

REPETITIVE BEHAVIORS AND ANXIETY IN CHILDREN
WITH AUTISM SPECTRUM DISORDER

by

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ABSTRACT

There has been limited research on repetitive behaviors in autism spectrum disorder (ASD) with little information about how repetitive behaviors in ASD differ from repetitive behaviors in other disorders, particularly obsessive-compulsive disorder (OCD). Further, there has been little research examining how repetitive behaviors are related to the social impairments characterizing ASD. This study examined the relation between repetitive behaviors, anxiety, and social problems in ASD, as well as symptoms that differentiate ASD and OCD.

Parents of 49 children with ASD and 12 children with OCD completed interviews and surveys regarding their children's repetitive behaviors (Children's Yale-Brown Obsessive Compulsive Scale; Repetitive Behaviors Scale – Revised), anxiety (Spence Children's Anxiety Scale for Parents), and social impairment (Social Responsiveness Scale). Within the ASD group, approximately half of participants were reported to have clinically significant levels of anxiety. Mediation analyses provided some support for Baron-Cohen's (1989) model suggesting that social difficulties lead to anxiety, producing repetitive behaviors in individuals with ASD. However, there was more support for an alternate mediation model suggesting that anxiety leads to repetitive behaviors, creating social problems. Both models support theories suggesting that anxiety leads to repetitive behaviors in children with ASD. The current study provides converging evidence that anxiety is a significant clinical issue for many children with ASD and is related to core social symptoms.

Multivariate analysis of variance and qualitative descriptions were used to compare children with ASD and children with OCD. Results indicated that the severity and frequency of

most types of repetitive behaviors are comparable in children with ASD and children with OCD. However, differences were evident between groups on the number of obsessions (more in OCD) and on stereotyped and restricted behavior (greater frequency and severity in ASD). The distinction between groups on these symptoms suggests that they may be useful in differentiating ASD from other disorders. A significant number (74%) of children with ASD met criteria for OCD, suggesting that it may be appropriate to use both diagnoses in the same individual. This research has implications for our conceptualization of repetitive behaviors in ASD and our assessment and treatment of children with this disorder.

DEDICATION

This dissertation is dedicated to my incredible husband Jeffrey, my family, and my friends who have provided countless hours of support, encouragement, and love over the years.

LIST OF ABBREVIATIONS AND SYMBOLS

<i>B</i>	Unstandardized multiple regression coefficient
<i>df</i>	Degrees of freedom
<i>F</i>	Fisher's <i>F</i> ratio
<i>M</i>	Mean (arithmetic average)
<i>MANOVA</i>	Multivariate analysis of variance
<i>MANCOVA</i>	Multivariate analysis of covariance
<i>n</i>	Number in a subsample
<i>N</i>	Total number in a sample
<i>p</i>	Probability
<i>r</i>	Pearson product-moment correlation
<i>R</i> ²	Multiple correlation squared; measure of strength of relationship
<i>SD</i>	Standard deviation
<i>SE B</i>	Standard error of <i>B</i>
<i>t</i>	Computed value of <i>t</i> test
<i>z</i>	A standard score
α	Alpha; Cronbach's index of internal consistency
β	Beta; standardized multiple regression coefficient
η_p^2	Partial eta squared; measure of strength of relationship

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CHAPTER 1

INTRODUCTION

Recent interest in whether autism spectrum disorder (ASD) and obsessive-compulsive disorder (OCD) can co-occur has led to an increased need to determine whether the repetitive behaviors in ASD are similar to or different from the repetitive behaviors in OCD. Because both groups experience anxiety, and because many of the symptoms of both disorders are similar, it is often difficult to distinguish between the two clinically. More specifically, it is often difficult to determine whether a child meets criteria for ASD only or for both ASD and OCD.

Unfortunately, the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision (DSM-IV-TR; American Psychiatric Association, 2000) offers little guidance in this area. While the DSM-IV-TR explicitly states that a diagnosis of ADHD (for example) should not be made in a child with Autistic Disorder, no reference is made to the differential diagnosis between Autistic Disorder and OCD. The DSM-IV-TR's discussion of Asperger's Disorder mentions that clinicians should be careful to consider whether a child's repetitive behaviors are more characteristic of the preoccupations of Asperger's Disorder or the obsessions and compulsions of OCD. However, no guidance is offered on whether a dual diagnosis of Asperger's Disorder and OCD should ever be made.

As a result of the lack of direction provided in the DSM-IV-TR, there is some disagreement among clinicians about whether a child with a diagnosis of ASD should ever receive a secondary diagnosis of OCD. Personal communication with professionals in the field

suggests that some clinicians feel that all repetitive behaviors present in ASD, even those typically thought of as characteristic of OCD, are subsumed under the diagnosis of ASD and that a second diagnosis of OCD is not appropriate. Other clinicians have offered anecdotal evidence of a subset of children with a diagnosis of ASD who also display “classic” OCD symptoms and, according to these clinicians, should receive a diagnosis of OCD in addition to the ASD diagnosis.

Clinicians would benefit from having guidelines based on research that would help them make an accurate distinction between ASD and OCD in some children. The study of repetitive behaviors in ASD has traditionally lagged behind the study of social and communication impairments in ASD. In order to distinguish between two disorders with potentially similar types of repetitive behaviors, a better understanding of repetitive behaviors in ASD is needed. One way to clarify the nature of repetitive behaviors in ASD is to examine how they are related to other symptom areas experienced by children with OCD, such as anxiety and social problems. Another element of developing guidelines for better distinguishing between ASD and OCD is determining whether a specific pattern of repetitive thoughts or behaviors is more or less characteristic of each group. An improved understanding of repetitive behaviors in ASD and the ability to distinguish between ASD and OCD could lead to improvements in treatment efficacy. If repetitive behaviors are conceptualized as being solely attributable to ASD they should be addressed using interventions proven effective in children with ASD. However, if a child with ASD experiences additional symptoms that warrant an OCD diagnosis, the treatment approach should also include strategies proven effective in children with OCD, such as medication and cognitive-behavioral therapy. A better understanding of repetitive behaviors could also improve future research. If repetitive behaviors can lead to clarification of comorbidity in ASD,

researchers may wish to use different types of repetitive behaviors to stratify samples and make comparisons among sub-groups of individuals with ASD with different symptom presentations. For example, researchers may wish to compare individuals with ASD who have comorbid OCD to individuals with ASD who do not meet criteria for an OCD diagnosis. This type of comparison could lead to a better understanding of how other characteristics of ASD, such as learning styles or genetic makeup, may be associated with certain types of repetitive behaviors. In the current study, the relation between repetitive behaviors, anxiety, and social problems in ASD was explored. In addition, the repetitive behaviors of children with ASD were compared to the repetitive behaviors of children with OCD using an instrument commonly used to measure repetitive behaviors in children with OCD (i.e., the Children's Yale-Brown Obsessive-Compulsive Scale, CY-BOCS; Seahill et al., 1997) and an instrument used to measure repetitive behaviors in children with ASD (Repetitive Behaviors Scale – Revised, RBS-R; Bodfish, Symons, & Lewis, 1999).

Repetitive Behaviors in ASD

Autistic Disorder, Asperger's Disorder, and Pervasive Developmental Disorder – Not Otherwise Specified (PDD-NOS) are pervasive developmental disorders characterized by impairments in three categories: social functioning, communication, and the presence of stereotyped behaviors, interests, and activities (American Psychiatric Association, 2000). Although the DSM-IV-TR uses the term Pervasive Developmental Disorders to describe these similar diagnoses, researchers have recently favored the term autism spectrum disorder (ASD) because it emphasizes that the disorder occurs along a continuum, rather than indicating that each DSM-IV-TR diagnosis occurs as a separate disorder. The term ASD will be used in this manuscript.

Certain symptoms of ASD, such as failing to turn when one's name is called, lower rates of looking at people's faces, delayed pretend play, and lack of demonstration of shared interest appear within the first two years of life (Baranek, 1999; Baron-Cohen et al., 1996; Osterling & Dawson, 1994). Thus, ASD is typically diagnosed during childhood. ASD is more common in males than females, with three to four males being diagnosed with ASD for every one female. Females diagnosed with ASD are more likely to be severely mentally retarded than males with ASD (Bryson, Clark, & Smith, 1988; Volkmar, Szatmari, & Sparrow, 1993). Recent estimates suggest that approximately 1 in 150 children are diagnosed with an autism spectrum disorder (United States Centers for Disease Control, 2007).

Description of repetitive behaviors in ASD. Repetitive behaviors observed in ASD include a wide array of symptoms such as stereotyped motor movements, repetitive verbal sequences, extreme desire for routine, circumscribed interests, repetitive manipulation of objects, self-injurious behavior, and attachment to specific objects (Charman & Swettenham, 2001). While different behaviors may be more prevalent at different ability levels, some form of repetitive behaviors are present in most individuals with ASD, regardless of age or ability level (Turner, 1999).

Turner (1999) described two subtypes of repetitive behaviors in individuals with ASD. Lower-level repetitive behaviors, which are repetitive movements, include repetitive manipulation of objects, tics, dyskinesias, repetitive self-injurious behavior, and stereotyped movements (i.e., stereotypies). These behaviors are common in individuals with ASD as well as in individuals with severe learning or developmental disabilities (Mooney, Gray, & Tonge, 2006; Richler, Bishop, Kleinke, & Lord, 2007; Turner, 1999) and even very young typically developing children (Evans et al., 1997; Richler et al., 2007). Some repetitive movements (e.g.,

dyskinesias, self-injurious behavior, and tics) may be less related to ASD than to concurrent factors such as ability level and general organic pathology, while other behaviors (e.g., stereotypies and repetitive manipulation of objects) appear at higher rates in individuals with ASD than in age and ability matched controls (Turner, 1999). The second subtype is termed higher-level repetitive behaviors and includes circumscribed interests, rigid routines, object attachments, and a focus on sameness. This second subtype of repetitive behaviors is more similar to the repetitive behaviors seen in persons with OCD.

Recent studies of large samples that include a wide range of ages and ability levels have provided support for Turner's (1999) description of two types of repetitive behaviors in ASD. Several researchers have conducted factor analyses of the repetitive behavior items on the Autism Diagnostic Interview – Revised (ADI-R; Lord, Rutter, & LeCouteur, 1994) and found evidence of two factors, a sensory-motor factor, which generally includes items measuring what Turner described as lower-level repetitive behaviors, and an insistence on sameness factor, which seems to capture higher-level repetitive behaviors (Bishop, Richler, & Lord, 2006; Papageorgiou, Georgiades, & Mavreas, 2008; Richler et al., 2007; Szatmari et al., 2006). However, these studies vary on whether circumscribed interests are included in the analysis, and if so, whether they load onto either of the two factors. A more recent study by Lam, Bodfish, & Piven (2008) found support for a three factor model of repetitive behaviors in ASD. This model included the sensory-motor and insistence on sameness factors found in previous studies but also included a separate factor for circumscribed interests. Honey, McConachie, Randle, Shearer, & Le Couteur (2008) also found evidence of three categories of repetitive behaviors in preschool children with ASD, including sensory-motor behaviors, resistance, and interests. These studies indicate that the diagnostic criterion of “repetitive behavior” is a heterogeneous concept and

might better be conceptualized by three different types of symptoms instead of a single symptom. In particular, the division of higher-level repetitive behaviors into two separate factors offers a more sophisticated understanding of this sub-group of repetitive behaviors. A better understanding of higher-level repetitive behaviors is especially important for making comparisons of repetitive behavior in ASD and OCD, as these behaviors are more similar to the types of behaviors observed in children with OCD.

Several studies have examined the effects of age and IQ on repetitive behaviors. Until recently, it was believed that repetitive behaviors are less likely to develop in individuals with ASD until the second or third year of life (Charman & Swettenham, 2001). However, with improved methods for the early identification of ASD and prospective studies of infants at high risk for developing ASD, recent studies have found that infants may show signs of repetitive behaviors as early as 12 months of age (Ozonoff et al., 2008). At this young age, the term “repetitive behaviors” refers to symptoms including repetitive object use, repetitive body movements, and atypical sensory behaviors (Richler et al., 2007; Watt, Wetherby, Barber, & Morgan, 2008). During early childhood, although social and communication symptoms may be improving, repetitive behaviors seem to be more severe and more characterized by lower-level behaviors than at later times (Bishop et al., 2006; Eaves & Ho, 1996; Klinger, Dawson, & Renner, 2003; Piven, Harper, Palmer, & Arndt, 1996). There does seem to be evidence that the severity and types of repetitive behaviors present may change over time, with a reduction in the severity of many lower-level repetitive behaviors and higher-level repetitive behaviors occurring more frequently in older children than in younger children (Esbensen, Seltzer, Lam, & Bodfish, 2009; Militerni, Bravaccio, Falco, Fico, & Palermo, 2002; South, Ozonoff, & McMahon, 2005). Ability level may temper this trend, with lower-level repetitive behaviors occurring more

frequently in individuals with lower IQs and lower adaptive functioning (Honey et al., 2008; Lam et al., 2008; Militerni et al., 2002; Szatmari et al., 2006; Turner, 1999).

The issue of whether certain repetitive behaviors are specific to ASD remains unclear. Few studies have directly compared repetitive behaviors in ASD to other clinical groups. The literature seems to suggest that lower-level behaviors are often found in other clinical populations, particularly individuals with intellectual disability. However, the pattern and intensity of these behaviors may be unique to ASD (Turner, 1999). Even less is known about the presence of higher-level repetitive behaviors in other clinical populations. Many of the rigid routines found in individuals with ASD can also be observed in individuals with OCD and it remains unclear how specific these behaviors are to ASD (Turner, 1999). Increased understanding of whether certain types of repetitive behaviors are uniquely present in ASD will improve professionals' ability to make accurate differential and possibly dual diagnoses, which can lead to more appropriate interventions for children with repetitive behaviors. Prior to discussing specific hypotheses for the current study, a review of the theories of repetitive behaviors in ASD and OCD will be provided.

Theories of repetitive behaviors in ASD. Given the varied presentation of repetitive behaviors in children with ASD, it is not surprising that there are several hypotheses for explaining repetitive behaviors in ASD. Current theories include beliefs that repetitive behaviors arise from cognitive impairments, are a result of operant conditioning, are related to high arousal levels, and are due to a combination of social and cognitive difficulties. Frith (1989) and Frith and Happé (1994) proposed one of the first cognitive theories of repetitive behaviors in ASD. They suggested that repetitive behaviors are a result of weak central coherence in individuals with ASD. Weak central coherence can be defined as focusing on individual parts or aspects of a

situation rather than attending to the whole picture. This preference for focusing on local, rather than global, features may explain repetitive behaviors such as insistence on sameness, narrow interests, and attention to insignificant details. Focusing on one aspect of a situation or object could lead to the circumscribed interests found in children with ASD. However, the weak central coherence theory does not explain other types of repetitive behaviors such as stereotyped motor movements (Turner, 1999). A second cognitive hypothesis for explaining repetitive behaviors is that they are a symptom of executive dysfunction (Ridley, 1994; Turner, 1997). If individuals have impairments in planning, generating, or controlling their behavior, it follows that they may become “locked into” one thought or behavior and subsequently show repetitive thoughts or behaviors. This theory may explain the diversity, pervasiveness, repetition, and rigidity of repetitive behaviors found in individuals with ASD (Turner, 1999).

Another hypothesis is that repetitive behaviors are operantly conditioned, with the behaviors themselves being rewarding to the individual (Lovaas, Newsom, & Hickman, 1987). This hypothesis is supported by the fact that many stereotyped motor behaviors provide sensory stimulation, a seemingly pleasant experience to the individual with ASD. Additionally, Lovaas and colleagues found that alternative sources of stimulation can reduce repetitive behaviors, and sensory extinction procedures are often successful in reducing repetitive behaviors. Repetitive behaviors can also sometimes be used to reinforce other behaviors, such as allowing a child to engage in finger flicking after completing a work task. Also supporting this hypothesis is research indicating that some repetitive behaviors (e.g., self-injurious behavior) may be reinforcing by obtaining social attention or task avoidance. However, Turner (1999) identified several problems with the research supporting the operant conditioning hypothesis. For example, although repetitive behaviors may serve as reinforcement for other behaviors, it is not clear that

the sensory consequences are what cause or maintain the behavior. In other circumstances, the sensory consequences of the behavior are not clear.

Hutt and Hutt (1965, 1970) and Hutt, Hutt, Lee, and Ounsted (1964) suggested that repetitive behaviors may serve as a means for reducing high arousal levels, and therefore maintaining homeostasis. According to this hypothesis, repetitive behaviors are meant to block further sensory input, thus reducing the level of arousal. For example, Hutt and Hutt (1965) found that children with ASD exhibited higher levels of stereotyped behaviors as their environments became more complex. The authors suggested that the more complex environments produced higher states of arousal and that the children engaged in repetitive motor movements as an attempt to block further sensory input. The over-arousal hypothesis has also been used to explain the need for sameness found in individuals with ASD, suggesting that novel situations would increase arousal levels and that individuals with ASD seek repetitive situations in an attempt to avoid increased arousal. While some studies have produced results supporting this theory, Turner (1999) noted that the support of this hypothesis should be considered tentative. Specifically, the over-arousal theory has not been replicated in some studies and other studies have suggested that alternative conclusions may explain results (Hermelin & O'Connor, 1963; Prizant & Duchan, 1981; Rydell & Mirenda, 1991, 1994).

Finally, another hypothesis is that repetitive behaviors in ASD are a means of reducing anxiety caused by difficulty understanding the mental states of other people (Baron-Cohen, 1989). Specifically, Baron-Cohen proposed a social-cognitive model of repetitive behaviors in which an impairment in attributing mental states to others leads to difficulty predicting others' actions, which then leads to increased anxiety in unpredictable social contexts, and finally to repetitive behaviors which are predictable and serve to reduce anxiety. Similarly, Carruthers

(1996) suggested that repetitive behaviors are a means for withdrawing from social situations that are difficult to understand. This hypothesis explains the insistence on sameness as an attempt to gain control over one's environment and explains circumscribed interests as nonsocial interests that develop due to impaired social functioning. It also predicts that repetitive behaviors will be highest when individuals with ASD are in novel social situations. However, other research has shown that stereotyped behaviors are lower, not higher, when individuals are engaged in social interaction (see Turner, 1999 for a review).

While each of these theories offers a partial explanation for certain repetitive behaviors, none completely explains the presence of all observed repetitive behaviors in ASD (Turner, 1999). The inability of any of the above theories to fully explain repetitive behaviors in ASD has led some researchers to propose a multiple deficits model of repetitive behaviors (e.g., Baron-Cohen & Swettenham, 1997; Happé & Frith, 1996; Pennington et al., 1997). This model acknowledges that no single deficit can adequately explain all repetitive behaviors and that, instead of a single explanation, multiple deficits exist independently in ASD. For example, anxiety, executive dysfunction, and weak central coherence may all develop independently in the individual with ASD. Thus, each of these deficits can singly explain some, but not all, of the symptoms exhibited. However, in combination, these deficits can explain all of the repetitive behaviors symptoms (see Charman & Swettenham, 2001 for a review).

Repetitive Behaviors in OCD

Obsessive-compulsive disorder is characterized by repetitive thoughts (obsessions) and/or repetitive behaviors (compulsions) that are distressing to the patient, time consuming, or interfere with daily activities. In contrast to individuals with ASD, individuals with OCD typically recognize that their obsessions are a product of their own mind and try to ignore or suppress their

obsessions (American Psychiatric Association, 2000). Most adults with OCD report experiencing symptoms prior to age 18. However, unlike ASD, which has an onset prior to age 3, children and adolescents with early-onset OCD report that symptoms typically first appear between 9 and 13 years of age. Similar to other childhood disorders, OCD is more common in males than females, with 66% of the childhood OCD population being male. This ratio may be because onset typically occurs at an earlier age in males (Thomsen, 1999). The male to female ratio becomes balanced in older children and adults (Albano, Chorpita, & Barlow, 1996). The prevalence of OCD in children and adolescents is between 0.5% and 3% (Rapoport et al., 2000).

Description of repetitive behaviors in OCD. Similar to children with ASD, there is evidence that repetitive behaviors in OCD may change over time. Very young children with OCD sometimes have compulsions with no obsessions, whereas adults may have obsessions with no compulsions (Thomsen, 1999). Many children with OCD who do have obsessions report repetitive thoughts about contamination, aggression (including fears of harm to self or others), religiosity, sexual themes, symmetry/exactness urges, and songs or rhymes. Children with compulsions report behaviors including washing routines, checking, counting, ordering/arranging, and repetition (Albano et al., 1996; Moore, Mariaskin, March, & Franklin, 2007). Often, the overall number of symptoms waxes and wanes throughout the course of the disorder (Thomsen, 1999). Unlike the cognitive theories of repetitive behaviors in ASD, previous research has found that, in general, the severity of symptoms in children with OCD is unrelated to neuropsychological functioning, including executive functioning and verbal and nonverbal memory (Greasberg, 2005). Some studies have found subtle differences in cognitive ability between individuals with OCD and individuals with other types of anxiety and typical controls. For example, one study found that increased IQ in children with OCD positively

predicted OCD symptoms in adolescence and early adulthood (Peterson, Pine, Cohen, & Brook, 2001). This finding is in direct contrast to the literature on ASD that reveals an inverse relation between IQ and the severity of repetitive behaviors.

Theories of repetitive behaviors in OCD. Current theories of repetitive thoughts and behaviors in OCD focus on thought processes and classical conditioning as playing a role in the development and maintenance of OCD (see Abramowitz, Taylor, & McKay, 2007 for a review). According to Salkovskis (1985, 1989), repetitive thoughts in OCD are a result of an increased appraisal of personal responsibility, probability of harm, and severity of harm. Specifically, obsessions are extreme examples of the intrusive thoughts often experienced by individuals without OCD. The thoughts become obsessions when the individual experiences an increased sense of responsibility for harm to themselves or others in connection with the thoughts or perceives an overestimated probability and severity of harm that may be caused by intrusive thoughts. The increased appraisal of responsibility and harm leads to increased anxiety. According to this theory, repetitive behaviors develop when the individual attempts to escape responsibility and harm by neutralizing the thought with a behavior (Salkovskis, 1996). This theory has obtained support through studies finding a relation between obsessive-compulsive symptoms, anxiety, and increased perceptions of responsibility (Clark & Purdon, 1993; Freeston & Ladouceur, 1993).

A second theory of OCD addressing thought processes is the theory of thought-action fusion (Rachman, 1993). According to this theory, the individual with OCD utilizes cognitive processes in which thinking about a negative or immoral behavior is essentially equivalent to engaging in the behavior and increases the likelihood of the behavior actually occurring (Shafran, Thordarson, & Rachman, 1996). This theory explains the development of repetitive

behaviors by suggesting that when individuals experience negative thoughts, they attempt to suppress or neutralize the thoughts due to the perceived consequences of the negative thoughts (i.e., increased likelihood of the action or feeling immoral) by engaging in repetitive behaviors. Support for this theory includes a positive relation between the presence of thought-action fusion and obsessive-compulsive symptoms (Rachman, Thordarson, Shafran, & Woody, 1995; Rassin, Muris, Schmidt, & Merckelbach, 2000).

Another theory suggests that the primary thought process involved in the etiology of OCD is self-doubt (O’Kearney, 1998). According to this theory, obsessions are characterized by repetitive self-doubt. Repetitive behaviors are performed as an attempt to reduce the chronic self-doubt experienced by the individual with OCD. O’Kearney also proposed that individuals with OCD have a decreased ability to control intrusive thoughts. Thus, a lack of control over intrusive thoughts leads to increased frequency of intrusive thoughts and subsequently an increase in repetitive behaviors to attempt to neutralize intrusive thoughts. While others have agreed with this theory (e.g., Clark & Purdon, 1993), specific studies have not been conducted that offer support for this theory.

Recent authors have explored whether the thought processes described above are present in children with OCD. Studies of non-clinical populations have found that increased appraisal of personal responsibility and thought-action fusion are related to obsessive-compulsive symptoms in children and adolescents (Magnúsdóttir & Smári, 2004; Muris, Meesters, Rassin, Merckelbach, & Campbell, 2001). In clinical samples, it is clear that maladaptive thought processes occur at higher rates in children with OCD than in non-clinical controls (Barrett & Healy, 2003; Libby, Reynolds, Derisley, & Clark, 2004). However, the findings are mixed on

whether specific thought processes distinguish between children with OCD and children with other anxiety disorders (Muris et al., 2001; Reynolds & Reeves, 2008; Turner, 2006).

In addition to theories of OCD that involve maladaptive thought processes, others have suggested that, in some cases, OCD is precipitated by a traumatic event (de Silva & Marks, 2001; de Silva & Rachman, 1998; Rachman & Hodgson, 1980). This theory suggests that anxiety develops in response to a traumatic event through classical conditioning. Behaviors that initially reduced the anxiety are reinforced and repeated, thus leading to compulsions (Eysenck & Rachman, 1965). Support for this theory includes increased rates of past traumatic events in individuals with OCD compared to typical control groups (Lochner et al., 2002). However, no studies have provided evidence of a causal link between traumatic events and OCD (Jones & Menzies, 1998). In addition, this theory does not explain the multiple types of obsessions that develop over time in individuals with OCD, long after the original traumatic event would have led to the initial classical conditioning (Abramowitz et al., 2007).

Each of the theories for the development of OCD provides a description of how repetitive thoughts can develop from particular thought processes. However, regardless of the theorized origin of the repetitive thoughts, individuals with OCD seem to engage in repetitive behaviors to attempt to neutralize, or reduce, the anxiety associated with repetitive thoughts. This is similar to some of the theories of repetitive behaviors in ASD. For example, theories of over-arousal and anxiety in ASD suggest that individuals engage in repetitive behaviors as an attempt to reduce arousal and anxiety. However, the origin of the anxiety seems to be different for the two disorders. In ASD, anxiety is theorized to stem from difficulty processing social information whereas in OCD, anxiety stems from repetitive intrusive thoughts. The operant conditioning theory of repetitive behaviors in ASD is also similar to theories of repetitive behaviors in OCD in

that both suggest that the behaviors are reinforcing to the individual, albeit for different reasons.

In ASD, repetitive behaviors are proposed to be reinforcing because the behaviors are often pleasurable to the individual. In OCD, however, repetitive behaviors are rewarding because they reduce anxiety associated with intrusive thoughts. Both theories of ASD and theories of OCD suggest that cognitive processes may be involved in the development and maintenance of repetitive behaviors. In ASD, these processes involve an impaired style of processing information (e.g., executive dysfunction and weak central coherence). In OCD, however, the cognitive processes implicated involve more of an impaired appraisal of intrusive thoughts.

Repetitive Behaviors, Social Problems, and Anxiety

Autism Spectrum Disorder. Although some authors have found relations among the core symptoms of ASD (i.e., social impairments, communication impairments, and repetitive behaviors), the relation between these core ASD symptoms and other related symptoms, such as anxiety, is less clear. While some studies have found that repetitive behaviors, in general, are associated with social impairment (Constantino et al., 2003), others have reported that only specific types of repetitive behaviors are related to social skills difficulties. For example, Lam and colleagues (2008) found that repetitive motor behaviors and insistence on sameness, but not circumscribed interests, were associated with social deficits. Szatmari and colleagues (2006) found that repetitive sensory motor behavior, more so than insistence on sameness, was related to social impairment. Thus, any examination of repetitive behaviors and anxiety in ASD needs to examine specific types of repetitive behaviors.

Since the disorder was first described by Kanner in 1943, researchers and clinicians have recognized that anxiety is often present in children with ASD. Previous studies have indicated that levels of anxiety in children with ASD are significantly greater than levels of anxiety in

typically developing children and similar to levels of anxiety found in children diagnosed with anxiety disorders (Gillott, Furniss, & Walter, 2001; Russell & Sofronoff, 2005). Studies using a variety of methods to measure anxiety have found that between 11% and 84% of children and adolescents with ASD experience significant symptoms of anxiety (White, Oswald, Ollendick, & Scahill, 2009). Some authors have suggested that it is this elevation in anxiety that leads to repetitive behaviors in children with ASD.

While it is clear that anxiety is present in many children with ASD, researchers are still exploring how anxiety relates to the symptoms of ASD. Kim, Szatmari, Bryson, Streiner, and Wilson (2000) found that none of the three core symptom areas of ASD was a predictor for later anxiety in children with ASD. However, others have proposed a relation between anxiety, social impairments, and repetitive behaviors. Meyer, Mundy, Van Hecke, & Durocher (2006) found that in children with Asperger's syndrome, impairments in social information processing were related to parent-reported anxiety. In other studies finding elevated rates of social worries in children and adolescents with ASD, researchers have, as an explanation for the presence of anxiety, suggested that for some children, anxiety may be secondary to a difficulty understanding social situations (Baron-Cohen, 1989; Gillott et al., 2001). Some authors have proposed that many of the behaviors found in children with ASD, particularly restricted and repetitive behaviors, may be coping strategies used in response to anxiety (Carruthers, 1996; Gillott et al., 2001). Thus, previous researchers have theorized that in individuals with ASD, social problems lead to anxiety, which leads to repetitive behaviors. Although a specific model directly examining the relation between social problems, anxiety, and repetitive behaviors in ASD has not yet been tested, research has indicated that all three of these symptoms are problematic for children with ASD.

Obsessive Compulsive Disorder. Unlike theories of ASD, writings on OCD indicate that the “core” symptom of OCD is anxiety. As many as 40% to 60% of children with OCD are also diagnosed with a comorbid anxiety disorder (Geller et al., 2001; Storch, Larson, Merlo, Keeley, Jacob, et al., 2008). While OCD is considered an anxiety disorder and children with OCD often have comorbid anxiety symptoms, there is little research available specifically examining the relation between general anxiety symptoms and repetitive behaviors in children with OCD. In general, most discussions of the disorder present anxiety in the context of obsessions (i.e., children are worried about or fearful of some negative event), which typically lead to compulsions as an attempt to prevent the undesired event (American Psychiatric Association, 2000). Thus, while rarely worded as such, the “definition” of OCD suggests a causal relation between anxiety and repetitive behaviors. Theories of OCD support this causal relation between anxiety and repetitive behaviors, suggesting that repetitive behaviors are performed to reduce the anxiety associated with obsessions (de Silva & Rachman, 1998; O’Kearney, 1998; Rachman, 1993; Rachman & Hodgson, 1980; Salkovskis, 1985, 1989).

As in the ASD literature, researchers have examined whether repetitive behaviors in OCD are linked to difficulties in social interaction. Obsessions and compulsions in children with OCD can become so time-consuming that they significantly interfere with social functioning and relationships (Albano et al., 1996; Ledley & Pasupuleti, 2007; Piacentini, Bergman, Keller, & McCracken, 2003). Previous research has found that the severity of social problems increases as the severity of OCD increases, rated individually by both parents and children (Piacentini et al., 2003; Storch, Ledley, Lewin, Murphy, Johns, et al., 2006; Valderhaug & Ivarsson, 2005; Ye, Rice, & Storch, 2008). In addition, Adams (1995) found that parents and teachers of adolescents with OCD rated the teens as having fewer social skills than typically developing adolescents.

Research on children with OCD suggests that repetitive behaviors are a direct result of a core elevation in anxiety and that the presence of repetitive behaviors may lead to social difficulties (American Psychiatric Association, 2000; O’Kearney, 1998; Piacentini et al., 2003; Rachman, 1993; Salkovskis, 1985, 1989). This is in contrast to the theories of how anxiety, repetitive behaviors, and social problems are related in ASD. In ASD, theories have suggested that a core impairment in understanding the social interactions of others can lead to anxiety, which in turn leads to repetitive behaviors (Baron-Cohen, 1989; Carruthers, 1996). Thus, individuals with ASD and individuals with OCD experience symptoms in the areas of social problems, anxiety and repetitive behaviors. However, theories of both disorders suggest different pathways between these symptom areas for each of these two diagnostic groups.

Comparing Symptom Profiles in ASD and OCD

Few studies currently exist directly comparing the symptom profiles of children with ASD and children with OCD. Previous research has described the symptom profiles of repetitive behaviors in ASD and OCD separately, but it is difficult to compare the populations across studies because the instruments used to examine repetitive behaviors are population-specific and are not typically administered in other diagnostic groups. Specifically, the Repetitive Behavior Scale – Revised (RBS-R) has been used to describe the repetitive behaviors found in ASD, and the Children’s Yale-Brown Obsessive-Compulsive Scale (CY-BOCS) has been used to describe the repetitive behaviors found in OCD. However, no studies have been published using the RBS-R in an OCD population, only a few studies have used the CY-BOCS in children with ASD, and no studies have used both the RBS-R and the CY-BOCS in children with ASD.

Repetitive Behavior Scale – Revised. A commonly used measure of repetitive behaviors in ASD is the Repetitive Behavior Scale – Revised. The RBS-R is a parent report measure of

repetitive behaviors in ASD. For each behavior, parents rate how severely the behavior interferes with functioning. Behaviors are divided into six subscales, including Stereotyped Behavior, Self-Injurious Behavior, Compulsive Behavior, Ritualistic Behavior, Sameness Behavior, and Restricted Behavior. Frequency and severity scores can be calculated for each subscale and for the total measure.

In a study examining clinical features associated with ASD, Gabriels, Cuccaro, Hill, Ivers, and Goldson (2005) found that RBS-R scores were inversely related to nonverbal IQ and adaptive behavior scores. That is, as nonverbal IQ and adaptive skills increased, the severity of repetitive behaviors decreased, which is consistent with previous findings that IQ tempers the severity of repetitive behaviors in children with ASD, but in contrast to findings in OCD that IQ is either unrelated or positively related to repetitive behaviors.

Lam (2005) found that items on some subscales of the RBS-R were endorsed more frequently than others. Over 50% of parents of individuals with ASD in her study endorsed items in the Stereotypic Behavior, Ritualistic Behavior, Sameness Behavior, and Restricted Behavior subscales. More recently, Cuccaro and colleagues (2007) used the RBS-R to compare repetitive behaviors in individuals with high-functioning autism and individuals with Asperger's Disorder. They found that there were no significant differences between the two groups on the frequency or severity of repetitive behaviors. Similar to the results reported by Lam (2005), Stereotyped Behaviors, Ritualistic Behaviors, Sameness Behaviors, and Restricted Behaviors were endorsed more frequently by both groups than Compulsive Behaviors or Self-Injurious Behaviors. Esbensen et al. (2009) also found that Self-Injurious Behavior occurred relatively infrequently in individuals with ASD across a wide range of ages. Restricted Behavior was the

most common type of repetitive behavior endorsed in their study, although Stereotyped Behavior also occurred frequently.

Children's Yale-Brown Obsessive Compulsive Scale. The most frequently used measure of repetitive behaviors in children with OCD is the Children's Yale-Brown Obsessive-Compulsive Scale (CY-BOCS). The CY-BOCS is a combination symptom checklist and caregiver or self-report interview regarding a child's obsessions and compulsions. The symptom checklist contains a list of compulsions divided by category (i.e., Washing/Cleaning Compulsions, Checking Compulsions, Repeating Compulsions, Counting Compulsions, Arranging/Symmetry, Hoarding/Saving Compulsions, Excessive Games/Superstitious Behaviors, Rituals Involving Other Persons, and Miscellaneous Compulsions) and a list of obsessions divided by category (i.e., Contamination Obsessions, Aggressive Obsessions, Hoarding/Saving Obsessions, Health-Related Obsessions, Religious/Moral Obsessions, Magical Obsessions, Sexual Obsessions, and Miscellaneous Obsessions). The CY-BOCS interview asks respondents to rate the severity of the symptoms endorsed on the checklist. It yields a Compulsions Severity score, an Obsessions Severity score, and a CY-BOCS Total Severity score.

While most studies report only mean CY-BOCS severity scores, recent researchers have begun reporting on the symptom profile of children with OCD based on the CY-BOCS symptom checklist. Aggressive and contamination obsessions and washing/cleaning, checking, and repeating compulsions are consistently among the most frequently endorsed symptoms in children and adolescents. Other common symptoms include symmetry/exactness and somatic obsessions and ordering/arranging and touching compulsions (Hanna, 1995; Ivarsson & Valderhaug, 2006; Mataix-Cols, Nakatani, Micali, & Heyman, 2008; Sabuncuoglu & Berkem, 2006; Stewart et al., 2008).

CY-BOCS use in ASD. Several treatment outcome studies have used the CY-BOCS to measure repetitive behaviors in children with ASD (DelGiudice-Asch, Simon, Schmeidler, Cunningham-Rundles, & Hollander, 1999; Hollander, Soorya, et al., 2006; Hollander, Wasserman, et al., 2006; King et al., 2009; McDougle et al., 2005; Wasserman et al., 2006). These studies using the CY-BOCS in children with ASD typically report only the Compulsions Total severity scores. Participants in these studies include a wide range of ability levels, and because many of the participants in each study have significant intellectual disabilities and some are nonverbal, the authors of previous studies have chosen not to include the Obsessions portion of the severity rating scale. Mean Compulsions Severity scores in children with ASD across studies varied, with some pre-treatment scores being lower and others higher than pre-treatment scores in studies of children with OCD.

Direct comparison of ASD and OCD. Several authors have speculated about the potential overlap of ASD and OCD, highlighting that the two disorders share common neurobiological and genetic features and suggesting that ASD and OCD occur along the same continuum or that the presence of ASD features may constitute a subtype of OCD (Bejerot, 2007; Rossi, 2006; McDougle, Hulvershorn, Erickson, Stigler, & Posey, 2008). However, few studies have directly compared symptoms across diagnoses of ASD and OCD.

DeRamus (2004) found that CY-BOCS Compulsions Severity was higher than Obsessions Severity in a small sample ($n = 14$) of children with high-functioning ASD. A qualitative comparison between children with ASD and the literature on children with OCD indicated some overlap of symptoms, with both groups showing high rates of contamination obsessions, high rates of repeating compulsions, and high rates of ordering/arranging compulsions. However, many differences in the types of obsessions and compulsions exhibited

in each group were also evident. For example, children with ASD in this sample had lower rates of aggressive obsessions, washing/cleaning compulsions, and checking/counting compulsions than have been reported in the OCD literature.

McDougle and colleagues (1995) directly compared repetitive thoughts and behaviors in adults with autism and adults with OCD using the symptom checklist of the adult version of the CY-BOCS, the Yale-Brown Obsessive Compulsive Scale (Y-BOCS; Goodman, Price, Rasmussen, Mazure, Delgado, et al., 1989; Goodman, Price, Rasmussen, Mazure, Fleischmann, et al., 1989). Using discriminant function analysis of the Y-BOCS, they were able to identify a subset of thoughts and behaviors that predicted membership in the autism group. Hoarding; touching, tapping, or rubbing; and self-mutilating behavior were the characteristics that best predicted autism. This cluster of behaviors was 96% accurate in predicting a diagnosis of autism. Aggressive obsessions and symmetry obsessions as well as checking and counting compulsions were more likely to occur in the OCD group and were 94% accurate in predicting a diagnosis of OCD. It should be noted, however, that the IQ of individuals in the ASD group was significantly lower than the IQ of individuals in the OCD group. Thus, results may have been impacted by the disparity of IQ between groups.

To minimize the potential confound of the IQ discrepancies in McDougle et al.'s (1995) study, Russell, Mataix-Cols, Anson, & Murphy (2005) compared adults with high-functioning ASD to adults with OCD. Although rates of obsessions and compulsions were high in both adults with ASD and adults with OCD, there were a few symptoms that occurred at higher rates in individuals with OCD. A discriminant function analysis revealed that group membership was best predicted by the presence of somatic obsessions and repeating compulsions, both of which occurred more frequently in adults with OCD. Although individuals with OCD displayed higher

rates of checking compulsions, this symptom did not add to the model for discriminating between OCD and ASD. While the specific symptoms that best predicted group membership were different in Russell et al.'s study and McDougle et al.'s (1995) study, both studies support the theory that a particular symptom profile of repetitive behaviors can distinguish between ASD and OCD.

Following these two studies of adults with ASD and adults OCD, one study has been published on a direct comparison of repetitive behaviors in children with ASD and children with OCD. Zandt, Prior, & Kyrios (2007) compared repetitive behaviors in 19 children with ASD and 17 children with OCD. Their sample included children ages 7 to 16 without intellectual disability. The CY-BOCS symptom checklist was used to describe the categories of symptoms endorsed by each diagnostic group. In their sample, children with OCD endorsed a greater number of symptoms on the CY-BOCS ($M = 11.06$) than children with ASD ($M = 4.94$). A greater percentage of children with OCD than children with ASD endorsed almost all categories of obsessions and compulsions. There were a few symptom categories that were endorsed by approximately half of each group (i.e., ordering compulsions, rituals involving another person, and religious obsessions), and only one symptom category (miscellaneous obsessions) that was endorsed by more participants with ASD than participants with OCD. Rates of obsessions and compulsions were moderately related in children with ASD ($r = .50$) and strongly related in children with OCD ($r = .71$).

Zandt and colleagues (2007) also administered the Repetitive Behaviors Questionnaire (Turner, 1995) to examine repetitive behaviors in children with ASD and children with OCD. The Repetitive Behaviors Questionnaire is a measure of repetitive behaviors that was developed for use with individuals with ASD. Both groups exhibited extremely low scores on the

Repetitive Language subscale of the Repetitive Behavior Questionnaire, and groups also did not differ significantly on the Sameness Behavior and Repetitive Movements subscales. Thus, the Total Repetitive Behavior score on the Repetitive Behavior Questionnaire was not significantly different between children with ASD and children with OCD. In addition to comparing groups on the Repetitive Behavior Questionnaire subscales, the authors grouped individual items of the questionnaire based on the types of behavior they represented. Children with ASD and children with OCD continued to be rated similarly for most types of behaviors, although children with OCD were rated higher than children with ASD on routines and rituals.

Overall, Zandt and colleagues found that children with ASD and children with OCD show equally high levels of repetitive behaviors on a measure developed for use in ASD. However, there is some suggestion that children with ASD showed less symptoms associated with classic OCD. Because there has only been one study examining these symptoms in children with ASD and because this was a relatively small sample size, more research is needed examining repetitive behaviors in ASD on measures that tap both ASD symptoms and OCD symptoms. Further, previous research has not examined the relationship between repetitive behaviors, anxiety, and social problems.

Research has found some differences in the symptom profiles of repetitive behaviors in both adults and children with ASD compared to adults and children with OCD. However, the evidence remains limited, as only one study has been published directly comparing repetitive behaviors in children with ASD and children with OCD. Although Zandt and colleagues (2007) used both a measure of repetitive behaviors in OCD (CY-BOCS) and a measure of repetitive behaviors in ASD (Repetitive Behavior Questionnaire), the Repetitive Behavior Questionnaire has not been as widely used in research on ASD as the measure used in the current study (RBS-

R). The current study also provides a comparison of both the frequency and severity of repetitive behaviors in children with ASD and children with OCD, whereas Zandt et al. only reported the frequency with which each group endorsed symptoms. In addition to limited research on how the symptom profile of children with ASD compares to the symptom profile of children with OCD, there is also little research currently available on how the symptom areas of repetitive behaviors, social problems, and anxiety are related in children with ASD.

Summary and Hypotheses

Much attention has been given to the areas of social and communication impairments in individuals with ASD, but until recently, research has been less focused on the area of repetitive behavior (Lewis & Bodfish, 1998; Rutter, 1996). There are multiple theories of repetitive behaviors in ASD, and how repetitive behaviors are related to other characteristics of ASD, such as social impairment and symptoms of anxiety, is still not well understood. Previous studies have reported the presence of anxiety symptoms in ASD (White et al., 2009). Understanding the relation among these symptoms is especially important if these areas of impairment cause clinically significant problems in children with ASD. Therefore, one goal of the current study was to examine whether anxiety and repetitive behaviors, as measured by instruments not specific to ASD, occur at clinically significant levels in children with ASD. A better appreciation for the significance of these areas of impairment in ASD could contribute to our understanding of whether examining these broader symptoms may be useful in differentiating ASD and anxiety disorders in general, and in particular OCD.

Although the literature is inconsistent, there have been several studies that have documented a relation between repetitive behaviors and social problems in children with ASD (Constantino et al., 2003; Lam et al., 2008; Szatmari et al., 2006), and at least one study has

found a relation between anxiety and social impairment (Meyer et al., 2006). Baron-Cohen (1989) has proposed that an inability to understand the mental states of others, and thus, the social interactions of others, is anxiety-provoking in children with ASD. He and Carruthers (1996), separately, discuss how anxiety surrounding the social interactions of others can subsequently lead to repetitive behaviors, namely, that children with ASD engage in repetitive behaviors as an attempt to withdraw from social interactions and impose an understandable structure, thus reducing anxiety. Although a relation between social problems, anxiety, and repetitive behaviors has been suggested, such a model has not yet been tested. Therefore, a second goal of the current study was to explore the relation between repetitive behaviors, anxiety, and social problems in children with ASD. Following from the theories of Baron-Cohen and Carruthers, the current study proposed a model for ASD in which the relation between social problems and repetitive behaviors is mediated by anxiety.

In addition to the model based on the theories of Baron-Cohen (1989) and Carruthers (1996), the current study also tested a model in children with ASD based on the OCD literature. Specifically, theories of OCD describe the anxious obsessions present in OCD as leading to the compulsive behaviors present in OCD (de Silva & Rachman, 1998; O’Kearney, 1998; Rachman, 1993; Rachman & Hodgson, 1980; Salkovskis, 1985, 1989). In addition, previous authors have found that obsessive-compulsive symptoms are related to social problems in children and adolescents with OCD (Piacentini et al., 2003). Therefore, a model was proposed in which the relation between anxiety and social problems is mediated by repetitive behaviors. Because neither this model nor the model based on the theories of Baron-Cohen and Carruthers have been previously tested in an ASD sample, both models were examined in a group of children with ASD to determine whether the relation between social problems, anxiety, and repetitive

behaviors in ASD is best described by theories from the ASD literature or theories from the OCD literature. Examining how these three symptom areas are related could contribute to our understanding of the development of repetitive behaviors in ASD.

Little research has been conducted examining whether the repetitive behaviors present in ASD are specific to ASD or related to behaviors in other disorders, such as the compulsions of OCD. More specifically, it is unclear based on the diagnostic information in the DSM-IV-TR whether children with ASD should ever receive an additional diagnosis of OCD. To date, there has only been one study making a direct comparison of repetitive behaviors between the two clinical groups in children. Zandt and colleagues (2007) found that although there was some similarity in symptom presentation between the two groups on repetitive behaviors characteristic of ASD, for most types of obsessions and compulsions, children with OCD endorsed higher rates of symptoms than children with ASD. Based on the research available, it was theorized that there is a subset of individuals with ASD who also appropriately meet criteria for, and thus should receive a diagnosis of, OCD. However, as previously mentioned, there are no guidelines currently available to help “tease apart” these diagnoses in children who seem to have some overlap between the two disorders. One way to potentially help clinicians determine which approach to diagnosis is appropriate is to determine whether the pattern of repetitive behaviors found in children with ASD is distinct from the pattern of behaviors found in children with OCD. Measuring the repetitive behaviors of each group with instruments developed for use in ASD and OCD separately will provide a more thorough understanding of the similarities and differences in these groups. Thus, a third goal of the current study was to directly compare the types of repetitive thoughts and behaviors found in children with ASD to those found in children with

OCD using both a traditionally ASD measure and a traditionally OCD measure of repetitive behaviors.

An additional approach to answering the question of whether other disorders with repetitive behaviors, such as OCD, should be dually diagnosed in ASD is to examine the percentage of children with ASD who also meet DSM-IV-TR diagnostic criteria for OCD. There is very little guidance in the literature to suggest how many children may meet criteria for both disorders, and there is currently no guide for how symptoms may present or be related in this group of children. Most studies of children with OCD exclude children with comorbid developmental disabilities, including ASD. Several studies of children with ASD have reported the presence of OCD symptoms (Farrugia & Hudson, 2006; Gillott et al., 2001; Williamson, Craig, & Slinger, 2008), but few have provided rates of individuals who actually meet criteria for both disorders, with rates ranging from 8% to 37% (Leyfer et al., 2006; Russell et al., 2005; Simonoff et al., 2008). Therefore, a final goal of the current study was to determine whether any children with ASD in the current sample meet DSM-IV-TR criteria for OCD.

Hypotheses.

1. The first goal of this study was to determine the clinical significance of symptoms of anxiety and repetitive behaviors in ASD. It was hypothesized that a qualitative description of these symptoms would reveal that a majority of children with ASD would endorse clinically significant levels of anxiety and repetitive behaviors.
2. The second goal of this study was to explore the nature of repetitive behaviors, anxiety, and social problems in children with ASD. Based on this goal, the following hypotheses were made:

- a. It was predicted that in children with ASD, the symptom areas of repetitive behaviors, anxiety, and social problems would be related to one another.
 - b. Further, as described by Baron-Cohen (1989) and Carruthers (1996), it was hypothesized that the relation between social problems and repetitive behaviors would be mediated by anxiety in children with ASD (Figure 1).
 - c. It was also hypothesized that, based on the OCD literature, the relation between anxiety and social problems would be mediated by repetitive behaviors in children with ASD (Figure 2), but it was expected that this model would not be as good a fit as the previous mediation model based on the ASD literature.
3. The third goal of this study was to examine repetitive behaviors in children with ASD using a traditionally ASD measure and a traditionally OCD measure. A direct comparison of the types and severity of repetitive behaviors in a group of children with a primary diagnosis of ASD and a group of children with a primary diagnosis of OCD was conducted.
- a. On the CY-BOCS, it was predicted that Compulsions Severity scores would be similar in children with ASD and children with OCD, but Obsessions Severity scores would be lower in children with ASD than in children with OCD. On the RBS-R, it was hypothesized that Stereotyped Behaviors, Ritualistic Behaviors, Sameness Behaviors, and Restricted Behaviors Subscale Severity scores would be higher in children with ASD than in children with OCD. It was expected that Compulsive Behavior Subscale Severity scores would be higher in the OCD group than in the ASD group.

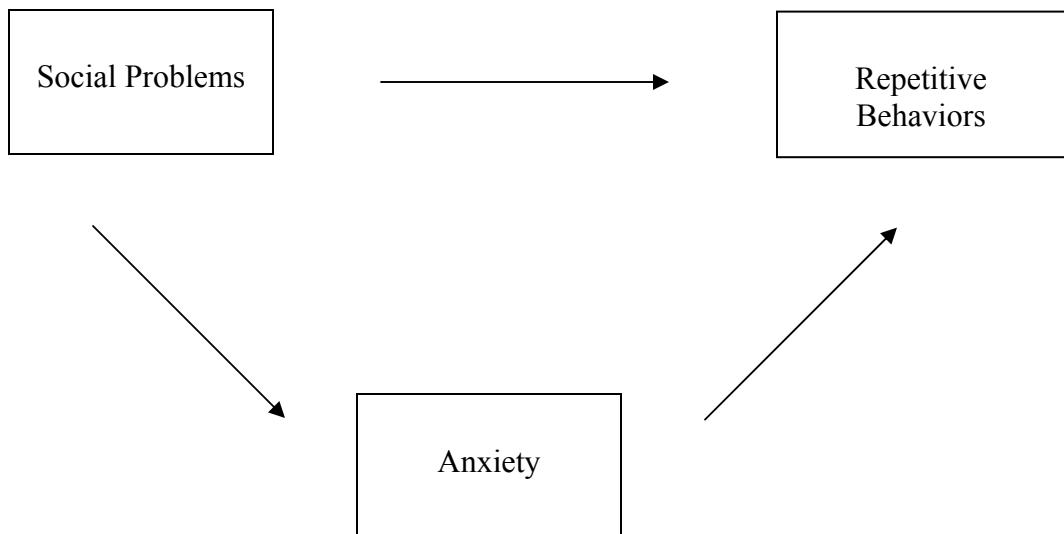


Figure 1. Model based on ASD literature with anxiety mediating the relation between social problems and repetitive behaviors.

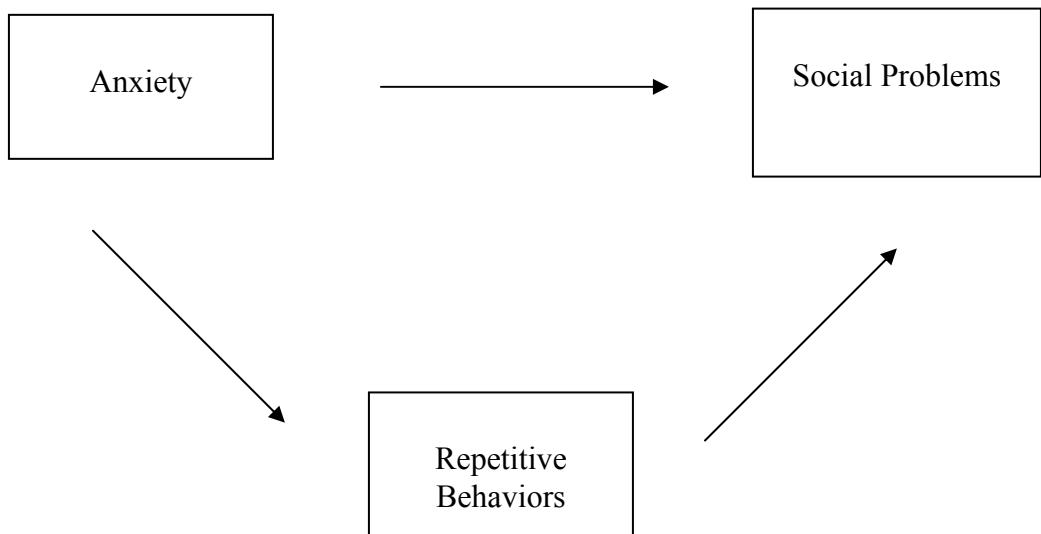


Figure 2. Model based on OCD literature with repetitive behaviors mediating the relation between anxiety and social problems.

- b. It was expected that a qualitative description of the types of symptoms endorsed on the CY-BOCS symptom checklist would reveal that certain symptoms occur more frequently in the ASD group while other symptoms occur more frequently in the OCD group. Specifically, it was hypothesized that a higher percentage of children with ASD would endorse Hoarding/Saving Compulsions than children with OCD, while a higher percentage of children with OCD would endorse Washing/Cleaning Compulsions, Checking Compulsions, Counting Compulsions, Aggressive Obsessions, Hoarding/Saving Obsessions, Magical Obsessions, and Sexual Obsessions than children in the ASD group. It was anticipated that a large percentage of both groups would endorse Repeating Compulsions, Arranging/Symmetry Compulsions, Rituals Involving Other Persons, and Contamination Obsessions.
4. It was expected that a subgroup of children with ASD would meet diagnostic criteria for both ASD and OCD. Thus, the fourth goal of the current study was to examine the rates of OCD in the group with a primary diagnosis of ASD and to explore the nature of symptom presentation in children who meet criteria for both ASD and OCD. Given the exploratory nature of this goal, no explicit hypotheses were made for this group of children.

CHAPTER 2

METHODS

Participants

Two groups of parents of children and adolescents between the ages of 7 and 17 were recruited for this study. For ease of reporting, participants will subsequently be referred to only as “children.” One group consisted of parents of children who have been diagnosed with ASD, and the other group consisted of parents of children who have been diagnosed with OCD. Parents of children with ASD were recruited through two university-based clinics. Clients of the University of Alabama Autism Spectrum Disorders Research Clinic who had previously indicated a willingness to participate in research were contacted and asked if they were interested in participating in the current study. Clients of the University of North Carolina Division TEACCH who had previously included their contact information in a research registry were mailed fliers about the current study. In addition, fliers were distributed to professionals and parents at the annual Alabama Autism Conference at the University of Alabama. Advertisements about the current study were placed in the Tuscaloosa News newspaper and in the Autism Society of Alabama newsletter.

Parents of children with OCD were recruited through the help of service providers (e.g., psychologists, psychiatrists, social workers, and support group leaders) specializing in OCD throughout the United States. Service providers were contacted through telephone or email, provided a description of the study, and asked if they would be willing to distribute fliers to their

clients. Professionals who agreed to advertise the study were then mailed or e-mailed copies of fliers and newsletter announcements. An announcement about the study was also submitted to the Tuscaloosa News newspaper and posted on the national website of the Obsessive-Compulsive Foundation and on the website of several local chapters of the Obsessive-Compulsive Foundation throughout the country. In addition, participants for the OCD group were recruited through fliers distributed at the Duke University Program in Child Affective and Anxiety Disorders. Parents were also recruited through advertisements posted on social networking sites with groups for parents of children with OCD. Interested participants in both groups contacted the researcher by returning the flier with their contact information, called the researcher, or e-mailed the researcher.

Although parents provided all data in this study, results are based on their children's behaviors and characteristics. Therefore, the group characteristics presented are about children, as reported by their parents. Fifty-eight parents of children with DSM-IV-TR diagnoses of Autistic Disorder, Asperger's Disorder, or PDD-NOS initiated participation in the study. Of these 58 participants, 49 completed the study (15.5% attrition). One participant did not complete the initial telephone interview; the other eight completed the telephone interview but did not complete the survey following the interview. Participants who did not complete the study did not differ from study completers on chronological age, $t(55) = 0.03, p = .98$, adaptive behavior (SIB-R) standard score, $t(55) = -0.19, p = .85$, or household income, $t(54) = -1.09, p = .28$. All participants not completing the study were male. Data for the ASD group was primarily provided by biological mothers, although two biological fathers provided data and six non-biological parent caregivers (e.g., adoptive parent) provided data.

Because parents provided all data for this study and the researcher did not directly assess children for the presence of an autism spectrum disorder, only families with a child who had been previously diagnosed with ASD by a professional (e.g., psychologists, psychiatrists, neurologists with experience working with individuals with ASD) were recruited. To confirm the diagnosis, parents completed the Social Responsiveness Scale (SRS; Constantino & Gruber, 2005). According to the SRS manual, a T-score of 60 to 74 (raw scores of 54 to 86) indicates mild to moderate levels of ASD symptomatology, and a T-score of 75 (raw score of 87) or greater indicates severe levels of ASD symptomatology. All 49 participants who completed the study obtained a T-score of 60 or greater on the SRS (raw score $M = 97.67$, $SD = 21.82$).

The ASD group consisted of 40 males and 9 females. Parents reported that 25 children had a diagnosis of autism, 22 had a diagnosis of Asperger's Disorder, and 2 had a diagnosis of PDD-NOS. The majority (85.7%) of participants were Caucasian. Three participants were African-American, one was Asian, one was Hispanic or Latino, one was American Indian or Alaska Native, and one was Biracial. Eleven participants (22.4%) were taking medication for anxiety or OCD symptoms.

Baron-Cohen (1989) noted that many individuals with ASD may lack the cognitive ability to speak about their internal state of mind. In addition, repetitive behaviors are related to intellectual ability in children with ASD (Militerni et al., 2002; Turner, 1999). Thus, in order to maximize the likelihood that children would be cognitively able to report internal thoughts to their caregivers and to reduce the effects of mental age on differences between the ASD group and the OCD group only high-functioning children with ASD, that is, children with average to above-average intelligence, were recruited for this study. As inclusion screening questions, parents were asked to provide their child's IQ score if their child had been tested and they knew

the score and to provide an estimate of their child's academic achievement level. Because IQ and achievement were not directly assessed, parents completed a measure of adaptive behavior, the Scales of Independent Behavior – Revised (SIB-R; Bruininks, Woodcock, Weatherman, & Hill, 1996), as a proxy measure of their children's ability level. In the general population, adaptive behavior is typically related to intellectual ability (Bruininks et al., 1996). Within the ASD population, this relation is weaker, with many individuals with average to above average intelligence exhibiting below average adaptive behavior skills (Shea & Mesibov, 2005). Therefore, participants were not excluded from the ASD group based on adaptive behavior scores.

The second group of participants was comprised of the parents of children diagnosed with OCD according to criteria in the DSM-IV-TR. Thirteen participants in the OCD group initiated participation in and completed the study (0% attrition). As in the ASD group, only families with a child who had been previously diagnosed with OCD by a professional were recruited. To confirm the diagnosis, parents were administered the OCD portion of the Anxiety Disorders Interview Schedule for Children for DSM-IV: Parent Version (ADIS; Silverman & Albano, 1996). Of the 13 participants completing the study, 12 met criteria for OCD on the ADIS. All further discussion of the OCD group, as well as reported results, includes this group of 12 participants. The OCD group included 6 males and 6 females. All 12 participants were Caucasian. Exactly half of the participants in this group were taking medication for anxiety or OCD symptoms. Only one biological father provided data for the OCD group; all other respondents were biological mothers.

The ASD group and the OCD group did not differ significantly on chronological age, $t(59) = 0.02, p = .99$, or household income, $t(58) = -1.29, p = .20$. However, the ASD group did

significantly differ from the OCD group on SIB-R standard score, $t(59) = -3.91$, $p < .001$.

Children with ASD had significantly lower adaptive behavior scores than children with OCD.

Because groups differed on adaptive behavior, SIB-R standard score was included as a covariate for group comparisons. Despite this difference, the range of SIB-R standard scores was similar for both groups, and the mean SIB-R standard score for each group was in the average range.

See Table 1 for participant characteristics.

Measures

Because one goal of this study was to examine the relation between social problems, repetitive behaviors, and anxiety, it was desired that parents report on their children's symptoms occurring within a similar time frame. For measures of repetitive behaviors, anxiety, and social problems, parents were asked to consider their child's behavior over the previous month when responding. This differed from the time frame typically used for a few of the measures, but consultation with authors of the measures revealed that the authors did not believe this would significantly affect the effectiveness of the measures.

Children's Yale-Brown Obsessive Compulsive Scale (CY-BOCS; Scahill et al., 1997).

The CY-BOCS measures symptom severity of OCD in 4- to 18-year-olds and was originally designed to be administered through a clinician interview. A self/parent-report version of the CY-BOCS was developed by Piacentini, Bergman, & Chang (2003) at The Childhood OCD, Anxiety, and Tic Disorders Program at the University of California at Los Angeles. Because the current study uses a survey format, the self/parent report CY-BOCS was used in the current study. The symptom checklist remains identical to the checklist from the original CY-BOCS, which includes symptoms of obsessions and compulsions. The severity rating scales, which include five items rating the severity of obsessions and five items rating severity of compulsions,

Table 1

Participant Characteristics

	ASD (n = 49)		OCD (n = 12)	
	Mean	SD	Mean	SD
Chronological Age (months)	146.06	30.60	145.92	29.31
SIB-R Standard Score*	84.16	22.96	111.27	15.69
Household Income	98,062	88,801	132,500	47,458
	%		%	
Race				
Caucasian	85.7		100	
African-American	6.1		0	
Asian	2.0		0	
Hispanic	2.0		0	
American Indian or				
Alaska Native	2.0		0	
Biracial	2.0		0	
Sex				
Male	81.6		50.0	
Female	18.4		50.0	
Currently Taking Medication				
Prescribed for Anxiety	22.4		50.0	

Diagnosis

Autistic Disorder	51.0	N/A
Asperger's Disorder	44.9	N/A
PDD-NOS	4.1	N/A

* Significance of difference between ASD group and OCD group $p \leq .05$

have been slightly reworded to be appropriate for self/parent rather than interview reporting, although question content and rating scales remain the same as in the original CY-BOCS. Thus, the self/parent-report CY-BOCS offers the symptom checklist as well as the Obsessions Severity score (ranging from 0 to 20), Compulsions Severity score (ranging from 0 to 20), and CY-BOCS Total Severity score (ranging from 0 to 40). Severity ratings are made using a 5-point Likert scale (i.e., 0 = *none* to 5 = *extreme*). Psychometric data on the self/parent-report CY-BOCS are not currently available; thus psychometric data for the original CY-BOCS will be reported. However, reliability of the self/parent-report CY-BOCS is believed to be similar to the original CY-BOCS (J. Piacentini, personal communication, March 29, 2005).

Internal consistency is high for the CY-BOCS, as indicated by Cronbach's $\alpha = .80$ to $.90$ (Scalhill et al., 1997; Storch et al., 2004). Pearson's correlation between items and subscale severity scores ranges from $.81$ to $.87$ (Scalhill et al., 1997). Test-retest stability of the severity scores and Total score ranges from intraclass correlations of $.70$ to $.76$ (Storch et al., 2004). The total score is significantly more correlated with measures of OCD symptoms than with measures of childhood depression, anxiety, and Attention Deficit/Hyperactivity Disorder, indicating convergent and divergent validity (Scalhill et al., 1997; Storch et al., 2004). The CY-BOCS has been used as a measure of treatment outcome in many studies measuring the effectiveness of medication and/or cognitive behavioral therapy in children and adolescents with OCD. Across several different treatments, the average CY-BOCS scores decreased with treatment; thus, the CY-BOCS can be considered a measure sensitive to small variations in obsessions and compulsions (Benazon, Ager, & Rosenberg, 2002; Geller et al., 2001; Hanna et al., 2002; Liebowitz et al., 2002; Riddle et al., 2001; Rosenberg, Stewart, Fitzgerald, Tawile, & Carroll, 1999; Thienemann, Martin, Cregger, Thompson, & Dyer-Friedman, 2001).

In the current study, parents completed the CY-BOCS as a measure of repetitive behaviors typically found in children with OCD. The CY-BOCS Symptom Checklist was used to describe the number and types of symptoms endorsed. The percentage of participants with ASD reaching clinical levels of repetitive behaviors on the CY-BOCS was also calculated.

Repetitive Behavior Scale – Revised (RBS-R; Bodfish et al., 1999). The Repetitive Behavior Scale – Revised is a parent report measure of repetitive behaviors in ASD. It consists of 43 items and takes approximately 20 minutes to complete. Six subscales are measured by the RBS-R, including Stereotyped Behavior, Self-Injurious Behavior, Compulsive Behavior, Ritualistic Behavior, Sameness Behavior, and Restricted Behavior. For each subscale, the number of items endorsed is computed as well as the severity score for the subscale. Severity ratings are made using a 4-point Likert scale (i.e., 0 = *behavior does not occur* to 3 = *behavior occurs and is a severe problem*). Total number of items endorsed and RBS-R Total Severity score (ranging from 0 to 129) is also computed. Interrater reliability for the subscales of the RBS-R is adequate, ranging from .55 to .78. Similarly, test-retest data ranges from .52 to .96 for the subscales. In the current study, parents completed the RBS-R as a measure of the severity, number, and types of repetitive behaviors typically found in children with ASD.

Spence Children's Anxiety Scale for Parents (SCAS-P; Spence, 1999). The Spence Children's Anxiety Scale for Parents is a 38-item parent-report measure of a child's symptoms of anxiety that takes approximately 10 minutes to complete. The subscales of the SCAS-P were developed to reflect anxiety disorders included in the DSM-IV. Thus, subscales include Panic Attack and Agoraphobia, Separation Anxiety, Physical Injury Fears, Social Phobia, Obsessive Compulsive, and Generalized Anxiety Disorder/Overanxious Disorder. Answers to each item

are scored on a 4-point Likert scale (i.e., 0 = *never* to 3 = *always*). The SCAS-P yields a score for each of the six subscales as well as a total anxiety score, ranging from 0 to 114.

Psychometric data for the SCAS-P are good. Internal consistency for the six subscales is good, as indicated by Cronbach's alphas of .83 to .92 for children with anxiety disorders. The alpha for the total scale is .89. The SCAS-P has good convergent validity with the internalizing subscale of the Children's Behavior Checklist (Achenbach, 1991) (.55) and divergent validity with the externalizing subscale of the Children's Behavior Checklist (.33, significantly less than with the internalizing subscale). In the current study, total score on the SCAS-P was used as a quantitative measure of anxiety. The percentage of participants with ASD with clinical levels of anxiety, as measured by the SCAS-P Total Score, was calculated.

Social Responsiveness Scale (SRS; Constantino & Gruber, 2005). The Social Responsiveness Scale is a 65-item parent-report measure of an individual's ability to engage in reciprocal social behavior, including social awareness, social information processing, capacity for reciprocal social responses, social use of language, and stereotypic/repetitive behaviors/preoccupations. The SRS was designed to be used with individuals with ASD, measuring symptoms of ASD across the range of severity of the disorder. Specific concepts measured include social awareness, social information processing, capacity for reciprocal social responses, social anxiety/avoidance, and characteristic autistic preoccupations/traits. All answers are scored on a 4-point Likert scale (i.e., 1 = *not true* to 4 = *almost always true*). The SRS provides a single index score which ranges from 0 to 195. Scores in the range of 65 to 85 indicate mild to moderate social impairment. For males in the general population, there is 75% specificity for a diagnosis of an ASD in individuals who score at least 70; a similar level of

specificity is found in females who score at least 65. In clinical settings, the specificity increases to 90% when a score of 85 is obtained on the SRS (Constantino & Gruber, 2005).

The SRS takes approximately 15 to 20 minutes to complete. The correlation between the SRS and the Autism Diagnostic Interview – Revised (ADI-R) is between .65 and .77. Test-retest reliability for the SRS ranges from .83 to .88, and interrater reliability between mother, father, and teacher report ranges from .75 to .91.

The SRS is considered an appropriate measure of social functioning in children with ASD and in children with OCD in the current study because previous studies have revealed similar levels of variability in total scores in both children with ASD and in children with non-ASD psychiatric conditions (Constantino, Przybeck, Friesen, & Todd, 2000). Thus, in the current study, parents completed the SRS as a quantitative measure of social functioning. The SRS was also used to confirm the diagnosis of ASD. Because all ASD participants had received previous diagnoses of ASD, this instrument is considered appropriate for the current study.

Anxiety Disorders Interview Schedule for Children for DSM-IV: Parent Version (ADIS; Silverman & Albano, 1996). The Anxiety Disorders Interview Schedule is a series of semi-structured interviews designed to diagnose anxiety and related disorders in children according to DSM-IV criteria. The interviewer asks questions about specific symptoms within a given disorder and determines whether a symptom is present or absent; the total number of symptoms endorsed is then summed to determine if diagnostic criteria are met.

Test-retest reliability for the parent version of the ADIS is excellent (intraclass correlations of .81 to .96). The reliability of the diagnosis of specific anxiety symptoms and disorders based on the parent interview is good to excellent, with Kappa coefficients ranging from .65 to .88 (Silverman, Saavedra, & Pina, 2001). In the current study, the OCD portion of

the ADIS was administered to parents to confirm the diagnosis of OCD. In addition, the interview was administered to parents of children in the ASD group as an exploratory measure to determine how many children in the ASD group meet DSM-IV criteria for OCD.

Scales of Independent Behavior – Revised, Short Form (SIB-R; Bruininks et al., 1996).

The Scales of Independent Behavior – Revised is an informant-based measure of adaptive and problem behaviors used with individuals from infancy to over 80 years of age. The short form of the SIB-R is a 40-item brief screening of adaptive behavior and takes approximately 15 to 20 minutes to complete. For each item, the informant rates the child's performance according to a 4-point Likert scale (i.e., 0 = *never or rarely* to 3 = *does very well*). It yields one overall adaptive standard score.

Internal consistency of the SIB-R Short Form, as measured by split-half reliability coefficients, is .76. It is correlated with chronological age ($r = .77$). In addition, scores are correlated with cognitive ability for both children without disabilities ($r = .77$) and children with disabilities ($r = .91$). Therefore, in the current study it was used as an estimate of developmental level for children.

In the current study, parents of children with OCD completed the SIB-R to determine eligibility for the study (i.e., overall adaptive score greater than 80). Parents of children with ASD completed the SIB-R as a measure of adaptive behavior. In addition, overall adaptive score was used to evaluate group differences.

Procedure

After learning about the study through fliers, newsletter and newspaper announcements, and websites, families interested in participating contacted the researcher by returning a flier, calling the researcher, or e-mailing the researcher. Potential participants were provided with a

brief description of the study and, if they were still interested in participating, scheduled for a telephone interview.

Participants from both groups were read the consent form at the beginning of the telephone interview before participating in the study. After providing verbal consent to the interviewer, participants completed a brief screening questionnaire in which they provided contact information, information about their child's diagnosis and treatment history, and demographic information about their family. If, during the course of the Background Questionnaire, it was determined that participants did not meet basic inclusion criteria (e.g., the child was nonverbal or had an IQ confirmed to be below 80), participants were thanked for their time and told they did not meet inclusion criteria for the study. Participants meeting basic inclusion criteria completed the remainder of the telephone interview, which included administration of the OCD portion of the ADIS, SCQ, and SIB-R. Completion of the telephone interview took approximately 60 to 75 minutes.

Following the telephone interview, participants completed a survey of questionnaires which included the CY-BOCS, the RBS-R, the SCAS-P, and the SRS. Completion of the survey of questionnaires took approximately 45 to 60 minutes. Participants chose to complete the survey on the internet or to have the survey mailed to them. Participants who chose to complete the study on the internet were sent an e-mail containing a link to the survey, an ID code, and a password for entering the internet survey. The first page of the internet survey included a copy of the consent form. Participants indicated whether they provided consent for continuing the study by using the computer mouse to click a "yes" or "no" response before moving on to instructions for completing the survey and the remainder of the survey measures. Participants choosing to receive the survey measures in the mail were mailed a packet including a letter

explaining the procedures for completing the questionnaires, the consent form, and all remaining measures. The packet also included a self-addressed, stamped return envelope in which participants could return completed survey measures. Participants who completed the telephone interview but did not complete the survey within two weeks were called or e-mailed to remind them about the study and inquire if they wished to continue their participation in the study.

Of the 70 participants completing the telephone interview, 54 (77.1%) chose to complete the survey on the internet and 16 (22.9%) chose to have the survey materials mailed to them. Fifty (92.6%) participants requesting to complete the internet survey completed the study, while 12 (75.0%) participants requesting to have the survey materials mailed to them completed the study. Among the 61 participants included in data analyses (i.e., participants who completed the study and met inclusion criteria), there were no differences between participants who completed the internet survey compared to those who completed the mailed survey on child's chronological age, $t(59) = -1.53, p = .13$, adaptive behavior (SIB-R standard score), $t(59) = -0.22, p = .83$, or household income, $t(58) = -0.13, p = .90$.

After all measures were completed, either by finishing the internet survey or returning the mailed packet to the examiner, a thank you letter with a small incentive for participating (i.e., a \$5 gift certificate for a bookstore) was mailed to each participant. The thank you letter also included study referral cards for participants to distribute to other families who might be interested in the study. Participants recruited from the University of North Carolina Division TEACCH research registry did not receive referral cards because registry policies prohibited their inclusion in the thank you letter.

CHAPTER 3

RESULTS

Statistical analyses were carried out using SPSS for Windows Program Version 16.0. For each participant, mean scores were calculated for measures of repetitive behaviors, anxiety, and social problems. On the Children's Yale-Brown Obsessive Compulsive Scale (CY-BOCS), means were calculated for Obsessions Severity score, Compulsions Severity score, and CY-BOCS Total Severity score, based on the CY-BOCS interview. From the CY-BOCS symptom checklist, the mean number of obsessions endorsed (Obsessions Number) and the mean number of compulsions endorsed (Compulsions Number) were calculated. See Table 2 for CY-BOCS means and standard deviations.

On the Repetitive Behavior Scale – Revised (RBS-R), mean severity scores were calculated for each of the subscales (subscale Severity, e.g., Stereotyped Behavior Severity) as well as the RBS-R Total severity score. Means were also calculated for the number of symptoms endorsed in each subscale (subscale Number, e.g., Stereotyped Behavior Number) and the total number of symptoms endorsed on the RBS-R. See Table 3 for means and standard deviations on the RBS-R.

In addition to individual scores on the CY-BOCS and RBS-R, a repetitive behaviors composite score that combined the CY-BOCS Total Severity Score and the RBS-R Total Severity Score was calculated. These two scores were related to each other, $r = .74$, $p < .001$, and, thus, were considered to measure similar constructs. Specifically, the Repetitive Behaviors

Table 2

CY-BOCS Calculations

	ASD (n = 48)		OCD (n = 12)		Effect Size (η_p^2) ^a
	Mean	SD	Mean	SD	
Obsessions Severity Score	8.19	4.94	8.67	3.03	.01
Compulsions Severity Score	8.90	4.11	9.58	4.68	.01
Total Severity Score	17.22	8.53	18.25	7.31	n/a ^b
Number of Obsessions Endorsed*	2.21	2.60	4.58	3.48	.16
Number of Compulsions Endorsed	4.21	3.40	5.33	4.58	.03

^a Effect size based on partial eta squared calculated for Multivariate Analyses of Covariance: $\eta_p^2 < .06$ is small; .06 to .14 is medium; $> .14$ is large

^b Partial eta squared was not calculated for single t-tests

* Significance of difference between ASD group and OCD group is $p \leq .05$

Table 3

RBS-R Calculations

	ASD (n = 48)		OCD (n = 12)		Effect Size (η_p^2) ^a
	Mean	SD	Mean	SD	
Stereotyped Behavior Severity*	3.35	2.51	1.17	1.59	.10
Self-Injurious Behavior Severity	2.58	3.57	1.58	2.58	<.001
Compulsive Behavior Severity	4.08	2.94	5.42	4.89	.03
Ritualistic Behavior Severity	5.58	3.98	3.33	3.20	.01
Sameness Behavior Severity	8.33	5.20	4.67	4.92	.02
Restricted Behavior Severity*	2.96	2.09	.42	.79	.17
RBS-R Total Severity*	26.90	15.31	16.58	13.43	n/a ^b
Stereotyped Behavior Number*	2.42	1.58	.75	.97	.13
Self-Injurious Behavior Number	1.60	1.81	1.17	1.90	<.001
Compulsive Behavior Number	2.98	1.87	3.58	2.81	.02
Ritualistic Behavior Number	3.33	1.77	2.25	1.82	.02

Sameness Behavior Number	5.65	2.51	3.50	3.45	.06
Restricted Behavior Number*	1.87	1.23	.33	.65	.20

^a Effect size based on partial eta squared calculated for Multivariate Analyses of Covariance: $\eta_p^2 < .06$ is small; .06 to .14 is medium; $> .14$ is large

^b Partial eta squared was not calculated for single t-tests

* Significance of difference between ASD group and OCD group is $p \leq .05$

Severity Composite was calculated by computing standardized scores (z-scores) for the CY-BOCS Total Severity score and for the RBS-R Total Severity Score. The standardized CY-BOCS score and the standardized RBS-R score were then averaged to form the Repetitive Behaviors Severity Composite score. The Repetitive Behaviors Severity Composite score was included in correlation and mediation analyses.

Means were calculated for total scores on the Spence Children's Anxiety Scale for Parents (SCAS-P) and the Social Responsiveness Scale (SRS). To reduce the effect of repetitive behavior symptoms included in the total scores on anxiety and social measures, variations of the total scores were also calculated for the SCAS-P and the SRS in which the subscales measuring repetitive behaviors were removed. Specifically, a variation of the SCAS-P Total score was calculated without including the OCD subscale. This variable will subsequently be referred to as the SCAS-P Anxiety Total score. Similarly, a variation of the SRS Total score was calculated that included all subscales except the Mannerisms subscale. This variable will subsequently be referred to as the SRS Social Total. The SCAS-P Anxiety Total score and the SRS Social Total score were included in correlation and mediation analyses. See Table 4 for a summary of the means and standard deviations of the Repetitive Behaviors Severity Composite, SCAS-P scores, and SRS scores.

Clinical Significance of Repetitive Behaviors and Anxiety in ASD

The first goal of the current study was to determine the clinical significance of symptoms of anxiety and repetitive behaviors in ASD. To examine the hypothesis that the majority of children with ASD would have clinically meaningful levels of anxiety and repetitive behaviors, the percentage of children with significant levels of anxious and repetitive behaviors on the CYBOCS and SCAS-P was calculated. According to Storch et al. (2007), CY-BOCS Total

Table 4

Repetitive Behaviors Severity Composite, SCAS-P, and SRS Calculations

	ASD (n = 48)		OCD (n = 12)		Effect Size (η_p^2) ^a
	Mean	SD	Mean	SD	
Repetitive Behaviors Composite	-.01	.94	.00	.88	<.001
SCAS-P Total	21.83	16.61	29.25	15.17	.03
SCAS-P Anxiety Total	19.19	15.05	23.25	12.05	.01
SRS Total*	97.67	21.82	37.42	22.69	.55
SRS Social Total*	79.31	17.59	29.75	17.12	.57

^a Effect size based on partial eta squared calculated for Multivariate Analyses of Covariance: $\eta_p^2 < .06$ is small; .06 to .14 is medium; $> .14$ is large

* Significance of difference between ASD group and OCD group is $p \leq .05$

severity scores of 8 to 15 are considered to represent mild severity of OCD symptoms, scores of 16 to 23 represent moderate severity, scores of 24 to 32 represent severe severity, and scores over 32 represent extreme severity. Many treatment outcome studies using the CY-BOCS as a measure of response to treatment utilize a CY-BOCS Total severity score of 16 (moderate) as an inclusion criterion. Therefore, a score of 16 was chosen to represent “clinically significant” levels of repetitive behaviors in the current study. As predicted, the majority of children with ASD (57.1%) were reported to have clinically significant levels of obsessive-compulsive behavior on the CY-BOCS. On the SCAS-P, children scoring one standard deviation above the mean SCAS-P Total score reported in the sample of typically developing children used to develop norms for the measure should be considered for further evaluation for an anxiety disorder (Nauta et al., 2004). One standard deviation above the mean of the norm sample is 23.9 and a score of 24 or higher was considered to represent “clinically significant” levels of anxiety in the current study. In the ASD group, 39.6% of children were reported to have clinically significant levels of anxiety. Therefore, the current study reveals that a substantial subset of children with ASD experience obsessive-compulsive behaviors and anxiety that are severe enough to cause impairment.

Repetitive Behaviors, Social Problems, and Anxiety in ASD

The second goal of the current study was to explore the relation between repetitive behaviors, anxiety, and social problems in children with ASD. In the ASD group, correlations were calculated among the CY-BOCS, RBS-R Total scores, SCAS-P, and SRS. Repetitive behaviors were examined in the correlation analyses using the CY-BOCS Obsessions, Compulsions, and Total severity scores; CY-BOCS Obsessions, Compulsions, and Total number of symptoms endorsed; and RBS-R Total Severity score and Total number of symptoms

endorsed. All of the CY-BOCS summary scores were significantly positively correlated with one another, and both of the RBS-R summary scores were significantly positively correlated with one another. In addition, CY-BOCS scores were significantly related to RBS-R scores (Table 5).

Social problems were examined in the correlation analyses using the SRS Social Total score, and anxiety was examined using the SCAS-P Anxiety Total score (Table 6). With the exception of the number of symptoms endorsed on the CY-BOCS, the hypothesis that repetitive behaviors would be significantly related to social problems was supported. Anxiety was also highly correlated with all measures of repetitive behavior. In addition, anxiety was significantly related to social problems, as predicted.

Because social problems was significantly correlated with repetitive behavior, $r = .51$, social problems was significantly correlated with anxiety, $r = .38$, and anxiety was significantly correlated with repetitive behavior, $r = .65$, mediation analyses were conducted to further clarify the relation between these symptom areas in children with ASD. According to Baron and Kenny (1986), a mediator is a variable that accounts for the relation between a predictor variable and a criterion variable. In the generic mediation model, three variables exist: the predictor, or independent, variable (A); the mediator variable (B); and the criterion, or dependent, variable (C). In order for a variable to function as a mediator, it must meet certain conditions. First, the independent variable (IV) must account for a significant portion of the variation in the mediator. Second, the IV must account for a significant portion of the variation in the dependent variable (DV), verifying that there is a relation to be mediated. Third, the mediator must account for a significant portion of the variation in the DV. Fourth, the relation between the IV and the DV is significantly reduced when the contribution of the mediator is taken into account. To test the above relations, a series of regression models may be used. In the case of full mediation, the

Table 5

CY-BOCS and RBS-R Correlations

Measures (r)	CY-BOCS Compulsions Severity	CY-BOCS Obsessions Severity	CY-BOCS Total Severity	CY-BOCS Compulsions Number	CY-BOCS Obsessions Number	CY-BOCS Total Number	RBS-R Total Severity	RBS-R Total Number
CY-BOCS Compulsions Severity	-	.79***	.94***	.51***	.37**	.48***	.69***	.69***
CY-BOCS Obsessions Severity		-	.96***	.61***	.48***	.59***	.72***	.68***
CY-BOCS Total Severity			-	.60***	.46**	.57***	.74***	.73***
CY-BOCS Compulsions Number				-	.74***	.95***	.62***	.65***
CY-BOCS Obsessions Number					-	.91***	.55***	.49***
CY-BOCS Total Number						-	.63***	.62***
RBS-R Total Severity							-	.92***
RBS-R Total Number								-

* $p \leq .05$ ** $p \leq .01$ *** $p \leq .001$

Table 6

Correlations between Repetitive Behaviors, Social Problems, and Anxiety

	<u>Social and Anxiety Scores</u>	
	SRS Social Total Score	SCAS-P Anxiety Total Score
<u>Repetitive Behaviors Score</u>	r	r
<u>CY-BOCS</u>		
Compulsions Severity	.39**	.52***
Obsessions Severity	.46**	.57***
Compulsions Number	.21	.57***
Obsessions Number	.18	.63***
<u>RBS-R</u>		
RBS-R Total Severity	.48**	.63***
RBS-R Total Number	.47**	.58***
Repetitive Behaviors Severity Composite	.51***	.65***
SRS Social Total Score	-	.38**

* $p \leq .05$
 ** $p \leq .01$
 *** $p \leq .001$

relation between the IV and the DV decreases to zero when the mediator is accounted for, although in the majority of mediation models presented in the psychological literature a partial mediation is more likely. In the case of partial mediation, the effect of the IV on the DV is significantly reduced, but is not eliminated, when controlling for the effects of the mediator (Baron and Kenny, 1986; Holmbeck, 1997).

The significance of a change in the effect of the IV on the DV when controlling for the mediator can also be examined using the Sobel method. The Sobel (1982) method of testing for mediation provides a test of the strength of the mediation between two variables. While the Baron and Kenny method provides converging evidence of mediation, the Sobel method specifically tests whether the effect of the IV on the DV is indirectly mediated by the potential mediator variable. The strength of the mediation effect (ab) is tested by multiplying the effect of the IV on the mediator (a) by the effect of the mediator on the DV (b) and determining whether the combined effect is significantly different from zero. Effect (a) is calculated with a regression model in which the mediator is predicted by the IV. Effect (b) is calculated with a regression model in which the DV is predicted by the mediator with the IV included in the model. If the mediation effect (ab) is significantly different from zero, there is evidence of mediation. The Sobel test for the current study was conducted using the Calculation for the Sobel Test on Kristopher Preacher's website at the University of Kansas (Preacher & Leonardelli, 2003).

In the first mediation analysis, it was hypothesized that the effect of social problems on repetitive behavior would be mediated by anxiety. Social problems were measured by the SRS Social Total score, anxiety was measured by SCAS-P Anxiety Total score, and repetitive behavior was measured by the Repetitive Behaviors Severity Composite score. As described by Baron and Kenny (1986), four regression models were used to test for mediation. See Table 7

Table 7

Mediation Model 1: Anxiety Mediates the Relation between Social Problems and Repetitive Behavior

Predictor Variable	Outcome Variable	R ²	B	SE B	β	Test	p-value
Social Problems (IV)	Repetitive Behavior (DV)	.26	.03	.01	.51	t(47) = 4.04	<.001
Social Problems	Anxiety (M)	.14	.32	.12	.38	t(47) = 2.78	.01
Anxiety	Repetitive Behavior	.43	.04	.01	.65	t(47) = 5.80	<.001
Mediation Model 1	Repetitive Behavior	.53					
Social Problems			.02	.01	.35	t(46) = 3.12	.003
Anxiety			.03	.01	.52	t(46) = 4.69	<.001

Test of mediation is significant, Sobel test = 2.37, $p = .02$

Note: R^2 = squared multiple regression coefficient, indicating the total variance in the dependent variable accounted for by the independent variable; B = multiple regression coefficient; SE B = standard error of the multiple regression coefficient; β = standardized multiple regression coefficient

for a summary of regression coefficients for this model. The relation between social problems and repetitive behavior was significant, $B = .03, p < .001$, showing that the IV was related to the DV. The relation between social problems and anxiety was also significant, $B = .32, p = .01$, showing that the IV was related to the mediator. The relation between anxiety and repetitive behavior was significant, $B = .04, p < .001$, showing that the mediator had a significant effect on the DV. The effect of social problems on repetitive behavior was still significant after controlling for the effects of anxiety $B = .02, p = .003$, but the magnitude of the coefficient was reduced. Because the relation between social problems and repetitive behavior decreased but remained significant when anxiety was included in the model, there is some evidence that anxiety may serve as a partial mediator between social problems and repetitive behavior. As an alternate way to test whether the relation between social problems and repetitive behaviors is mediated by anxiety, the Sobel test was performed. Using the path coefficients and standard errors from the regression models described above, it was found that anxiety does partially mediate a significant amount of the relation between social problems and repetitive behavior, mediated effect = .01, $z = 2.37, p = .02$, using a Sobel test.

The second mediation analysis examined whether the relation between anxiety and social problems is mediated by repetitive behavior. See Table 8 for a summary of regression coefficients for this model. The relation between anxiety and social problems was significant, $B = .45, p = .01$, showing that the IV was related to the DV. The relation between anxiety and repetitive behavior was also significant, $B = .04, p < .001$, showing that the IV was related to the mediator. The relation between repetitive behavior and social problems was significant, $B = 9.66, p < .001$, showing that the mediator had a significant effect on the DV. The effect of anxiety on social problems was no longer significant when controlling for the effects of

Table 8

Mediation Model 2: Repetitive Behavior Mediates the Relation between Anxiety and Social Problems

Predictor Variable	Outcome Variable	R^2	B	SE B	β	Test	p-value
Anxiety (IV)	Social Problems (DV)	.14	.45	.16	.38	t(47) = 2.78	.01
Anxiety	Repetitive Behavior (M)	.43	.04	.01	.65	t(46) = 5.80	<.001
Repetitive Behavior	Social Problems	.26	9.66	2.39	.51	t(46) = 4.04	.001
Mediation Model 2	Social Problems	.30					
Anxiety			.04	.20	.04	t(46) = 218	.83
Repetitive Behavior		10.12	3.25	.52		t(46) = 3.12	.003

Test of mediation is significant, Sobel test = 2.72, $p = .02$.

Note: R^2 = squared multiple regression coefficient, indicating the total variance in the dependent variable accounted for by the independent variable; B = multiple regression coefficient; SE B = standard error of the multiple regression coefficient; β = standardized multiple regression coefficient

repetitive behavior, $B = .04$, $p = .83$, showing evidence that repetitive behavior serves as a mediator between anxiety and social problems. As an alternate way to test whether the possible mediation was significant, the Sobel test was performed. Using the path coefficients and standard errors from the regression models described above, it was found that repetitive behavior does mediate a significant amount of the relation between anxiety and social problems, mediated effect = $.40$, $z = 2.72$, $p = .01$, using a Sobel test. Thus, there was evidence that the relation between anxiety and social problems is mediated by repetitive behaviors using both the Baron and Kenny method and the Sobel test of mediation. Results indicate that the first mediation model was only partially supported in children with ASD while the second mediation model of the relation between social problems, anxiety, and repetitive behavior was strongly supported.

Comparison of Repetitive Behaviors in ASD and OCD

The third goal of this study was to explore the pattern of repetitive behaviors in children with ASD and children with OCD. Multivariate analysis of covariance (MANCOVA) was used to compare the subscale severity scores on the CY-BOCS and the RBS-R between the OCD group and the ASD group while controlling for SIB-R. It was anticipated that CY-BOCS Compulsions Severity scores would be similar in children with ASD and children with OCD, while Obsessions Severity scores would be higher in the OCD group than in the ASD group. On the RBS-R, it was hypothesized that Stereotyped, Ritualistic, Sameness, and Restricted Behavior Severity scores would be higher in the ASD group than in the OCD group, while the Compulsive Behavior Severity score would be higher in children with OCD than in children with ASD.

Diagnosis (ASD or OCD) was included as a between-subjects independent variable and severity scores were included as dependent variables. Specifically, Obsessions Total severity score and Compulsions Total severity score were included from the CY-BOCS and the six

subscale severity scores were included from the RBS-R. See Tables 2 and 3 for means and standard deviations of CY-BOCS and RBS-R severity scores. Because the two groups differed significantly on adaptive behavior, the SIB-R score was included as a covariate. Partial eta squared (η_p^2) are provided as a measure of effect size, with $\eta_p^2 < .06$ indicating a small effect, $\eta = .06$ to $.14$ indicating a medium effect, and $\eta_p^2 > .14$ indicating a large effect (Kittler, Menard & Phillips, 2007).

The multivariate test for the effect of diagnosis on severity scores was significant, $F(8, 50) = 3.75, p = .002$, while the multivariate test for the effect of the SIB-R was not significant, $F(8, 50) = 1.09, p = .38$. Univariate tests of the effect of diagnosis revealed that children with ASD and children with OCD did not differ on mean Compulsions Severity score, $F(1, 57) = 0.63, p = .43, \eta_p^2 = .01$, or mean Obsessions Severity score, $F(1, 57) = 0.33, p = .57, \eta_p^2 = .01$. On the RBS-R, only two subscales were significantly different between groups. As predicted, Stereotyped Behavior Severity was higher in the ASD group than in the OCD group, $F(1, 57) = 6.14, p = .02, \eta_p^2 = .10$. Also as predicted, Restricted Behavior Severity was higher in the ASD group than in the OCD group, $F(1, 57) = 11.44, p = .001, \eta_p^2 = .17$. Despite the hypothesis that groups would differ on all RBS-R subscales, no significant differences were found on the severity of the other four subscales (all $p > .18$, all η_p^2 's $< .001$ to $.03$).

These results suggest that when symptoms are present, the severity of Compulsions, Obsessions, Self-Injurious Behavior, Compulsive Behavior, Ritualistic Behavior, and Sameness Behavior is the same for children with ASD and children with OCD. However, this does not provide information about whether the frequency of these behaviors differs across groups. Therefore, a follow-up MANCOVA was performed comparing the two groups on the number of symptoms endorsed on the two measures of repetitive behaviors. Diagnosis (ASD or OCD) was

included as a between-subjects independent variable and subscale frequency scores were included as dependent variables. Specifically, Obsessions Number and Compulsions Number were included from the CY-BOCS and the number of symptoms endorsed on each of the six subscales was included from the RBS-R. See Tables 2 and 3 for means and standard deviations of the number of symptoms endorsed on CY-BOCS and RBS-R subscales. Adaptive behavior was again included as a covariate in the follow-up MANCOVA. The multivariate effect of diagnosis was significant, $F(8, 50) = 6.29, p < .001$, while the multivariate test for the effect of the SIB-R was not significant, $F(8, 50) = 0.80, p = .61$. Univariate tests of the effect of diagnosis found no differences in the endorsement of Compulsions symptoms, $F(1, 57) = 1.69, p = .20, \eta_p^2 = .03$, but did find that endorsement of Obsessions symptoms was higher in the OCD group than in the ASD group, $F(1, 57) = 10.93, p = .002, \eta_p^2 = .16$. The numbers of symptoms endorsed on the Stereotyped Behavior, $F(1, 57) = 8.76, p = .004, \eta_p^2 = .13$, and Restricted Behavior subscales, $F(1, 57) = 14.36, p < .001, \eta_p^2 = .20$, were significantly higher in the ASD group than in the OCD group. The number of symptoms endorsed on the other four RBS-R subscales was not significantly different between groups (all $p > .07$, all η_p^2 's < .001 to .06). Thus, the comparison of severity and frequency scores between groups revealed that children with OCD had a significantly greater number of obsessions, while children with ASD had significantly more severe and a significantly greater number of stereotyped and restricted behaviors. All other subscales of the CY-BOCS and RBS-R were similar in children with ASD and children with OCD.

In the previous analyses, participants with OCD endorsed a greater number of obsessions than participants with ASD. However, this analysis did not provide a description of the pattern of obsessions present in each diagnostic group. Thus, a qualitative comparison was conducted to

examine specific patterns of obsessive behavior in each group. The percentages of each group endorsing each category of symptoms on the CY-BOCS symptom checklist and each subscale of the RBS-R were calculated and qualitatively compared. Overall, more participants from the OCD group than from the ASD group endorsed all types of obsessions (Figure 3). The most common obsessions in each group were similar as well. The most frequently endorsed type of obsessions in the ASD group were Contamination and Aggressive obsessions; these two types of obsessions were also among the most frequently endorsed type of obsession in the OCD group. However, Religious/Moral obsessions and Health-Related obsessions were also some of the most frequently endorsed symptoms in the OCD group, while they were not among the top few types of obsessions endorsed in the ASD group.

A similar qualitative comparison was conducted examining the pattern of compulsions in each diagnostic group. More participants from the OCD group than from the ASD group endorsed all but one type of compulsions (Figure 4). The only category of compulsions endorsed by more participants in the ASD group than the OCD group was Arranging/Symmetry compulsions. The most common compulsions endorsed were similar in both groups. Checking compulsions and rituals involving other persons were the most frequently endorsed compulsions in both the ASD group and the OCD group. Repeating compulsions and Hoarding/Saving compulsions were also among the most frequently endorsed types of compulsions endorsed in both groups.

On the RBS-R, Compulsive Behavior was the only subscale endorsed by more participants in the OCD group than the ASD group, although the difference was small (Figure 5). Despite high percentages of both groups endorsing several of the subscales (i.e., Compulsive Behavior, Ritualistic Behavior, and Sameness Behavior), there were very large differences in the

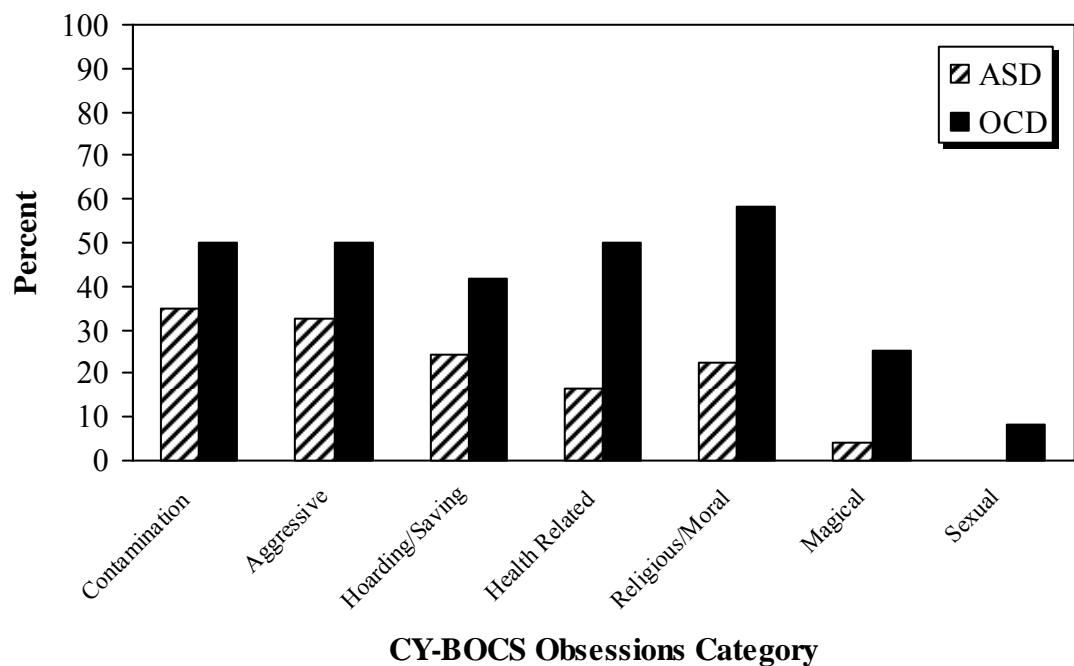


Figure 3. Percent of participants endorsing each Obsessions category on the CY-BOCS Symptom Checklist.

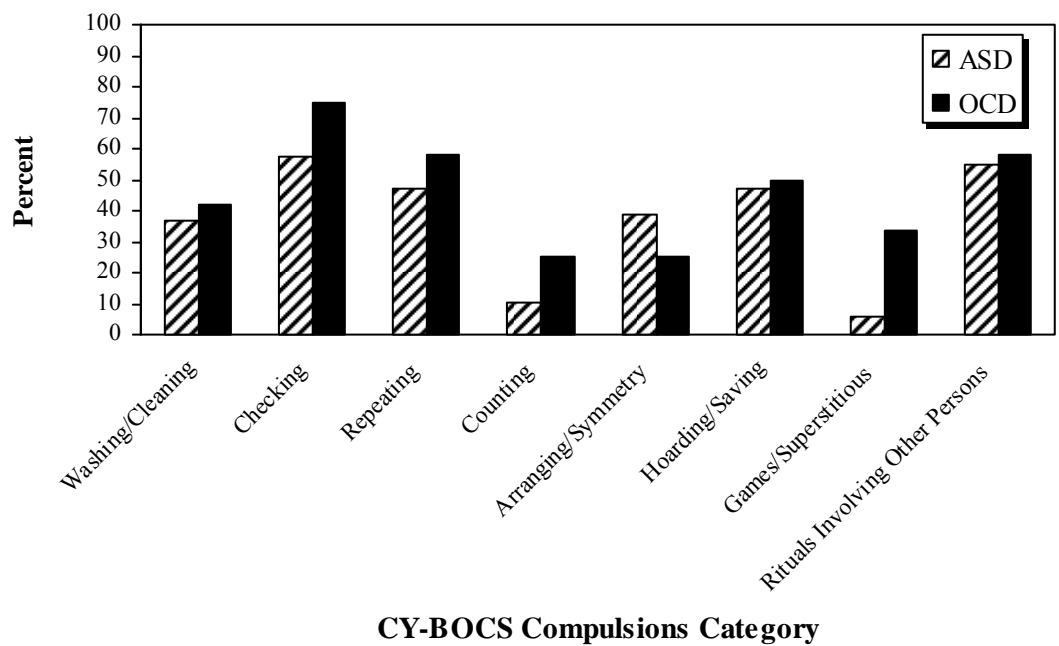


Figure 4. Percent of participants endorsing each Compulsions category on the CY-BOCS Symptom Checklist.

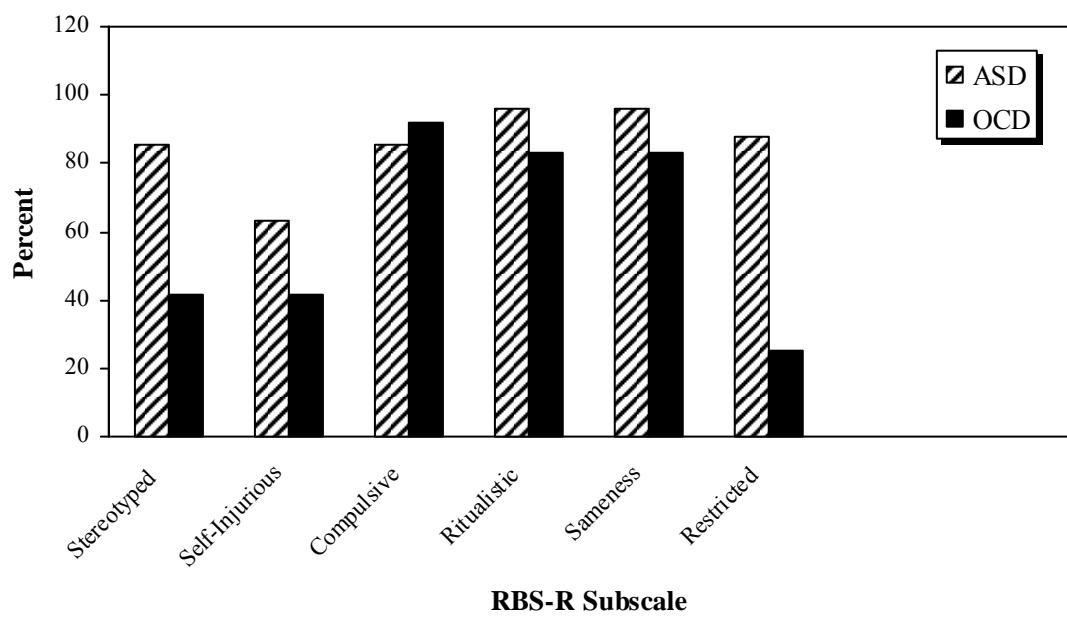


Figure 5. Percent of participants endorsing each subscale on the RBS-R.

percentages of children from each group endorsing the Stereotyped Behavior and Ritualistic Behavior subscales, with these symptom types being much more common in the ASD Group.

Diagnostic Overlap Between ASD and OCD

Finally, it was predicted that there would be a subset of children recruited from the ASD group that meet criteria for both ASD and OCD. The third goal of the current study was to explore the nature of symptomatology in this group of children that meet criteria for both ASD and OCD. Descriptive statistics were calculated for this group of children. The OCD portion of the ADIS recommends that OCD be considered as a possible diagnosis if two out of the following three conditions are met: 1) the parent reports clinically significant levels of compulsions, 2) the parent reports clinically significant levels of obsessions, or 3) the parent indicates any symptoms reported have caused a clinically significant level of interference in the child's life. Following these guidelines, OCD may be considered as a possible diagnosis if a child has significant levels of either obsessions or compulsions that have interfered in daily life. In the OCD group, all but one participant reported clinically significant levels of both obsessions and compulsions. The percentage of participants in the ASD group meeting the criteria for OCD on the ADIS by having clinically significant levels of obsessions, compulsions, or both was calculated.

Of the 49 participants in the ASD group, 36 participants (73.5%) met criteria for OCD on the ADIS. The majority of these participants ($n = 30$) had clinically significant levels of both obsessions and compulsions. Five participants met criteria for OCD based on compulsions alone, and only one participant met criteria for OCD based on obsessions alone. According to their parents, five children in the ASD group had been formally diagnosed with OCD. Of these five participants, three met criteria for OCD on the ADIS, endorsing clinically significant levels

of both obsessions and compulsions. The parents of the other two children reported clinically significant levels of obsessions (but not compulsions), but did not meet criteria because the obsessions did not cause significant interference in the child's life.

A MANOVA was performed to examine whether participants in the ASD group who met ADIS criteria for OCD differed from participants who did not meet criteria for OCD on age, adaptive behavior, or ASD symptoms. Table 9 provides a summary of the means compared in this MANOVA. Partial eta squared (η_p^2) are provided as a measure of effect size, with $\eta_p^2 < .06$ indicating a small effect, $\eta_p^2 = .06$ to $.14$ indicating a medium effect, and $\eta_p^2 > .14$ indicating a large effect (Kittler, Menard & Phillips, 2007). OCD diagnosis based on the ADIS was included as the IV, and chronological age, SIB-R standard score, and SRS Total score were included as DVs. The multivariate test for the effect of ADIS OCD diagnosis on age, adaptive behavior, and ASD symptoms was not significant, $F(3, 45) = 0.52, p = .67, \eta_p^2 = .03$.

A second MANOVA was performed to compare participants in the ASD group who met ADIS criteria for OCD to participants who did not meet criteria for OCD on anxiety, repetitive behavior, and social measures used in the mediation analyses described above. See Table 10 for means included in this MANOVA. Once again, ADIS OCD diagnosis was included as the IV, and CY-BOCS Total Severity score, RBS-R Total Severity score, SCAS-P Anxiety Total score, and SRS Social Total score were included as DVs. The multivariate test for the effect of ADIS OCD diagnosis on the primary study measures was significant, $F(4, 42) = 2.82, p = .04$. Univariate tests of the effect of group found that children in the ASD group who met ADIS criteria for OCD had significantly higher CY-BOCS Total Severity scores, $F(1, 45) = 9.65, p = .003, \eta_p^2 = .18$, RBS-R Total Severity scores, $F(1, 45) = 9.71, p = .003, \eta_p^2 = .18$, and SCAS-P Anxiety Total scores, $F(1, 45) = 5.22, p = .03, \eta_p^2 = .10$. Because differences on the CY-BOCS

Table 9

Characteristics of ASD Groups with and without OCD

<u>Meet ADIS Criteria for OCD?</u>					
	Yes (n = 36)		No (n = 13)		
	Mean	SD	Mean	SD	Effect Size (η_p^2) ^a
Chronological Age (months)	147.56	29.25	141.92	34.98	.01
SIB-R Standard Score	84.58	22.49	83.00	25.12	.001
<u>SRS Total Score</u>	<u>99.67</u>	<u>21.39</u>	<u>92.15</u>	<u>22.94</u>	<u>.02</u>

No significant differences between groups

Table 10

Calculations on Primary Study Measures for ASD Groups with and without OCD

	<u>Meet ADIS Criteria for OCD?</u>				
	<u>Yes (n = 36)</u>		<u>No (n = 13)</u>		<u>Effect Size (η_p^2)^a</u>
	<u>Mean</u>	<u>SD</u>	<u>Mean</u>	<u>SD</u>	
<u>CY-BOCS</u>					
CY-BOCS Total Severity*	19.12	7.60	11.15	8.54	.18
Obsessions Total Severity*	9.31	4.52	5.15	4.90	.14
Compulsions Severity*	9.97	3.61	6.00	4.10	.19
<u>RBS-R</u>					
RBS-R Total Severity*	29.97	14.38	16.31	10.48	.18
Stereotyped Behavior Severity	3.40	2.53	3.23	2.56	.001
Self-Injurious Behavior Severity*	3.23	3.88	.85	1.68	.09
Compulsive Behavior Severity*	4.77	2.97	2.23	1.92	.15
Ritualistic Behavior Severity*	6.51	4.03	3.08	2.60	.15
Sameness Behavior Severity*	9.69	5.26	4.69	2.81	.19
Restricted Behavior Severity	3.23	2.05	2.23	2.13	.05

SCAS-P Anxiety Total*	22.29	15.78	11.46	10.37	.10
<u>SRS Social Total</u>	81.65	17.64	74.77	18.04	<u>.03</u>

^a Effect size based on partial eta squared calculated for Multivariate Analyses of Covariance: $\eta_p^2 < .06$ is small; $.06$ to $.14$ is medium; $> .14$ is large

* Significance of difference between ASD group and OCD group is $p \leq .05$

Total Severity and RBS-R Total Severity were significant, a third MANVOA was performed to examine the severity subscales of both measures (Table 10). With ADIS OCD diagnosis included as the IV, Compulsions Severity score and Obsessions Severity score from the CY-BOCS and the six RBS-R subscale severity scores were included as DVs. The multivariate test for the effect of ADIS OCD diagnosis on the severity subscales was significant, $F(8, 39) = 2.53$, $p = .03$. Univariate tests of the effect of ADIS OCD diagnosis revealed that within the ASD group, participants meeting ADIS criteria for OCD scored significantly higher on all severity subscales except the Stereotyped Behavior subscale, $F(1, 46) = .04$, $p = .84$, $\eta_p^2 = .001$, and the Restricted Behavior subscale of the RBS-R, $F(1, 46) = 2.21$, $p = .14$, $\eta = .05$. All other $ps < .04$ and all other η_p^2 s $\geq .09$.

CHAPTER 4

DISCUSSION

Despite the fact that the presence of repetitive behavior is one of the three main diagnostic categories in ASD, the nature of this category of symptoms is still not well understood. In particular, there is only limited research on how repetitive behaviors are related to other diagnostic and associated characteristics of ASD, such as social problems and anxiety. Further, it remains unclear how repetitive behaviors in ASD may be related to repetitive behaviors in other disorders, such as OCD. The current study expanded the literature in this area in four ways. First, previous reports that children and adolescents with ASD experience significant levels of anxiety were replicated. Second, it explored the relation between repetitive behaviors, anxiety, and social problems in ASD and tested Baron-Cohen's (1989) theory that social problems may result in anxiety which produce repetitive behaviors. Third, the current study compared the types of repetitive behaviors exhibited in a group of children with ASD and a group of children with OCD. Finally, the co-occurrence of ASD and OCD in a group of children with a primary diagnosis of ASD was explored.

Clinical Significance of Repetitive Behaviors and Anxiety in ASD

The first goal of this study was to examine obsessive-compulsive behaviors and anxiety symptoms in children with ASD. While anxiety is not a diagnostic criterion for ASD, authors have noted its presence in individuals with ASD since ASD was first described (Kanner, 1943), and previous research has found that between 11% and 83% of children with ASD experience

anxiety (White et al., 2009). Current results were consistent with these previous reports. Specifically, over 50% of parents rated their children as exhibiting moderately severe levels or higher of obsessive-compulsive behaviors on the CY-BOCS. Similarly, many children with ASD (almost 40%) also experienced clinically significant levels of anxiety. The fact that so many children in the current study scored in the clinically significant range on these measures that were not developed specifically for use in an ASD population suggests that large numbers of children with ASD are significantly affected by symptoms that are not necessarily attributable to ASD. Findings from the current study would support the need for clinicians to screen all clients with ASD for the presence of obsessive-compulsive behaviors and anxiety symptoms not traditionally considered to be part of the ASD diagnosis.

Repetitive Behaviors, Social Problems, and Anxiety in ASD

In children with ASD, the relation between the symptom areas of repetitive behaviors, anxiety, and social problems was examined. The first hypothesis of the second goal, that these three symptom areas would be related in children with ASD, was supported. The two measures of repetitive behaviors were very strongly related to one another. In addition, most repetitive behavior scores were related to social impairment and anxiety, and social impairment and anxiety were related. The only exception found was that the number of obsessions and compulsions endorsed on the CY-BOCS was not related to social problems. Thus, the severity of obsessive-compulsive symptoms and the severity and frequency of ASD repetitive behaviors have more effect on children's social impairment than how many obsessions and compulsions they exhibit. The overall finding that most repetitive behaviors, social problems, and anxiety were related is consistent with previous studies finding relations between anxiety and social

information processing and between repetitive behaviors and social impairment in children with ASD (Meyer et al., 2006; Constantino et al., 2003).

The relation between repetitive behaviors, anxiety, and social problems in children with ASD was further supported by the examination of two mediation models. In the first model, there was inconsistent evidence that anxiety partially mediated the relation between social problems & the severity of repetitive behaviors. As predicted, this model somewhat supports the theory that the core ASD symptom of social impairment leads to anxiety, and that children with ASD then engage in repetitive behaviors to impart predictability in a confusing, anxiety-provoking situation (Baron-Cohen, 1989; Carruthers, 1996). This is the first statistical test of this theory and results offer encouraging, though not exceptionally strong, support for the theory. Because the mediation was only partial, anxiety does not fully explain the relation between social problems and repetitive behaviors in ASD. There are currently many theories of repetitive behaviors in ASD, and none completely explains the development and maintenance of all types of repetitive behaviors (Turner, 1999). The first mediation model examined in the current study tested only one of those theories. Thus, the fact that only a partial mediation was found is consistent with the suggestion other authors have made that a multiple deficits model of repetitive behaviors in ASD is likely to provide the most thorough understanding of this symptom area (Baron-Cohen & Swettenham, 1997; Happé & Frith, 1996; Pennington et al., 1997).

Because of the possible overlap between ASD and OCD, an alternate model that has been indirectly suggested in the OCD literature (de Silva & Rachman, 1998; O’Kearney, 1998; Piacentini et al., 2003; Rachman, 1993; Salkovskis, 1985, 1989) was also tested. This model was more strongly supported in children with ASD than the previous model. Specifically, the

relation between anxiety and social problems was fully mediated by the severity of repetitive behaviors. In other words, when children with ASD are anxious, they may engage in repetitive behaviors to cope, and these behaviors lead to the development of social problems. According to this model, repetitive behaviors fully account for the relation between anxiety and social problems in children with ASD.

Both mediation models suggest that the severity of a child's anxiety predicts the severity of a child's repetitive behaviors. Researchers who study ASD and researchers who study OCD have suggested that children engage in repetitive behaviors to reduce anxiety. However, the reason for experiencing anxiety in the first place may be different in each group. In ASD, anxiety is hypothesized to be a result of impairment in social understanding, while in OCD, anxiety is thought to be a result of intrusive thoughts. Regardless of the source of the anxiety, this study supports the link between anxiety and repetitive behaviors in children with ASD. In the partial mediation of the first model, social problems continue to predict some amount of repetitive behaviors, even when controlling for anxiety. Alternatively, the second model indicates that repetitive behaviors also predict social problems. The rigidity and insistence on sameness exhibited by children with ASD can, indeed, interfere with a child's ability to understand social interactions. Similarly, circumscribed interests can lead to difficulty making friends as children with ASD are unable to talk about their peers' interests. Finally, stereotyped behavior may lead to children with ASD being ostracized by their peers for their unusual mannerisms.

Because both models were at least partially significant, it is difficult to interpret these results as providing indication of causal relations between the three symptom areas. The second model, in which the relation between anxiety and social problems was fully mediated by

repetitive behaviors, was clearly a better fit in the current group of children with ASD than the first model, in which the relation between social problems and repetitive behavior was only partially and weakly mediated by anxiety. However, in addition to interpreting each model separately, it is possible that the two models do not have to be mutually exclusive. For example, the relation between repetitive behaviors, anxiety, and social problems may be more circular in nature. In some cases, the core ASD symptom of social impairment does lead to anxiety, and children may engage in repetitive behaviors to make the environment more predictable or reduce arousal. However, an increase in anxiety and the subsequent repetitive behaviors may compound the already present social problems. This potentially circular relation between repetitive behaviors, anxiety, and social problems supports the complexity of the development and maintenance of repetitive behaviors in ASD. The fact that both models are supported has implications for the treatment of children with ASD. The ASD model suggests that the most appropriate treatment approach would begin by addressing social impairments. However, the alternate model suggests that treating anxiety first would be more effective in improving repetitive behaviors and social problems. Results from the current study indicate that either treatment approach could be potentially effective. The implication of a circular relation among symptom areas would be that intervening at any point in the cycle could potentially lead to improvements in other symptom areas. This approach to treatment is consistent with the cognitive-behavioral model that thoughts, feelings, and behaviors are related, and that treating one area affects the other two areas. However, some children may have more primary deficits in social skills, while anxiety may be more prominent in other children. If a child is dually-diagnosed with ASD and OCD, the primary diagnosis may lend support to choosing which model from the current study will best inform the approach to treatment. Regardless which

model is followed, it is clear that both models suggest that anxiety leads to repetitive behaviors in children with ASD, and treating anxiety will likely affect the severity of repetitive behaviors. Because the alternate model, which was informed by the OCD literature, was supported in this group of children with ASD, the OCD treatment literature may be useful in guiding the treatment of children with high-functioning ASD.

Comparison of Repetitive Behaviors in ASD and OCD

The third goal of the current study was to compare repetitive behaviors in children with ASD and children with OCD. In support of this goal, the first hypothesis predicted that both groups would have similar Compulsions Severity scores on the CY-BOCS, but that Obsessions Severity scores would be higher in children with OCD. Results indicated that the severity of compulsions and obsessions were similar in both groups. However, when the frequency of CY-BOCS symptoms was examined, it was found that the number of obsessions symptoms endorsed was greater in children with OCD. The number of compulsions symptoms endorsed, like the severity of compulsions, was similar in both groups.

In addition, it was hypothesized that on the RBS-R, children with ASD would have higher Stereotyped, Ritualistic, Sameness, and Restricted Behavior Severity scores while children with OCD would have higher Compulsive Behavior Severity scores. The current study found that the severity of the Stereotyped Behavior and Restricted Behavior subscales was greater in children with ASD, but the two groups had similar levels of severity on all other subscales. A comparison of the frequency of symptoms endorsed on the RBS-R also revealed that children with ASD had more symptoms of Stereotyped Behavior and Restricted Behavior than children with OCD. Again, the frequency of items endorsed on other subscales was not significantly different between groups.

Taken together, the results of these comparisons reveal that when children with ASD and children with OCD have obsessions and compulsions, they are similarly impairing in both groups. However, a greater number of obsessions may be a distinguishing factor between many children with ASD and children with OCD, as children with OCD had more obsessions than children with ASD. Conversely, the Stereotyped Behavior and Restricted Behavior subscales on the RBS-R may be particularly helpful in setting apart children with ASD, as they had significantly more severe symptoms and a greater number of symptoms on these two subscales. In the only published study directly comparing repetitive behaviors in children with ASD and children with OCD, Zandt and colleagues (2007) also found differences in the number of symptoms endorsed on the CY-BOCS. Although their groups differed on the number of compulsions and obsessions endorsed, the current study found evidence only for increased number of obsessions in children with OCD.

The second hypothesis addressing the goal of comparing symptoms between children with ASD and children with OCD was that certain types of CY-BOCS symptoms would occur more frequently in one group than in the other group. Because of the qualitative nature of this type of data (i.e., percentage of children endorsing each symptom), this hypothesis was more exploratory in nature than hypotheses for the direct comparison of means between groups. The qualitative approach of examining which symptoms were endorsed has been used by other investigators and was included in the current study to allow for comparison to other research findings.

While there were some symptoms that occurred at similar rates in both groups, only Arranging/Symmetry compulsions was endorsed by more children the ASD group than children in the OCD group. Across both obsessions and compulsions categories, all other symptoms

occurred more often in the OCD group than in the ASD group. Despite more children with OCD than children with ASD exhibiting almost all types of compulsions, the most common compulsions in each group were similar, regardless of what percentage of the group endorsed having them. Checking Compulsions, Rituals Involving Other Persons, Repeating Compulsions, and Hoarding/Saving Compulsions were the most commonly reported types of compulsions in both groups. Zandt and colleagues also found that these four types of compulsions were among the most frequently endorsed in both children with ASD and children with OCD. The most common types of obsessions reported were also similar for each group.

With the exception of Religious/Moral obsessions, which were more frequently endorsed in the OCD group than in the ASD group, the top few types of obsessions endorsed by each group were similar. Although the OCD group endorsed all obsessions at greater rates than the ASD group, Contamination and Aggressive obsessions were among the most common types of obsessions endorsed by both groups. These results are somewhat consistent with Zandt and colleagues' (2007) study in which Contamination and Aggressive obsessions were the most frequently endorsed obsessions in the OCD group and Contamination obsessions were among the top two types of obsessions endorsed in the ASD group. However, Aggressive obsessions occurred at much lower rates and Religious/Moral obsessions occurred at higher rates in Zandt et al.'s ASD sample. The qualitative analysis from the current study suggests that when comparing obsessive-compulsive symptoms, as measured by the CY-BOCS, between these two groups, the number of obsessions endorsed seems to be the best way to distinguish between diagnoses; the severity and types of obsessions and compulsions were similar in children with ASD and children with OCD.

The percentage of children in each group endorsing the six types of repetitive behaviors measured by the RBS-R was also examined. Among the most common symptoms in both children with ASD and children with OCD were Compulsive Behavior, Ritualistic Behavior, and Sameness Behavior; over 80% of both groups endorsed items on these subscales. Despite this significant overlap, the RBS-R did provide useful information for measuring differences between the two groups. Consistent with the results of the comparison of severity and frequency scores, symptoms on the Stereotyped Behavior and Restricted Behavior subscales of the RBS-R were present at much higher rates in the ASD Comparison group than in the OCD group. Therefore, the current study provides support for the idea that examining stereotyped behavior and restricted behavior will be particularly useful in differentiating ASD from OCD.

From this comparison of the pattern of symptoms exhibited by children with ASD and children with OCD, it is understandable that so many clinicians struggle with differential diagnosis between these two disorders. This study revealed a great deal of overlap in both the severity and type of repetitive behaviors present in both groups. However, there does appear to be support for differences between the groups. In particular, obsessions (as measured by the CY-BOCS), and stereotyped and restricted behaviors (as measured by the RBS-R) may best distinguish between children with ASD and children with OCD.

Previous studies have found support for three different types of repetitive behaviors in ASD: repetitive motor movements, insistence on sameness, and circumscribed interests (Honey et al., 2008; Lam et al., 2008). Findings from the current study, that stereotyped and restricted behavior are different in children with ASD and children with OCD, lend support to the literature on the heterogeneity of repetitive behaviors. Perhaps Stereotyped Behavior was different between children with ASD and children with OCD in the current study because it clearly

measures lower-level, sensory-motor repetitive behaviors whereas most of the subscales on the RBS-R and the obsessions and compulsions measured by the CY-BOCS reflect higher-order repetitive behaviors. Because these lower-level behaviors are often found to diminish with increased age and cognitive ability in children with ASD, their presence in higher functioning children could be especially indicative of ASD (Militerni et al., 2002). Therefore, stereotyped behavior may be particularly helpful with differential diagnosis in children without intellectual disability. A second type of repetitive behavior, restricted behavior (i.e., circumscribed interests), may also be predominantly found in children with ASD. Previous authors have suggested that stereotyped motor movements occur in both ASD and other disorders such as intellectual disability and insistence on sameness resembles the compulsions observed in OCD (Turner, 1999). However, circumscribed interests are rarely, if ever, described in other clinical groups. The current study supports the uniqueness of intense circumscribed interests to ASD. The subscales that were similar in children with ASD and children with OCD measure the third type of repetitive behaviors, insistence on sameness. The lack of difference between groups on these subscales supports Turner's suggestion that these behaviors are similar to the compulsions of OCD.

Overall, the comparison of repetitive behaviors in children with ASD and children with OCD suggests that different patterns emerge in each group and that the CY-BOCS and RBS-R, when used in combination, may be particularly useful tools in differentiating ASD and OCD. However, to be most effective, the current study would indicate that the CY-BOCS should be used in a slightly different way than it is traditionally used in the OCD population. This study did not find significant differences in severity scores between the two groups; therefore using only the scores generated by the interview portion may not be especially useful, other than to

evaluate the clinical significance of a child's symptoms. A close review of the number of symptoms endorsed on the symptom checklist, however, may provide important information that can aid in differential diagnosis. Particularly, high rates of obsessions may be more indicative of OCD than ASD. Similarly, children with ASD seem to be more likely than children with OCD to exhibit frequent and severe symptoms on the Stereotyped Behavior and Restricted Behavior subscales of the RBS-R.

It should be noted that the results of the current study may not be generalizable to all individuals with OCD. Particularly, a comparison of adults with ASD and adults with OCD may yield different results. Many researchers have proposed that early-onset OCD is a distinct subtype of OCD and may be more likely to be associated with male gender, comorbid tic disorders or Tourette's syndrome, family history of OCD, increased symptom severity, and possibly treatment resistance (Delorme et al., 2005; Lomax, Oldfield, & Salkovskis, 2009; Rosario-Campos et al., 2001). In addition, symptom presentation may be somewhat different for children with early-onset OCD. For example, symptoms such as touching/rubbing, blinking/staring, symmetry/exactness, aggressive obsessions, and feelings of incompleteness or the need for things to be "just right" have been found to be more common in tic-related OCD, which is often associated with early-onset OCD (King & Scabhill, 1999). In addition, children with early-onset OCD may be less likely to have specific obsessions related to their compulsions and may have less insight into the disorder (Geller et al., 1998; King & Scabhill, 1999).

However, a number of studies have found that the symptom presentation of children with early-onset OCD is typically very similar to the presentation found in adults with OCD (e.g., Flament et al., 1988; Swedo, Rapoport, Leonard, Lenane, & Cheslow, 1989). In addition, the only study published directly comparing adults with high-functioning ASD and adults with OCD

found results that are somewhat consistent with results from the current study. For example, Russell et al. (2005) found similar patterns of obsessions and compulsions in adults with ASD and adults with OCD. A direct comparison between the most commonly endorsed symptoms in Russell et al.'s study and the current study is difficult, however, because the symptom categories on the Y-BOCS (used in Russell et al.'s study) are not exactly the same as the symptom categories on the CY-BOCS. Therefore, more studies comparing both children and adults with ASD and OCD should be completed to determine whether findings from the current study and from Russell and colleagues' study are representative of all children and adults with OCD.

Diagnostic Overlap Between ASD and OCD

The fourth goal of the current study was to explore the diagnostic overlap between ASD and OCD. In this sample of children with ASD, 74% met criteria for OCD on the ADIS. Most of these participants met criteria for both obsessions and compulsions. Seventy-four percent is significantly higher than previously reported rates of OCD in ASD; for example, Russell and colleagues (2005) found that only 25% of adults with ASD met criteria for OCD. However, 74% is within the range for children with ASD who exhibit clinically significant levels of anxiety (White et al., 2009). There are a number of possible reasons why the current study found such high rates of OCD in the ASD group. One possibility is that this study measured a slightly different construct than other studies. Specifically, many previous studies report on symptoms of anxiety, not necessarily whether DSM-IV-TR diagnostic criteria are met for specific anxiety disorders. In addition, some previous studies examining the overlap between ASD and anxiety disorders have included the full spectrum of ASD, whereas the current study included only children with high-functioning ASD. It is possible that anxiety, and OCD in particular, is more common in children with ASD who are more cognitively able. It is also possible that the method

of data collection affected results. The majority of studies have relied on teacher-, self-, and parent-report questionnaires rather than on an interview format. The use of an interview format in the current study allowed for clarification and additional probing of symptoms reported, possibly yielding more accurate results than questionnaires. However, it is possible that the current study overestimated the overlap between ASD and OCD. Only the OCD portion of the ADIS was administered, so a more thorough clinical interview may have revealed that symptoms parents reported on the ADIS may have actually been better explained by a different anxiety disorder, or even by the ASD diagnosis. In addition, the current sample may have been biased and not representative of all children with high-functioning ASD. Advertisements indicated that the project was a study on repetitive behaviors, and it is possible that only parents of children who had high rates of repetitive behaviors chose to participate.

A comparison of the children in the ASD group who also met ADIS criteria for OCD and the children who did not meet criteria for OCD revealed no differences in chronological age, adaptive behavior skills, or level of ASD symptomatology (i.e., SRS scores). As might be expected, children who met criteria for both ASD and OCD were reported to have higher severity scores on all subscales of both the CY-BOCS and the RBS-R, with the exception of Stereotyped Behavior and Restricted Behavior. The groups did not differ on these two subscales. In the previous comparison of the two study diagnostic groups, the ASD Comparison group and the OCD group had significantly different severity scores *only* on the Stereotyped and Restricted Behavior subscales. The lack of difference on these subscales between the children with ASD only and the children with ASD who also met criteria for OCD is consistent with previous conclusions that these subscales are particularly sensitive to ASD symptomatology. Because all of the participants in this analysis had been formally diagnosed with ASD, it follows that they

would have similar severity on these two subscales. Participants who met criteria for OCD in addition to ASD also had significantly higher rates of anxiety than participants who did not meet criteria for OCD. This pattern would be expected, given that, in this sample, children in the OCD group had higher rates of anxiety than children in the ASD group. In a future study, the separate examination of the two mediation models tested in the current study in each of these subgroups of children with ASD would be interesting. It is possible that separating children with ASD into subgroups, such as those who do meet criteria for OCD and those who don't, would reveal that one model fits one group better than the other, instead of the circular pattern found in the current study. As described above, the two models have different implications for treatment approaches. A logical hypothesis would be that children who meet criteria for both disorders might be better treated by following the model in which the relation between anxiety and social problems is mediated by repetitive behaviors, with treatment focusing first on anxiety reduction. Alternatively, it is possible that a more "pure" ASD group would show even stronger support (i.e., full mediation) for the model in which social problems lead to anxiety and then to an increase in repetitive behaviors. In that case, beginning treatment with social skills training would potentially have the greatest impact on anxiety and repetitive behaviors.

Limitations and Future Directions

The number of participants in the full ASD group was adequate for exploring the relation between repetitive behaviors, anxiety, and social problems. However, the smaller samples used to compare the ASD group and the OCD group as well as the subsamples of children with ASD who did and did not meet ADIS criteria for OCD should be considered a limitation. Despite the limited number of participants, the sample is comparable to the only other published study comparing repetitive behaviors in children with ASD and children with OCD. Zandt and

colleagues (2007) included only 19 participants with ASD and 17 participants with OCD. Because results from the current study are reasonably consistent with Zandt et al.'s study, it is possible that a larger sample would find similar results. However, this specific area of research is in its infancy, and additional studies, especially with larger samples, should replicate the findings before they are widely accepted.

A second limitation of the current study is that all data were reported by parents. This design was chosen for several reasons, including an attempt to maximize participant recruitment. The parent interview and survey design allowed for recruitment across the country. In addition, parents were chosen as reporters to minimize the possibility that the communication impairments associated with ASD would lead to less clear reporting by children and adolescents. Many parents indicate that they can understand their children better than strangers can understand their children; thus, parents may have been able to report on their children's thoughts and behaviors more accurately than the children could report to a researcher. Alternatively, including only parents' reports may have limited the accuracy of the data. While behaviors are readily observable by parents, thoughts and feelings are not. Children may be experiencing significantly more or less symptoms than their parents realize because they have not reported internal symptoms to their parents. This may especially be true for children with ASD, given the frequency of communication impairments. Ideally, selecting a group with high-functioning ASD minimized this possibility, as all participants in the current study were verbal and of average intelligence. However, a future study may better capture the symptom areas explored in this study if children reported on their own symptoms, either individually or jointly with their parents.

A third area for improvement upon the current study would be the inclusion of a more comprehensive measure of social behavior. The SRS is a measure of social impairment that includes many items that target symptoms typically observed in children with ASD, rather than a measure of more general social development or functioning. One possible way to more fully assess the range of social problems (as well as other symptom areas) that may be experienced by children with ASD and children with OCD would be to design a study in which the symptom areas can be directly observed. Although parent-report is a very common method of data collection, both for research and clinical practice, direct observation of target behaviors would remove any potential bias parents may have in their report. Even more ideal would be to include experimental manipulation of repetitive behaviors, anxiety, and social problems. If experimental conditions were developed that allowed for manipulation of these behaviors, more conclusions could be drawn regarding causal relations among the symptom areas.

The current study expanded the literature on repetitive behaviors in ASD by examining the relation between obsessive-compulsive behaviors, anxiety, and social problems through statistical analysis of the mediation model of these symptom areas suggested by previous authors, directly comparing repetitive behaviors in children with ASD and children with OCD for only the second time, and exploring the diagnostic overlap between ASD and OCD in a large group of children with a primary diagnosis of ASD. While the ASD sample was sufficiently large for the analyses in the current study, a much larger sample of children with ASD would allow future studies to attempt to replicate findings from the current study in different subgroups of children with ASD. For example, it would be interesting to examine the mediation models supported by this study in subsamples of children with ASD who do and do not meet diagnostic criteria for OCD. While both models were supported in the current study, it is possible that more

refined samples would yield stronger support for one or the other model. Results could also be studied in subgroups of children of different ages, children with different specific diagnoses within the autism spectrum, and children with varying ability levels. The models could also be tested in a group of children with OCD to determine if the same circular pattern emerges.

Another idea for future research would be to interview children and adolescents about their own symptoms instead of relying solely on parent report. The choice to use only parent report measures in the current study was a practical one. It would be interesting to learn if a self-report of symptoms would reveal similar findings as those based on parents' perceptions of their children's thoughts, behaviors, and feelings. To clarify the findings further, a study including a direct manipulation and observation of anxiety or social behavior would provide a less biased assessment of the effect of these symptoms on repetitive behaviors. For example, children's repetitive behaviors could be observed and their anxiety could be measured during a time of solitude compared to a time of complex social interaction. Alternatively, level of social impairment could be assessed directly through the administration of social problem solving vignettes, anxiety could be assessed through physical symptoms of anxiety, and repetitive behaviors could be directly observed.

Finally, future research should include additional comparisons of repetitive behaviors between children with ASD and children with OCD. While the current study provided a basic comparison of symptoms between groups and was consistent with the only other published study on this topic, larger sample sizes would allow for more complex statistical analyses. For example, previous studies have performed factor analyses on measures of repetitive behaviors in each group separately using measures specifically developed for that group (e.g., ADI-R in ASD, CY-BOCS in OCD). Performing similar analyses on measures of ASD and measures of OCD in

both groups would provide an additional way to compare the types of repetitive behaviors present in each group. Similar to the ideas described above, comparing children with ASD and children with OCD on direct observations and self-reports of repetitive behaviors, anxiety, and social problems would also provide a more thorough comparison between groups.

Summary

Despite a recent surge in research on repetitive behaviors in ASD, this topic has traditionally lagged behind the amount of literature on social and communication impairments in ASD. The limited availability of research on repetitive behaviors has led to an inadequate understanding of the similarities and differences between the repetitive behaviors observed in ASD and the repetitive behaviors observed in other disorders, particularly in OCD. In the current study, the examination of the relation between repetitive behaviors, anxiety, and social problems in ASD, as well as the diagnostic overlap between ASD and OCD, was aimed at providing a deeper understanding of this third category of symptoms (after social and communication impairments) in ASD. In addition, the current study attempted to add to the literature as only the second study directly comparing repetitive behaviors in children with ASD and children with OCD.

Results indicated that at least moderate percentages of children with ASD experience significant levels of repetitive behaviors and anxiety. In children with ASD, repetitive behaviors, anxiety, and social problems are clearly related, although conclusions about directionality cannot be drawn from this study. Both mediation models tested seem to indicate that anxiety does lead to repetitive behaviors in children with ASD. Restricted and Stereotyped Behaviors were less clearly related to other symptoms, contributing to the growing evidence that these types of repetitive behaviors may be particularly useful in differentiating ASD, especially high-

functioning ASD, from other disorders. The current study provides converging support for other studies that anxiety is a significant clinical issue for many children with ASD. This sample exhibited particularly high rates of OCD-type symptoms.

When comparing children with ASD and children with OCD, there were initial similarities, but upon closer inspection significant patterns emerge. Although the severity of repetitive behaviors is generally comparable in children with ASD and children with OCD, the pattern of the specific types of repetitive behaviors reported is different. Differences are particularly evident between the two groups on the number of obsessions endorsed, with higher rates in OCD, and on Stereotyped and Restricted Behavior, with greater frequency and severity in ASD. The distinction between the two groups on these symptom categories suggests that these symptoms may be useful in differential diagnosis. These differences in the types of symptoms present in each group also supports the theory that a child could potentially exhibit both the ASD “pattern” and the OCD “pattern,” suggesting that both diagnoses may be appropriate in some children.

In conclusion, the current study contributes to the growing body of research on repetitive behaviors and anxiety in ASD by testing one of the theories of repetitive behaviors in ASD. It is also one of the first studies to make a direct comparison between children with ASD and children with OCD. A strength of this study is the variety of repetitive behaviors measured, including those typically observed in OCD and those typically observed in ASD. In addition, this is one of the first studies with examination of the relation between repetitive behaviors, anxiety, and social problems as a major goal of the study. Future research should include larger sample sizes, child-reported symptoms, and experimental manipulations of the symptoms of interest.

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