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Examining the Moderating Role of Anxiety Symptoms on Insistence on Sameness in
Children with Autism Spectrum Disorder

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A dissertation submitted in partial fulfillment for the requirements for the degree of

Doctor of Philosophy

In

Clinical Psychology

Seattle Pacific University

School of Psychology, Family, and Community

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Dedication

Sometimes opportunities pass us without giving us the chance to fully demonstrate our maximum potential, only leaving us with the ghosts or stories of our true intent. This document is dedicated to my friends, family, and comrades who never got to fulfill their dreams.

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First, I would like to acknowledge Dr. David G. Stewart for giving me the opportunity to embark on this journey and earn my Ph.D. in clinical psychology. Second, I would like to thank Dr. Beverly Wilson for her willingness to ensure that I successfully completed graduate school; and finally, to my family, friends, and comrades who supported me throughout this process, I thank you all.

Wayne E. Mason Jr.

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Abstract

Restricted and repetitive behaviors (RRBs) have been a core symptom of Autism Spectrum Disorder (ASD) since discovered in the 1940's (Kanner, 1943). More specifically, insistence on sameness, which is considered a subtype of RRBs, has been shown to affect children with considered higher verbal skills in this population. In addition, it is well documented that anxiety symptoms commonly co-occur with ASD, and anxiety symptoms (AS) and IS have been linked through previous research. Using archival data, the purpose of the present study was to investigate the conditional effect on anxiety symptoms on the relation between developmental status (DS) and insistence on sameness (IS) in children with ASD with verbal abilities greater than 85. The sample included 108 individuals (ages 3:0 – 6:11) and was comprised of two groups. The first group was the ASD group, which consisted of 36 children diagnosed with ASD (Male = 27, Female = 9), and the second group was comprised of 72 typically developing (TD) children (Male = 44, Female = 28). All participants were involved in a greater study called the Study of Autism and Self-Regulation (STAR). Findings revealed a significant interaction between DS and IS ($B = .06$, $SE = .03$, $p = .04$, $\Delta R^2 = .36$) at low, moderate, and high levels of anxiety symptomatology. Developmental status was shown to have a main effect on IS ($B = -5.78$, $SE = 1.71$, $p = .001$). Additionally, verbal ability and age were significantly correlated with developmental status. The relations between anxiety symptoms and DS, AS and VA, and AS and IS were insignificant. Interestingly, and contrary to expectations, only children with typical development varied in frequency of

their IS behaviors based on their level of anxiety symptoms. Anxiety symptom levels had no impact on IS in the ASD group. This suggests that anxiety in general may onset behavior problems with sameness in populations' non-specific to ASD. Therefore, more research is needed to understand the potential relations among ASD, AS and IS in children.

Chapter I:

Introduction

There is an abundance of evidence suggesting that restricted and repetitive behaviors (RRBs) significantly impact individuals diagnosed with autism spectrum disorder (ASD) during early childhood. More specifically, behavioral patterns and features such as an insistence on “sameness “ and difficulties with adverse reactions to changes in routines and/or environment have been shown to negatively affect children diagnosed with ASD across multiple contexts such as home, school, or social situations (Kanner, 1943). Kanner (1943) first described sameness in association with autism spectrum disorder (ASD) as the “anxiously obsessive desire for the maintenance of sameness” (p. 245). In general, these behaviors are characterized by difficulties with minor changes in routine, resistance to change, and behavioral rigidity (Gotham et al., 2013; Szatmari et al., 2006). Researchers have identified insistence on sameness (IS) behaviors as a core feature and behavioral subdomain of RRBs within autism literature (Lam & Aman, 2007; Mirenda et al., 2010). Unfortunately, the underlying factors that influence these behaviors are not yet fully understood. Therefore, more research is needed to examine the factors associated with ASD that predict IS behaviors in this population.

Anxiety is also a highly prevalent, comorbid, and co-occurring condition in ASD populations (Kerns & Kendall, 2012). Studies show that approximately 40% of individuals diagnosed with ASD also meet criteria for an anxiety disorder (Sukhodolsky et al., 2008), and that children with ASD and anxiety are more likely to exhibit behavioral problems than children who have ASD without anxiety problems. Additionally, there is

evidence to suggest that anxiety is a conditional variable in ASD symptom severity (Wood & Gadow, 2010); such that high levels of anxiety are directly correlated with an increase in RRBs, particularly IS behaviors (Gotham et al., 2012; Sukhodolsky et al., 2008). In general, RRBs are believed to function as an anxiety reduction strategy or consequence of ASD (Joosten et al., 2009; Sukhodolsky et al., 2008). Amaral, Schumann, and Nordahl (2008) argue that the relation between RRBs and anxiety needs to be further explored.

Understanding the role of anxiety in relation to RRBs such as IS appears to be unspecified within literature. Researchers have yet to determine if anxiety symptomology correlates with an increase in restricted and repetitive behaviors among children with autism, or if children with autism engage in higher rates RRBs as a maladaptive coping strategy to reduce anxiety symptoms. Therefore, it is important to study the moderating effect of anxiety on the relation between ASD and IS behaviors in this population. Understanding the nature of this association may lead to the development of more specific treatment interventions regarding IS behaviors. Moreover, there appears to be a gap in the literature exploring the effects of anxiety on IS behaviors in preschoolers diagnosed with ASD.

In the following sections of this paper, I will discuss the constructs used in this study in more depth. I will begin by providing a comprehensive overview of autism spectrum disorder and then restricted and repetitive behaviors (to include insistence of sameness) and anxiety. I will then attempt to demonstrate a nexus among these variables by reviewing empirical studies applicable to the proposed study and conclude with theoretical foundations that reinforce the continued need for study in this area.

Autism Spectrum Disorder

Autism spectrum disorder is considered a complex and heterogeneous neurodevelopmental disorder characterized by impairments in social interaction and communication in addition to restricted and repetitive behaviors or interest in activities and objects (DSM-5; APA, 2013). These deficits typically vary in severity, symptom presentation, and persist throughout the lifespan (Blumberg et al., 2013). In addition, a broad range of other developmental challenges often accompany or are comorbid with ASD, which include intellectual disability, adaptive functioning deficits, and delays in language (expressive and receptive). Further complicating some of these challenges related to atypical developmental processes is the fact that children with ASD are frequently diagnosed with psychiatric conditions such as anxiety, depression, and attention-deficit hyperactivity disorder (ADHD) (Honey et al., 2007; Lawson et al., 2015). These differential diagnoses tend to muddle the diagnostic, cognitive, and behavioral profiles of children with ASD.

Prevalence Rates of ASD

In 2015, the National Health Interview Survey (NHIS) reported that as many as 1 per 45 individuals meet criteria for ASD (Zablotsky, Black, Maenner, Schieve, & Blumberg, 2015), and are four times more likely to be diagnosed in males (DSM-5; APA, 2013). This represents a significant increase in ASD diagnoses within the last 10 years. For example, the prevalence rate for children diagnosed with ASD was 1 in 86 for children ranging from 6 – 17 years old in 2007. In 2012, this rate significantly increased to one per 50 individuals within the same age range. Risk factors appear to be related to parental age, exposure to teratogenic agents in utero, and genetic mutations (APA, 2013)

Etiology of ASD

First described by Kanner (1943) and Asperger (1944), ASD was considered a pervasive development disorder characterized exclusively by observable behavioral and cognitive characteristics. Over the last few decades, advancements in technology such as neuroimaging, neuropsychological assessment, and genetics have improved our ability to study the multifaceted complexities and causal mechanisms associated with ASD. As a result, a myriad of studies and theories have attempted to explain the causes of ASD, which have linked the core symptoms and associated features of ASD to molecular/genetic, neural networks (micro and macro), and behavioral deficiencies (Inui, 2013; see reviews). South, Ozonoff, and McMahon (2007) propose that ASD is a very complex disorder with numerous causal pathways that arise from a combination of factors; however, some researchers assert that the most plausible explanation regarding the etiology of ASD appears to be attributable to atypical brain development (Just, Keller, Malave, Kana, & Varma, 2012).

Evidence suggests that individuals diagnosed with ASD are predisposed to anatomical changes in the brain along with problems stemming from functional connectivity between brain systems (Belmonte et al., 2004; Cools, Clark, & Robbins, 2016; Herbert et al., 2004; Inui, 2013; Just, Keller, Malave, Kana, & Varma, 2012). Areas of the brain that have been found to deviate from typical brain development include the following brain structures: amygdala, hippocampus, and prefrontal and parietal cortices of the brain (Inui, 2013). For example, increased cell size and cell-packing density in the amygdala and hippocampus was observed in individuals with ASD; and parietal cortex abnormalities, which have been shown to correlate with social

communication and interaction scores on the Autism Diagnostic Interview-Revised (ADI-R; Rutter, Le Couteur, & Lord, 2003). In the prefrontal lobe, which primarily encompasses the orbital cortex, dorsolateral prefrontal cortex, and inferior prefrontal cortex, studies show a disproportionate increase of white matter and reduced gray matter in individuals diagnosed with ASD compared to controls in the frontal lobes areas of the brain (Herbert et al., 2004). This is important because the prefrontal cortex is responsible for a bevy of cognitive processes such as executive functioning, emotional and behavioral regulation. However, increases in white matter are correlated with larger brain volume and lower overall brain functioning in autism, and researchers postulate increases in gray matter might lower the efficiency of information processing between neurons. It is suggested that larger brain size causes reductions in functional neural connectivity between brain systems, which result in conduction delays (Belmonte et al., 2004; Just, Cherkassky, Keller, & Minshew, 2004). Some researchers believe that these neurological abnormalities contribute to RRBs in ASD (Boyd, McBee, Holtzclaw, Baranek, & Bodfish, 2009).

Restricted and Repetitive Behaviors

In the mid 20th century, Asperger (1944) and Kanner (1943) designated RRBs as a core symptom of autism. Kanner (1943) defined RRBs as group of anxious behaviors high in frequency, repetitious, and inflexible in nature. The “restricted” component of RRBs are considered perseverative and rigid in nature—highlighted by an “insistence on sameness” and “preoccupations” with certain interests and activities; whereas, the “repetitive” component represents behaviors such as the repetitive use of words or speech, stereotyped motor movements, and routine and ritualistic behaviors that are

repeatedly acted out (Leekam, Prior, & Uljarevic, 2011). This original description of RRBs is similar to contemporary conceptualizations of RRBs in the ASD research community (Lam & Aman, 2007; Leekam, Prior, & Uljaveric, 2007). The *Diagnostic and Statistical Manual of Mental Disorders*, characterizes RRBs into four subtypes: a) repetitive or stereotyped motor movements with the body, objects, or use of speech, b) inappropriate insistence with sameness, rigidity regarding routines, and ritualistic verbal and nonverbal behaviors, c) restricted or preoccupied interests that are unusual in intensity or focus; and, d) unusual sensory interest or hyper-reactivity and/or hypo-reactivity to sensory stimuli (DSM-5; American Psychiatric Association [APA], 2013). Overall restricted and repetitive behaviors represent a heterogeneous constellation of behaviors that can be further divided into different dimensions or subcategories (Bishop et al. 2013). According to Joseph, Thurm, Farmer, and Shuway (2013), RRBs onset approximately at the age of two years old and remain relatively stable until the age of seven. However, the severity and frequency of RRBs often depend on variables such as age, IQ, and sex.

RRBs Order Classifications

Bishop and colleagues (2013) note that RRBs can be subdivided into two distinct subcategories. One is “repetitive sensory motor (RSM)” behaviors and the other is, IS behaviors. In the autism literature, RSM behaviors are considered “lower order,” and encompass motor stereotypies, sensory seeking behaviors, and repetitive use of objects (Bishop et al., 2009; Cuccaro et al. 2003). Research has identified age and IQ as negatively correlated predictors of RSM behaviors. As a result, evidence shows RSM behaviors are more common among children with ASD who are younger than age three

and those who have severe symptoms presentation (Bishop et al. 2013; Leekam, Prior, & Uljaveric, 2007). For example, children on the spectrum who experience significant deficits in their cognitive profiles are more likely to engage in RSM behaviors compared to those with relatively intact cognitive functioning (Bishop et al., 2013; Cuccaro et al., 2003). Alternatively, IS behaviors are typically associated with higher-order mental functions in ASD, and are not dependent on age and IQ. Insistence on sameness differs in its phenotypic expression and tends to be more associated with ASD even in the absence of challenges related to cognition.

Insistence on Sameness Behaviors

Insistence on sameness behaviors represent a cluster of behaviors that are ritualistic, compulsive and resistant to change (Cuccaro et al., 2003); and, unlike RSM behaviors, have been associated with higher-functioning abilities in children with ASD such as intelligence (Gotham et al., 2013). Examples of IS behaviors include adherence to routines, peculiarity about certain food, and preoccupations with certain interest or objects (Leekam et al., 2007). Insistence on sameness behaviors was considered a core symptom of RRBs in early autism literature (Kanner, 1943). Presently, factor analyses consistently identify IS behaviors as a factor within the RRBs domains (Cuccaro et al., 2003; Szatmari et al., 2006). Researchers argue that IS behaviors tend to be more chronic and persistent, which they hypothesize might be attributable to neural pathways in the brain (Factor et al., 2016).

Anxiety and ASD

According to Gotham et al. (2013), anxiety is associated with a broad range of behavioral and cognitive problems (e.g. attention deficits, aggression, etc.) in children

with ASD. Anxiety symptoms fit within a cluster of disorders commonly characterized by unrealistic or irrational notions of fear or anxiousness (DSM-5; APA, 2013). This constellation of disorders, which include social anxiety, separation anxiety, generalized anxiety disorder, obsessive-compulsive disorder, and several other disorders, frequently present in children with ASD (Gotham et al., 2013; Kerns & Kendall, 2012). Researchers believe that anxiety and ASD may share some of the same underlying genetic and biological causal mechanism (Gotham et al., 2013); and that understanding how anxiety and ASD interact will contribute the development of phenotypic profiles across ASD.

Children with ASD and co-occurring anxiety often report greater symptom impairment, more social challenges, and require more treatment-related services than children without comorbid anxiety and ASD (see Kerns & Kendall, 2012). Prevalence rates of anxiety symptoms in ASD appear to be markedly high. Community-based, clinical, and experimental samples reveal that anxiety symptoms in ASD populations may be as high as 84% in youth (White, Oswald, Ollendick, & Scahill, 2009). Studies performed in community-based samples reveal that rates of anxiety symptoms in individuals range between 11% and 42% with 50% of those who experience anxiety reporting a lifetime rate (Kerns & Kendall, 2012). In clinical samples, it is reported that anxiety symptoms range from 14% - 59%, while experimental settings report statistics ranging between 50% – 84%. Often times, these individuals meet clinical criteria for an anxiety disorder (Sukhodolsky et al., 2008). Typically, anxiety disorders onset during childhood and are more common in females than males (2:1 ratio; DSM-5; APA, 2013); however, in ASD populations, this ratio appears to be proportionate (1:1) and null of gender effects (Kern & Kendall, 2012).

Even though research shows that a large percentage of individuals diagnosed with ASD also qualify for a diagnosis of anxiety (Leyfer et al. 2006; Simonoff et al. 2008), findings ascertaining the relation between ASD and anxiety remain relatively variable for reasons that appear related to methodology, sample characteristics, and differences in the definition of anxiety across studies (Kerns & Kendall, 2012). Additional confounds that complicate the role of anxiety in ASD are prevalence rates, unique symptom presentations, and symptom overlap between anxiety and ASD symptomatology (Kerns & Kendall, 2012; Leyfer et al., 2006; Simonoff et al, 2008). Furthermore, research has shown that children with high-functioning ASD often experience greater challenges with anxiety (Gotham et al., 2013).

Anxiety and RRBs in Autism Spectrum Disorder

Multiple studies have shown a direct correlation between anxiety and insistence on sameness in children with ASD. More specifically, greater rates of anxiety are associated with increases in RRBs, but researchers are uncertain if anxiety instigates RRBs or if RRBs are a mechanism used to minimize anxiety in ASD (Jootsen et al., 2009; Sukhodolsky et al., 2008). For example, Rodgers, Riby, Janes, Connolly, and McConachie (2011) conducted a study investigating anxiety and RRBs in children ($n = 54$) diagnosed with either ASD ($n = 34$) or Williams Syndrome (WS, $n = 34$). Their findings revealed that children with ASD had increased levels of anxiety compared to the WS group; increased levels of anxiety were associated with an increase in RRBs only in the ASD group even though the WS group was just as likely to engage in RRBs. Studies examining insistence on sameness and anxiety illustrate a similar relationship.

Anxiety and Insistence on Sameness in ASD

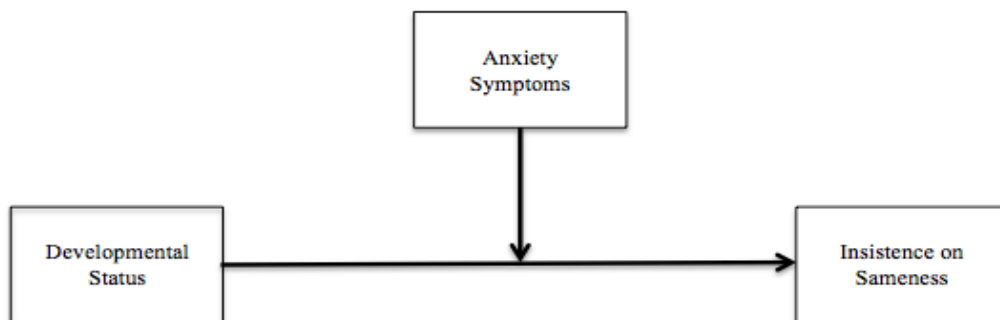
Lidstone and colleagues (2014) found that the relation between anxiety and IS behaviors was mediated by sensory avoidance and sensory sensitivity in a sample of children ages 2 to 17 ($n = 49$) diagnosed with ASD. A direct correlation was identified using parent-reported ratings between anxiety and RRBs as indicated by scores on the Spence Children's Anxiety Scale-Parent version (SCAS-P) and the Preschool Anxiety Scale (PAS)—and a modified version of the Repetitive Behavior Questionnaire-2 (RBQ-2). Anxiety predicted RBQ-2 Total scores ($r = .41, p = .004$) and IS behaviors ($r = .46, p < .001$). In another study conducted by Gotham et al. (2013), anxiety levels were found to predict rates of RRBs and IS behaviors in children and adolescents with ASD ($n = 1429$, ages 5 – 18 year old). The results of this study also revealed that anxiety and IS behavior were directly linked ($r = .28, p < .001$). In addition, 46% of the participants in this study had anxiety scores that were within or above the subclinical range as evidenced by the Child Behavior Checklist. Although research consistently links IS behaviors to anxiety, studies show that these two variables are distinguishable constructs (Bishop et al. 2013; Chowdhury et al. 2010; Gotham et al., 2012). Researchers in these studies' assert that future studies need to examine anxiety and RRBs using different measures.

The Current Study

A plethora of studies have demonstrated that children with ASD experience significant challenges with insistence on sameness, and anxiety symptoms and/or anxiety disorders. Additionally, anxiety is a highly common co-occurring and comorbid condition in ASD. Studies routinely show that greater levels of anxiety predict greater frequency of RRBs in ASD (Jootsen et al., 2008; Rodgers et al., 2012; Sukhodolsky et al., 2008).

Identifying whether or not anxiety symptoms will moderate the relation between ASD status and insistence on sameness will help researchers further outline the predictive power of anxiety in relation to RRBSs in general. This should inform treatment interventions and improve our understanding of the potential role of anxiety in common behaviors and symptoms associated with ASD and those with typical development. Thus, the current study examined the conditional effect of anxiety on the relation between DS (ASD vs. TD) and IS (composite of two items from the Autism Behavior Checklist, ABC) in young children diagnosed with ASD. It was hypothesized that DS would predict insistence on sameness in this population. The second hypothesis suggested that anxiety symptoms would predict insistence on sameness. Finally, it was hypothesized that AS would moderate the relation between DS and IS. A conceptual model of these hypotheses is provided below in *Figure 1*.

Figure 1.



Chapter II

Method

Participants

A priori power analysis was conducted to determine an adequate sample size and computed for a linear multiple regression using G*Power software (Faul, Erdfelder, Buchner, & Lang, 2009). Statistical power was set at .80, alpha level at $p < .05$, Cohen's f^2 at 0.20, and number of predictor variables at two (developmental status and anxiety symptoms). Based on the results of the power analysis, a sample size of 81 participants was needed to achieve adequate power for statistical analyses. The author of the study was able to obtain 108 participants (ASD $n = 36$, 75% male and 25% female; TD, $n = 72$, 61% male, and 39% female) using archival data available through a larger ongoing study being conducted at Seattle Pacific University's STAR lab (Study of Autism and Self-Regulation).

Procedure

Recruitment. Families were recruited from various establishments such as pre- and elementary schools (public and private), outpatient clinics serving ASD populations, and local organizations in the greater Seattle area that support autism research. Recruitment involved three methods: sign-up sheets, face-to-face contact, and local advertisements and announcements. Sign-up sheets were used for parents who were interested in receiving a phone call from a graduate research assistant (GRA) to learn more about our study. Recruitment was also conducted in local community or schools or through advertisement/announcements containing general information about our study and contact information.

Enrollment Visit. The original study included an enrollment visit and a laboratory visit. Enrollment visits typically took place at a location that accommodated the preference of the parent and child and were conducted by graduate research assistants. These visits were typically conducted at the family's home or at a local venue such as a library. Parents and their children were asked to sign consent and assent forms during the enrollment visit. Parents with children in the ASD group were also asked to sign a medical release of information form to confirm that the child participants had been given an official diagnosis of ASD. The child's medical record was sent to the STAR lab and stored securely for official use only.

During the enrollment visit, children completed a verbal ability assessment prior to performing the remaining experimental tasks. For inclusion into this study, children were required to obtain a performance score of 85 or greater verbal ability cluster score, which was used to determine whether or not the child's expressive and receptive language abilities were strong enough to complete the remainder of the study. If a participant did not meet eligibility for entry into our study, the family was notified and informed that the child could not be enrolled at that time. Finally, TD children were excluded from this study if they have a sibling diagnosed with ASD or presented with significant levels of ASD symptoms as measured by an autism screener.

University Visit. The university visit typically lasted for approximately 120 minutes. Each visit to the university was videotaped and coded. During this visit, the child completed several standardized experimental tasks in addition to completing two tasks with a parent (Free-play and Parent-Child reading tasks). At the end of each task, the child was given stickers as a motivational incentive. The parent completed a meta-

emotion interview in a separate room where the child can be view from a video monitor. Once the university visit was completed, child participants were given a gift worth \$5.00. The parent/caregiver was compensated with \$50.00 cash and a \$5.00 Starbucks gift card.

Measures

Verbal ability assessment. Child participants in this study completed select subtests from the Differential Ability Scales, Second Edition (DAS-II; Elliot, 2007), during the home visit. Specifically, children were administered both Naming Vocabulary and Verbal Comprehension from the Early Years battery of the DAS-II. Each child's ability score, *T*-score, percentile ranking, and age equivalents were utilized in determining verbal ability. The DAS-II is a norm-referenced comprehensive assessment designed to measure cognitive abilities in children ranging from 2:6 to 17:11. Normative data were collected using 3,480 individuals (DAS-II; Elliot, 2007).

Restricted and repetitive behaviors: One parent of each participant was required to complete the Autism Behavior Checklist (ABC; Krug, Arick, & Almond, 1988). The ABC is a 57-item measure designed to screen for autism symptoms in children ages two to fourteen. It was normed using 1,049 participants and shows strong internal consistency (Krug, Arick, & Almond, 1988). The ABC consists of five subscales, which include: a) Sensory, b) Relating, c) Body and Object Use, d) Language; and, e) Social and Self-Help Skills (Miranda-Linne & Melin, 2002). This measure has items that use a four-point Likert scale, which has the following corresponding values: No = 0, Yes = 1 - 4 (weighted values). Aggregated responses on the ABC can have a maximum of 154 for total score and range from 0 -154. For this study, the TD group had a cutoff score of 54 or below whereas the ASD group had cutoff of 68 or greater. Previous research

indicates that the inter-rater reliability coefficient was .95, with a reliability coefficient of .87 (Krug et al., 1980). Items nine (“Insists on keeping certain objects with him/her”) and fourteen (“Strong reactions to changes in routine/environment”) were compiled into a composite score, which ranged from zero to six. If one item was endorsed, the child was given a score of “3.” If both items were endorsed, the child was given a score of “6.” A score of “0” was given if neither item was endorsed on this measure. These items were selected for the current study because they appeared to closely match Kanner’s description and are consistent with definition of IS in the literature (Cuccaro et al., 2003).

Anxiety. The Behavior Assessment System for Children – Second Edition (BASC-2, Reynolds & Kamphaus, 2004) is a scientifically validated and norm-referenced measure intended to assess a broad range of adaptive and behavioral problems in children and adolescents ages 2 -21. The BASC-2 is comprised of two rating scales, one for parents and one for teachers, along with three unique rating forms: preschool (ages 2 – 5), child (ages 6 -11), and adolescent (12 -21). Respondents answer items on the BASC-2 using a 4-point Likert scale format (*Never, Sometimes, Often, and Almost Always*). Each form takes approximately 20 minutes for respondents to complete. The BASC-2 is designed in this format to capture parent/caregiver and teacher perspectives in domains such as behavior, communication, and social development across developmental age ranges. This study utilized the preschool and child versions’ of the BASC-2 to assess anxiety symptoms in children ranging from ages 3:0 to 6:11. According to Reynolds and Kamphaus (2004), the BASC-2 Parent Report Preschool for children was normed using 478 individuals and has an alpha coefficient of .85. For children ages 4 -5, the preschool version was normed using 640 participants and has an alpha coefficient of .83. Finally,

the child version of the BASC-2 was normed using 546 individuals and has an alpha coefficient of .84. The alpha coefficient was set a .05 in this study.

Chapter III:

Results

Data Analysis

This cross-sectional study investigated a sample of children with ASD compared to children considered typically developing in a laboratory setting. The study included three variables: developmental status, insistence on sameness, and anxiety symptoms. Developmental status (TD vs. ASD) was established as the independent variable and hypothesized to predict insistence on sameness in young children with ASD, which has been empirically supported by a plethora of scientific literature. Thus, it was hypothesized that anxiety symptoms would predict insistence on sameness in addition to developmental status. The final hypotheses proposed that developmental status and anxiety symptoms would interact to have a greater effect on insistence on sameness in young children with ASD. Based on an a priori power analysis, it was determined that 81 participants were required for inclusion into this study to detect statistical significance using a moderated multiple regression analysis from Hayes (2015; see Figure 1 below). The final sample size for this study included 108 children, 36 children diagnosed with ASD and 72 children with TD. Developmental status was established using diagnostic evaluation records confirming the participant's ASD diagnosis. Mean age for the ASD group was 4.78($SD = 1.12$) and the 4.22($SD = 1.05$) for the TD group.

Table 1.
Gender information ASD vs. TD Groups

Child	TD		ASD		Total	
	<i>n</i>	(%)	<i>n</i>	(%)	<i>n</i>	(%)
<u>Sex</u>						
Male	44	(40.74)	27	(25.0)	71	(66%)
Female	28	(25.92)	9	(8.34)	37	(34%)

Note. Total sample size $n = 108$, mean age = 4.41 years of age.

Date entry. Data in this study were analyzed using the Statistical Package for the Social Sciences (SPSS) Version 25 software. Developmental status was input as a categorical variable and coded one for the TD group, and two for the ASD group. Each participant's diagnostic status was previously determined prior to entry into this study. The caregivers of the participants involved in this study completed the ABC. Items 9 and 14 were standardized and computed into total scores using z-scores along with 95% confidence intervals. For anxiety, the total number of anxiety symptoms was calculated and entered based on number on symptoms per individual using t-scores from the anxiety composite of the BASC-2. Software for this instrument standardized parent-reported scores into t-scores.

I conducted several types of statistical analyses using the SPSS software, which included: a) correlational analysis to examine linear relationships between variables and to test for effect sizes; b) independent samples t-test to determine differences in performance and effect sizes between groups; and, b) a moderated multiple regression to determine whether AS would moderate the relations between DS and IS in this study. PROCESS automatically centered the continuous moderator (anxiety symptoms) for this analysis.

Group Differences

An independent samples *t*-test was conducted to compare differences between typically developing children ($n = 72$) versus children diagnosed with ASD ($n = 36$) in this sample. Results revealed statistically significant differences between the ASD group ($M = 3.72$, $SD = 2.32$) and the TD group ($M = 1.03$, $SD = 1.74$) for insistence on sameness ($t[55.11] = 6.15$, $p = .005$, verbal ability ($t[59.88] = -2.78$, $p = .007$) and age ($t[66.07] = 2.47$, $p = .02$). However, for analyses including IS and verbal ability, equal variances were not assumed because Levene's test of equality of variances indicated that these variables violated the assumption homogeneity of variance. Therefore, the results of these analyses were reported as "equal variances not assumed."

Table 2.

Group means and standard deviations among study constructs

	ASD		TD		Range Min/Max
	Mean	(SD)	Mean	(SD)	
Insistence on Sameness	.77	(1.00)	-.39	(.75) *	0 - 6
Anxiety Symptoms	53.38	(14.75)	52.03	(10.38)	29 – 68
Verbal Ability	104.25	(13.79)	111.65	(11.44) *	84 - 146

Note. $N = 108$. * $p < .01$.

Moderation Analysis

A moderation multiple regression was conducted using PROCESS macro add-on for SPSS 25.0 (Hayes, 2008), which provided bootstrapped estimates of the conditional effect based on 5000 resamples. PROCESS was used to explore the conditional effects of anxiety symptoms on the relation between developmental status (X; ASD = 1, TD = 2) and sameness total scores (Y) as measured by items 9 and 14 from the ABC. Age and verbal ability were included as covariates in this analysis because they were significantly

correlated with the DS. The first hypothesis in this study, which suggested that developmental status would predict sameness, was supported by a statistically significant main effect ($B = -5.78, SE = 1.71, p = .001$). An analysis of the full moderated-model revealed a statistically significant interaction between developmental status and anxiety symptoms ($B = .06, SE = .03, p = .04, \Delta R^2 = .36$). This significant interaction between DS and AS was therefore examined at the 16th, 50th, and 84th percentiles as shown in Table 4. Results yielded a significant interaction effect at the 16th percentile ($B = -3.16, SE = .56, p < .001$), the 50th percentile ($B = -2.61, SE = .42, p < .001$), and the 84th percentile ($B = -1.85, SE = .49, p < .001$).

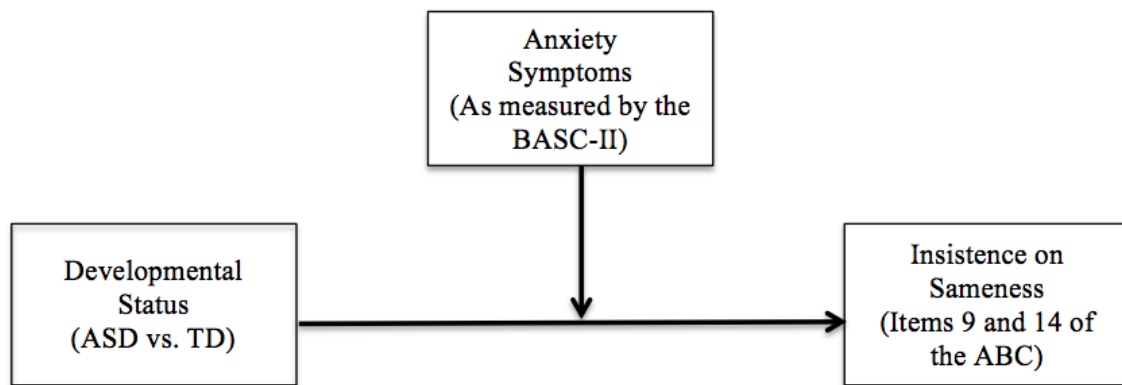


Figure 1. Moderation model evaluated the conditional effect of anxiety on the relation between developmental status and insistence on sameness.

Table 3.
Conditional Effects of Anxiety Symptoms on Insistence on Sameness

DS	AS	IS	β	p	95% CI
ASD (Low)	41.44	3.7045	-3.1568	< .001	-4.2579, -2.0558
TD (Low)	41.44	.5477			
ASD (Mean)	50.00	3.6094	-2.6133	< .001	-3.4613, -1.7653
TD (Mean)	50.00	.9961			
ASD (High)	62.00	3.4761	-1.8513	< .001	-2.8393, -.8633
TD (High)	62.00	1.6248			

* $p < .05$

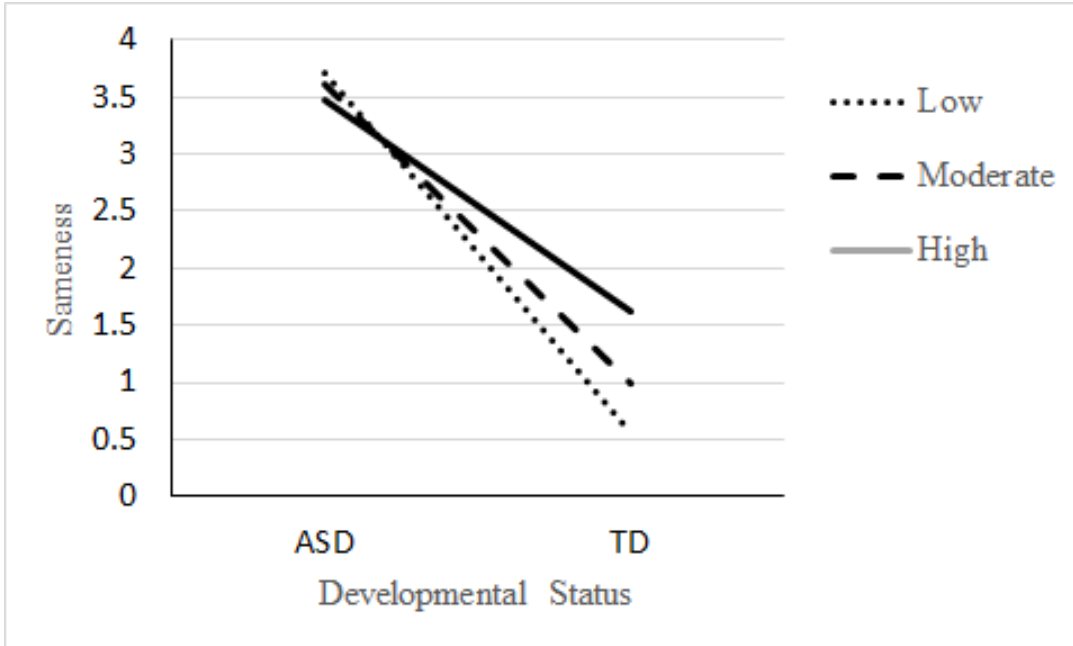


Figure 2. Graphed moderation model illustrating the interaction effect of developmental status and anxiety symptoms on sameness in children with ASD vs. TD children.

Chapter IV:

Discussion

I investigated the conditional effect of anxiety on the relation between developmental status and insistence on sameness in young children (3:0 – 6:11) diagnosed with ASD and with TD as highlighted by the model in *Figure 2*. As hypothesized, the full moderation model in this study was supported, which revealed that anxiety symptoms moderated the relation between DS and IS at low, moderate, and high levels specifically for children in the TD. The TD group showed significant increases in the amount of insistence on sameness behaviors they exhibited at the 16th (.55), 50th (1.00), and 84th (1.62) percentiles indicating that as severity levels of anxiety increased, so did behaviors that reflect IS in typically developing children. This finding suggests that the presence of anxiety impacts behavioral features consistent with IS in typically developing children in the current sample ranging in age from three to six. It is important to note that although anxiety was shown to significantly impact IS scores in the TD group, the TD group's still had significantly lower scores on IS than the ASD group. On the other hand, low, moderate, and high levels of anxiety symptoms were not shown to impact severity levels of IS in the ASD group. Individuals in the TD group with anxiety scores in the clinical range demonstrated the highest level of IS, which was still observably lower than the ASD group. In the ASD group, scores for insistence on sameness were relatively homogenous despite varying levels (i.e., low, moderate, and high) of anxiety symptomatology. Anxiety symptoms had no effect on rates of insistence on sameness in children diagnosed with ASD.

Insistence on sameness was also significantly correlated with age and verbal ability. It is unclear whether age is meaningful in regards to diagnostic status, but in the case of verbal ability among children with ASD, this study confirmed that this population is still more likely to demonstrate lower verbal performance than TD children. This finding suggests that tasks requiring the use of language likely will be more challenging for these children than for children with TD. This appears to be true even when considering the current sample of children with ASD who had relatively higher verbal skills compared to many children with ASD. Surprisingly, there was no significant correlation between AS and IS which has been shown by previous research (Gotham et al., 2013). Other studies have shown significant correlations between AS and IS, and restricted and repetitive behaviors in general (Sudhodolsky et al., 2008). According to Gotham et al. (2013), the findings from the current study provide support that AS and IS are distinct constructs although they appear to share some variance.

It is well established in research that children with ASD often exhibit behavioral features consistent with insistence on sameness (Asperger, 1944; Bishop et al. 2013). This likely explains why IS was significantly correlated and predicted by developmental status ($r = -.55, p < .001$) as shown by correlational analysis. This finding supports the abundance of scientific literature demonstrating restricted and repetitive behaviors such as insistence on sameness are a pervasive pattern of behaviors associated with an ASD. Furthermore, DS was shown to be significantly associated with expressive and receptive verbal abilities and age in ASD. Because children diagnosed with ASD are likely to exhibit behaviors consistent with IS, it is also likely that they will experience social and

behavioral problems at home and school, as these behaviors are typically challenging for families to manage.

Overall, the findings in this study continue to support research demonstrating that RRBs are a core feature of ASD as shown by the statistically significant correlations and main effect between DS and IS. This study also contributed to previous literature by showing that IS behaviors function independently of anxiety symptoms for children with ASD in the current sample. Although children with ASD exhibited greater challenges with behaviors that reflect insistence on sameness compared to TD children, anxiety symptoms negatively impacted typically developing children with regards to IS. As illustrated in Figure 2, typically developing children exhibited an increase in behaviors that reflect IS as anxiety problems increased although at lower thresholds. Children with ASD, on the other hand, had higher scores on IS compared to children TD regardless of their level of anxiety. Therefore, it is plausible to argue that the biological and psychological correlates associated with anxiety symptomatology might contribute to behaviors consistent with insistence on sameness not only in children with ASD but TD children as well. More research is needed to determine the functionality of anxiety in relation to insistence on sameness. Researchers argue that there is uncertainty regarding whether anxiety increases or decreases RRBs in children with ASD (Jootsen et al., 2009; Sukhodolsky et al., 2008). However, neurobiological deficits might account for IS particularly in children with ASD as suggested by previous research (Just et al., 2004; Hill, 2004)

There are several brain-based theories that viably attempt to explain the underlying factors that cause ASD (e.g. theory of under-connectivity, theory of executive

dysfunction, central coherence theory, and the theory of mind deficit hypothesis). For example, the “under-connectivity” theory proposes that ASD is a neurobiological and cognitive disorder resulting from the poor connectivity of neural circuitry between anatomical structures in the brain (Just et al., 2004). Another theory that relies on neurobiological deficits to explain impairments in cognitive processes in ASD is the theory of executive dysfunction in autism. The theory of executive dysfunction proposes that many of the social and non-social behaviors that characterize autism are an attribute of disrupted frontal lobe functioning (Hill, 2004). There is an abundance of research that has linked deficits in executive functions such as cognitive flexibility to problems with anxiety and insistence on sameness (Hill, 2004; Lawson et al, 2015; Lopez et al., 2005; South, Ozonoff, & McMahon, 2007).

Strengths

There were several strengths highlighted in this study. First, this study had a relatively large sample size ($N = 108$). Next, there were no values or data missing in this study due to the data collection method. Another strength of this study is that it examined a specific group of children with ASD and average or higher verbal skills. All participants in this study had standard scores on the verbal composite of the DAS-II that were greater than 85. Thus, the results of this study contribute to the paucity of research that evaluates children with ASD who have average to above average language abilities. Another strength of this study is that it examined developmental status and anxiety symptoms in relation to a specific subtype of restricted and repetitive behaviors, which was insistence of sameness. Finally, each measure or instrument used in this study was scientifically validated and psychometrically strong.

Limitations

There were several notable limitations encountered in this study. First, this study used two parent-report measures to capture problems with anxiety and IS in children with ASD; therefore, this study was unable to directly examine differences between the two groups based on individual performance scores. This represents a problem because outcomes originating from this study are based on the subjective interpretations of each participant's parent, which might be negatively impacted or influenced by personal biases and/or over-or-under reporting of symptoms. Additionally, unequal group sizes limited the author's ability to adequately compare means and differences between the two groups in this study. The homogenous demographics, such as lack of ethnic and economic diversity as well as low parental education or income levels below the national poverty limit, were not reflective of the general population and limited the generalizability of the findings. Finally, this study utilized a cross-sectional design, which removed its ability to determine if causal relations occurred between the different constructs. Another limitation is this study is that it used only two items from ABC to estimate sameness, which may have decreased clinicians' ability to understand how the presence of anxiety might contribute to RRBs such as sameness assessed by the ABC. Finally, this study could have used other standardized measures that specifically measure insistence on sameness in children with ASD such as the Repetitive Behavior Scale-Revised (Lam & Aman, 2007).

Future Directions

Future studies should continue to examine ASD, IS, and AS as distinct constructs to further determine if and how anxiety specifically affects ASD and non-specific ASD

populations. This might assist researchers and clinicians in understanding how insistence on sameness is related to unitary deficits in executive functioning particularly in young children with ASD and comorbid anxiety features. In addition, it is suggested that future research further explore the relation between DS and IS moderated by anxiety in children diagnosed with ASD who have lower expressive and receptive language abilities than assessed in the current study.

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