consent forms and testing materials will be kept in a locked box at the university for three years.

If you have questions about the study, you may contact Bobbie Burton at (865) 974-9876 or bburton3@utk.edu. If you have questions about your rights as a participant, please contact the University of Tennessee, Office of Research Compliance Officer at (865) 974-3466.

Please sign below if you understand the study and agree to allow your child to participate.

Name of Child (please print)_____

Parent's signature_____ Date_____

Appendix C

Demographic Questionnaire

DEMOGRAPHIC QUESTIONNAIRE

Child's Name_____ Child's Birthday_____

Child's Grade_____ Child's Sex____ Child's Age at Time of Diagnosis_____

Child's Race *(Circle one):* White/African American/Asian/Pacific Islander/Native American/Other

Hispanic Origin *(Circle one):* Hispanic/Non-Hispanic

Classroom Placement *(Circle one):* Full-Time General Education Classroom/ Full-Time Self-Contained Classroom/Part-Time Special Education Resource/Other

Community Setting *(Circle one):* Urban/Suburban/Rural Community Population:_____

Previous Full Scale Intelligence Score:_____ Test Used:_____

Rate your child's verbal abilities:

0	**1**	**2**	**3**	**4**	**5**
Completely Nonverbal	Makes less than 10 sounds	Uses 1 to 10 words	Uses more than 10 words	Combines words	Uses sentences to communicate

Describe your child's verbal abilities.

Describe any of your child's behaviors that would be helpful for the examiner to be aware of prior to assessment.

Please note anything else that would be helpful for the examiner to know about your child.

Parent/Guardian's Name_____

Highest Level of Education:
Mother_____Father_____

Would you like a copy of your child's results from this study? _____
If so, where should we send those results?
Emergency Contact: (Name)_____
(Number)_____
How should we contact you to arrange an assessment time?

Appendix D

Child Assent Form

CHILD ASSENT FORM
Universal Nonverbal Intelligence Test

(To be read to each participant)

I understand that this project is about the skills needed to solve problems, learn, and think.

If I choose to be part of this project, I understand that the following things will take place:

I will complete four activities. These activities will include playing with blocks, looking at pictures, and remembering pictures and designs.

These activities will take about one hour.

Confidentiality: I understand that my name will not be on anything, and no one will know how I did except my parents.

Participation: I understand that I do not have to complete these activities. I can take breaks if I need to. I may drop out of this project at any time without penalty.

I understand that I may talk to the person working with me at any time if I have questions.

Contacts: If I have questions at any time about the project, I may contact Bobbie Burton at (865) 974-9876. If I have questions about my rights, I may contact the University of Tennessee at (865) 974-3466.

I will sign my name below if I agree to be part of this project and if I understand every thing listed on this page. *(If a child is unable to sign his/her name, verbal consent will be documented by the researcher).*

_____

Student's Signature Date

VITA

Bobbie Ann Burton, daughter of Bill Burton and the late Barbara Burton, was born in Murfreesboro, Tennessee. After graduating as valedictorian from Oakland High School in 1999, she attended Auburn University where she graduated Summa Cum Laude with a degree in Psychology in 2003. She is currently working on her Ph.D. in Education in the School Psychology program at the University of Tennessee, Knoxville.