Modified Exposure Protocol for the Reduction of Repetitive Behavior in Children with Autism

by

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Submitted in Partial Fulfillment of the Requirements for the
Degree of Doctor of Philosophy

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August 8, 2013

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ABSTRACT

Literature on the treatment of maladaptive repetitive behavior for individuals with autism has been lacking, with treatment studies being added only recently (Bodfish, 2004; Davis, Kurtz, Gardner, & Carman, 2007; Malmberg, 2007; Turner, 1999). The current study aimed to implement a modified exposure protocol for the treatment of six children, 3 to 5-years-old. Each participant was diagnosed with an autism spectrum disorder and exhibited repetitive behavior which interfered with his (or her) school day. A multiple baseline across behaviors design was used.

Participants were assessed using the Repetitive Behavior Scale-Revised (RBS-R) and Questions about Behavioral Function (QABF). Two target repetitive behaviors were chosen for each student. A brief preference and alternative behavior assessment determined which behaviors were reinforced during treatment. Data were collected by teachers during the school day. Treatment consisted of 10 minute response blocking sessions and differential reinforcement of alternative behaviors at the participants' school. The intervention was implemented for both repetitive behaviors identified. Follow-up occurred one month after completion of treatment for both targeted behaviors for each child.

It was hypothesized that the intervention would increase the latency and decrease the frequency of target repetitive behaviors, and increase the frequency of alternative behaviors observed during sessions. It was also hypothesized that the frequency of repetitive behavior and problem behavior during the school day would decrease.

Data were analyzed using visual inspections, statistical process control charts (SPC), ipsative z tests, and paired samples t-tests. Results largely supported the hypotheses. Visual

inspections revealed increases in latency, and decreases in frequency during intervention and follow-up. Participants also engaged in more alternative behaviors during intervention and follow-up. Statistical analyses provided mixed results. SPC and paired-samples t-tests supported visual inspections, and ipsative z tests did not find statistically significant changes. School day data were inconsistently collected and therefore could not be analyzed. The current study provides support for the use of exposure therapy for the treatment of repetitive behavior in children with an autism spectrum disorder. Just as social skills and communication are viewed as deficits that can be mediated by intervention, the treatment of repetitive behavior could be similarly conceptualized.

Acknowledgements

First and foremost, I need to thank my parents, who taught me that anything is possible with hard work. Their unwavering love, support and encouragement has made me who I am today. I would also like to thank my sister and friend, Laura, for cheering me on no matter what the challenge.

I am forever grateful to my mentor and sponsor, Dr. Mitchell L. Schare. His knowledge and guidance has made all the difference. I have admired his expertise from my training in the Phobia and Trauma Clinic from start to finish.

I would also like to thank my committee, Dr. Kimberly A. Gilbert, Dr. Keith M. Shafritz, orals committee Chair, Dr. Richard M. O'Brien, and Reader, Dr. Oskar Pineño. Their patience, input, and careful review of this manuscript has been invaluable to this process.

An additional thank you goes to Dr. Kimberly A. Gilbert for her infectious love of working with individuals with autism. Her enthusiasm and ever positive approach has guided my practice in countless ways.

The advice given to me by Dr. Dawn Chirichella-Besemer helped me find the courage to change course. I have learned so much from her adept interpersonal manner.

I would also like to thank Dr. Charles A. Dill, who selflessly took the time to help me understand the impossible.

My research assistants, Elizabeth Pignatelli and Rebecca Berger, went above and beyond in helping me with this project. Their contributions were insightful, relevant, and expedient.

I owe so much to Dr. Jay Saul. His advocacy and goodwill made my research possible. I will never forget how he was able to make what was once a pipe dream a reality. His generosity and kindness during the implementation of this study have been refreshing.

The munificent participation of the students and parents of Just Kids was critical to the success of this endeavor. Working with them has kept me in love with this field. I am indescribably grateful and honored to have spent time with each of them.

This project would have also not been possible without the commitment and participation of the administrators, teachers, and support staff of Just Kids, especially, but not limited to Donna Morrison, June Hamilton, and Dr. Sarah Woodward. They were gracious hosts and an instrumental resource.

I also need to thank Dr. Mark S. Closson, for his fortitude and kind words throughout this project and beyond. He has instilled hope in me and my work. I truly believe the best is yet to come.

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CHAPTER I

Introduction

Autism

Autism is currently conceptualized as a spectrum disorder which encompasses a range of severity and functional impairment. The current criteria incorporate persistent deficits in social communication and social interaction across contexts in addition to restricted, repetitive patterns of behavior, interests, or activities (American Psychiatric Association [APA], 2013). Although the diagnostic criteria for autism have changed with the most recent edition of the Diagnostic and Statistical Manual - 5, the core feature of restricted repetitive patterns of behavior, interest, or activities has remained. Because the current study utilized the diagnostic criteria of the Diagnostic and Statistical Manual-Fourth Edition-Text Revised (DSM-IV-TR; APA, 2000), this will be the criteria referenced. Autism spectrum disorders were previously diagnosed as a type of pervasive developmental disorder, and represent a triad of deficits in the areas of social reciprocity (give-and-take interactions), communication, and stereotyped patterns of behavior (APA, 2000). Although other disorders share the diagnostic feature of social impairment, the difficulties are generally a result of other impairments of the disorder (e.g., aggression, inattention, impulsivity, hyperactivity, shyness), while social impairment is a core feature of autism (Bishop, Gahagan, & Lord, 2007). Diagnosis can occur reliably as early as age 2. Early signs of the disorder include poor joint attention, eye contact, gesture, vocalization, and initiation of conversation (APA, 2000; Gilbert, 2008; Volkmar, Lord, Bailey, Schultz, & Klin, 2004).

Comorbidity with anxiety disorders.

Recent findings suggest that comorbid diagnoses are a common occurrence among individuals diagnosed with an autism spectrum disorder. Anxiety disorders are a common

comorbid condition with a 42% current prevalence and 56% lifetime occurrence. Anxiety disorders studied included Separation Anxiety Disorder, Panic Disorder with Agoraphobia, Agoraphobia, Social Phobia, Specific Phobia and Obsessive-Compulsive Disorder. Specific Phobia and Obsessive-Compulsive Disorder were the most common amongst the anxiety disorders, with 28% of individuals currently meeting criteria for a Specific Phobia (34% lifetime) and 22% meeting the criteria for Obsessive-Compulsive Disorder (28% lifetime).

The comorbid expression of autism and Posttraumatic Stress Disorder has recently been studied by Mehtar, Motvalli, and Mukaddes (2011), who examined the trauma types, prevalence, risk factors and symptoms of PTSD in 69 individuals diagnosed with an autism spectrum disorder. They identified 17.4% of individuals as meeting full criteria for Posttraumatic Stress Disorder. Mehtar et al. (2011) found a trauma history in 26.1% of cases. Witnessing or being a victim of accidents/disasters and witnessing or being a victim of violence each occurred in 13% of cases, physical abuse occurred in 4.35% of cases and sexual abuse occurred in 1.45%. Multiple trauma history was identified in 4.35% of cases. The only significantly associated risk factor identified between groups was the number of siblings. Those with a history of trauma had an average of 1.66 siblings and those without had an average of 2.23 siblings. The most common symptoms experienced by those with an identifiable history of trauma were aggressiveness and anger bursts, distractibility, and sleep disturbances, which occurred in 94.4% of individuals. Mehtar et al. (2011) explained that low rates of trauma could be attributed to the sampling method they utilized. Participants were clinic referred children with regular follow-ups at a university autism clinic. This clinic provided educational programs for parents on how to deal with behavioral problems and protection of their children.

Autism and Obsessive-Compulsive Disorder.

Considering the striking similarities in diagnostic criteria of repetitive behaviors between autism spectrum disorders and Obsessive-Compulsive Disorder, as well as the prevalence of comorbid anxiety for many individuals, it is no surprise that recent research has focused on the overlap between the two disorders. For proper differential diagnosis it is important to consider impairment of socialization as a core feature of autism spectrum disorders and relatively intact socialization for individuals with Obsessive-Compulsive Disorder (APA, 2000). When focusing on the nature of repetitive behaviors observed in individuals with the disorders, the differential diagnosis becomes less clear. "Restricted repetitive and stereotyped patterns of behavior" (APA, 2000, p. 60), a diagnostic feature of Autistic Disorder, and "repetitive behaviors that the person feels driven to perform in response to an obsession, or according to rules that must be applied rigidly" (APA, 2000, p. 217), the criteria for a compulsion, both described nearly identical behavior which can occur as a manifestation of either disorder. The DSM-IV-TR distinguished compulsions from stereotyped movements by describing stereotyped movements as being "typically less complex and are not aimed at neutralizing an obsession" (APA, 2000, p. 80). The absence or presence of cognition precipitating the behaviors determines the proper diagnosis. Although this distinction is made, both symptoms can manifest together and therefore warrant a dual diagnosis. Determining the symptomological threshold to warrant a comorbid diagnosis of autism and Obsessive-Compulsive Disorder is a matter of debate, as the level of repetitive behavior present in autism is not defined concretely (Zandt, Prior, & Kyrios, 2007). The distressing nature of compulsions present in Obsessive-Compulsive Disorder may be difficult to assess in some individuals with autism due to potentially limited insight and diminished

communicative ability (Witwer & Lecavalier, 2010; Zandt et al., 2007). The additional diagnosis may also be redundant since the diagnosis of autism may already signify the need for intervention when functional impairment in the domain of repetitive behavior is endorsed (Zandt et al., 2007).

Berjerot, Nylander, and Lindström (2001) sought to investigate the frequency of occurrence of autistic traits in patients with Obsessive-Compulsive Disorder after reviewing literature that suggested negative predictors of Obsessive-Compulsive Disorder included males living alone, difficulties with interpersonal relations, hoarding, abnormal personality, social impairment, and childlessness. The sample consisted of 64 patients recruited through the Swedish Obsessive-Compulsive Disorder Association, with a diagnosis established by the Structured Clinical Interview for DSM-IV (SCID). Researchers found 20% of individuals diagnosed with Obsessive-Compulsive Disorder were identified as having "pronounced autistic traits" (Berjerot et al., p. 175). Neither subgroup (those with autistic traits and those without) differed in the areas of age of onset, Yale-Brown Obsessive-Compulsive Scale (Y-BOCS) total score, or the National Institute for Mental Health (NIMH) Global Obsessive-Compulsive Scale.

By interviewing parents of individuals diagnosed with an autism spectrum disorder, Hollander, King, Delaney, Smith and Silverman (2003) investigated the familial link between Obsessive-Compulsive Disorder in parents and autism in children in 57 families from the United States. Researchers found that children with high scores on the repetitive behavior domain of the Autism Diagnostic Interview- Revised (ADI-R) were significantly more likely to have one or more parents meet the diagnostic criteria of Obsessive-Compulsive Disorder (as confirmed by the Yale-Brown Obsessive-Compulsive Scale).

Because repetitive behavior is a core diagnostic feature of both autism spectrum disorders and Obsessive-Compulsive Disorder, recent research has focused on clarifying the similarities and differences in symptomology. Zandt et al. (2007) examined the nature of repetitive behavior in children with high functioning autism (and expressive verbal ability) compared to those with Obsessive-Compulsive Disorder and typically developing peers. They reported that when both groups were compared with controls they endorsed similar degrees of sameness behaviors and repetitive movements. Both groups reported low, but similar levels of repetitive language. The autism group reported slightly more stereotyped movement, self-interest, and limited interests.

Children with Obsessive-Compulsive Disorder reported higher levels of compulsions and obsessions than those with autism, and both groups reported more compulsions and obsessions than their neurotypical peers (Zandt et al., 2007). Compulsions occurred more often in children diagnosed with Obsessive-Compulsive Disorder, except in the specific categories of ordering, and those involving another person, where those with autism showed insignificantly higher levels. Obsessions occurred most often in children with Obsessive-Compulsive Disorder categorically, with the exception of comparable rates in the category of religious obsessions, and children with autism reported more miscellaneous obsessions. Unfortunately examples of miscellaneous obsessions were not provided by researchers. Additionally, the compulsions and obsessions reported by those with autism were said to be less sophisticated than those reported by children with Obsessive-Compulsive Disorder. However, an operationalized description of sophistication could not be found within the article. As previously mentioned, lower levels of obsessions and compulsions and less sophisticated phenomenology may be explained by the lack of insight into the function of

compulsive behavior, and all repetitive behavior, for individuals with autism spectrum disorders (Witwer & Lecavalier, 2010).

Repetitive Behavior

There are many different forms of repetitive behavior which observed in individuals with autism spectrum disorders. Stereotypies are described as movement which is purposeless and involuntary yet performed in a pattern and repetitive (Mink & Mandelbaum, 2006). The function, or lack thereof, has been widely debated in the literature. Lovaas, Newsom and Hickman (1987) explained that the repetitive behavior can produce visual, vestibular, tactile, or auditory stimulation, and sometimes a combination of these senses (see also Lovaas, Varni, Koegel, & Lorsch, 1977). Other terms for stereotypies include "rhythmic habit patterns," "gratification phenomena," "self-stimulation" and "motor rhythmias" (Mink & Mandelbaum, 2006, p. 69).

Self-injurious behavior can also be repetitive in nature. This behavior ranges from mild to severe and may overlap with compulsions (Mink & Mandelbaum, 2006). Compulsions are described as more complex behaviors that have a clearer function and are generally rule-bound or performed until the feeling of being "just right" is achieved. Compulsions can take the form of arranging, grooming, checking, counting, collecting, and need for completion or repetitious excessive and purposeless routine. (Mink & Mandelbaum, 2006).

Tics differ from stereotypies in age of onset (tics age 6-7 and stereotypies before age 2-years), and that the pattern is variable over time. They are discrete behaviors that are non-rhythmic, in contrast to stereotypies which are seemingly the opposite, and can be motor or vocal. Rituals are another type of repetitive behavior, which signify the completion of daily activities in a consistent, rigid manner (Mink & Mandelbaum, 2006). Rituals often occur

during mealtime, bedtime, dressing, transportation, play, activities of daily living, and communication. (Mink & Mandelbaum, 2006). Rituals can be differentiated from compulsions by their focus on daily routine activities, but crossover with compulsions with the goal of feeling just right and rule-bound topography.

Similar to rituals, sameness involves the refusal to alter the surroundings or deviate from routine. Despite the similarity to rituals, the distinctive feature of sameness is opposition to change. Behavioral restriction, also known as behavioral rigidity, corresponds to a circumscribed breadth of interests. These interests can involve strong attachments to particular objects, preoccupation with specific subject matter, and fixation on moving objects or parts of objects. Behavioral restriction limits interest and engagement in other activities (Mink & Mandelbaum, 2006). Therefore, behavioral restriction and opposition to change is cyclical and has an additive adverse effect on functioning.

As previously mentioned, repetitive behaviors are not unique to autism. Evans et al. (1997) investigated the occurrence of "compulsive-like" behavior in typically developing young children and found that that these behaviors were "relatively prevalent" in young children. Additionally, children age 2 to 4 engaged in compulsive-like behavior more frequently and intensely, and a larger percentage of this age group performed these behaviors when compared to younger and older children. Also, repetitive behaviors tended to develop earlier than compulsive behaviors and compulsive behaviors earlier than the just right behaviors (Evans et al., 1997). This work confirms the presence of repetitive, compulsive, and just right behaviors in typical child development. The presence of compulsive and just right behaviors occurring later in development also supports that these behaviors are of a higher-order than repetitive behaviors lacking this cognitive component.

Circumscribed interests are also not unique to autism. When children with high-functioning autism were matched on age, IQ and gender with typically developing peers, researchers found that although groups did not differ on the number of interests endorsed, they differed on types of interests and associated impairment of functioning (Turner-Brown, Lam, Holtzclaw, Dichter, & Bodfish, 2011). Parents of both groups endorsed an average of 12 interests for their children. Children with autism spectrum disorders preferred topics that were nonsocial and mechanical in nature. Parents reported higher frequency and resulting interference of these interests. They also noted resistance by their children when interrupted, and flexibility, and accommodation required by the parents to accommodate these interests. Additionally, less people were involved in the interests of children with autism when compared to parents of typically developing peers (Turner-Brown et al., 2011). These findings provide support for the potential need for intervention targeting repetitive behaviors in some individuals with autism.

Additionally, when the prevalence and functional impairment due to circumscribed interests in individuals with Asperger's were compared to those with high functioning autism, no reliable differences could be identified (South, Ozonoff, & McMahon, 2005). These results reflect the uniformly high level of impairment found in even the highest functioning individuals on the autism spectrum. Also, repetitive behavior was recorded in similar rates among both of these groups, highlighting the commonalities between diagnoses.

Researchers have also identified a high frequency of repetitive behaviors exhibited by individuals with Mental Retardation. When individuals with autism and Severe and Profound Mental Retardation were matched with individuals without autism on age, gender and IQ, researchers identified a high incidence of repetitive behaviors in both groups. These repetitive

behaviors included stereotypies, self-injurious behaviors and compulsions. They also found lower incidences of akathisia (commonly referred to as restless leg syndrome), dyskinesia (which involves interference with voluntary movement and the presence of involuntary movements), and tics (Bodfish, Symons, Parker, & Lewis, 2000). The group with autism displayed a higher incidence of repetitive behaviors overall, but only compulsions were significantly higher in the individuals diagnosed with autism than the matched controls. The severity of stereotypies and compulsions were greater in the group with autism (Bodfish et al., 2000). These findings may implicate greater functional impairment related to individuals who have autism and mental retardation when compared to mental retardation alone. It also disputes theories suggesting that repetitive behavior is a phenomenon resulting from mental retardation alone.

When the repetitive behavior of individuals with higher nonverbal IQ (IQ greater than or equal to 97), and lower nonverbal IQ (IQ less than or equal to 56) were compared, those with lower IQ displayed higher rates of sameness behaviors. Developmental level, as measure by nonverbal IQ, was identified as a mediating factor for repetitive behavior found in autism (Gabriels, Cuccaro, Hill, Ivers, & Goldson, 2005).

Lower-order and higher-order repetitive behavior.

Researchers are beginning to question the validity of restricted and repetitive behaviors as a single diagnostic entity of autism. Cuccaro et al. (2003) conducted a factor analysis of the Autistic Diagnostic Interview-Revised and found statistical evidence to support two major factors of restricted and repetitive behavior: repetitive sensory-motor behaviors, described as lower-order, and resistance to change, described as higher-order (Cuccaro et al., 2003). The classes of behaviors are differentiated by their proposed function. Repetitive

sensory-motor behaviors are self-stimulatory in nature, while resistance to change reflects an insistence on sameness of the environment. Insistence on sameness is associated with compulsions and rituals and aversion to even slight changes, which could be due to the individual creating an order or responding to an environment which is not in order (Cuccaro et al., 2003). Lovaas et al. (1987) explained that lower-order and higher-order repetitive behaviors may also be distinguished by their involvement with the body only, (i.e., rocking), or involving the manipulation of an object, (i.e., lining blocks up or the reassembly of puzzles). Lovaas et al. (1987) similarly distinguished the two by explaining that higher-order repetitive behaviors are more complex than lower-order repetitive behaviors. Lovaas et al. (1987) also noted that lower and higher-order repetitive behaviors are similarly repetitive and not socially mediated (Lovaas et al., 1987).

Cuccaro et al. (2003) also noted that resistance to change may be specific to autism, while repetitive sensory-motor behaviors are observed across many different developmental disabilities. Bodfish et al., (2000) previously postulated that more complex repetitive behavior like circumscribed interests or rituals may be observed more frequently in higher functioning individuals with autism when compared to stereotypy and compulsions, although in other literature compulsions are categorized as complex. Carcani-Rathwell, Rab-Hasketh, and Santosh (2006) similarly concluded that sensory and motor repetitive behaviors are linked to lower developmental age and are less specific to autism. They also concluded that cognitive rigidity (e.g., higher-order repetitive behavior) was prototypical to autism, just as Turner (1999) posited 7 years earlier.

Szatmari et al. (2006) also examined restricted, repetitive behaviors and interests in the Autism Diagnostic Interview-Revised, and revealed a two factor structure: Insistence on

Sameness and Repetitive Sensory and Motor Behaviors (Szatmari et al., 2006). These two factors were similar to the factors devised by Cuccaro et al. (2003). Repetitive sensory and motor behaviors were identified as being negatively correlated with adaptive functioning (Szatmari et al., 2006). Insistence on sameness was linked to symptoms in the communication domain of the Autism Diagnostic Interview-Revised. This positive correlation may indicate a commonality between behavioral rigidity and communicative inflexibility, as demonstrated by delayed echolalia, repetitive speech and questions, and scripted speech (Szatmari et al., 2006).

The work of Richler, Huerta, Bishop and Lord (2010) supported the existence of two separate subtypes of restricted and repetitive behaviors and interests: a lower-order factor of repetitive sensorimotor behavior and a higher-order factor of insistence on sameness. Repetitive sensorimotor behavior was considered lower-order because fewer of these behaviors were witnessed when children at age 2-years-old demonstrated higher levels of cognitive ability, and these behaviors also improved over time for these individuals. In contrast, milder social/communicative impairments at age two were associated with more severe behaviors related to insistence of sameness, thereby giving further support to the notion that this behavior is of a higher-order (Richler et al., 2010).

Another conceptualization of repetitive behavior is that the construct exists on a continuum which ranges from lower-order, as in stereotypy and self-injury, to higher-order, as in compulsions, rituals/sameness, and restricted interests (Boyd, McBee, Holtzclaw, Baranek, & Bodfish, 2009). This conceptualization could account for topographical similarities in behavior and also fits well into the spectrum conceptualization given to those with autism. The distinction between lower-order and higher-order repetitive behaviors is especially

important for treatment implications. Higher-order behaviors may respond better to treatment if they are related to autism versus mental retardation. Additionally, if higher-order repetitive behavior is similar in topography to compulsive behavior, similar modes of intervention for compulsive behavior may be appropriate.

Neurological dysfunction.

The exact neurobiological mechanisms underlying repetitive behavior are unknown. Some think that stereotypies occur due to the circuitry of the basal ganglia, because other involuntary movement disorders have been associated with this brain region, more specifically the striatum (Hollander et al., 2005; Mink & Mandelbaum, 2006). Striatal abnormalities have also been implicated in adults with Obsessive-Compulsive Disorder (Scarone et al., 1992).

Repetitive behavior has also been modeled in animals. Repetitive behavior has been observed in animals that have insult to the central nervous system and can also be induced by drugs (Lewis, Tanimura, Lee, & Bodfish, 2007). Animal models of stereotypies have been produced by the administration of dopamine agonists to the basal ganglia and frontal lobes (Pierce & Kalivas, 1997; Segal, Weinberger, Cahill, & McCunney, 1980). Despite the similarities, these animal models fail to replicate stereotypies which naturally occur without medication in human populations with autism. Serotonin has also been thought to be linked to the maintenance of repetitive behaviors. This theory comes from the established benefit of selective serotonin reuptake inhibitors on the symptoms of Obsessive-Compulsive behavior (Mink & Mandelbaum, 2006).

Thakkar et al. (2008) sought to investigate activation of the anterior cingulate cortex in relation to repetitive behavior in individuals with autism and a control group. The authors

proposed that response monitoring is controlled by the anterior cingulate cortex, and deficiencies in response monitoring may lead to inflexible and repetitive behaviors. The researchers utilized a rapid presentation event-related functional MRI to compare anterior cingulate cortex activation for an eye tracking task which required shifting gaze towards a moving target. They found that participants with autism showed hyperactive anterior cingulate cortex response when they responded to trails accurately. Thakkar et al. (2008) explained that this hyperactive responding may be misinterpreted by the brain as an affective signal that something is wrong and requires action to correct this interpreted misfiring. This exaggerated anterior cingulate cortical response to correct trials is also observed in individuals with Obsessive-Compulsive Disorder, although it is present in the dorsal anterior cingulate cortex rather than the anterior (Maltby, Tolin, Worhunsky, O'Keefe, & Kiehl, 2005).

Dichter et al. (2010) recently studied the effects of Citalopram, a selective serotonin reuptake inhibitor medication, on brain activity for two high functioning individuals with autism during an "oddball task" pre and post 12 weeks of psychopharmacological treatment. Of the two participants, one demonstrated significant reductions in repetitive behaviors, as measured by the Yale-Brown Obsessive-Compulsive Scale − Pervasive Developmental Disorder Version (YBOCS-PDD). In this participant, prefrontal regions which are implicated in repetitive behaviors in autism, the anterior cingulate cortex, showed increased activation post treatment (Dichter et al., 2010). Although these results must be interpreted with caution due to the same sample of two and lack of controls, it may indicate the need to further investigate the anterior cingulate cortex as a mechanism of action and biomarker for the treatment of repetitive behavior in autism.

Learning conceptualization.

Skinner (1992) described the superstitious repetitive behavior of pigeons to be the result of conditioning. Reinforcement contingent upon a response is only temporal, and Skinner (1992) suggested that learning must take place on the part of the animal since it engaged in this behavior predictably.

Coleman and Maier (2010) utilized positive reinforcement training to reduce stereotypic behavior in rhesus macaque monkeys. They trained the rhesus macaques to touch a specified target, and accept venipuncture. They shaped these behaviors with a small food treat. The monkeys who were reinforced for alternative behavior showed less stereotypic behavior than the control group after 1 month of training. Interestingly, the treatment gains did not maintain during months 2-4 of intervention. The authors concluded that the lack of discrepancy between the groups during the last months of treatment was due to a decrease in stereotypy in the control group, not an increase in stereotypy in the treatment group. The authors attribute the decrease in stereotypy in the control group to the monkeys becoming more comfortable with the observers over time.

Lovaas et al. (1987) hypothesized that self-stimulatory, or sensorimotor behavior, are operant responses that are reinforced automatically through interoceptive and exteroceptive perceptual consequences. These behaviors do not seem to be the result of a typical pattern of social reinforcement history, since they are often resistant to extinction by means of withdrawal of attention and other social reinforcers. The behavior is also very isolative in that it garners the full attention of the individual. Lastly, when individuals received extensive behavioral intervention to acquire skills they were previously lacking, they often developed a repetitive behavior associated with the skill.

Lovaas et al. (1987) explained that as the children were taught vocal imitation, about half of the previously nonverbal children engaged in persistent echolalia. The notion that repetitive behavior is under operant control is based on several considerations. First, the behavior is intricate and idiosyncratic, and does not seem of innate origin (e.g., lining up blocks on the floor repeatedly). Secondly, these behaviors result in perceptual or sensory stimulation which is a "reliable and inevitable consequence" (Lovaas et al., 1987 p. 47). This stimulation can therefore be argued to maintain the antecedent repetitive behavior. Acquisition of this self-stimulatory behavior may be attributable to trial and error, since the behavior is uniquely pleasing to the individual. Another consideration is that the described stereotyped, or fixed pattern of repetitive behavior, is only as valid of a descriptor as the person who is observing and how well they are making their observation. Variability of repetitive behavior maintains the occurrence of the behavior, as a truly stereotyped behavior would lose its reinforcing value due to satiation (Lovaas et al., 1987).

It is important to consider that these theories regarding the etiology and maintenance of repetitive behavior are not mutually exclusive (Turner, 1999). It is likely there are several contingencies in place that evoke and maintain repetitive behavior. Special consideration should be made when conceptualizing a treatment plan to address the functional impairment often associated with repetitive behavior in autism (Patterson et al., 2010).

Anxiety.

Just as anxiety has been recognized as a comorbid disorder with pervasive developmental disabilities, it has also been indicated as an etiology for some forms of restricted and repetitive behaviors observed in individuals with autism (Leekam, Prior & Uljarevic, 2011; Mattila et al., 2010; Patterson et al., 2010; Witwer & Lecavalier, 2010).

Patterson et al. (2010) compiled a systematic review of experimental studies targeting stereotypic and repetitive behaviors in individuals with autism spectrum disorders. Patterson et al. (2010) noted the potential for restricted and repetitive behavior to increase the predictability of an environment and therefore decrease anxiety for the individual. They continued to explain that this association is then maintained and strengthened by various reinforcement contingencies. Animal models of repetitive behavior have also demonstrated a relationship between stereotyped behavior and a resulting decrease in stress. Pomerantz, Paukner, and Terkel (2012) found that self-directed stereotypy in the rhesus macaque was negatively correlated with an increase in fecal corticoids following a stress challenge. The authors explained that self-directed stereotypy could serve as a coping mechanism for the animal.

Functional Impairment and Treatment for Repetitive Behavior

When designing an intervention for any behavior it is essential to consider the resulting functional impairment. Gaining a clear understanding of functional impairment can lead to more successful implementation of treatment.

Impact on family life.

Autism has been linked to increased stressors in the home environment, affecting the well-being of both parents and siblings over the course of the lifespan. Siblings of individuals with autism seem to be especially pessimistic about their sibling's future, even when compared to siblings of people with other disabilities. When considering the possibility of early onset Alzheimer's disease in adults with Down's Syndrome, siblings are reported more optimistic about their sibling's future when compared to the siblings of those with an autism spectrum disorder (Orsmond & Seltzer, 2007).

Mothers of adolescents and young adults with autism reported increased levels of pessimism, less close bonds with their child, and higher levels of depressive symptoms when compared to mothers of adolescents and young adults with Down's Syndrome (Abbeduto et al., 2004). These findings did not control for differences in problem behaviors exhibited by the two groups, which is likely to account for the discrepancy. Researchers also postulated that "genetic vulnerability" and "the broader autism phenotype" in mothers may have contributed to their higher levels of depressive symptoms and impaired connectedness with their child (Abbeduto et al., 2004).

As one would expect, mothers who parent a child diagnosed with autism and another child with a disability (4.6% with Attention Deficit/Hyperactivity Disorder and 2.4% with autism spectrum, 2.1% with other psychiatric and 2.0% with Learning Disabilities) reported higher levels of depressive symptoms and anxiety and decreased family adaptability and cohesion when compared to matched age and family size of other families with only one child with a disability (Orsmond, Lin, & Seltzer, 2007).

Barker et al. (2010) conducted a longitudinal 10 year study on parenting an emerging adult on the autism spectrum (parent mean age of 51 and child mean age of 22). Mothers endorsed a stable number of depressive symptoms when controlled for age, although at the beginning of the study older mothers endorsed fewer depressive symptoms than younger mothers (Barker et al., 2010). Older mothers also reported less anxiety at the beginning of the study, and anxiety was shown to decrease for mothers over time. Although anxiety symptoms were shown to decrease, depressive symptoms endured over time, which suggests the difficulty in adjustment to parenting adolescents and adults with autism and the burden associated with being a caregiver.

Most notably, repetitive behaviors have been identified as some of the most challenging symptoms of autism for parents to manage daily (Mercier, Mottron, & Belleville, 2000; South et al., 2005). First person accounts of the impact of restricted interests explain these challenges. “Basically what others will tell me is that I monopolize time that could have been used for better things. But sometimes I can’t think of better things to do when I have free time” (Mercier et al., 2000, p. 414). Regarding her brother’s interests a sister explained they “swallow up everything, all the time . . . we can’t talk about anything else. It’s more of a handicap than anything else” (Mercier et al., 2000, p. 414).

Autism can be challenging disorder for a family to navigate. Of all the symptoms, repetitive behaviors have been identified as the most challenging to manage within the family. Since the repetitive behavior exhibited by those with autism markedly interferes with their family life, it stands to reason that this behavior may warrant intervention.

Functional impairment.

Repetitive behaviors also pose a significant functional impairment to the individual exhibiting the behavior. Functional impairment can be measured by the severity and chronicity of behavior. Chowdhury, Benson, and Hillier (2010) examined changes in repetitive behavior for adults with high functioning autism retrospectively at age 4-5 utilizing the Autism Diagnostic Interview-Revised (ADI-R) and the repetitive Behavior Scale-Revised (RBS-R). They found that the greatest number of participants endorsed improvement in the Compulsive Behavior subscale (75% of participants), and the Stereotyped Behavior subscale (71% of participants). Interestingly, although there were low base rates for the Self-Injurious Behavior subscale, it was among the lowest to show improvement in the proportion of participants (only 52.6% of individuals). The Restricted Behavior subscale showed the least

improvement for individuals (44.1% improved). Despite the limitations of a small, homogenous sample and potential for informant recall bias, these results emphasize the persistence of these behaviors across the lifespan (Chowdhury et al., 2010).

South et al. (2005) investigated the differences between repetitive behaviors in individuals with high functioning autism compared to Asperger's Disorder. They found no reliable differences in the frequency, intensity, duration, or functional impairment between groups. These results are relevant given the controversy regarding the diagnosis of Asperger's Disorder. This study highlighted the debilitating nature of repetitive behaviors that were present even in high functioning individuals. Parents spontaneously reported that difficulties with "incessant talking about one topic and the inability to flexibly adapt to ongoing changes in the family schedules" were among the most challenging aspect of autism that they encountered day to day. As mentioned earlier, lower- and higher-order repetitive behaviors were present throughout both samples, and even manifested in the same individual. Although South et al. (2005) hypothesized that circumscribed interests would be more prevalent and cause more distress in the Asperger's group when compared to the high functioning autism group, and the opposite would hold true for the other categories of repetitive behavior, these differences were not supported. The high functioning autism group demonstrated the same number of circumscribed interests, and occasionally more of them. The only significant differences found between groups were in the lifetime severity of Object Use and Rigid Routines categories, with no differences found in the current level of functioning. These results reflect the differences in early development for those with Asperger's (and early intact communicative ability) and autism, and also show how these developmental discrepancies do

not maintain over time (they lead to a similar level of functional impairment later in childhood).

Additionally, repetitive behaviors have reportedly been so severe that they can "consume the majority of waking hours in an individuals and interfere with daily family activities," as previously described by those effected (Fombonne, 2011). Problem behaviors often occur when repetitive behaviors are interrupted or blocked. Engaging in repetitive behavior can negatively impact the salience of and decision to participate in other educational tasks and opportunities to socialize (Fombonne, 2011). It is also important to recognize that repetitive behaviors persist into adulthood, and can remain a severe problem despite improvement in social skills and communication (Fombonne, 2011; Piven, Harper, Palmer, & 1996; Shattuck et al., 2007).

Repetitive behaviors often remain a problem across the lifetime. Since repetitive behaviors exhibited by individuals with autism do not seem to ameliorate free from intervention, treatment for repetitive behaviors in autism may be necessary.

Current treatment.

Of the three core features of autism, repetitive behaviors have been studied substantially less than social reciprocity and communication (Bodfish, 2004; Malmberg, 2007; Matson & Dempsey, 2009). Bodfish (2004) identified the three behavioral interventions that have received empirical support for the treatment of repetitive behavior: "(1) teaching, occasioning, and reinforcing alternative adaptive behaviors . . . (2) environmental arrangement or structuring . . . and (3) shaping or graded change" (p.321).

Reinforcement of alternative behavior can be conceptualized as a mechanism for treatment in several ways. Since children with autism behave under the same contingencies as

neurotypical children, the principles of reinforcement, punishment and extinction can be utilized to control repetitive behavior (Horner, Carr, Strain, Todd, & Reed, 2002). Functional Assessment is an essential tool to identify contingencies of the repetitive behavior, including antecedent stimuli, the topography of the target behavior, and consequential events. A successful intervention would facilitate the implementation of behavior that is socially appropriate and help the child achieve a higher level of functioning within the environment. It would also provide the child with the same environmental consequence as the original target problem behaviors (Carr, 1988; Horner et al., 2002).

Teaching and reinforcing an alternative adaptive response is the focus of Functional Communication Training (FCT). In one study patients were taught means of communication adapted to their intellectual ability to achieve the same functional equivalence of the targeted repetitive self-injurious behaviors (Carr & Durand, 1985; Durand & Carr, 1992). Functional communication is well suited to address repetitive self-injurious behavior when the individual can be taught a potentially more effective and less harmful means of communicating the same information (Matson, Benavidez, Compton, Paclawskyj, & Baglio, 1996). Functional communication training can also result in a more effective means for individuals to communicate their needs to others who are not aware of the contingencies in place (e.g., someone banging their head on a table means he wants to stop working; Matson et al., 1996). Since it can be a universally understood way to communication, it may be generalized with ease.

Alternatively, Lee and Odom (1996) studied social interaction as a means to reduce stereotypy. Bodfish (2004) classified this intervention as teaching, occasioning, and reinforcing alternative adaptive behaviors. With a small sample of two individuals with

autism, each participant was grouped with two neurotypical peers who were matched on age and gender. The promising results showed that the participants were less likely to engage in stereotypy when socially engaged with their peers, yet there was little to no understanding of the contingencies working on this social interaction. The social interaction could have been the intervention, but these changes could also be accounted for by increased structure, focused attention, and learning advanced aspects of toy play from peer models, or simply the incompatible nature of interactive toy play and socialization with the target stereotyped behavior.

Second, structuring the environment can be in the form of any modification to the environment to lessen the burden of excessive demands, and help the individual cope with changes that occur in their daily living, which previously led to repetitive behaviors (Howlin, 1998). Providing alternatives for tasks that are particularly distressing to the individual may decrease the need for rituals. Additionally, the structure of visual schedules and other visual aids could provide helpful support. Conroy, Asmus, Sellers, and Ladwig (2005) implemented visual cues to indicate when it was appropriate for a kindergarten student enrolled in an inclusive classroom environment to engage in his preferred stereotyped behavior of hand flapping. This visual cue, which was explained each school day to the student, was shown to decrease the stereotypy of hand flapping during the treatment intervals. When the student would engage in hand flapping during time when hand flapping was not permitted, the experimenter reminded the student that the card signaled that it was not a time to engage in that behavior. No other consequences were implemented, demonstrating the powerful effects of simple environmental arrangement and teaching (Conroy et al., 2005).

Lastly, gradual change could benefit an individual who would respond adversely to drastic changes in their ability to perform ritualistic acts which might provide structure and predictability to their perceived chaotic worldview (Howlin, 1998). A concern is that one form of repetitive behavior will be replaced by a different form when the original behavior is blocked. Careful consideration should be given to the function of the repetitive behavior to determine an adaptive alternative. When this adaptive alternative behavior is implemented gradually the individual may be able to modify their actions without the use of replacement repetitive behavior.

Another popular approach to manage problem behaviors is Positive Behavior Support (PBS). Positive Behavior Supports encompass individualized treatment plans which are an alternative to aversive, punishment approaches to decrease target problem behavior. It incorporates teaching skills, adaptations to the environment specifically suited to aid the individual, and utilizes contingency management principles (Erbas, 2010). Positive behavior supports can also be implemented as a full scale school-wide intervention plan which has been shown to be effective in decreasing school-wide problem behaviors to create a positive school atmosphere (Cohen, Kincaid, & Childs, 2007).

Even when behavioral interventions were implemented for the treatment of repetitive behaviors of individuals with autism, there is a lack of research which focused on insistence on sameness or resistance to change (Patterson et al., 2010). Behaviors targeted in the articles reviewed included motor stereotypy, stereotyped object manipulation, repetitive use of language, and circumscribed interests.

In one study, Cicero (2008) reported that noncontingent reinforcement alone was ineffective at reducing stereotyped and repetitive behaviors. Carr et al. (2002) found that

noncontingent reinforcement was only successful after it was combined with response blocking, and that initial response blocking was more effective than the combination. When repetitive use of language that was determined to be maintained by attention was targeted for intervention, Smith, Scahill, and Dawson et al. (2007) reported that differential reinforcement of alternative behavior combined with extinction procedures were successful in reducing the behavior. The participant was an adult male with comorbid intellectual impairment and autism. Despite this promising finding, Patterson et al. (2010) note that this study was of weak methodological quality and that replication of the results was unlikely.

Most research has focused on the simple, sensorimotor, or stereotyped repetitive behaviors. Bodfish (2004) noted that there is paucity in knowledge regarding effective methods of intervention to address higher-order ritualistic repetitive behaviors and more general rigidity/inflexibility.

Exposure therapy.

The theoretical underpinnings of exposure therapy can be traced back to acquisition and maintenance of avoidance learning described in Mower's Two Factory Theory (Mowrer, 1960). Implosive therapy, flooding, and systematic desensitization, are all interventions which aim to decrease avoidance responding. Although the mechanism used to achieve this goal varies by treatment condition, (extinction in implosive therapy and flooding; reciprocal inhibition or counterconditioning in systematic desensitization), they all incorporate exposure to conditioned aversive stimuli (Rachman, 1969; Stampfl & Levis, 1967; Wolpe, 1959). Since exposure therapy works on the principle of extinction, it requires repeated presentations of conditioned aversive stimuli without the presence of unconditioned aversive response to lead to extinction of the previously learned response (Stampfl & Levis, 1967). Extinction and

exposure are connected theoretically, yet can be viewed as discrete theoretical entities. For this reason a chronological review of research will cover both extinction and exposure as it relates to treatment of repetitive behavior exhibited by individuals on the autism spectrum.

As previously mentioned, research in the area of repetitive behavior in autism spectrum disorders, specifically treatment studies, are scarce (Bodfish, 2004; Malmberg, 2007; Matson et al., 1996; Matson & Dempsey, 2009). The following review is not exhaustive, but meant to highlight treatment of repetitive behavior over time, especially when it incorporates exposure and/or an extinction paradigm. It is important to note that response blocking has been cited in the treatment of repetitive behavior associated with autism more often in the literature than response prevention. The two terms represent synonymous interventions (Hersen et al., 2005; Miltenberger, 2012). For this reason response blocking and response prevention are used interchangeably during this review and following methodology.

The earliest treatment study that Matson and Dempsey (2009) could identify which addressed the treatment of ritualistic behavior was Rincover, Newsom, and Carr (1979). They utilized sensory extinction to treat two children who were described as developmentally disabled, and one being diagnosed with the cohort-specific diagnosis of Schizophrenic, Childhood Type. The extinction paradigm removed the reinforcing sensory aspects of turning lights on and off for the children, and thereby decreased the frequency of that repetitive behavior.

Barrett, Staub, and Sisson (1983) reported a case study of a 4-year-old boy who repetitively kissed, licked and fondled the shoes of inpatient staff. He fixated on shoes by staring at them when greeting someone and proclaimed “shoes” in a loud voice. The intervention phase introduced blocked access to the reinforcing stimuli of shoes by covering

the child's eyes until the target behavior ceased. Although the behavior took 485 applications in the span of six weeks, the target behavior was eliminated in the hospital environment. The experimenters then generalized the results by implementing the treatment condition in the home for another six weeks with 104 applications of the visual blocking. Both Rincover et al. (1979) and Barrett et al. (1983) targeted behaviors that were pleasurable.

In contrast, Reaven and Hepburn (2003) designed an intervention for behaviors that were not pleasurable to the individual but still compulsive. In order to accomplish this task Reaven and Hepburn (2003) utilized a modified cognitive behavioral approach to treat a 7-year-old girl with a dual diagnosis of Asperger's and Obsessive-Compulsive Disorder. The experimenters provided psychoeducation, mapped Obsessive-Compulsive Disorder symptoms, and established a hierarchy of obsessive and compulsive behaviors. Then, exposure and response prevention was implemented. Reaven and Hepburn (2003) explained that exposure refers to the principle that when a feared stimulus is encountered it will prompt anxiety and the need to engage in compulsive behavior. Alternatively, response prevention is the blocking of the ritual during periods of exposure. This leads to the minimization of avoidance behaviors and eventual decrease in anxiety over time The team came up with a variety of tools to facilitate exposure, including identifying the participant's anxiety as Obsessive-Compulsive Disorder, providing encouraging statements, and distraction (Reaven & Hepburn, 2003). Note that this distraction is viewed as counter-productive to the theory and clinical application of exposure for the purposes of extinction (Stampfl & Levis, 1967). Reaven and Hepburn (2003) implemented traditional in vivo exposure with modifications including visual images, social stories and comic strip conversations to foster social understanding.

The Children's Yale Brown Obsessive-Compulsive Scale (CY-BOCS) was used to measure progress pre and post treatment, and revealed a 65 percent decrease in symptoms over the 14 week treatment period. The patient described her progress best in her own words: "Y.R. and her family were planning a lengthy vacation, and the therapist asked her how she would handle her OCD symptoms on the trip. She replied, 'I'm not going to pack my OCD'" (Reaven & Hepburn, 2003, p. 156). The article is noteworthy for its clear description of procedural modifications to address the patient's diagnosis of Asperger's. This study also provides support for the efficacy of an exposure based approach for individuals with a dual diagnosis of autism and Obsessive-Compulsive Disorder. Lehmkuhl, Storch, Bodfish and Geffken, (2008) implemented an exposure treatment paradigm for a 12-year-old boy with a diagnosis of autism and Obsessive-Compulsive Disorder. The adaptations made to address the dual diagnosis of autism and Obsessive-Compulsive Disorder was informative. A limitation of the study is that it did not outline specific clinical gains of the participant.

Davis et al. (2007) implemented the first known attempt to utilize a cognitive behavioral treatment approach to address a specific phobia of a child with severe problem behavior (self-injury, aggression, and disruption) as well as developmental delays. This study was the first to utilize exposure with an individual exhibiting severe problem behavior. The experimenters performed a functional analysis of the problem behavior. The functional analysis indicated that the child engaged in the behavior to gain access to adult attention and tangible items. The function of the problem behavior was addressed with a combination of functional communication training and extinction.

The child's specific phobias included water and heights. Functional impairment was severe, as the child did not bath or shower for 3 years prior to treatment (he was only cleaned

with baby wipes and waterless cleanser). The severe problem behaviors described earlier were observed when accompanied by the proposition of taking a bath. The fear of heights exhibited by the patient manifested as avoidance of any second story, marked distress in elevators, and an insistence that his mother carry him across fences, spaces in flooring and up and down novel stairways (Davis et al., 2007). The experimenters implemented one session of massed exposure therapy. This session combined flooding and graduated in vivo exposure. Exposure was modeled and verbal and physical reinforcement was provided. Psychoeducation was also incorporated (Davis et al., 2007, see also Öst, 1989).

Following treatment the child no longer met diagnostic criteria for either phobia. Six month follow-up reports showed that the child was taking regular baths and having minimal daily living impairment related to heights. Remarkably, "he reportedly had gone on several trips to the beach during which he was in water up to his neck (previously he would not enter the water beyond his ankles)." (Davis et al., 2007, p. 556).

Kuhn, Hardesty, and Sweeney (2009) contributed to the literature by implementing an extinction paradigm to treat the repetitive behavior of straightening and resulting destructive behavior of an individual with autism and Moderate Mental Retardation. The term straightening was used to describe the participant's behavior of discarding both trash and non-trash items. The participant was a 16-year-old male admitted to an inpatient facility. Straightening impaired the functioning of the individual because he had discarded important documents such as bills and insurance forms, as well as expensive electronics, like his iPod and cellular phone, when he was straightening. The experimenters performed a functional analysis, blocking analysis, and functional communication training evaluation. During functional communication training the individual was taught to ask whether or not an item

was trash as a discriminative stimulus to determine the appropriateness of discarding the item. They observed low and undifferentiated rates of destructive behavior in all conditions of the initial functional analysis (failing to reveal a distinct function of the behavior), but did not observe destructive behavior during noncontingent access to straightening. This result suggested that the individual's destructive behavior was maintained by contingent access to his repetitive straightening behavior. Following implementation of functional communication training, and blocking of straightening, destructive behavior deceased to near-zero levels, even when non-trash items were removed from the trash by the experimenter. Further evidence of efficacy was that the individual did not attempt to throw the items out a second time. This study shows the success of a response blocking intervention despite the severe problem behavior which occurred when the repetitive behavior was blocked prior to treatment.

Wolff (2010) conducted a treatment study to address maladaptive higher-order repetitive behavior in three adult males diagnosed with autism. Wolff (2010) drew a similarity between higher-order repetitive behaviors in autism to those observed in other disorders (e.g., Obsessive-Compulsive Disorder). Wolff (2010) also acknowledged that both share maintenance by means of avoidance, and that flooding and graduated exposure have been well established in treating avoidance maintained behaviors. Wolff (2010) found that implementation of exposure and response prevention resulted in reduced target behavior for each of the three participants, with two out of the three participants showing zero-occurrences of target behavior by the end of the study.

Most recently, Boyd, Woodard, and Bodfish (2011) implemented an intervention for repetitive behavior in a 14-year-old boy with autism and comorbid intellectual disability. His

cognitive capability was measured to be at the 1 to 2 year age level for language skills and near the 3 year ability mark for visual motor skills. He did not exhibit spoken language but effectively used an augmented communication device. Assessment of repetitive behavior revealed that the participant frequently arranged and ordered objects, engaged in ritualized play, and experienced distress when these activities were interrupted (Boyd et al., 2011). Puzzles were chosen for intervention because the participant consistently became distressed when his play with puzzles was interrupted. Additionally, when the participant was allowed to complete the puzzles prior to intervention this activity consumed excessive amounts of time. It was also an activity that could be easily recreated in the clinic setting. The experimenters incorporated competing response training as part of the exposure and response prevention treatment protocol. Competing response training is a component of habit reversal training, when the individual is taught an acceptable behavior to replace the current maladaptive target behavior (Nicholson-Adams, Adams, & Miltenberger, 2009). The implementation of a competing response is indicated when the individual is unlikely to engage in a behaviorally neutral response during exposure sessions and will likely persist in engaging in evolving forms of maladaptive behavior. Therefore, they would likely not be able to tolerate flooding. The treatment phase of the study took place for 2 weeks and featured 15-20 minute sessions with at least two sessions in a day. Boyd et al. (2011) measured the therapist's rating of the participant's interest in repetitive behavior, distress when access to the repetitive behavior was blocked, and intensity of problem behavior. The puzzle was present during treatment, along with a set of number identification cards, which were known to the participant, and identified as an appropriate competing response for him. Data provided by therapist ratings indicated that the student’s level of distress and co-occurring problem behavior significantly decreased

over the treatment sessions. Despite these gains his interest in puzzles was unwavering, which was demonstrated by his persistence in engaging in the task when the opportunity was present.

Statement of the Problem

Treatment of maladaptive repetitive behavior in individuals with autism has been lacking, especially studies which consider the function of the behavior when implementing an intervention (Bodfish, 2004; Davis et al., 2007; Leekam, Prior, & Uljarevic, 2011; Malmberg, 2007; Patterson et al., 2010; Turner, 1999). Although exposure therapy has long been touted as an efficacious treatment for avoidance based anxiety disorders, very few studies have incorporated it as a treatment for higher-order repetitive behavior that is exhibited by individuals with autism (Abramowitz, 1997). The current study aimed to implement a modified exposure protocol for the treatment of six children, 3 to 5-years-old. Each participant was diagnosed with an autistic spectrum disorder and exhibited repetitive behavior which interfered with their school day. An intervention was designed to address the needs of children who have limited expressive language abilities. The treatment was implemented in their primary educational setting of participants to determine the efficacy of a modified exposure based treatment protocol for the treatment of target higher-order repetitive behavior in the school. The modified treatment protocol consisted of 10 minute response blocking sessions. During sessions the individual encountered the antecedent stimuli which have been shown to predictably evoke the target repetitive behavior chosen for intervention. Alternative behaviors that were determined to be more adaptive for the individual were reinforced. Data were collected on the frequency of target repetitive behavior, as well as the latency between introduction of evoking stimuli and initiation of target repetitive behavior.

Hypotheses

Based upon the literature reviewed, the following hypotheses were made:

1) It is expected that the target restricted/repetitive behavior of resistance to change in the environment will be nonsocial in function.

2) It is expected that the intervention will increase the latency between evoking stimuli and target repetitive behavior when the behavior does occur.

3) It is expected that the intervention will decrease the frequency of the target repetitive behavior. The frequency of the target repetitive behavior will initially increase to levels higher than baseline, and then decrease to below baseline levels during the treatment phase, indicating an extinction burst.

4) It is expected that the frequency of alternative behaviors will increase from baseline levels.

5) It is expected that the frequency of the targeted repetitive behaviors and problem behavior will initially increase during the school day, and then decrease to below baseline levels, indicating an extinction burst.

CHAPTER II

Method

Participants

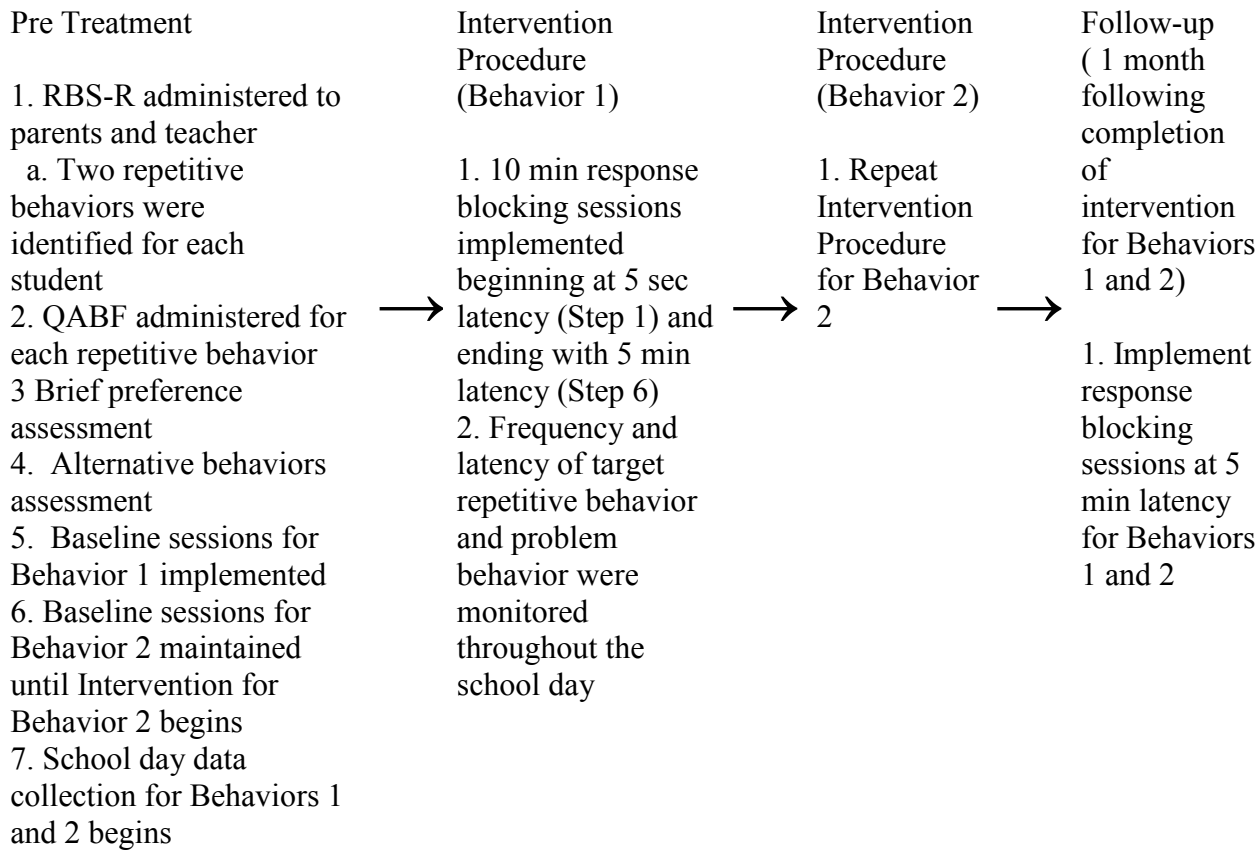
Participants were six students diagnosed with a pervasive developmental disorder age 3 to 5 years-old (according to the DSM-IV-TR criteria, APA, 2000). These six children were chosen based on teacher report that they demonstrate repetitive, ritualistic, and rigid behaviors that interfere with their school day. The presence and severity of these behaviors were evaluated with the Repetitive Behavior Scale- Revised (RBS-R; Bodfish, Symons, & Lewis, 1999; Bodfish et al., 2000; Lam & Aman, 2007). Students were identified for participation in the current study if parents and/or teachers endorsed the presence of repetitive behaviors with moderate to severe severity on the RBS-R. The intervention took place within the participant's primary educational facility. Data obtained from participants were confidential, as data were not tied to any names or other identifiers. Permission from the school and parents was obtained for each participant and consent for recording sessions was obtained (Appendix A). Approval was obtained from Hofstra University's Institutional Review Board.

Design

A multiple baseline across behaviors design was used. Data were collected on frequency of target repetitive behavior, as well as the latency between change in the environment and initiation of a behavioral response from the participant. Frequency of alternative behaviors during intervention sessions was also recorded. Additionally, data on frequency of target repetitive behaviors and frequency of associated problem behavior was recorded throughout the school day pretreatment, during treatment, and during post treatment phases by teachers (Figure 1).

Figure 1.

Procedure



Measures

Repetitive behavior scale-revised (RBS-R).

The Repetitive Behavior Scale- Revised (Appendix B) is a 43 item questionnaire measuring repetitive behaviors exhibited by individuals with autism within the last month (Bodfish, Symons, & Lewis, 1999; Bodfish, Symons, Parker, & Lewis, 2000; Lam & Aman, 2007). The questionnaire is comprised of six subscales: stereotyped behavior, self-injurious behavior, compulsive behavior, ritualistic behavior, sameness behavior, and restricted behavior. Each domain is quantified in terms of presence of behavior, whether the behavior is perceived by the rater as mild, moderate or severe, distress when interrupted, and functional

impairment involved in engaging in the behavior. Each domain is rated on a scale from 0 to 3, with 0 representing the individual does not perform this behavior, 1 representing the individual performs the behavior and it is a mild problem, 2 representing that the individual performs the behavior and it is a moderate problem, and 3 representing that the individual performs the behavior and it is a severe problem. Both Lam and Aman (2007) and Mirenda et al. (2010) examined the factor structure of the scale when given to individuals ranging in age from young child to adult. They concluded that the results confirmed the validity of the scale as a measure of repetitive behaviors in individuals with autism. Subscale inter-rater reliability ranged from .55 (Sameness Behavior) to .78 (Self-Injurious Behavior). Test-retest data ranged from .52 (Ritualistic Behavior) to .96 (Restricted Interests). The scale was utilized to determine the presence of repetitive behaviors demonstrated by children in the school.

Questions about behavioral function (QABF).

Questions about Behavioral Function is a 25 item questionnaire which is used to assess causal factors related to a specific behavior exhibited in persons with developmental disabilities *(*Appendix C; Matson & Vollmer, 1995). The questionnaire is comprised of five categories of behavioral function: attention, escape, physical, tangible, and nonsocial. The student's teacher rated each item, which is on a four point likert scale to determine frequency (choices include Never, Rarely, Some, and Often). Items include "Engages in the behavior to get attention," "Engages in the behavior when there is nothing else to do," and "Engages in the behavior to escape work or learning situations" (Matson & Vollmer, 1995). This measure has been determined to be valid for determining the functionality of behaviors with 56.3% convergent validity with analog sessions (Paclawskyj, Matson, Rush, Smalls, & Vollmer, 2001).

Procedure

Pretreatment.

Students were assessed using the Repetitive Behavior Scale- Revised (Appendix B; Bodfish, Symons, & Lewis, 1999; Bodfish et al, 2000; Lam & Aman, 2007) to determine if there were exhibiting repetitive behaviors which were currently interfered with their school day and rated as moderate to severe on the 0 to 3 likert scale. Two target repetitive behaviors were chosen for each student, based on level of functional impairment (to necessitate intervention), higher-order characteristics (most importantly that the function of the behavior is hypothesized to be nonsocial) and feasibility to implement in school setting. Each behavior was operationally defined.

The Questions about Behavioral Function (Appendix C; Matson & Vollmer, 1995) was administered to determine the maintaining variables for each of the two target repetitive behaviors.

Problem behavior which was predictably a result of restricting access to the target repetitive behaviors was identified by the teachers of each student. The problem behavior was monitored on the School Day Data Form (Appendix I).

Prior to baseline, during baseline, and during treatment implementation, both target repetitive behaviors were monitored throughout the school day on the School Day Data Form (Appendix I). Frequency of target behaviors and associated problem behavior were recorded throughout the school day. These behaviors were monitored to assess for the effects of the intervention throughout the school day.

A brief preference assessment was conducted for each participant based on the general procedure of Roane, Vollmer, Ringdal, and Marcus (1998) to determine which tangible

reinforcers were utilized with the student. The preference assessment was five minutes in length. Prior to the assessment each participant was presented with ten stimuli that were arranged in a circle on a table. The participant was free to manipulate the items of their choice. The examiner placed the participant's hand on the items and/or modeled item manipulation. After each item was sampled, the participant was moved a meter away from the assessment area, the examiner moved away from the assessment area, and the session began. During the assessment period the examiner calculated the percentage of intervals spent manipulating each item using a 10-s partial-interval recording procedure (Appendix D).

A 10 minute discrete trial teaching session of the five alternative behaviors was conducted (Appendix H). Sessions were divided into 2 minute increments to teach each alternative behavior. Each alternative behavior was taught by pointing to the visual display, reading the verbal prompt on the visual ("I can stretch"), and demonstrating the behavior for the learner. The learner was reinforced for approximations and correct completion of all five alternative behaviors. The learner was given their preferred reinforcer (edible, tangible etc.) for each approximation or correct demonstration of alternative behavior. This was given at a fixed continuous ratio schedule and labeled praise ("Good job, that's stretching!") was provided. Frequency of approximations (A) and correct (C) demonstrations of alternative behaviors throughout the 10 minute session were recorded.

Each baseline session was 10 minutes in length. Target behaviors were prompted from the initiation of a change in environment by the experimenter. Each arrangement made by the learner to return the environment to their preferred state was recorded (frequency) as well as the latency between the change and arrangement (Appendix E). The environment was returned to the changed state (with each learner response) to allow for more behavioral

opportunities from the learner. No corrective feedback or differential reinforcement was provided to the learner. Any approximations or completion of alternative behaviors was also recorded to assess for demonstration of these behaviors prior to treatment. Baseline was complete when the frequency of responding was stable for two consecutive sessions.

Operational definitions

a. Repetitive Behavior

a. **Compulsive Behavior** (e.g., arranging/ordering, completeness, washing/cleaning, checking, counting, hoarding/saving, repeating, touch/tap) Any behavior that is repeated and performed according to a rule, or involves things being done "just so."

b. **Ritualistic Behavior** (e.g., routine insisted on at eating/mealtime, sleeping/bedtime, self-care, travel/transportation, play/leisure, communication/social interactions) Activities of daily living which occur in a predictably similar manner.

c. **Sameness Behavior** (e.g., insistence on things remaining in same places, objection to visiting new places, upset when interrupted, insistence on walking in particular pattern, insistence on sitting in same place, dislikes alterations to appears or behavior of others, insistence on use of particular door, preference for same audio or visual recording which is playing continuously, difficulty with transitions, insistence on same daily routine or schedule, insistence of maintenance of previously established time schedule) Any behavior that consists of difficulty with environmental change and insistence that conditions stay the way they were previously

established (Bodfish, Symons, & Lewis, 1999; Bodfish, Symons, Parker, & Lewis, 2000; Lam & Aman, 2007).

b. Problem Behavior (i.e. aggression, self-injurious behavior, and disruptions)- Any behavior that disrupts the continuation of the school day, any attempt or instance of hitting or kicking self or others, scratching with nails, pinching, biting, grabbing (including other's clothing), head butting by making contact with the participant's head to another person's body and applying pressure and/or throwing/kicking items (6 inches or greater), ripping items, banging or kicking furniture, floor, door, or other hard surfaces from a distance of 6 inches or greater, stomping the floor with foot from 1 inch off the floor or higher, elopement of 3 feet or greater from assigned instructor, slamming doors or items on the floor or table from a distance of 6 inches or greater, dumping items or fluids from a distance of 6 inches or greater, or flopping on the floor.

c. **Session Signal and Alternative Behavior Visual Prompts**- (e.g., waiting time session indicator, deep breathing, jumping jacks, run into the mat, positive self-statement, stretching, squeeze stress ball)- Alternative behaviors were identified after an assessment of the five alternative behaviors on the Assessment of Alternative Behaviors Data Form (Appendix F). These alternative behaviors were chosen based on the premise of soothing the individual and having a calming effect based on the proposed function of repetitive behavior being negatively reinforced by reducing anxiety. Visual prompts were utilized. They illustrated the alternative behaviors which served as an appropriate and functionally equivalent alternative to the target repetitive behavior (Appendix J).

Intervention procedure (behavior 1).

Teaching steps (Appendix G) with gradual increases in latency between presentation of the evoking stimuli and initiation of the target repetitive behavior were applied to each of the targeted repetitive behaviors. Frequency and latency of target repetitive behaviors one and two were collected during the length of the school day throughout baseline, intervention and follow-up.

Response blocking sessions were 10 minutes in duration, 1 to 3 sessions per day, 3 to 5 days per week at the student's primary educational facility. Sessions began with the first teaching step of a 5 second latency. Data were recorded throughout the session on the Response Blocking Session Data Form (Appendix E) to determine the frequency of target repetitive behavior, and latency between introduction of evoking stimuli and initiation of target repetitive behavior. The next teaching step of the intervention was then implemented when the student was able to wait the specified latency in the teaching step for 80% of possible opportunities for two consecutive sessions or did not engage in the target behavior during the session.

Response blocking with differential reinforcement of alternative behavior was implemented as follows:

a) Response blocking

    a. Session signal visual was displayed to indicate when response blocking sessions were in progress (Appendix I)

    b. Any attempt to engage in target repetitive behavior was blocked by the experimenter by placing the experimenter's hand or body between the student and the materials

If the student was able to initiate the target repetitive behavior the environment was returned to the previous state to allow for more instances of the target or alternative behaviors to be demonstrated during the remainder of the 10 minute period.

i. All occurrences of problem behavior were ignored or blocked

c. If the student waited the specified latency of the teaching step before engaging in the target repetitive behavior

i. High quality enthusiastic labeled praise verbal praise (e.g., "good job waiting 2 seconds") on a FR1 schedule of reinforcement for waiting specified latency was provided.

ii. Tangible reinforcement on FR3 schedule with child's preferred reinforce was provided.

d. No physical contact or redirection was provided when problem behavior occurred

b) Differential reinforcement of alternative behavior (DRA)

a. Alternative behavior visuals were displayed throughout response blocking sessions (Appendix I).

b. Tangible reinforcement and high quality enthusiastic praise verbal praise (e.g., "great job running into the mat") was given on a FR1 schedule of reinforcement for engaging in specified alternative behavior and compliance with task demands during the 10 minute session.

c. When student attempted to engage in the target repetitive behavior the experimenter verbally redirected the child to the alternative behavior by

pointing to visual prompt and providing corrective feedback (e.g., "breathe, stretch" etc.).

i. If the student initiated the target repetitive behavior the environment was immediately returned to the previous state to allow for more instances of the target or alternative behaviors to be demonstrated during the remainder of the 10 minute period.

d. When the student engaged in any problem, behavior no praise, attention, or physical contact was provided.

Sessions were video recorded and coded for inter-rater reliability.

Intervention procedure (behavior 2).

Repeat Intervention Procedure for the second identified target behavior.

Post treatment (behavior 1 and 2).

Frequency and latency of target repetitive behavior and associated problem behavior were collected during the school day.

Follow-up.

One month following completion of the intervention phase of the second target repetitive behavior two response blocking sessions with a 5 minute expected latency were implemented for each target behavior to determine the frequency and latency of target repetitive behavior at 1 month follow-up.

Coding of data.

Data on frequency and latency of both target repetitive behaviors as well as all alternative behaviors for each individual were recorded from baseline to follow-up response blocking sessions and graphed by the experimenter. Additionally, the frequency of repetitive

and resulting problem behavior (e.g., tantrum, aggression, destructive behavior) which occurred during the school day (during baseline, treatment, post treatment, and at one month follow-up), were recorded for each student during the school day by the student's teacher or aide.

A video coder independently and randomly chose a selection of videos to code for reliability. The video coder was trained on the topography of target repetitive behaviors for each participant, and all alternative behaviors present during session. The video coder was trained to watch response blocking session videos and record data on the Response Blocking Session Data Form (Appendix G). Inter-observer Agreement was calculated by dividing the number of agreed upon events (frequency of target behavior, frequency of alternative behavior, and latency within 5 seconds) by the observers by the total possible events recorded and multiplying by 100 (Cooper, Heron & Heward, 2007). Latency data were considered in agreement if the discrepancy between the two data points was less than or equal to 5 seconds. Agreement also included the frequency of the target behaviors indicated and the frequency of alternative behaviors recorded. Any discrepancies between the instructor and the video coder were discussed with videos being recorded by each individual until an agreement was met. A minimum of 20% of total sessions were coded by an independent research assistant with a goal of achieving a minimum of 80% consistency overall prior to collaborative review of video.

CHAPTER III

Results

Visual inspections of all data were conducted. Visual inspections were complemented by the use of statistical process control charts (SPC; Orme & Cox, 2001). Statistical process control charts are constructed by creating a running record of outcome variability by plotting time against the outcome variable and adding three elements: a central value (the mean outcome) is computed and plotted as a solid line and referred to as the center line (the CL). Upper and lower control limits corresponding to plus and minus a certain criterion from the midpoint are computed and plotted as dashed lines parallel to the center line and are referred to as the upper control limit (UCL) and lower control limit (LCL), respectively. This type of chart is also referred to as a moving range chart or X-mR-Chart. The following formulas were used:

1. Compute the range (*R*) of each two adjacent data points. This is known as a "moving range" for *n*=2. (Note there was one fewer range value than data points.)

2. Compute the mean moving range (where "*n*" represents the number of observations).

$$\bar{R} = \sum R/n - 1$$

3. Compute the estimate of the population standard deviation.

$$\sigma_X = \frac{\bar{R}}{1.128}$$

4. Compute the UCL and LCL 1.96 standard deviations from the mean, and plot these along with the mean to determine significant differences of p>.05.

$$UCL_x = \bar{X} + 1.96\sigma_x$$

$$LCL_x = \bar{X} - 1.96\sigma_x$$

5. Analyses were also calculated for three standard deviations from the mean to determine significant differences of p >.01. These differences are indicated on graphs with red as rule violations.

$$UCL_{x_2} = \bar{X} + 3\sigma_x$$

$$LCL_{x_2} = \bar{X} - 3\sigma_x$$

6. The range of responses was indicated by a dotted line for the upper specification (U Spec) and lower specification (L Spec). For frequency data this was the highest frequency outcome of the set as the U Spec and zero as the L Spec. For the latency data 10 minutes was used as the U Spec, as this was the length of sessions, and .01667 was the L Spec, as 1 sec response was the shortest latency response possible.

In SPC literature variability is determined to be within or outside the limits set by chance. Chance variability is outcomes that fall within the boundaries of the UCL and LCL. When all outcomes are within the UCL and LCL, the process producing these outcomes is said to be "in statistical control." Therefore the output of this process is predictable and stable within the UCL and LCL, and there is no change in the process parameter (the mean). When the outcomes are above the UCL or below the LCL, the process producing these outcomes is said to be "out of statistical control." This means there has been a change in the process parameter (the mean) and the process is not predictable and stable with the limits of the UCL

and LCL (Orme & Cox, 2001). Note that when there was no target repetitive behavior during response blocking sessions, a latency of 10 minutes was substituted for the SPC analyses.

In addition to SPC analyses, ipsative z-scores were utilized (Mueser, Yarnold, & Foy, 1991). Ipsative z-scores calculate within-subject differences over time. Raw data were converted into ipsative z-scores derived from each participants mean and standard deviation, creating a standardized variable. Statistical significance was calculated by using each participant's data points at baseline, each step of intervention and follow-up, and calculating the z-score by subtracting the data point for each variable from the mean score for that variable and dividing it by the standard deviation for that variable. The following formula:

$$1.64(J[1\text{-}ACF(1)])^{1/2}$$

where J is the number of scores to be compared (three, for baseline, step 6 of intervention, and follow-up), and 1.64 equals a one-tailed constant due to the hypothesized increase of latency scores, frequency of alternative behavior, and hypothesized decrease in frequency of repetitive target behavior (Feryo, 2008; Hoffman, 2011). To achieve significance at an alpha level of .05 the absolute value of the contrasted z-score would need to be equal to or greater than the critical difference. Ipsative z scores were used to determine significant differences between the baseline, final intervention step (Step 6) and follow-up, not between each session. See Table 1 for the mean and standard deviation of latency, Table 2 for frequency of target repetitive behavior, and Table 3 for frequency of alternative behavior for participants.

A paired-samples t-test was conducted to compare latency during baseline and latency during the last step of intervention and follow-up. Step 6 and follow-up latency data were combined for this analysis. When all 11 behaviors were combined into one pre group and one

post group, there was a significant difference in the scores for latency pre (*m* = .70, *SD* = 1.32) and latency post (*m* = 8.58 , *SD* = 1.03); t(9) = -17.12, *p* = .000 .

A paired-samples t-test was conducted with Behavior 1 separated from Behavior 2 for each participant. This analysis excluded BH because he only completed treatment for one target repetitive behavior. For Behavior 1, there was a significant difference in the scores for latency pre (*m* = .08, *SD* = .05) and latency post (*m* = 8.49, *SD* = 1.34); *t*(4) = -13.57, *p* = .000.

Lastly, a paired-samples, t-test was conducted with Behavior 2 separated from Behavior 1 for each participant. Again, this analysis excluded BH because he only completed treatment for one target repetitive behavior. For Behavior 2, there was a significant difference in the scores for latency pre (*m*= 1.33, *SD* = 1.72) and latency post (*m* = 8.66, *SD* = .76); *t*(4) = -11.29, *p* = .000. See Figure 2, 3 and 4 for the latency of target behavior, frequency of target behavior, and frequency of alternative behaviors across sessions by participant and behavior.

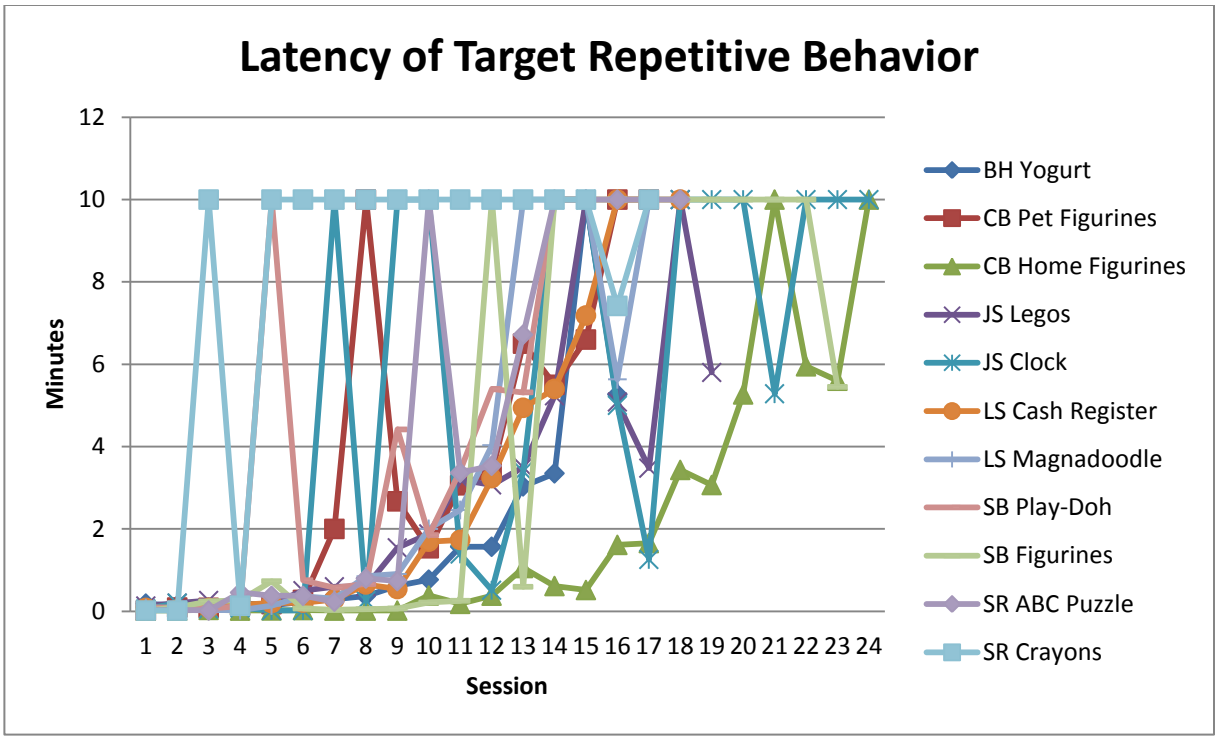


Figure 2. Latency of Target Repetitive Behavior by Participant and Behavior

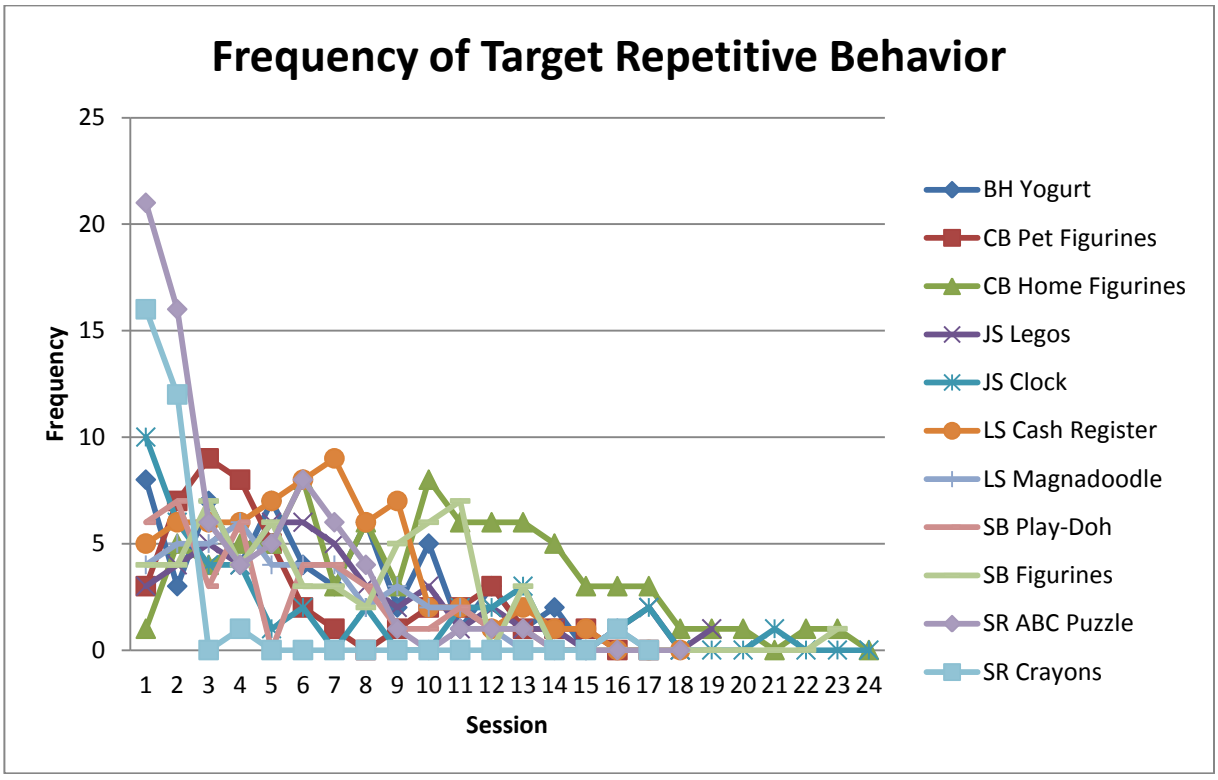


Figure 3. Frequency of Target Repetitive Behavior by Participant and Behavior

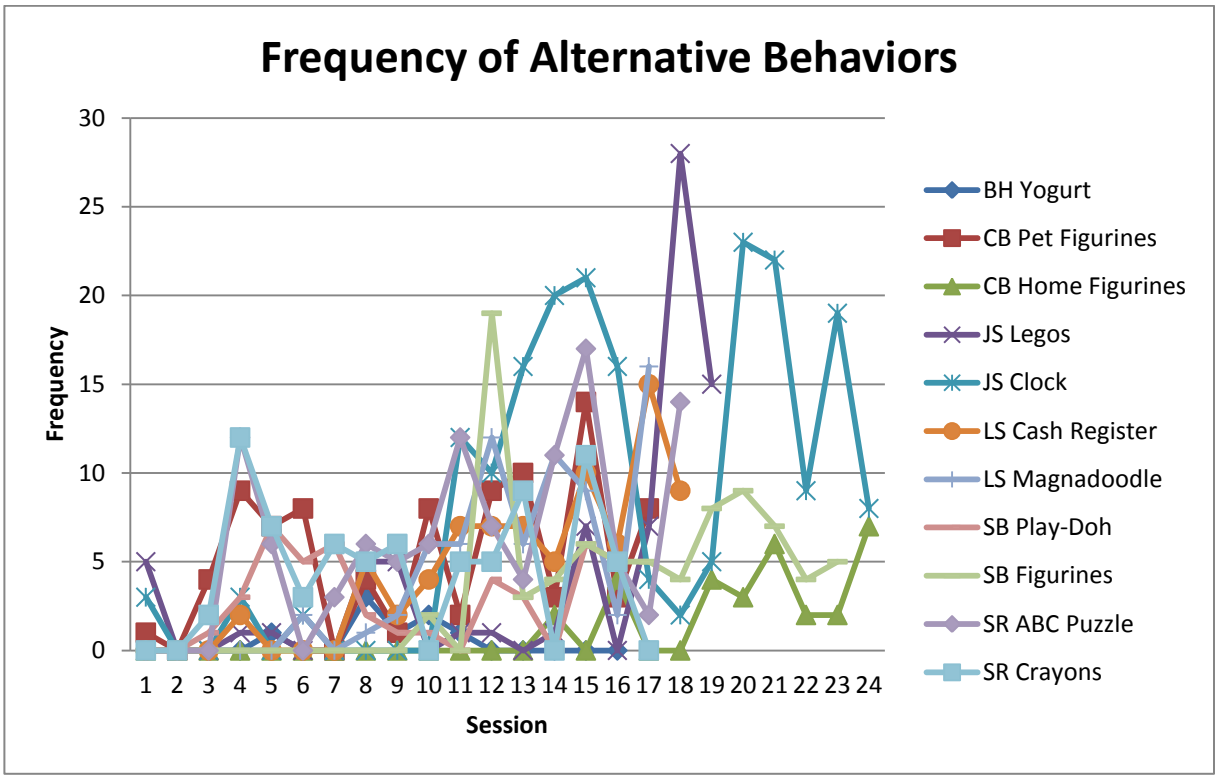


Figure 4. Frequency of Alternative Behaviors by Participant and Behavior

Table 1
Mean and Standard Deviation of Latency in Minutes for Participants at Baseline, Step 6, and Follow-Up

	Mean (SD) Baseline	Mean (SD) Step 6	Mean (SD) Follow-Up
BH Latency	.15 m (.05)	3.19 m (.22)	7.63 m (3.35)
CB Latency Pet Figurines	.05 m (.05)	6.2 m (.61)	10 m (0)
CB Latency Home Figures	.02 m (.01)	7.07 m (2.56)	7.8 m (3.11)
JS Latency Legos	.16 m (.05)	5.95 m (2.82)	7.9 m (2.97)
JS Latency Clock	3.07 m (4.78)	7.64 m (3.34)	10 m (0)
LS Latency Cash Register	.07 m (.02)	8.59 m (1.99)	10 m (0)
LS Latency Magnadoodle	.04 m (.02)	10 m (0)	7.82 m (3.09)
SB Latency Play-Doh	.08 m (.02)	7.66 m (3.31)	10 m (0)
SB Latency Pet Figurines	.17 m (.23)	10 m (0)	7.73 m (3.22)
SR Latency ABC Puzzle	.03 m (.01)	10 m (0)	10 m (0)
SR Latency Crayons	3.35 m (5.77)	10 m (0)	8.71 m (1.83)

Note: Since BH did not complete follow-up sessions the scores represented in Step 6 were from BH's Step 5 and the scores represented in follow-up were from Step 6 of intervention.

Table 2

Mean and Standard Deviation of Frequency of Target Behavior for Participants at Baseline, Step 6, and Follow-Up

	Mean (SD) Baseline	Mean (SD) Step 6	Mean (SD) Follow-Up
BH Frequency Yogurt	5.5 (2.38)	1.5 (.71)	.5 (.71)
CB Frequency Pet Figurines	5 (2.83)	1 (0)	0 (0)
CB Frequency Home Figures	4.44 (2.01)	.67 (.58)	.5 (.71)
JS Frequency Legos	3.1 (.71)	1 (.82)	.5 (.71)
JS Frequency Clock	2.9 (3.21)	.5 (.71)	0 (0)
LS Frequency Cash Register	5.67 (.58)	.5 (.71)	0 (0)
LS Frequency Magnadoodle	5 (.82)	0 (0)	.5 (.71)
SB Frequency Play-Doh	5.33 (2.08)	.5 (.71)	0 (0)
SB Frequency Pet Figurines	4.22 (1.56)	0 (0)	.5 (.71)
SR Frequency ABC Puzzle	14.33 (7.64)	0 (0)	0 (0)
SR Frequency Crayons	9.33 (8.33)	0 (0)	.5 (.71)

Note: Since BH did not complete follow-up sessions the scores represented in Step 6 were from BH's Step 5 and the scores represented in follow-up were from Step 6 of intervention.

Table 3
Mean and Standard Deviation of Alternative Behavior for Participants at Baseline, Step 6, and Follow-Up

	Mean (SD) Baseline	Mean (SD) Step 6	Mean (SD) Follow-Up
BH DRA	0 (0)	0 (0)	0 (0)
CB Frequency DRA Pet Figurines	.5 (.71)	9 (5.57)	5.5 (3.54)
CB Frequency DRA Home Figurines	0 (0)	3.67 (2.08)	4.5 (3.54)
JS Frequency DRA Legos	2.5 (3.54)	3.75 (3.78)	21.5 (9.19)
JS Frequency DRA Clock	.8 (1.32)	15.5 (9.19)	13.5 (7.78)
LS Frequency DRA Cash Register	0 (0)	8 (2.83)	12 (4.24)
LS Frequency DRA Magnadoodle	0 (0)	10 (1.41)	9 (9.9)
SB Frequency DRA Play-Doh	.33 (.58)	1.5 (2.12)	5.5 (.71)
SB Frequency DRA Pet Figurines	0 (0)	8 (1.41)	4.5 (.71)
SR Frequency DRA ABC Puzzle	0 (0)	11 (8.49)	8 (8.49)
SR Frequency DRA Crayons	.67 (1.15)	5.5 (7.78)	2.5 (3.53)

Note: Since BH did not complete follow-up sessions the scores represented in Step 6 were from BH's Step 5 and the scores represented in follow-up were from Step 6 of intervention.

Participant 1 (BH)

BH was a 4-year-old Caucasian male diagnosed with Pervasive Developmental Disorder, Not Otherwise Specified. BH was talkative and opinionated, eager to assert his preferences in the school and home environments. BH's mother reported that a difficulty at home was his restricted diet. He had several preferred food textures that limited his ability to meet his nutritional needs. BH's teacher also noted that BH only ate his less preferred food when given a more preferred food as reinforcement for each bite of a less preferred food. BH's inability to generalize skills he learned in the school environment to the home environment was noteworthy. For example, although during school BH drank from a cup without a lid since the beginning of the school year, at home BH continued to drink exclusively from his preferred "sippy" cup.

The Repetitive Behavior Scale-Revised (RBS-R) was completed by BH's teacher. For arranging/ordering (arranges certain objects in a particular patter or place; need for things to be even or symmetrical Under the Compulsive Behavior Subscale, BH's teacher indicated that he had a moderate problem). Under the Ritualistic Behavior Subscale BH's teacher noted that rituals involving eating/mealtime (strongly prefers/insists on eating/drinking only certain things; eats or drinks items in a set order; insists that meal related items are arranged a certain way) in addition to travel/transportation (insists on taking certain routes/paths; must sit in specific location in vehicles; insists that certain items be present during travel, e.g., toy or material; insists on seeing or touching certain thing or places during travel such as a sign or store) occurred and was a severe problem, and sleeping/bedtime (insists on certain pre-bedtime routines; arranges items in room "just so" prior to bedtime; insists that certain items be present with him/her during sleep; insists that another person be present prior to or during

sleep) occurred and was a moderate problem. For the Sameness Behavior Subscale BH's teacher indicated that he likes the same media (CD, tape, record, music, or video) played continually and resists changing activities (difficulty with transitions) and both issues were a moderate problem. BH's teacher indicated that on a scale from 1-100 where 1= not a problem at all, and 100= as bad as you can image, BH's behaviors described in the questionnaire were at a 25. Based on the results of the RBS-R and consultation with both BH's teacher and parent, BH's ritualistic eating behavior was targeted for intervention. Specifically, BH's insistence on receiving a preferred food item (string cheese, cheese puffs, or veggie sticks) after every bite of a non-preferred item (yogurt) was the agreed upon target behavior. Latency was built into this behavior to weaken the association between BH's eating behavior and reinforcement without sacrificing the gains BH had made with varying his diet. Response blocking sessions took place during BH's regularly scheduled morning snack time. During this intervention BH was in the process of transitioning to a less restrictive classroom setting which meant that he had progressively less availability during the school day. For this reason BH completed the intervention for only one target behavior: ritualistic eating of yogurt. When BH completed the intervention he was then missing his snack time to attend his new classroom setting, and therefore was not able to complete follow-up sessions.

BH's teacher completed the Questions About Behavioral Function (QABF) for BH's ritualistic eating of yogurt. Responses indicated that the function of BH's target behavior was nonsocial, as in it is a behavior in which BH would engage in while alone, and lacks the social component of attention, escaping a demand situation, of physiological origin, and is not performed in an attempt to obtain access to a tangible item. BH's Alternative behavior assessment revealed that he was capable of performing all five alternative behaviors,

including breathing, saying a positive self-statement ("I am okay"), running into the mat, stretching, and squeeze a squishy ball. BH's preference assessment indicated that he chose to play with the Thomas train, sports squeezes, and key chain pulls, and therefore these items would be made readily available during intervention sessions as potential reinforcers.

Latency data.

Visual inspections of BH's latency of target behavior revealed a stable baseline with a gradual increase in the latency over the 12 sessions of intervention (see Figure 5). SPC analysis of BH's latency of eating his preferred food following a bit of yogurt during response blocking sessions revealed that during Step 6 of intervention the latency data were out of statistical control ($p < .01$; see Figure 6). The mean latency during baseline was .15 min ($SD = .05$) with an increase to Step 6 to a mean latency of 7.63 min ($z = 1.99$, ns), with 10 minutes being substituted for analyses when the behavior did not occur during follow-up session 15. See Table 1 for mean latency scores and standard deviations.

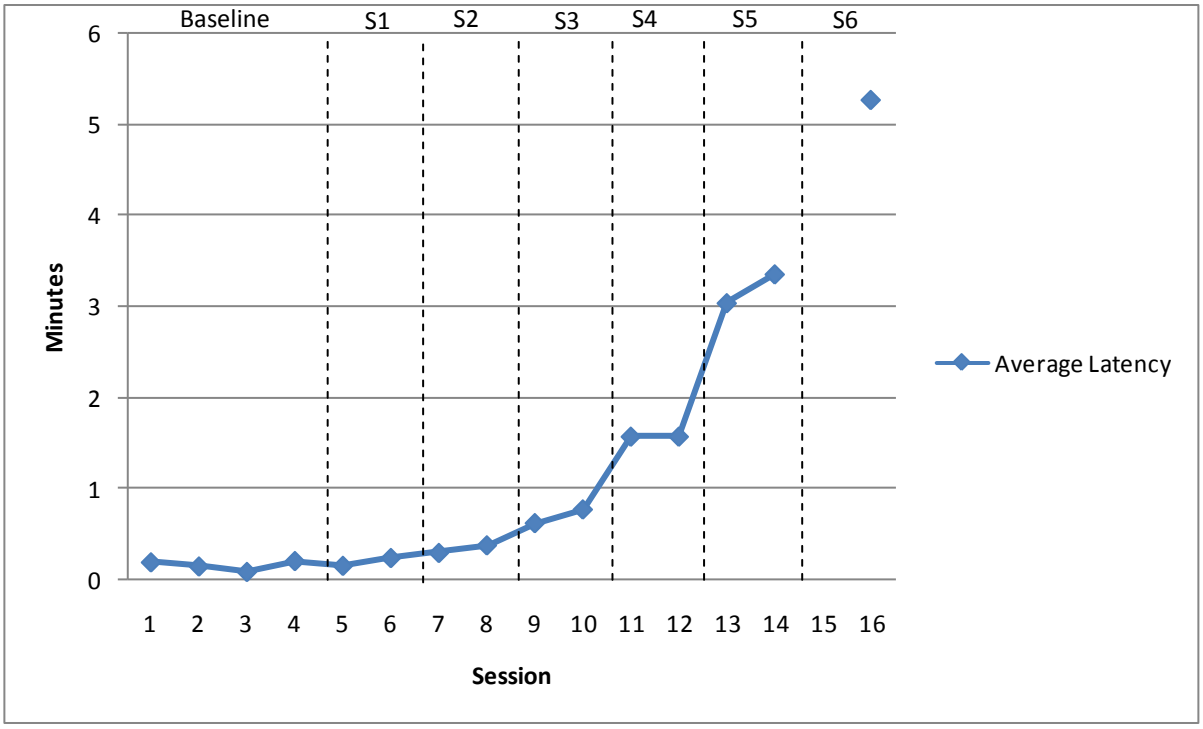


Figure 5. BH's Average Latency for Ritualized Eating of Yogurt during Response Blocking Sessions

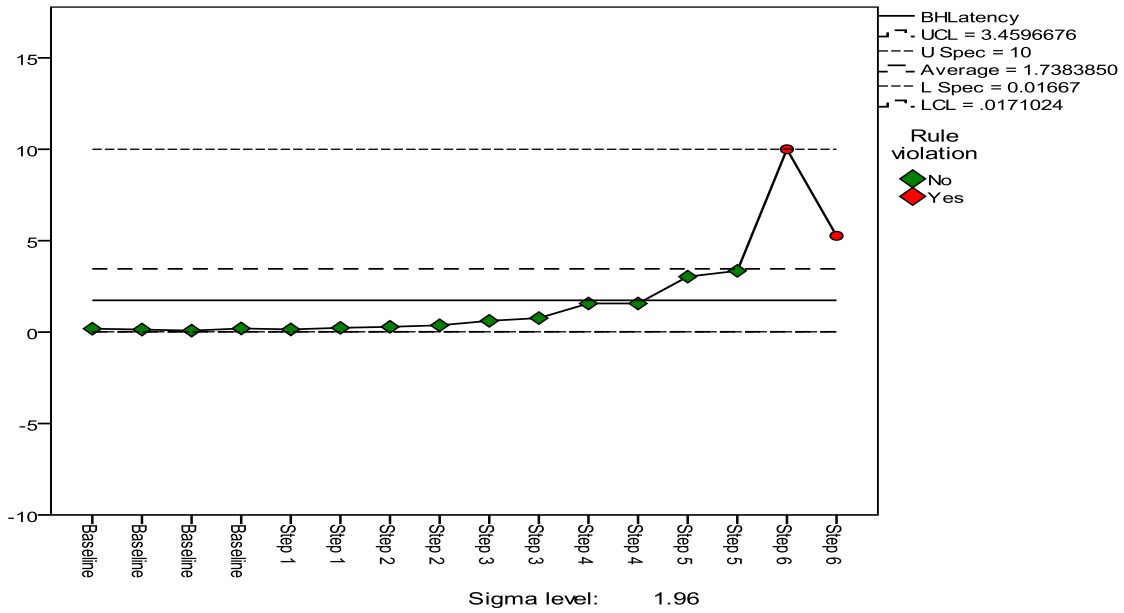


Figure 6. BH's Average Latency for Ritualized Eating of Yogurt during Response Blocking Sessions.

Frequency data.

Visual inspections of the frequency of BH's target behavior of eating a preferred food item following a bite of yogurt during response blocking sessions revealed no clear relationship between the different behaviors, as the target behavior decreased and the alternative behavior showed a symmetrical, unimodal, bell-shaped curve (see Figure 5). SPC of the frequency of BH's target behavior of eating a preferred food item following a bite of yogurt during response blocking sessions revealed that the treatment was in statistical control, therefore not statistically significant ($p > .05$, *ns*; see Figure 6). Ipsative z analyses were consistent with SPC. The mean frequency of BH's target behavior during baseline was 5.5 ($SD = 2.38$). At the end of the intervention phase, Step 6, the frequency dropped to .5 ($z = 1.89$, *ns*), as illustrated in Figure 7. See Table 2 for mean frequency scores and standard deviations.

SPC analysis of the frequency of BH's alternative behaviors during sessions revealed that during Step 2 of the intervention BH's frequency of three alternative behaviors was out of statistical control ($p < .01$) and again during Step 3 with a frequency of 2 alternative behaviors ($p < .05$). Ipsative z analyses revealed a steady baseline with a mean of 0 ($SD = 0$), followed by an increase to a mean of 1.5 during Steps 2 and 3, followed by another decline of alternative behaviors during Steps 5 and 6 to baseline levels ($m = 0$, $SD = 0$). Significant changes in alternative behavior were not noted with the ipsative z. See Table 3 for mean alternative frequency scores and standard deviations.

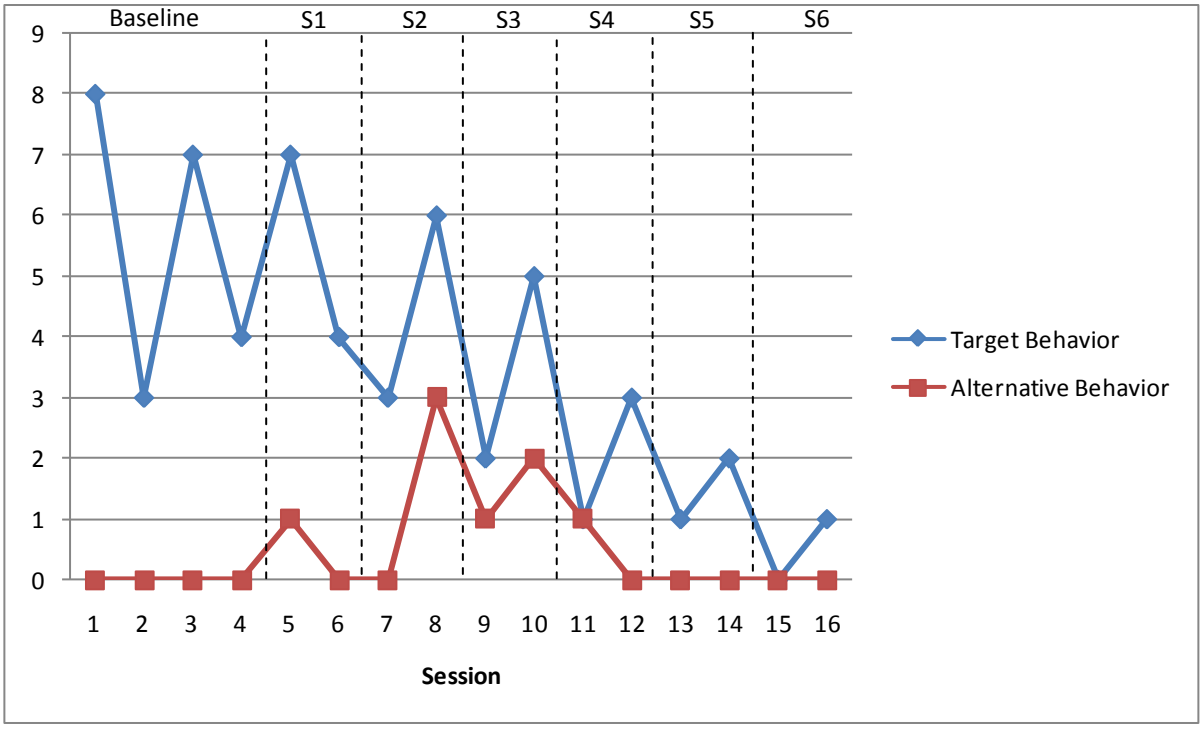


Figure 7. BH's Frequency of Ritualized Eating of Yogurt and Alternative Behavior during Response Blocking Sessions.

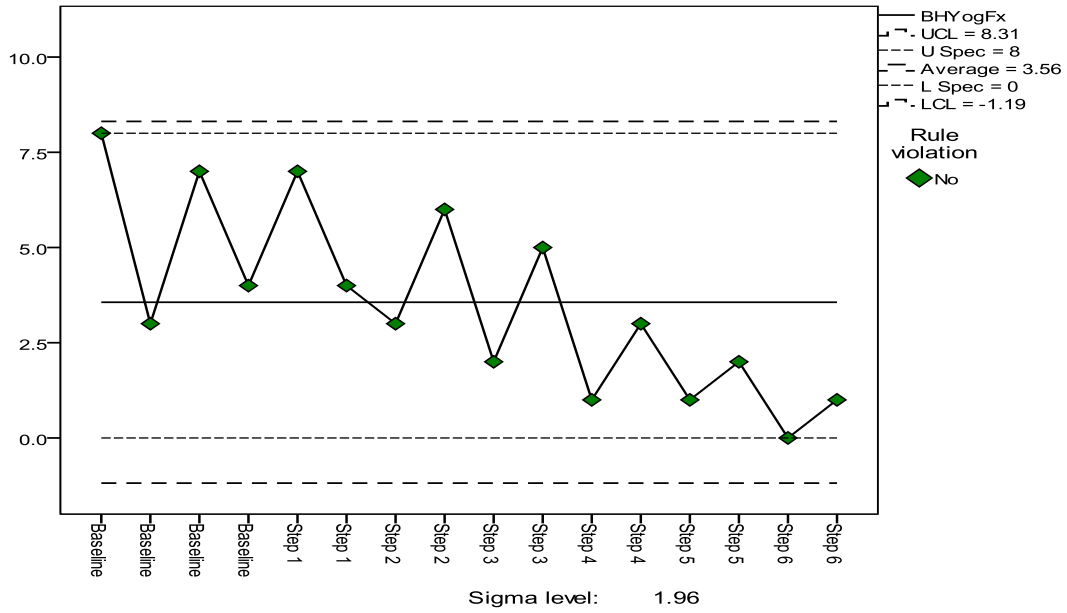


Figure 8. BH's Frequency of Ritualized Eating of Yogurt during Response Blocking Sessions

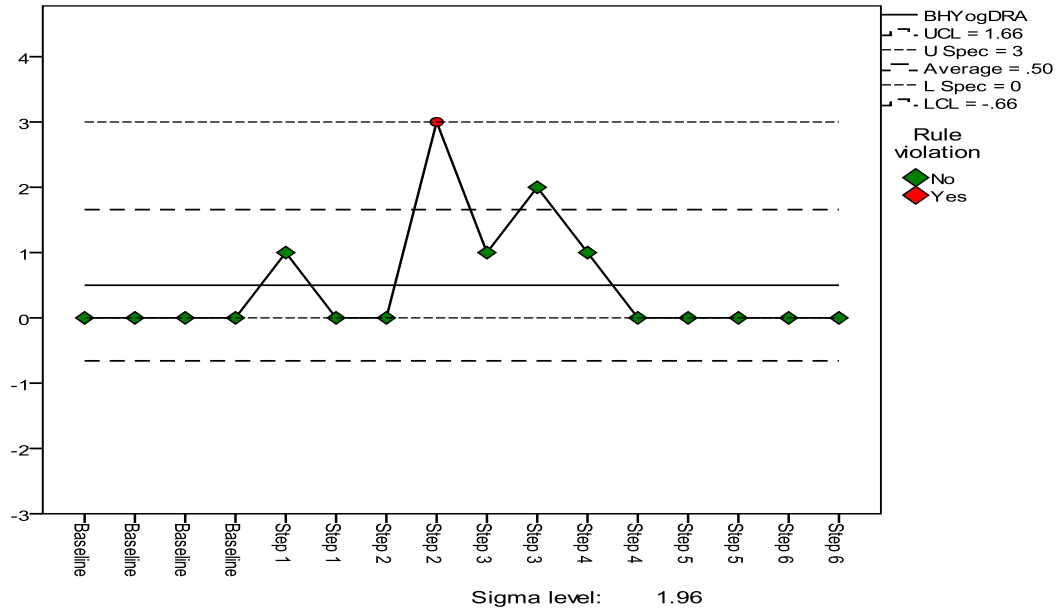


Figure 9. BH's Frequency of Alternative Behavior during Response Blocking Sessions.

School day data.

Visual inspections of BH's frequency of ritualistic eating and associated problem behavior during the school day revealed relatively steady levels of ritualistic eating and problem behavior throughout the intervention (see Figure 10).

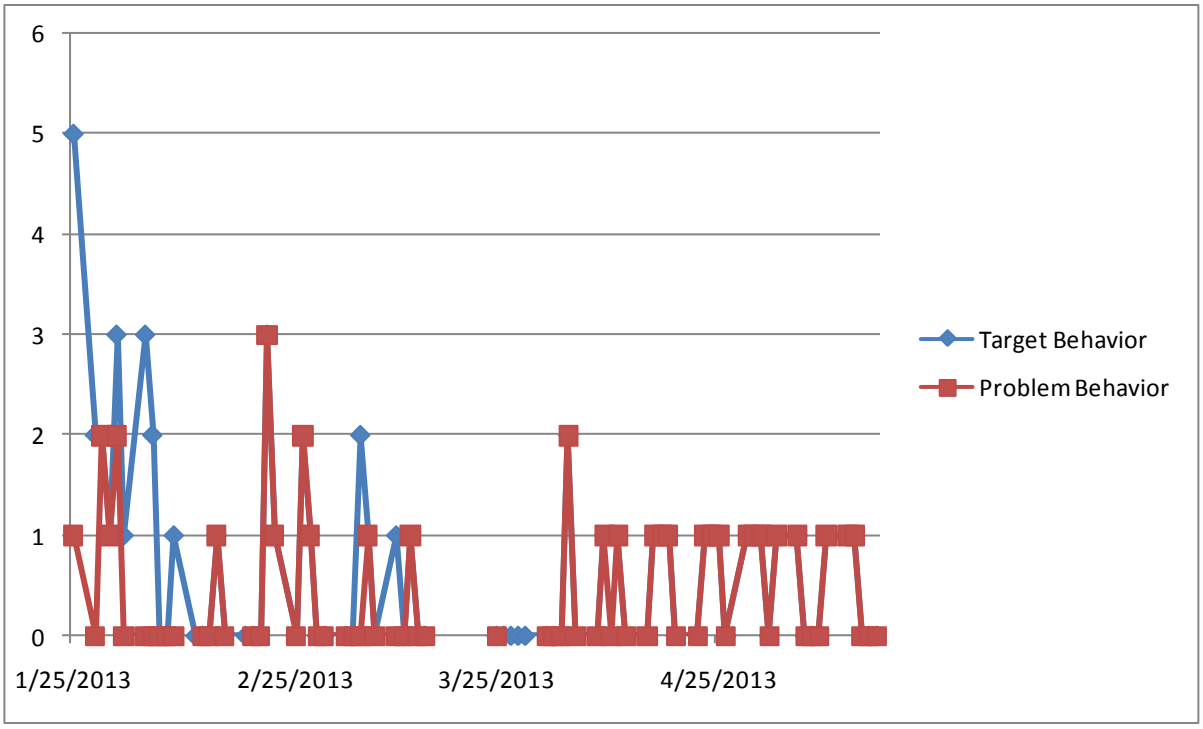


Figure 10. BH's Frequency of for Ritualized Eating of Yogurt and Problem Behavior during the School Day.

Inter-observer Agreement was reached at a level of 96.43% agreement between instructor and video coder for BH sessions.

Participant 2 (CB)

CB was 4-year-old Caucasian female diagnosed with Autistic Disorder who turned 5 during the intervention. CB was noted by teachers to engage in scripting which comprised most of her expressive language. Spontaneous language was noted to be minimal, as CB often appeared to be reacting to internal stimuli rather than responding to her surroundings. Teachers noted that during the school day CB was often fixated on obtaining toy figurines which CB brought in from home. CB was so insistent on finding and playing with these figurines that it would often interrupt her school day, as she would not engage in her educational programming. Teachers reported that when CB played with the figurines she

would line up them up repetitively, and would not let others join in her play. When others would attempt to move a figurine from her arrangement CB would say "no no no!" and move their hand away.

Both CB's parent and teacher filled out a RBS-R. Under the Compulsive Behavior Subscale CB's teacher indicated that she engaged in arranging/ordering and that it was a severe problem, hoarding/saving (collects, hoards or hides specific items) and it was a moderate problem, along with touch/tap (need to touch, tap, or rub items, surfaces, or people) which was also a moderate problem. CB's parent indicated that she had a severe problem with completeness (must have doors opened or closed; takes all items out of container or area). Under the Ritualistic Behavior Subscale both CB's teacher and parent indicated that she had a severe problem with eating/mealtime rituals. CB's parent also reported that she had severe problems with sleeping/bedtime rituals as well as play/leisure rituals (insists on certain play activities; follows a rigid routine during play/leisure; insists that certain items be present/available during play/leisure; insists that other persons do certain things during play). Under the Sameness Behavior Subscale both CB's teacher and parent agreed that she had a moderate problem with becoming upset if interrupted in what she is doing and a moderate problem with resisting a change in activities (difficulty with transitions). CB's parent also indicated that she has a severe problem with liking the same media (CD, tape, record, music, or video) played continually. CB's teacher indicated that on a scale from 1-100 where 1= not a problem at all, and 100= as bad as you can image, BH's behaviors described in the questionnaire were at a 40, while CB's parent rated the severity to be an 85.

Based on the results from the RBS-R and consultation with CB's parent and teachers, CB's behavior of arranging/ordering figurines during play was targeted for intervention. CB's

teacher indicated that if someone would move a figurine off of the line, CB would take the figure back and return the figurine to the line or move the entire line of figurines to join the moved figurine. In consultation with CB's teacher it was decided that CB's first behavior for intervention would be novel figurines brought by the experimenter (Behavior 1). Once intervention was completed for the novel figurines, the intervention would be replicated with the arranging/ordering of her preferred figurines which CB brought to school from home (Behavior 2).

Both CB's parent and teacher filled out the QABF for her arranging/ordering toy figurines. Both CB's parent and teacher indicated that the function of her arranging/ordering figurines during play was predominantly nonsocial in nature. CB's assessment of alternative behaviors indicated that she was capable of performing all five of the alternative behaviors when prompted. CB's preference assessment indicated that she chose the key chain pulls, mini M&Ms, and Thomas the Train most often from the reinforcers provided.

Behavior 1

Latency data.

Visual inspections and ipsative z analyses of the latency of arranging/ordering pet figurines during response blocking sessions for CB revealed stability at baseline with a mean of .05 min (*SD* = .05; see Figure 11) and a steady increase until Step 6 with a mean of 6.2 min ($z = 1.22$, *ns).* During follow-up, no target repetitive behavior occurred, making the latency immeasurable ($z = 1.98$, *ns*). SPC revealed that sessions when no target behavior occurred, during Step 3 and at follow-up, the outcomes were out of statistical control ($p < .01$; see Figure 12).

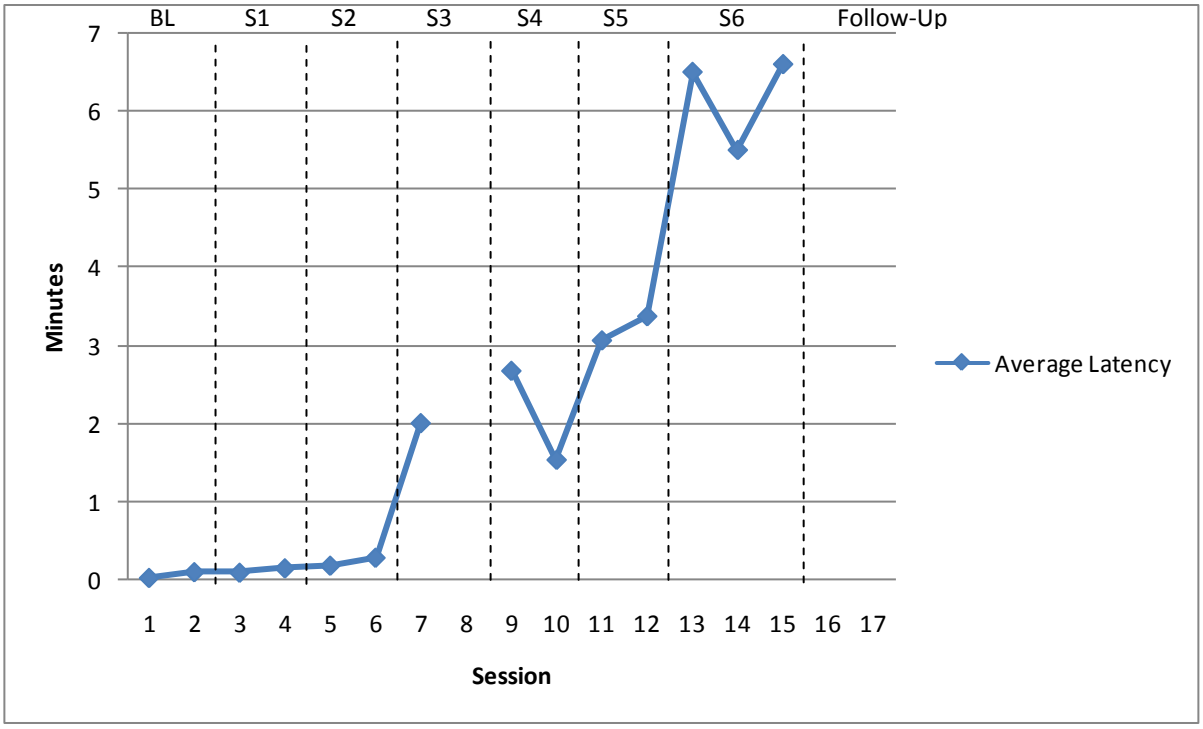


Figure 11. CB's Average Latency for Arranging/Ordering Pet Figurines (Behavior 1) during Response Blocking Sessions.

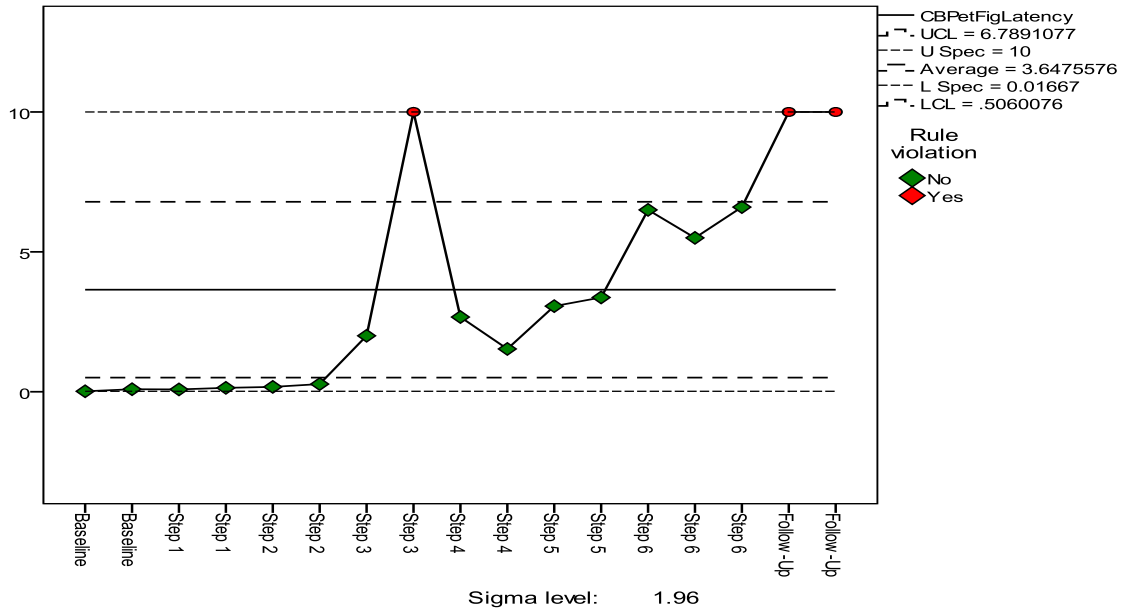


Figure 12. CB's Average Latency for Arranging/Ordering Pet Figurines (Behavior 1) during Response Blocking Sessions.

Frequency data.

Visual inspections of CB's frequency of arranging/ordering pet figurines compared to alternative behaviors during sessions revealed an inverse relationship between target repetitive behavior and alternative behavior*;* see Figure 13). SPC revealed that the frequency of arranging/ordering pet figurines was significantly lower than the other sessions during a session in Step 3 and during follow-up when no behavior was observed during any of those session ($p < .05$, see Figure 14). SPC of CB's frequency of alternative behaviors during session revealed that although there was an increase in alternative behavior during response blocking sessions, the outcomes were in statistical control ($p > .05$, *ns*, see Figure 15). Ipsative z analysis revealed an increase in the behavior during baseline with a mean of 5 ($SD = 2.83$) with an initial rise during Step 1 with a mean of 8.5, then a decline during intervention to Step 3 with a mean of 0.50, an increase at Step 5 to a mean of 2.5, followed by another decrease during Step 6 to a mean of 1 ($z = 1.51$, *ns).* Gains were maintained during follow-up when frequency remained at a mean of 0.

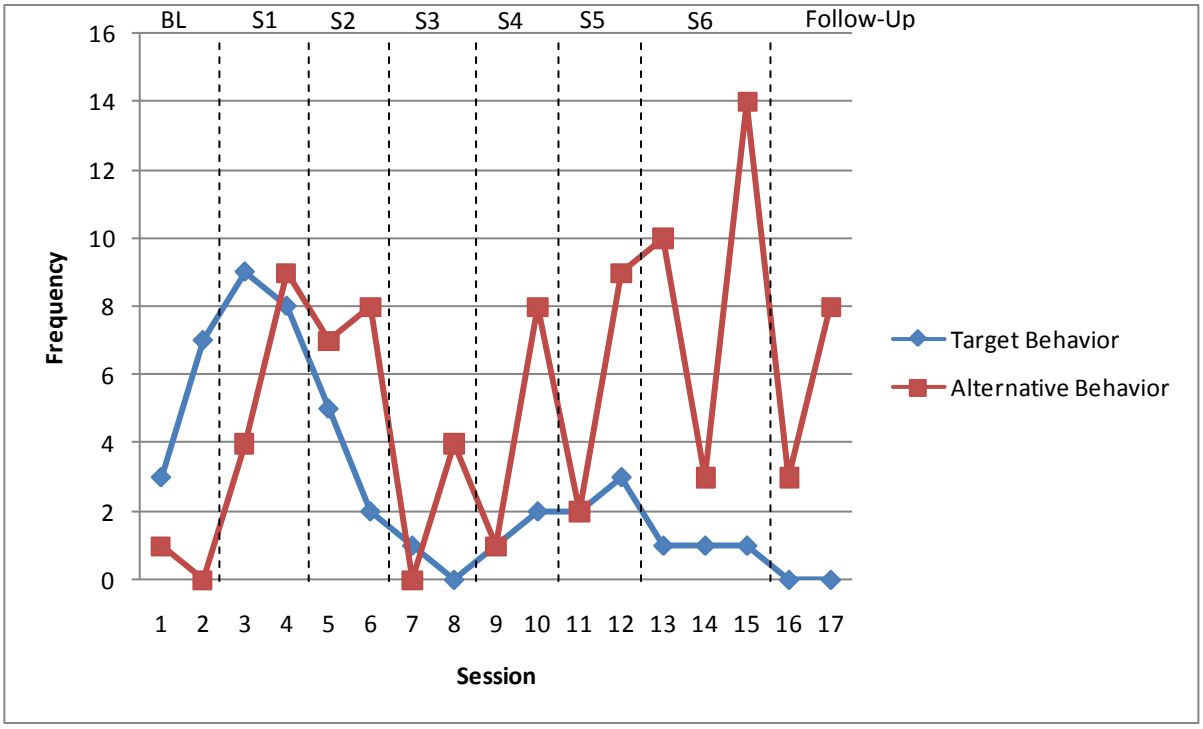


Figure 13. CB's Frequency of Arranging/Ordering Pet Figurines (Behavior 1) and Alternative Behavior during Response Blocking Sessions.

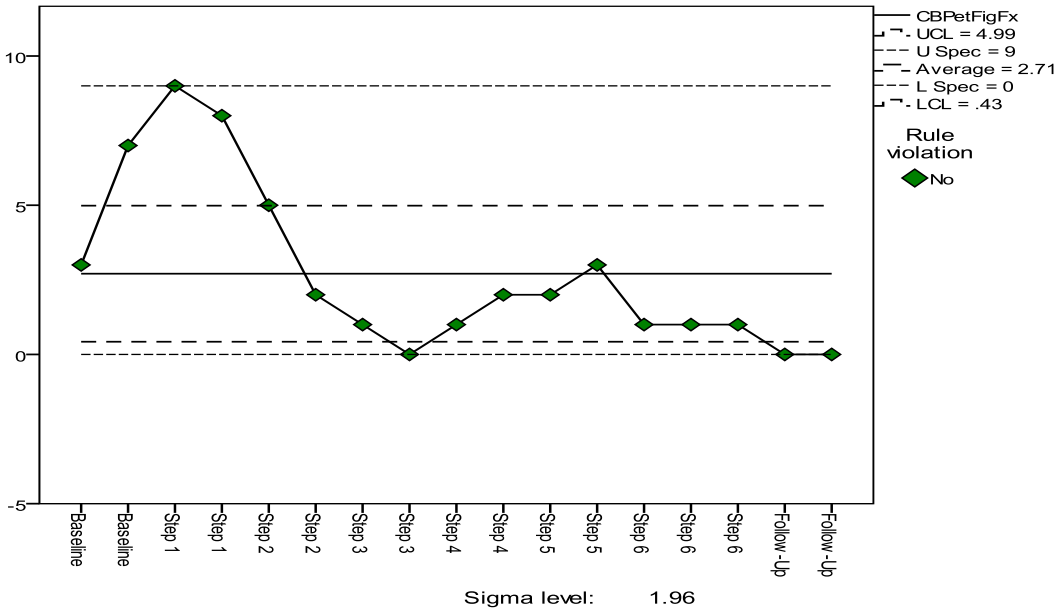


Figure 14. CB's Frequency of Arranging/Ordering Pet Figurines (Behavior 1) during Response Blocking Sessions.

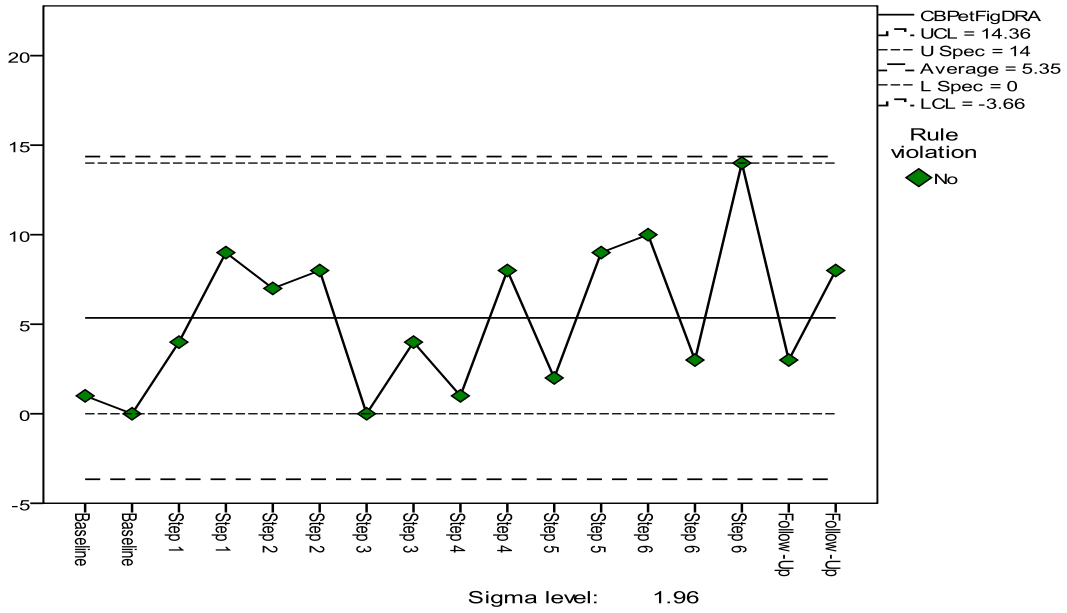


*Figure 15. C*B's Frequency of Alternative Behavior during Response Blocking Sessions.

Behavior 2

Latency data.

Visual inspections and ipsative z analysis of latency data for arranging/ordering figurines from home revealed a stable baseline with a mean of .02 min (*SD* = .01) and a steady increase in latency (with a slight decrease during Step 3; See Figure 16). The latency mean for Step 6 was 7.07 min ($z = 1.64$, *ns*) and at follow-up was 7.8 min ($z = 1.81$, *ns*). SPC for latency during response blocking sessions for CB's figures from home revealed that the latency was out of statistical control and violated the three standard deviation control rule during all sessions in Step 6 and follow-up ($p < .01$; see Figure 17)

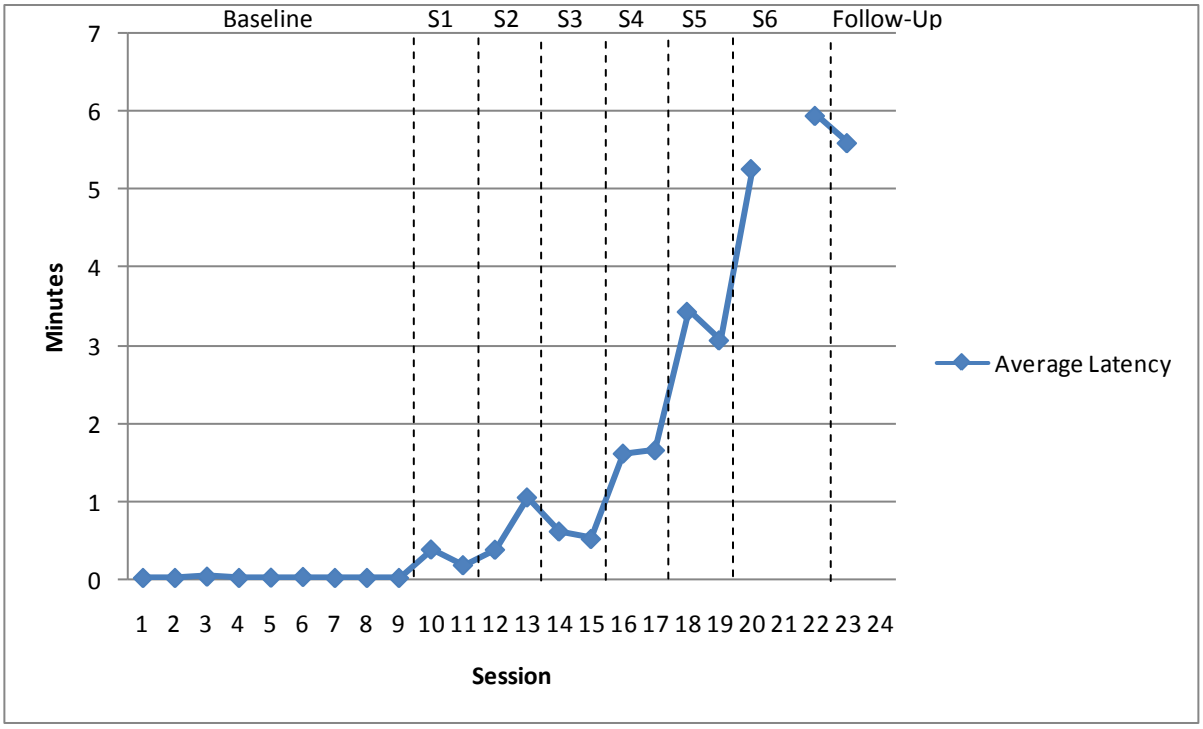


Figure 16. CB's Average Latency of Arranging/Ordering Figurines from Home (Behavior 2) during Response Blocking Sessions

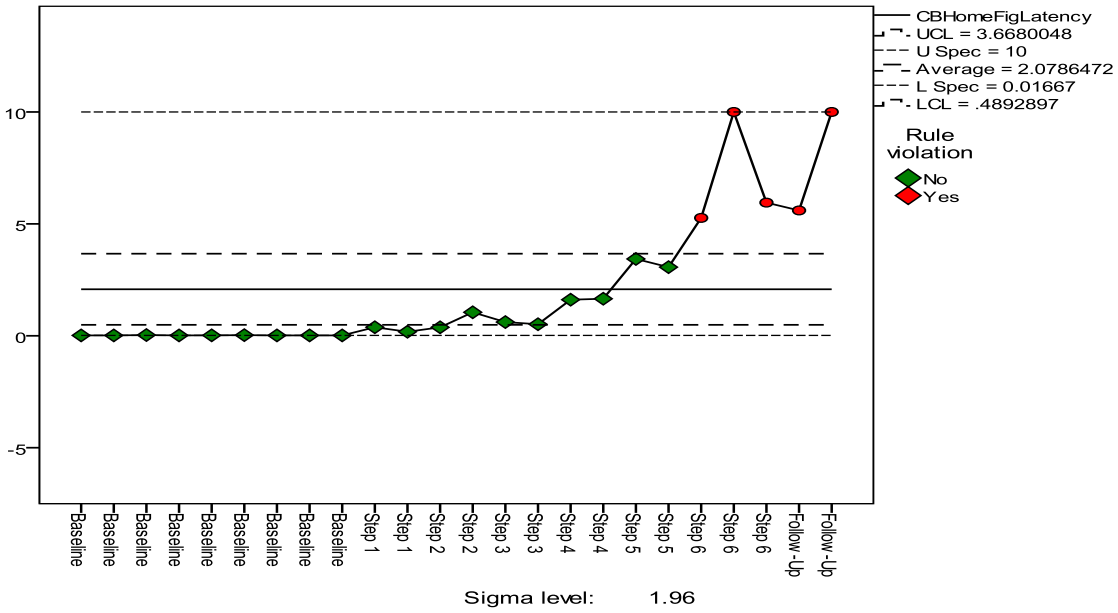


Figure 17. CB's Average Latency of Arranging/Ordering Figurines from Home (Behavior 2) during Response Blocking Sessions.

Frequency data.

Visual inspections of frequency of arranging/ordering pet figurines from home revealed a relatively steady baseline for the target repetitive behavior and a stable baseline for alternative behavior, followed by an inverse relationship between the outcome variables during intervention and follow-up; See Figure 18). Ipsative z analysis revealed baseline with a mean of 4.4 (*SD* = 2.01). During Step 1 the frequency rose to a mean of 7, and then consistently fell during Step 6 and follow-up to a mean of .67 of .50, respectively ($z = 1.69$, *ns*; $z = 1.77$, *ns*). Visual inspections of alternative behavior frequency revealed baseline was stable with a mean of 0 (*SD* = 0). Frequency of alternative behaviors rose throughout intervention, ending during Step 6 and follow-up with a mean of 3.67 and 4.50, respectively ($z = 1.53$, *ns*; $z = 1.88$, *ns*). SPC for arranging/ordering pet figurines from home revealed that when the frequency was zero during Step 6 of intervention and follow-up, the outcome variable was out of statistical control ($p < .05$, *ns*; see Figure 19). SPC for alternative behavior during home figurines response blocking sessions revealed that alternative behavior was out of statistical control with frequencies of four and above during Step 4 and Step 6 of intervention ($p < .05$), with the rule violation occurring during Step 6 and follow-up ($p < .01$; see Figure 20).

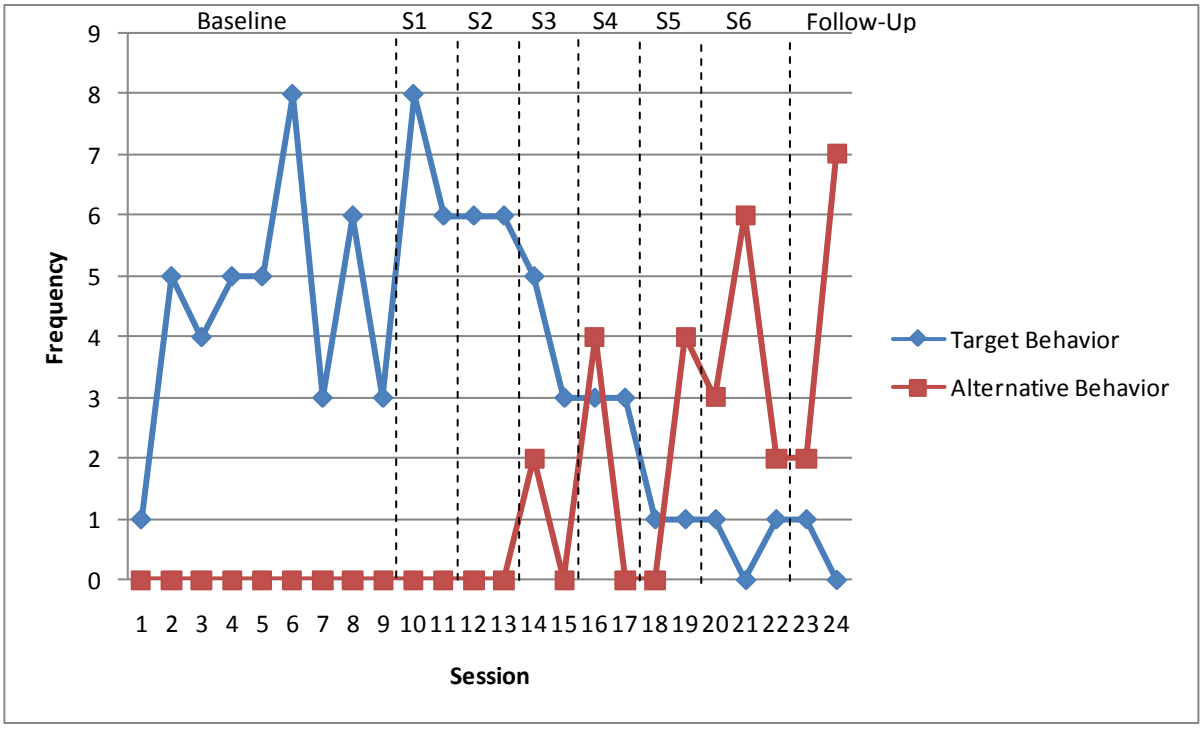


*Figure 18. C*B's Frequency of Arranging/Ordering Figurines from Home (Behavior 2) and Alternative Behavior during Response Blocking Sessions.

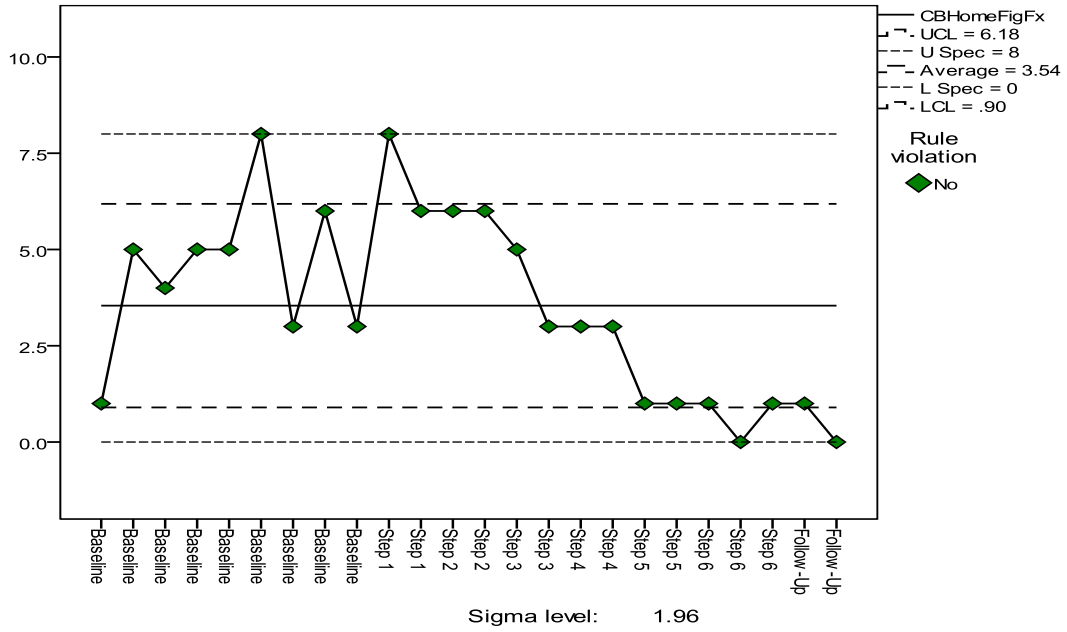


*Figure 19. C*B's Frequency of Arranging/Ordering Figurines from Home (Behavior 2) during Response Blocking Sessions.

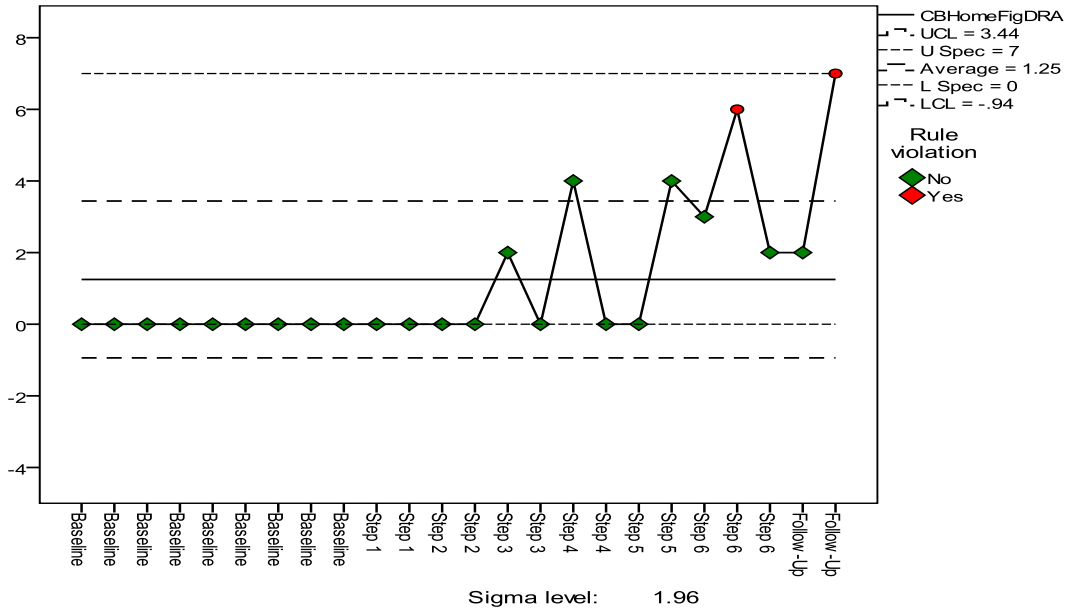


*Figure 20. C*B's Frequency Alternative Behavior during Response Blocking Sessions.

School day data.

Visual inspections of frequency of arranging/ordering objects in school and associated problem behavior revealed initially higher levels of arranging/ordering during the school day which decreased by mid-February, with generally stable lower levels of problem behavior throughout the intervention and follow-up (see Figure 21).

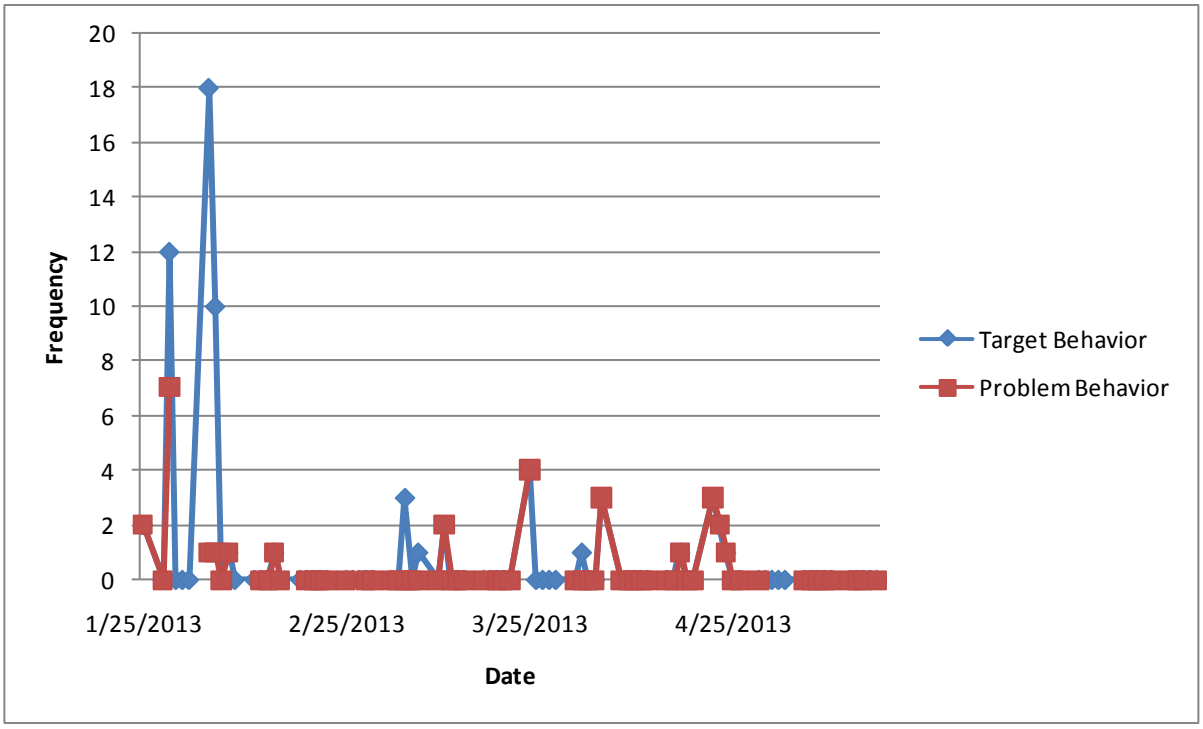


Figure 21. CB's Frequency of Arranging/Ordering Figurines and Problem Behavior during the School Day.

Inter-observer Agreement was reached at a level of 88.49% agreement between instructor and video coder for CB session data.

Participant 3 (JS)

JS was a 4-year-old Caucasian male who turned 5 during the intervention. JS was diagnosed with Pervasive Developmental Disorder, Not Otherwise Specified. JS had well developed expressive language skills and was able to initiate and maintain conversation with both peers and adults. JS had an intense interest in trains. This interest manifested when JS played with Legos, as he was noted to exclusively build trains with his Legos. During this play JS would not allow peers or teachers join his play by refusing to let others add or take away any piece of his Lego trains. JS was also noted to have an interest in Cinderella. This interest incorporated JS's fixation on a toy clock that was present in the classroom. Teachers

noted that JS would frequently request to play with the toy clock and would get stuck in this play by not being easily redirected and refusing to transition to a different activity.

The RBS-R was completed by both JS's parent and teacher. Under the Compulsive Behavior Subscale JS's parent indicated that he had a severe problem with completeness, and a moderate problem with arranging/ordering as well as checking (repeatedly check doors, windows, drawers, appliances, clocks, locks, etc.). JS's teacher reported that he had a severe problem with touch/tap. Under the Ritualistic Behavior Subscale JS's parent reported several items to be a severe problem for him, including rituals during eating/mealtime, sleeping/bedtime, play/leisure, and communication/social interactions (repeats same topic(s) during social interactions; repetitive questioning; insists on certain topics of conversation; insists that others say certain things or respond in certain ways during interactions). JS's teacher agreed that ritualistic behavior involving play/leisure and communication/social interactions were a severe problem for him. Additionally, both JS's parent and teacher reported that travel/transportation were a moderate problem for him. Under the Sameness Behavior Subscale both JS's parent and his teacher agreed that he had a severe problem with liking the same media (CD, tape, record, music, or video) played continually, and a moderate problem with objecting to visiting new places, and insisting on the same routine, household, school or work schedule every day. JS's teacher noted that he had a severe problem with resists changing activities (difficulty with transitions), while his parents reported that this was a moderate problem. JS's parent also noted that he had a moderate problem with insisting that things remain in the same place, became upset if interrupted in what he was doing, and insisted that specific things take place at a specific time. JS's teacher indicated that on a scale

from 1-100 where 1= not a problem at all, and 100= as bad as you can image, JS's behaviors described in the questionnaire were at a 70, while JS's parent rated the severity to be an 85.

Based on the results from the RBS-R and consultation with JS's teachers, the behaviors that were determined to be more disruptive for JS during the school day and most appropriate for treatment was his ritualistic play with Legos (not allowing others to add or take away blocks from trains built; Behavior 1) and repetitive play with a toy clock (insistence that clock be set to certain time, insistence on manipulating hands of clock without them being altered by others; Behavior 2).

Both JS's parent and teacher completed the QABF for his ritualistic play with Legos and repetitive play with the toy clock. For each target behavior both JS's parent and teacher indicated that the function of his behavior was nonsocial. JS's assessment of alternative behaviors indicated that he was capable of performing all five of the alternative behaviors when prompted. During the preference assessment JS chose the Thomas train, silly putty, and Lightning McQueen to play with most often.

Behavior 1

Latency data.

Visual inspections of JS's latency of ritualistic play with Legos during sessions revealed a stable baseline with a*;* steady increase in latency during intervention and follow-up (see Figure 22). During each session of Step 6 and follow-up, the average session latency was out of statistical control and violated the three standard deviation control rule ($p < .01$; see Figure 23). Ipsative z analyses revealed a mean of .16 min ($SD = .05$) and a gradual increase in latency ending at Step 6 with a mean of 4.60 min ($z = 1.49$, *ns*) and demonstrated again in follow-up with a mean of 5.8 min ($z=1.90$, *ns).*

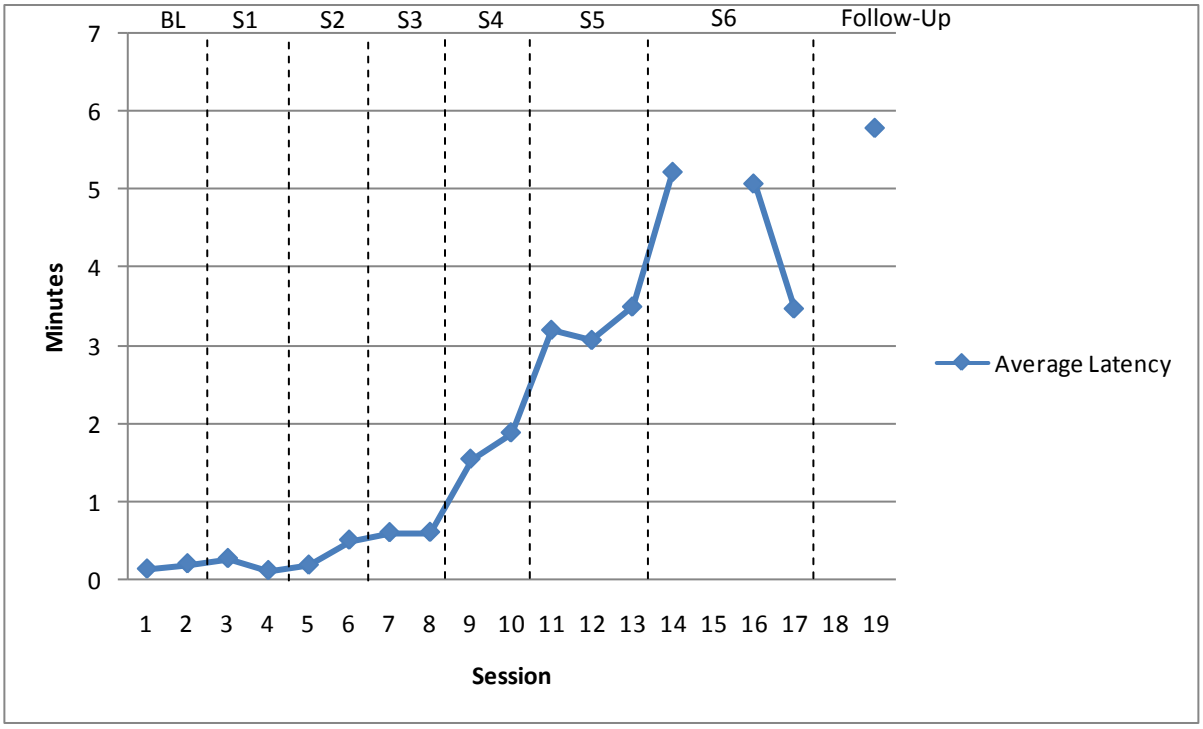


Figure 22. JS's Average Latency of Ritualistic Play with Legos (Behavior 1) during Response Blocking Sessions.

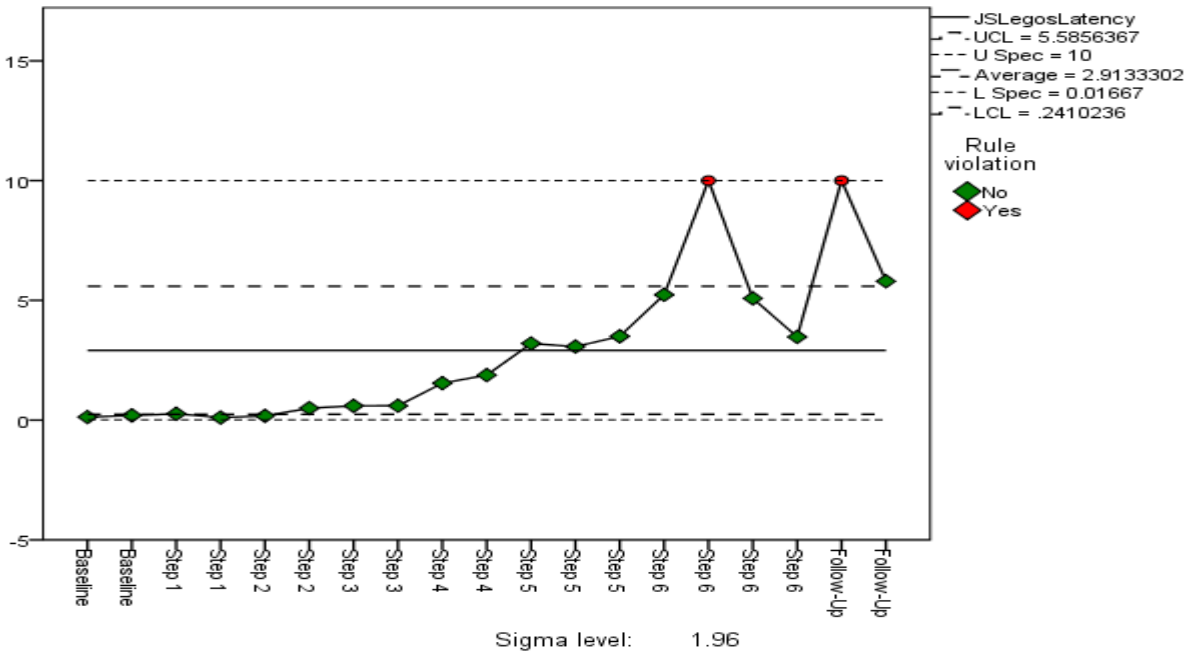


Figure 23. JS's Average Latency of Ritualistic Play with Legos (Behavior 1) during Response Blocking Sessions.

Frequency data.

Visual inspections of the frequency of arranging/order of Legos compared to alternative behavior during sessions revealed a downward trend observed in the target repetitive behavior and a variable upward trend with alternative behavior (see Figure 24). SPC for the target repetitive behavior revealed that when the frequency reached zero during Step 6 and follow-up, frequency was out of statistical control ($p < .05$; see Figure 25). SPC for alternative behaviors revealed that during follow-up the frequency of alternative behavior was out of statistical control and violated the three standard deviation control rule ($p < .01$; see Figure 26).

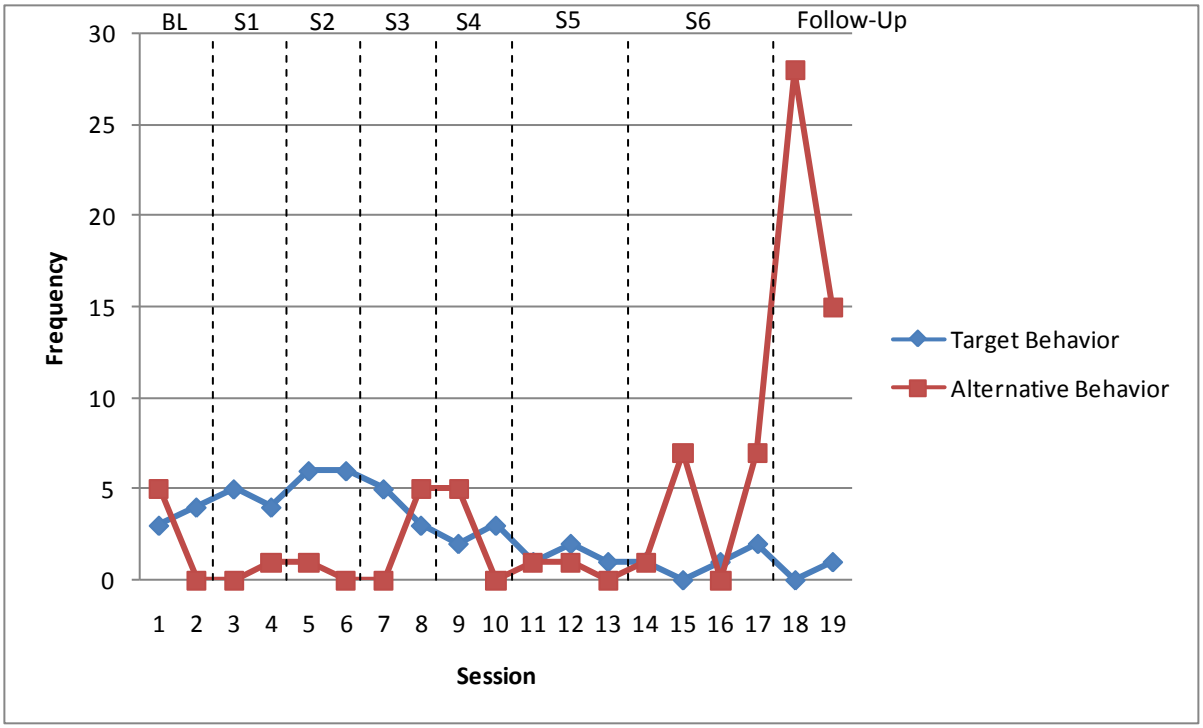


Figure 24. JS's Frequency of Ritualistic Play with Legos (Behavior 1) and Alternative Behavior during Response Blocking Sessions.

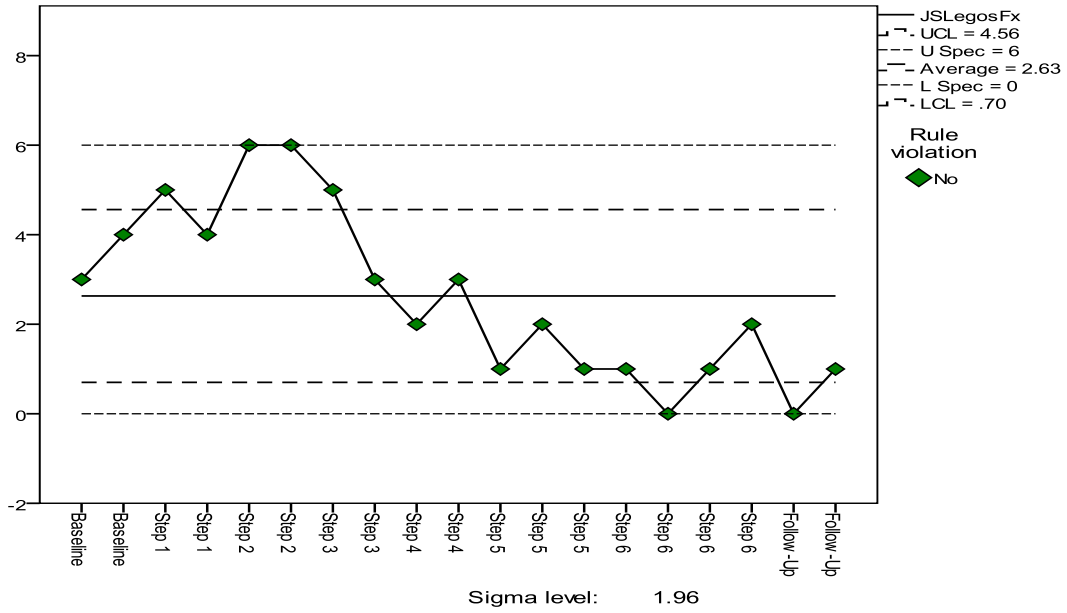


Figure 25. JS's Frequency of Ritualistic Play with Legos (Behavior 1) during Response Blocking Sessions.

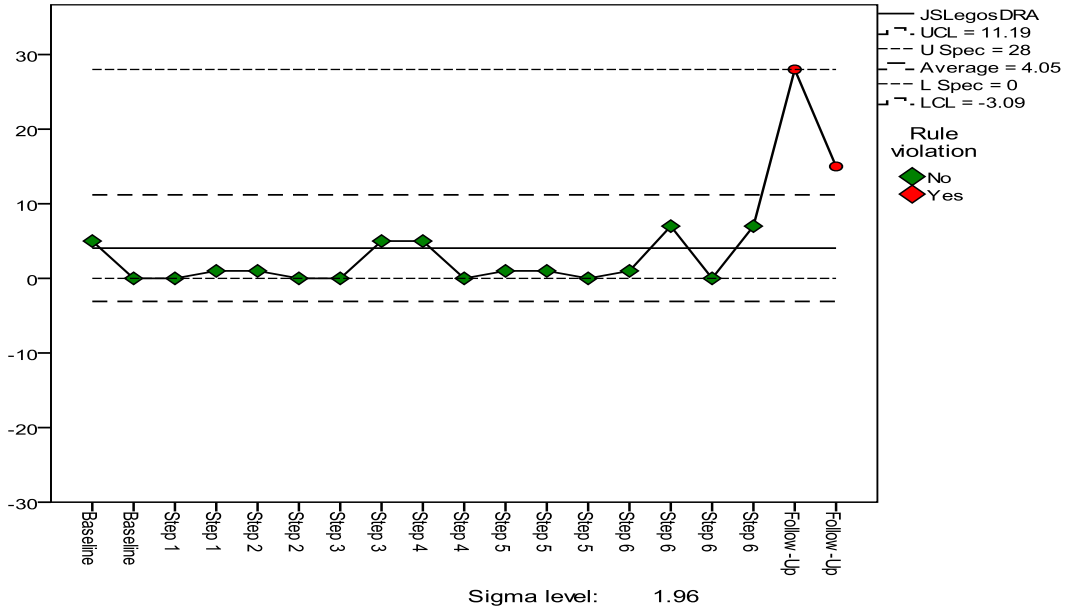


Figure 26. JS's Frequency of Alternative Behavior during Response Blocking Sessions.

Behavior 2

Latency data.

Visual inspections of latency of repetitive play with the toy clock during sessions revealed a relatively stable baseline when the behavior did occur, followed by variable latency during sessions during intervention when the behavior occurred and no behavior occurred during follow-up (see Figure 27). SPC of latency for repetitive play with the clock during response blocking sessions revealed that throughout intervention and follow-up the latency was under statistical control. The overall mean of baseline was 3.7 min (*SD* = 3.21). There were no significant differences between baseline and intervention and follow-up, although there were many sessions during the intervention (8 out of 14) when none of the target behavior took place.

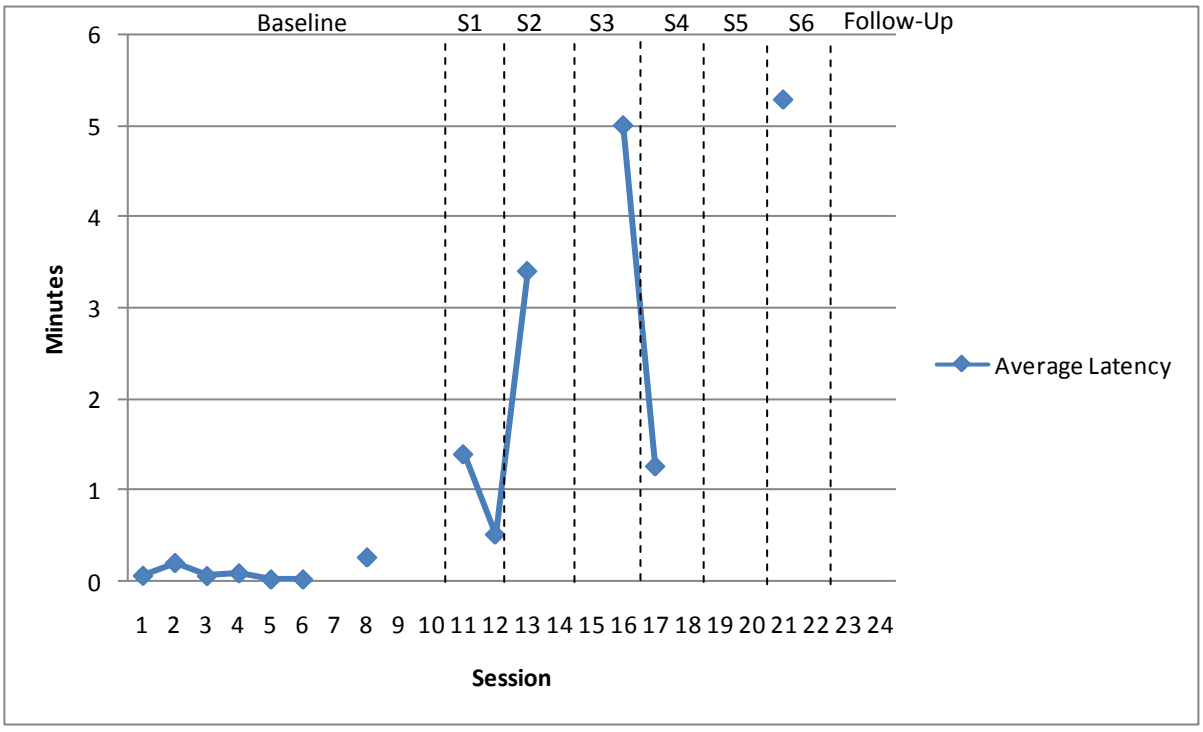


Figure 27. JS's Average Latency of Repetitive Play with Clock (Behavior 2) during Response Blocking Sessions.

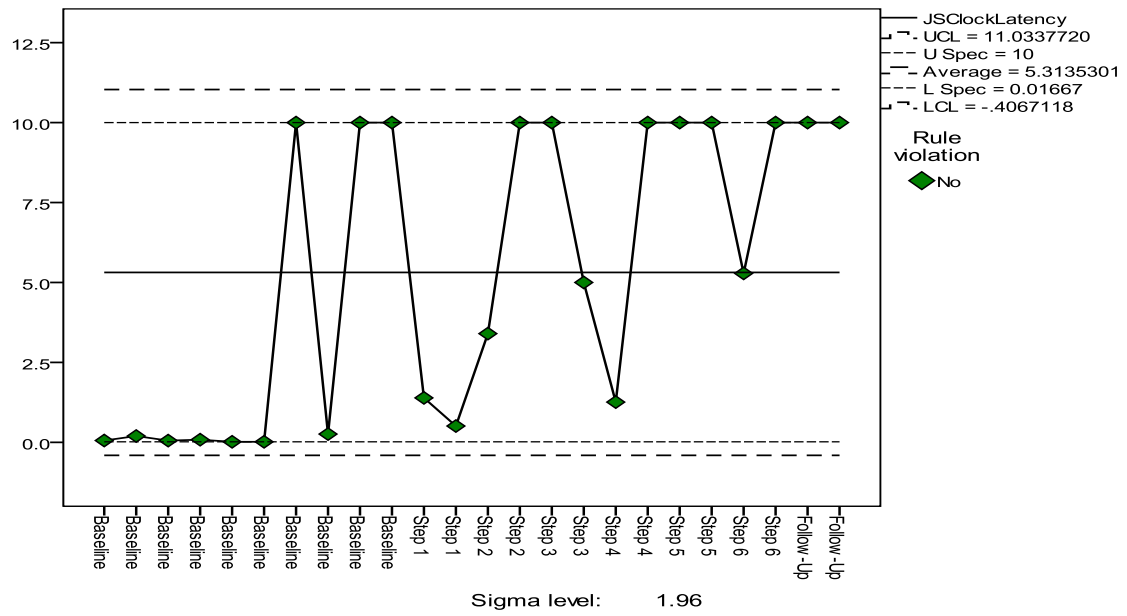


Figure 28. JS's Average Latency of Repetitive Play with Clock (Behavior 2) during Response Blocking Sessions.

Frequency data.

Visual inspections of frequency of repetitive play with the toy clock during sessions revealed a decrease during baseline followed by fluctuation during intervention (see Figure 29). Alternative behavior during sessions also fluctuated, with a bimodal trend. Baseline of target behavior had a mean of 2.9 and a range of 0 to 10 (*SD* = 3.21). Following baseline frequency varied with a range of 0 to 3. Frequency of the target behavior at Step 6 had a mean of .5 (z = 1.55, *ns*), and during both follow-up sessions a mean of 0 was maintained (*z* = 1.87, *ns*).

SPC revealed the target repetitive behavior remained in statistical control throughout intervention and follow-up (see Figure 30). The frequency of alternative behaviors during baseline varied from 0 to 3 with a mean of .80 (*SD* = 1.32) and then increased starting with

Step 1 of intervention to a mean of 11 and continued to increase until Step three with a mean of 18.5.

SPC of alternative behavior during sessions revealed during a session of Step 2 and a session of Step 3 along with a session from Step 5 and a session from Step 6 and the first follow-up session, the frequency of alternative behavior was out of statistical control ($p < .05$; see Figure 31). Additionally during those sessions in Step 5 and Step 6 the control rule of three standard deviations was violated ($p < .01$). Ipsative z analyses were not consistent with SPC. The frequency of alternative behaviors during Step 4 then decreased to a mean of 3. The frequency of alternative behaviors rose again during Step 5 with a means of 14, and again in Step 6 and follow-up, with means of 15.5, and 13.5, respectively ($z = 1.84$, *ns*; $z = 1.59$).

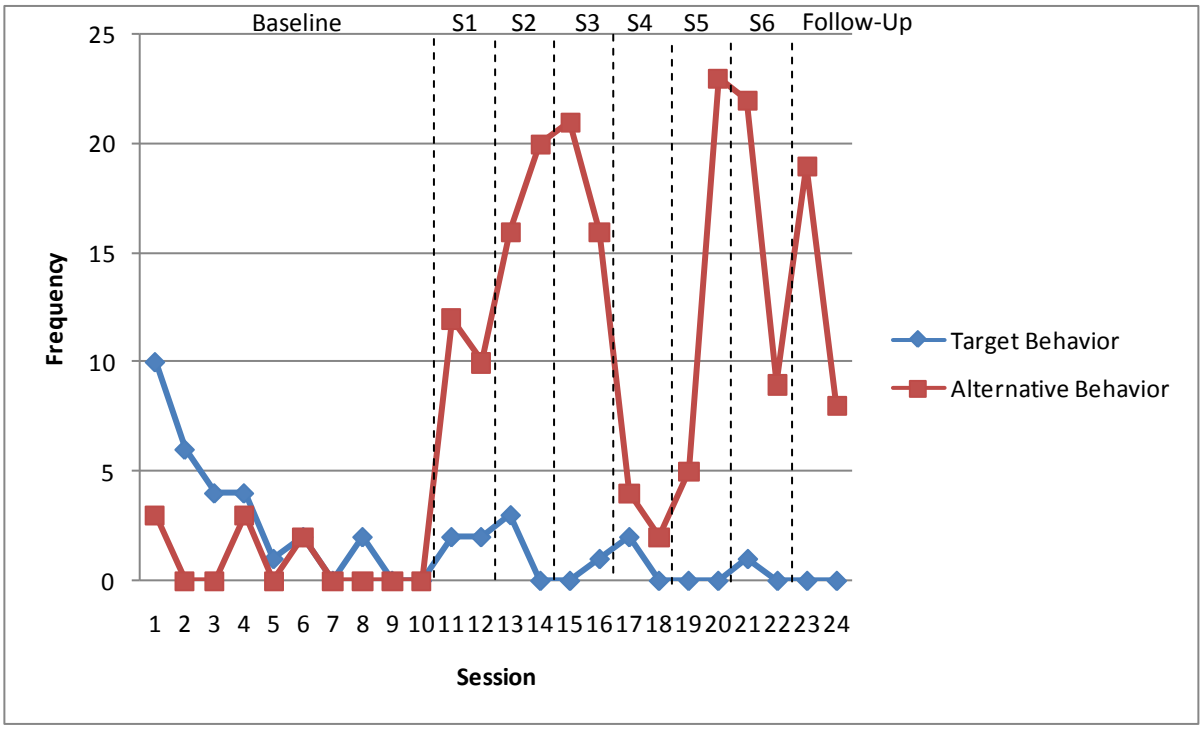


Figure 29. JS's Frequency of Repetitive Play with Clock (Behavior 2) and Alternative Behavior during Response Blocking Sessions.

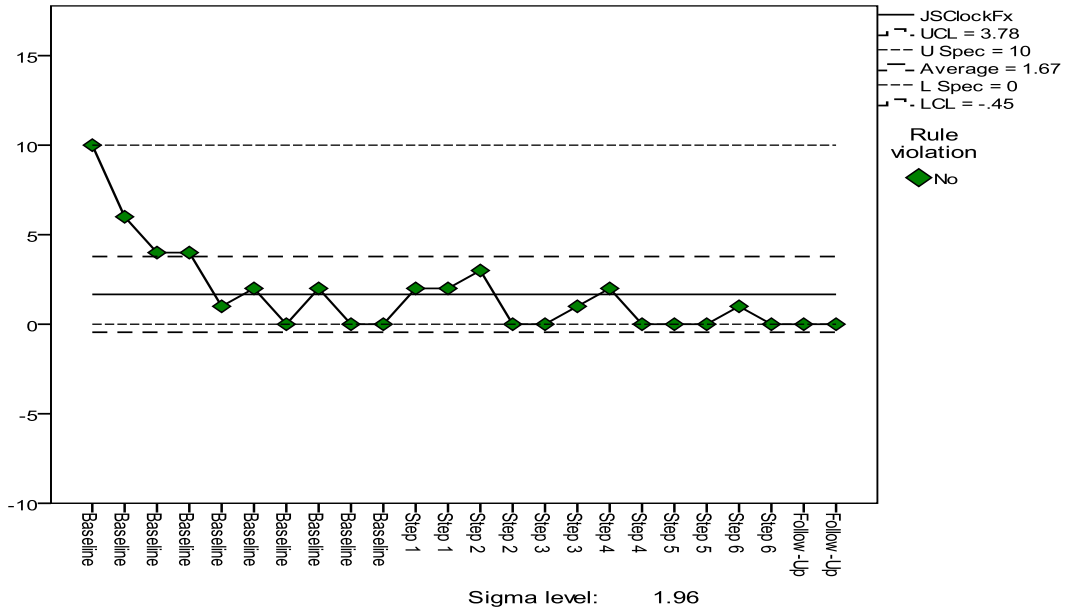


Figure 30. JS's Frequency of Repetitive Play with Clock (Behavior 2) during Response Blocking Sessions.

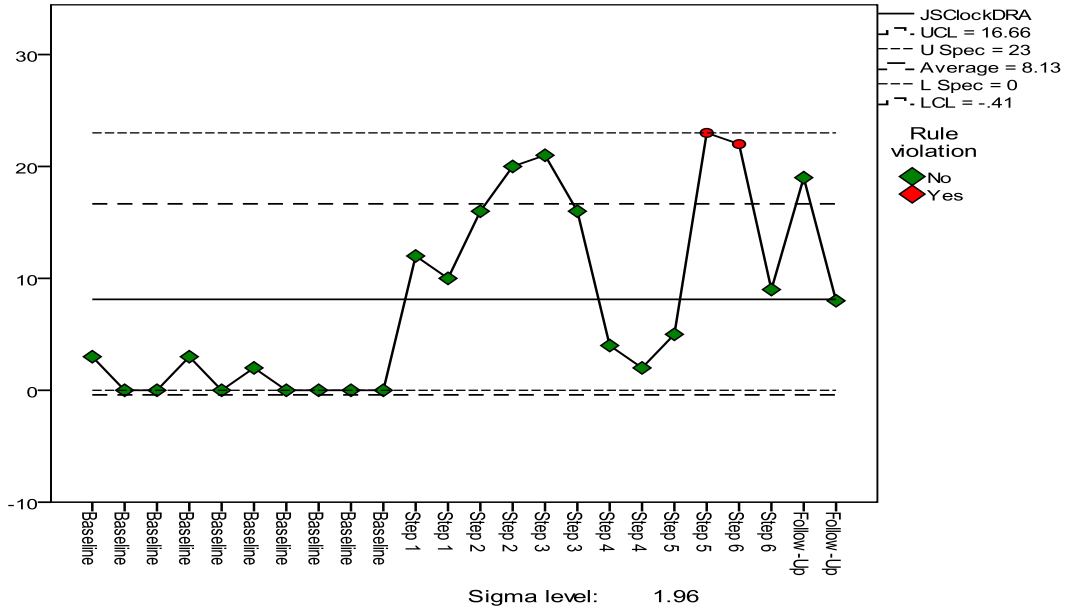


Figure 31. JS's Frequency of Alternative Behavior during Response Blocking Sessions.

School day data.

Visual inspections of JS's target behaviors and problem behavior during the school day revealed that the frequency remained low throughout treatment (as the frequency ranged from 0 to 2 at its peak; see Figure 32). Unfortunately staff stopped recording following the intervention, so no inferences can be made post treatment.

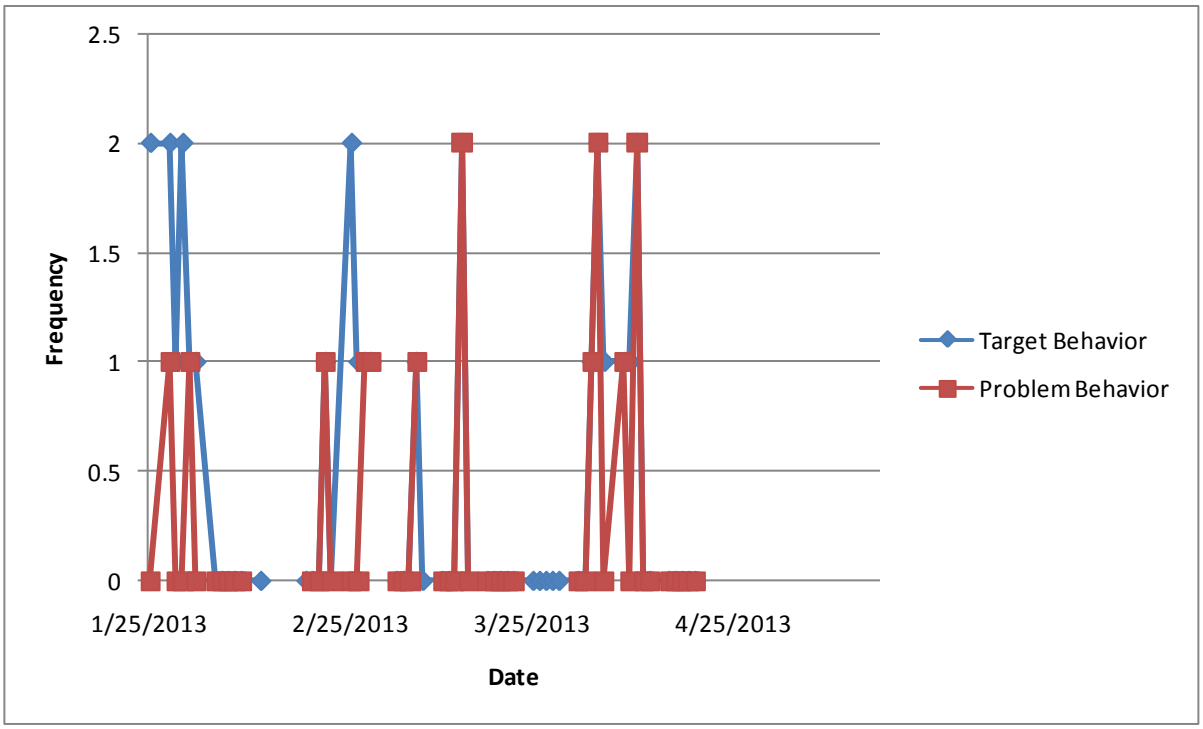


Figure 32. JS's Frequency of Ritualistic and Repetitive Play and Problem Behavior during the School Day.

. Inter-observer Agreement was reached at a level of 83.55% agreement between instructor and video coder for JS session data.

Participant 4 (LS)

LS was a 4-year old Caucasian male who turned 5 during the intervention. LS was diagnosed with Autistic Disorder. LS was friendly and talkative. LS had difficulty with personal pronoun usage, as he often confused the first and third person when speaking to

others. LS also utilized self-talk which narrated his actions and often seemed to be repeated sentences or phrases he had heard previously (e.g., "L, take a sip," as in drink water when you are eating a snack). He had difficulty during times of transition throughout the school day. These transitions would often result in LS crying and screaming, and would require a teacher's assistant to remove him from the classroom and attempt to implement verbal coping strategies with LS so that he could return to class quietly. Often LS's difficulty with transition would involve the termination of a preferred play activity. Both LS's teachers and parents noted that LS had a heightened interest in numbers, with manifested in LS requesting to exclusively wear shirts with a number on them and counting seemingly random objects and happenings throughout the day. LS also enjoyed reciting large numbers, and would do so in different forms (e.g., 1234 recited both one thousand two hundred thirty-four and twelve hundred thirty-four). LS had a keen interest in a toy cash register originally located in his classroom. His incessant requests for the cash register and difficulty transitioning to other play materials and learning tasks led to teachers deciding to relocate the cash register to a different classroom so that LS would not be privy to its whereabouts. Another toy which LS preferred to play with was a Magnadoodle. Teachers noted that LS would use the toy exclusively to write and recite numerals. During LS's number play with the Magnadoodle he demonstrated difficulty transitioning to other play activities and did not readily include others in this play.

LS's teacher completed the RBS-R. Under the Compulsive Behavior Subscale LS's teacher indicated that he had a severe problem with arranging/ordering and repeating (need to repeat routine events; in/out door, up/down from chair, clothing on/off). LS's teacher indicated that both of these items related to his preoccupation with numbers, as he would arrange items and repeat events according to numbers. Under the Ritualistic Behavior Subscale, LS's teacher

indicated that he had a severe problem with rituals during eating/mealtime, as he insisted on eating yogurt and chocolate chip cookies every day. Under the Sameness Behavior Subscale, LS's teacher indicated that he had a moderate problem with becoming upset if interrupted in what he was doing as well as resisted changing activities (difficulty with transitions).

Based on the results of the RBS-R and consultation with LS's teachers, it was determined that LS's repetitive play with numbers involving a toy cash register (Behavior 1) and Magnadoodle (Behavior 2) were chosen for intervention. LS's teacher completed the QABF for his repetitive play with numbers with the cash register and Magnadoodle. Responses indicated that the function of LS's behavior was nonsocial. LS's assessment of alternative behaviors indicated that he was capable of performing all five of the alternative behaviors when prompted. Results from LS's preference assessment indicated that he preferred to play with the Thomas train, windup toys, and silly putty.

Behavior 1

Latency data.

Visual inspections of latency of repetitive play with the toy cash register during sessions revealed a stable baseline with a steady increase in latency during intervention (see Figure 33). SPC of the latency of repetitive play with the toy cash register during response blocking sessions revealed that beginning in the second session of Step 5 to the end of follow-up the latency was out of statistical control and violated the control rule ($p < .01$; see Figure 34). Baseline had a mean of .07 min ($SD = .02$) followed by an initial gradual increase during Steps 1 through 3 to a mean of .60 min. The latency then steadily increased during the remaining steps, ending in a mean 8.59 min ($z = 1.59$, *ns*) during Step 6 and a mean of 10 min

during follow-up (z = 1.85, *ns*). Note that 10 minutes was substituted for statistical analyses because the behavior did not occur during follow-up sessions.

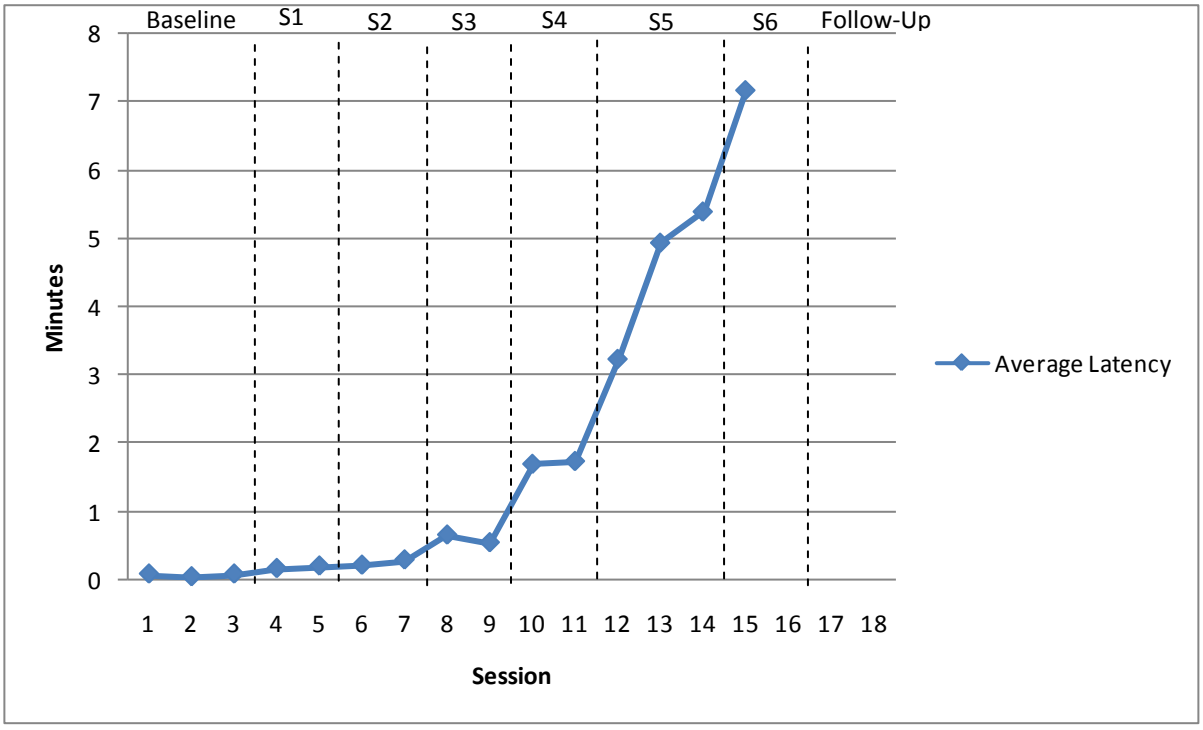


Figure 33. LS's Average Latency of Repetitive Play with Cash Register (Behavior 1) during Response Blocking Sessions.

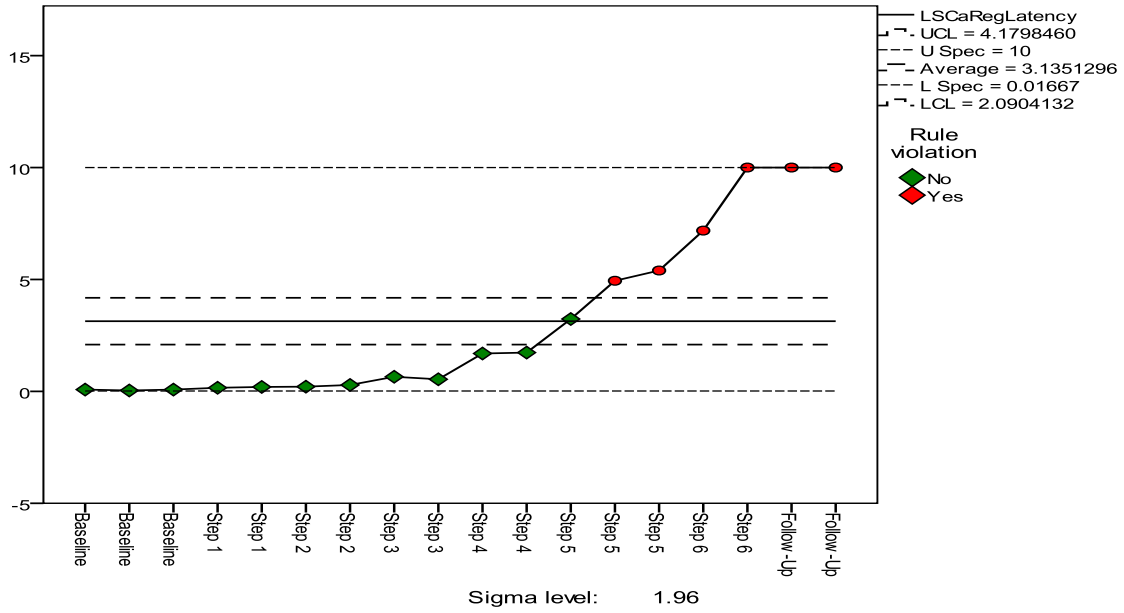


Figure 34. LS's Average Latency of Repetitive Play with Cash Register (Behavior 1) during Response Blocking Sessions.

Frequency data.

Visual inspections of the frequency of repetitive play with the toy cash register when compared with alternative behavior during response blocking sessions revealed a stable baseline for both behaviors, followed by an inverse relationship between them: target behavior initially increased then steadily decreased during intervention with gains maintained at follow-up, while alternative behavior steadily increased during intervention and follow-up (see Figure 35).

SPC of LS's frequency of target repetitive play with the toy cash register revealed that during and following Step 4 of intervention the frequency was out of statistical control ($p < .05$) with two out of three sessions during Step 5 and all following sessions violating the control rule ($p < .01$; see Figure 36). Baseline had a mean of 5.67 ($SD = .58$), followed up an initial increase in frequency during Steps 1 and 2 with a mean of 6.5 and 8.5, respectively.

The frequency then decreased for the remaining sessions, ending in Step 6 with a mean of .5 (z = 1.65, *ns*) which then dropped further to a mean of 0 during follow-up (z= 1.81, *ns*).

Visual inspections of the frequency of alternative behaviors during sessions revealed a mean of 0 during baseline (*SD*=0) with an increase during intervention ending in Step 6 with a mean of 8 (z= 1.31, *ns*), and increasing to a mean of 12 (z = 1.96, *ns*) at follow-up.

SPC of LS's alternative behavior during these sessions revealed during a session of Step 6 and follow-up the frequency was out of statistical control (p < .05) and during the first session of follow-up the frequency violated the control rule (p < .01; see Figure 37).

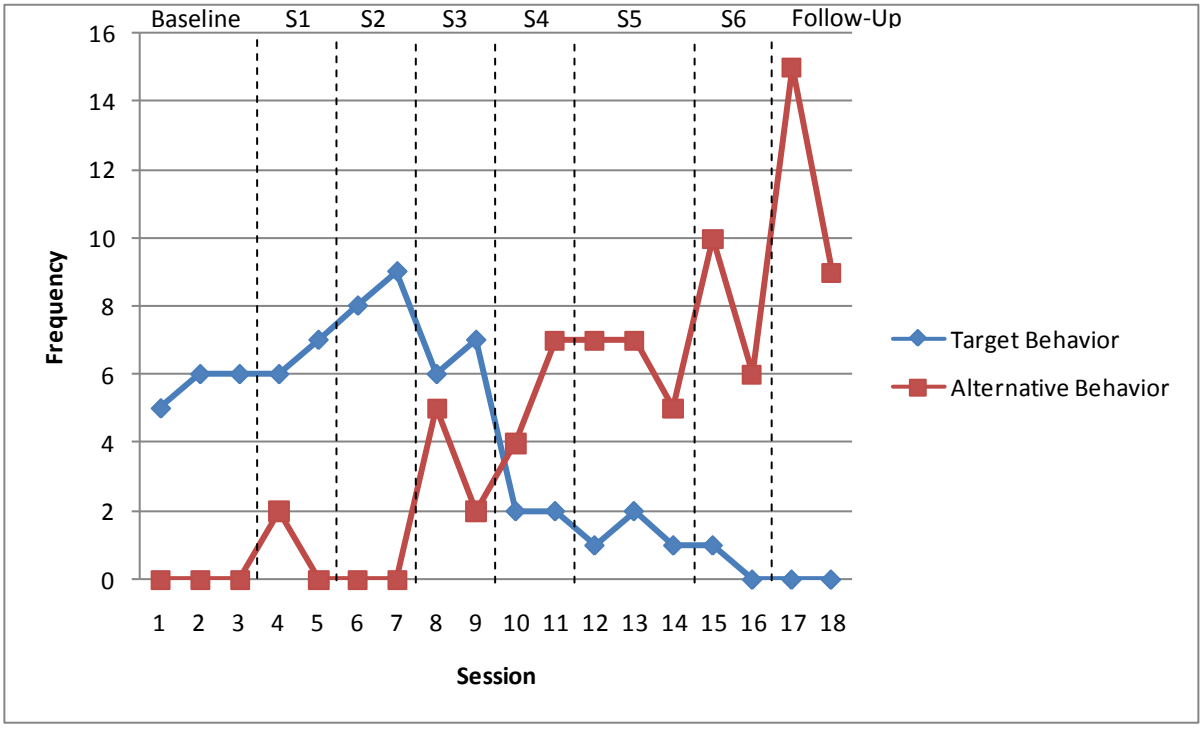


Figure 35. LS's Frequency of Repetitive Play with Cash Register (Behavior 1)and Alternative Behavior during Response Blocking Sessions.

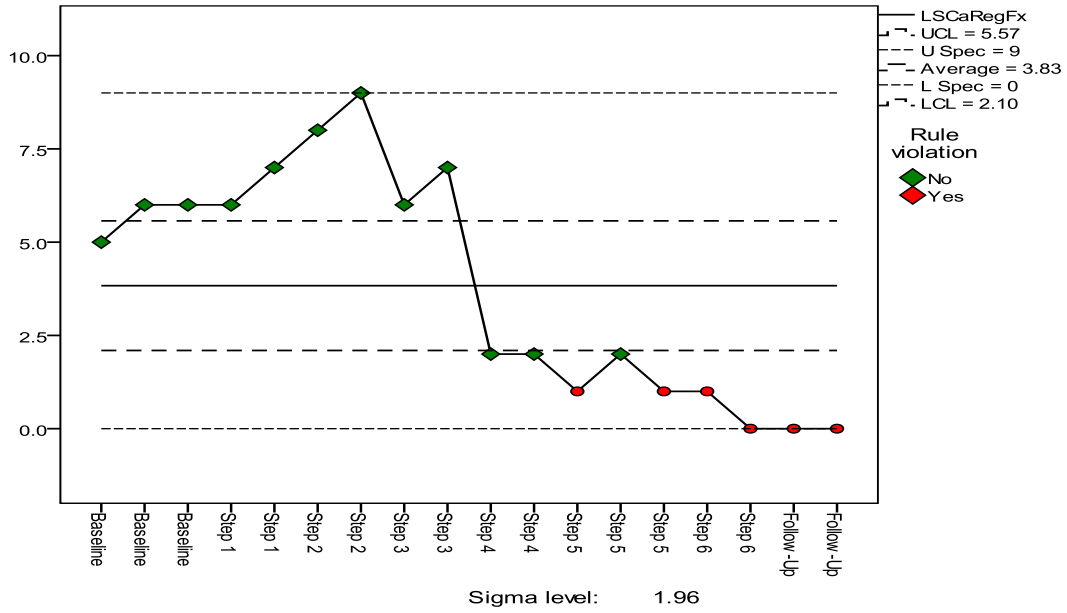


Figure 36. LS's Frequency of Repetitive Play with Cash Register (Behavior 1) during Response Blocking Sessions.

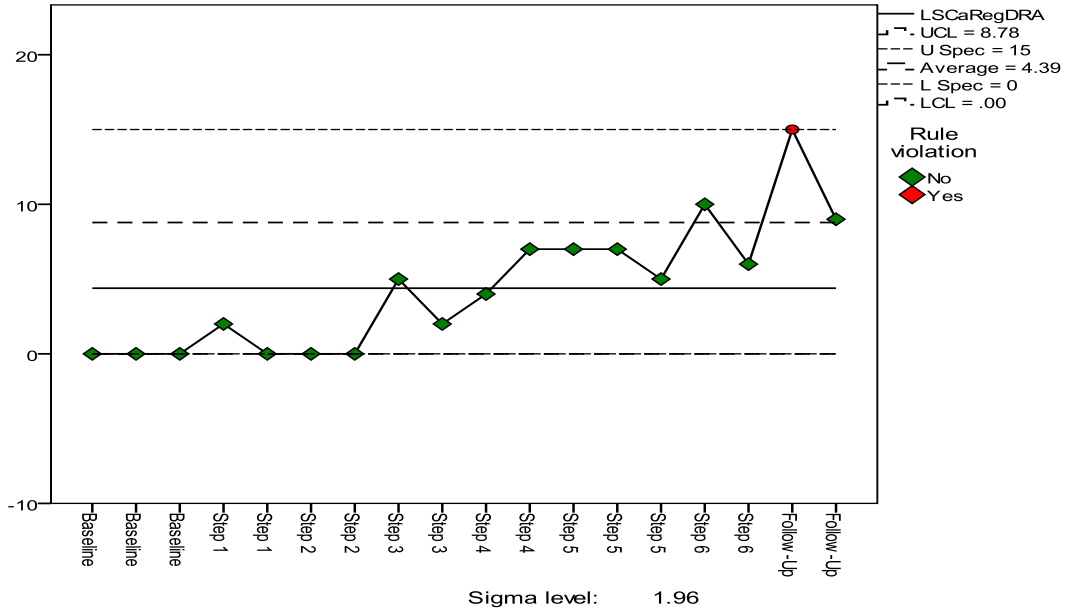


Figure 37. LS's Frequency of Alternative Behavior during Response Blocking Sessions.

Behavior 2

Latency data.

Visual inspections of the latency for repetitive play with Magnadoodle revealed a stability at baseline with a steady increase throughout intervention and follow-up (see Figure 38). SPC for latency of LS's repetitive play with the Magnadoodle during response blocking sessions revealed that the latency was out of statistical control during and following the second session of Step 5 ($p < .05$) and violated the control rule during the second session of Step 5, all of Step 6, and the last session of follow-up ($p < .01$; see Figure 39). Baseline had a mean of .04 min ($SD = .02$) with an increase shown throughout the steps. During Step 6 no behaviors were observed, therefore a latency mean of 10 min ($z = 2.90$, *ns*) was achieved. Gains were maintained at follow-up, with a mean of 7.82 min ($z = 1.49$, *ns*).

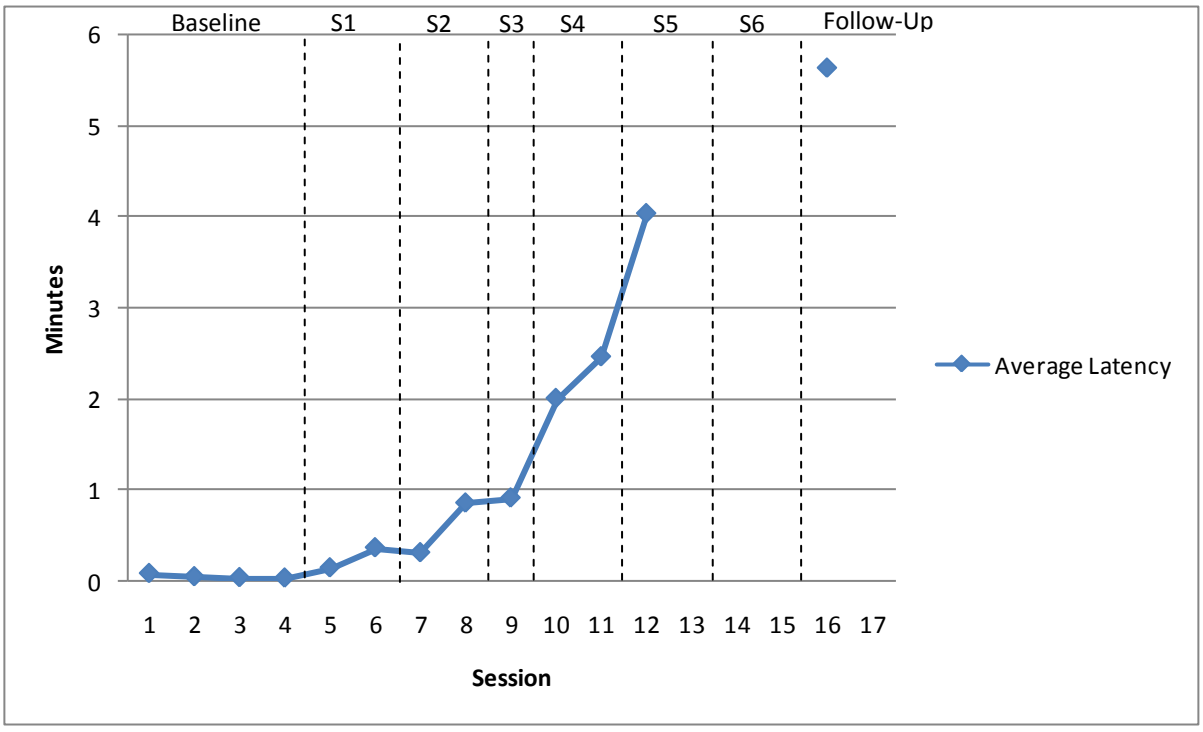


Figure 38. LS's Average Latency of Repetitive Play with Magnadoodle (Behavior 2) during Response Blocking Sessions

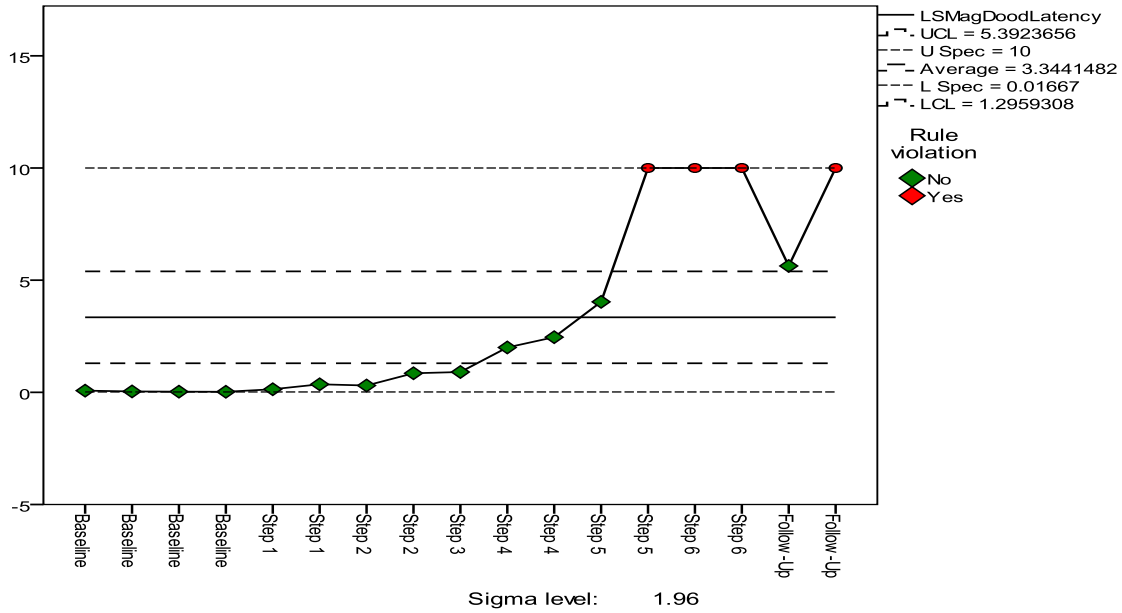


Figure 39. LS's Average Latency of Repetitive Play with Magnadoodle (Behavior 2) during Response Blocking Sessions.

Frequency data.

Visual inspections of frequency of repetitive play with Magnadoodle and alternative behavior during response blocking sessions revealed stability at baseline for both behaviors followed by an inverse relationship between the decrease in repetitive play with the Magnadoodle and increase in alternative behavior during response blocking sessions *(*see Figure 40). SPC for LS's frequency of repetitive play during response blocking sessions revealed that during Step 5, Step 6 and follow-up the frequency was out of statistical control ($p < .05$; see Figure 41). During the second session of Step 5, all of Step 6, and the last follow-up session the control rule was violated ($p < .01$). Baseline had a mean of 5 ($SD = .82$). Frequency gradually decreased throughout intervention to a mean of 0 ($z = 1.82$, *ns* during Step 6. Gains were maintained at follow-up with a mean of .50 ($z = 1.63$, *ns*).

Alternative behaviors showed an inverse pattern when compared to the target repetitive behavior. Baseline was steady with a mean of 0 (*SD* = 0) alternative behaviors. The frequency increased throughout intervention to Step 6 with a mean of 10 ($z = 1.82$, *ns*) and was maintained at follow-up with a mean of 9 ($z = 1.63$, *ns*). The SPC for alterative behavior during response blocking sessions revealed that the frequency of alternative behavior was out of statistical control the first session of Step 5 and the first session of Step 6 ($p < .05$) and violated the control rule during the last session of follow-up ($p < .01$; see Figure 42).

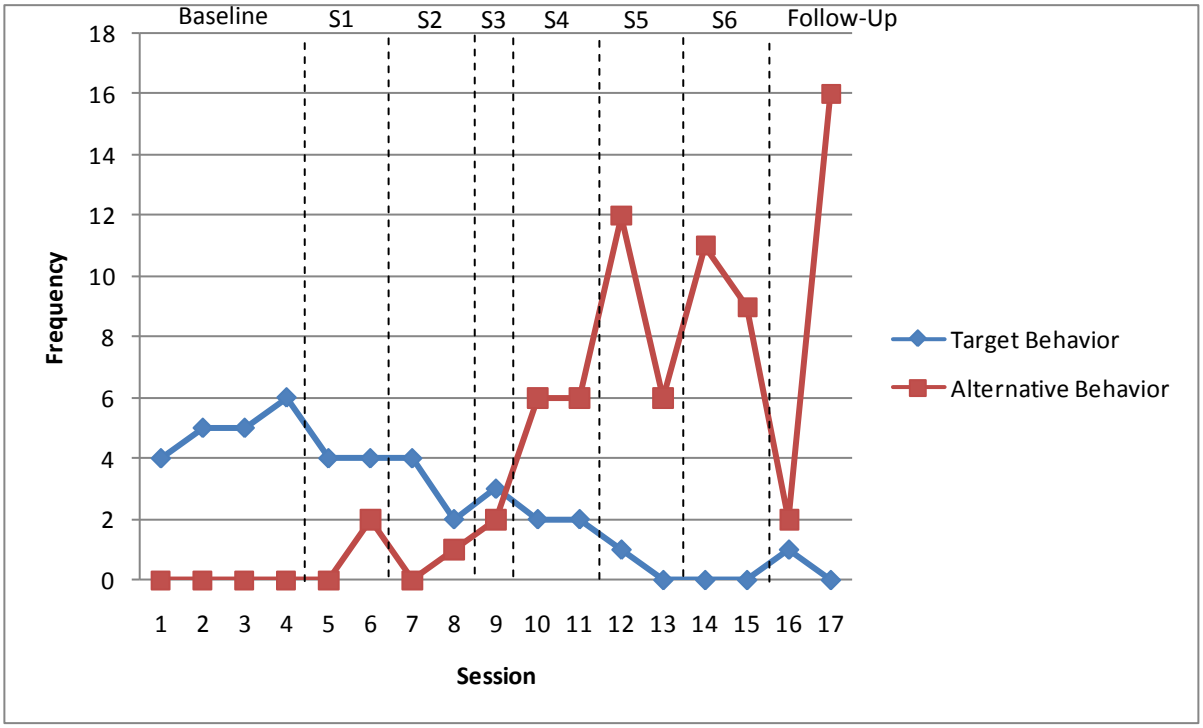


Figure 40. LS's Frequency of Repetitive Play with Magnadoodle (Behavior 2) and Alternative Behavior during Response Blocking Sessions

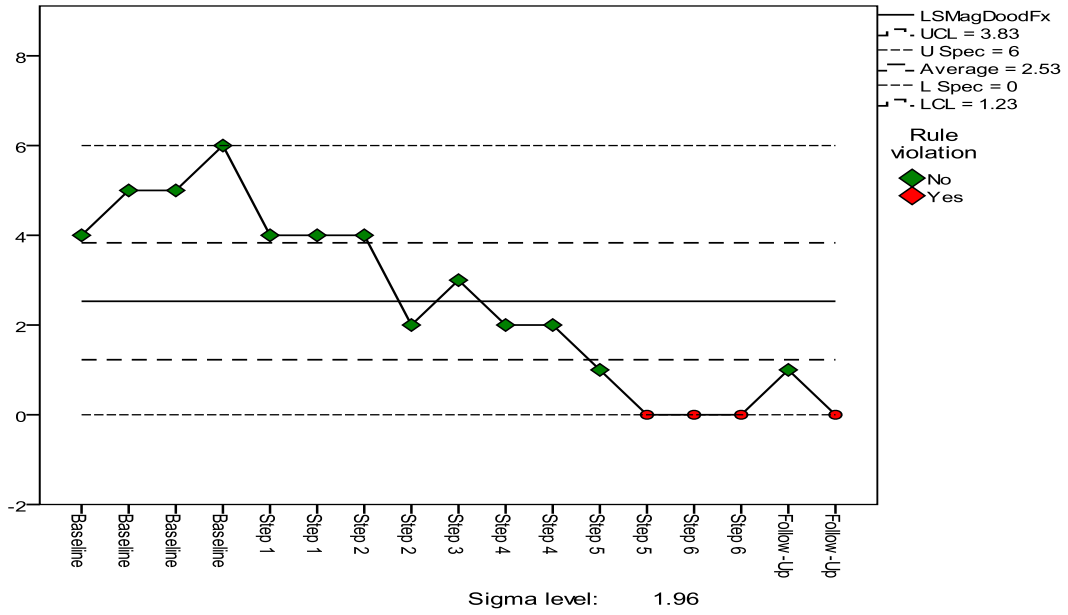


Figure 41. LS's Frequency of Repetitive Play with Magnadoodle (Behavior 2) during Response Blocking Sessions.

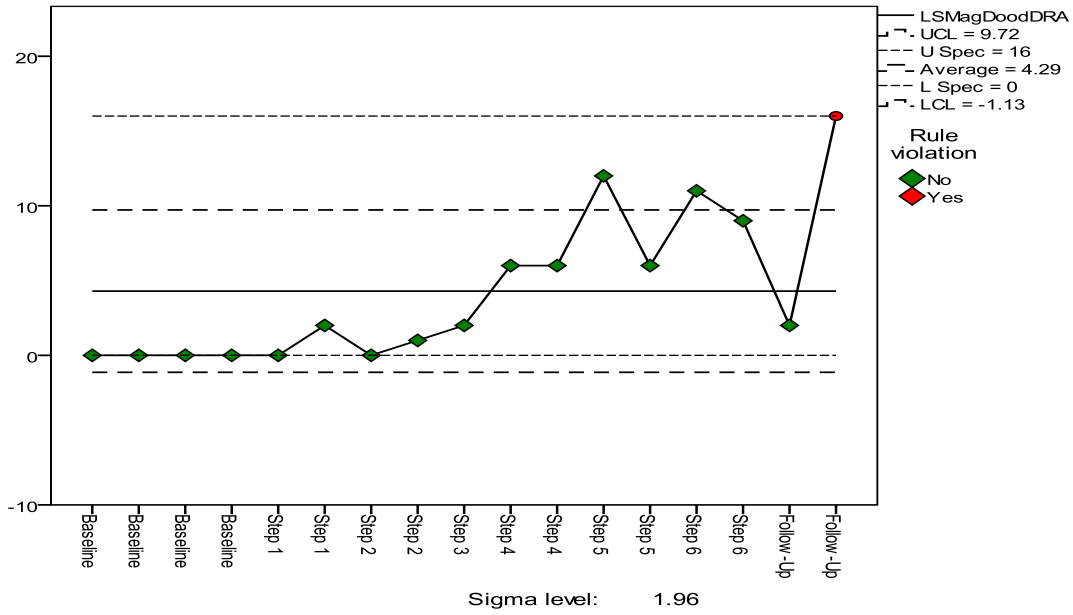


Figure 42. LS's Frequency of Alternative Behavior during Response Blocking Sessions.

School day data.

Visual inspections of LS's target behaviors and problem behavior during the school day revealed that the frequency ranged from 0 to 11 (see Figure 43). Unfortunately staff stopped recording during several weeks in March and following the intervention, so inferences cannot be made.

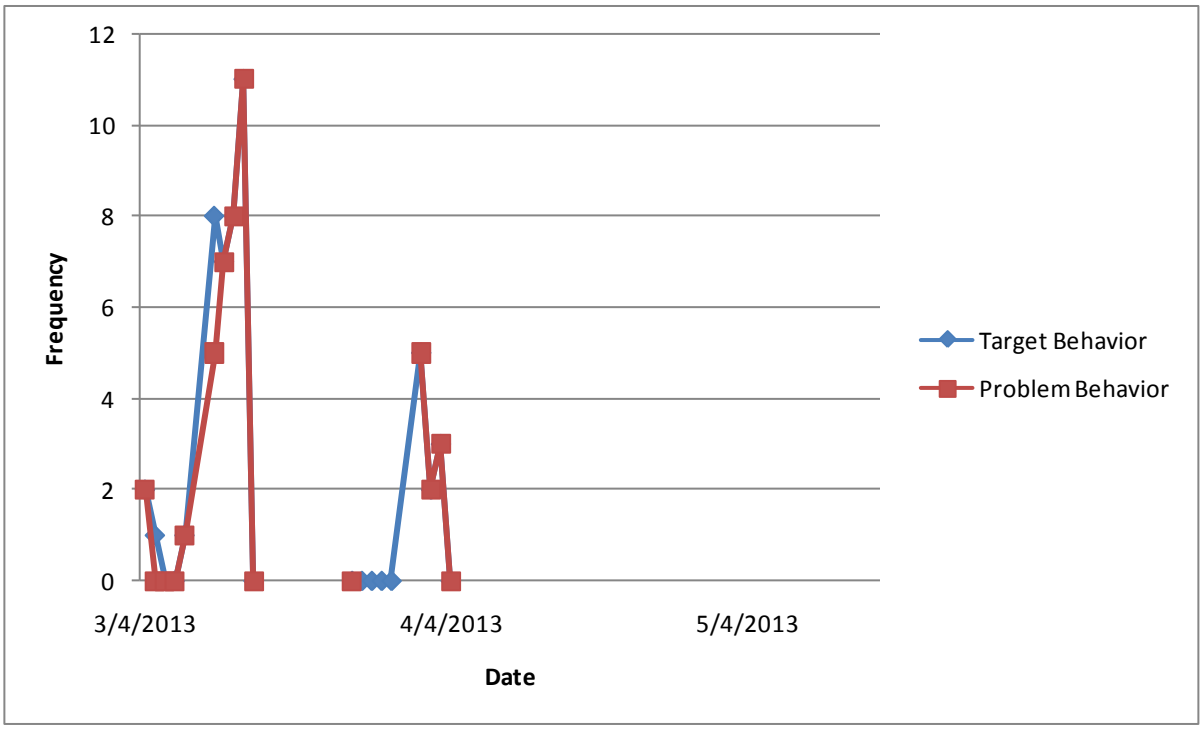


Figure 43. LS's Frequency of Repetitive Play and Problem Behavior during the School Day.

Inter-observer Agreement was reached at a level of 97.28% agreement between instructor and video coder for LS session data.

Participant 5 (SB)

SB was a 3-year-old Black and Caucasian male diagnosed with Pervasive Developmental Disorder, Not Otherwise Specified. SB was amiable and smiled often. Teachers noted that SB had minimal spontaneous speech. Most of his speech consisted of vocal stereotypy with one and two word utterances. Teachers reported that SB had difficulty

transitioning from preferred play activities during the school day. He would get stuck in play which involved moldable material (e.g., Play-Doh, Silly Putty), and small figurines.

Both SB's parent and teacher completed the RBS-R. For the Compulsive Behavior Subscale SB's parent reported that he had a severe problem with arranging/ordering, and touch/tap and a moderate problem with completeness. On the Ritualistic Behavior Subscale SB's parent indicated that he had a moderate problem with eating/mealtime, and his teacher indicated that this was a severe problem for him. Under the Sameness Behavior Subscale SB's parent indicated that he had a severe problem with becoming upset if interrupted in what he was doing and a moderate problem with insisting that things remain the same place.

SB's teacher indicated that on a scale from 1-100 where 1= not a problem at all, and 100= as bad as you can image, SB's behaviors described in the questionnaire were at a 50, while SB's parent rated the severity to be a 60.

Based on results of the RBS-R and consultation with SB's teacher two behaviors were chosen for intervention: the need for completeness when playing with Play-Doh (e.g., if a piece of Play-Doh is taken from SB that he insists on making the piece whole again by getting back the missing piece; Behavior 1), and repetitive play of gathering toy figurines when they are dispersed (Behavior 2).

SB's parent completed the QABF separately for Behaviors 1 and 2. SB's parent indicated that for both behaviors the function was nonsocial. SB's assessment of alternative behaviors indicated that he was capable of performing all five of the alternative behaviors when prompted. Results of SB's preference assessment indicate that he preferred to play with shaking eggs and the Thomas train.

Behavior 1

Latency data.

Visual inspections of latency for repetitive play with Play-Doh revealed stability at baseline with a mean of .08 minutes (*SD*=.02) followed by fluctuations during intervention with an upward trend (see Figure 44). During sessions 5, 14, 15, and 16, no target behavior occurred. Even when considering that during follow-up (sessions 15 and 16) when no target behavior occurred, statistical significance was not found with a mean of 10 minutes (z=1.91, *ns*) when compared to baseline levels. SPC of latency during response blocking sessions revealed that the average latency during sessions was out of statistical control and violated the control rule during the second session of Step 1 and the second session of Step 6 and follow-up (p<.01; see Figure 45).

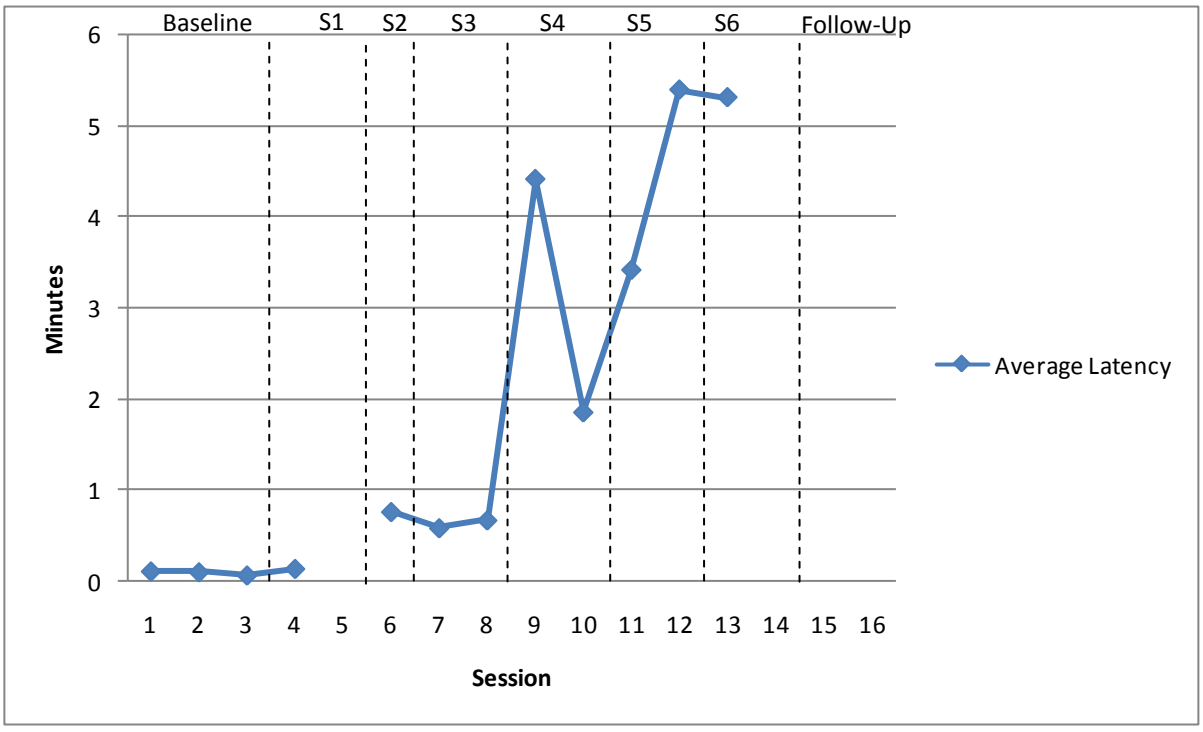


Figure 44. SB's Average Latency of Repetitive Play with Play-Doh (Behavior 1) during Response Blocking Sessions.

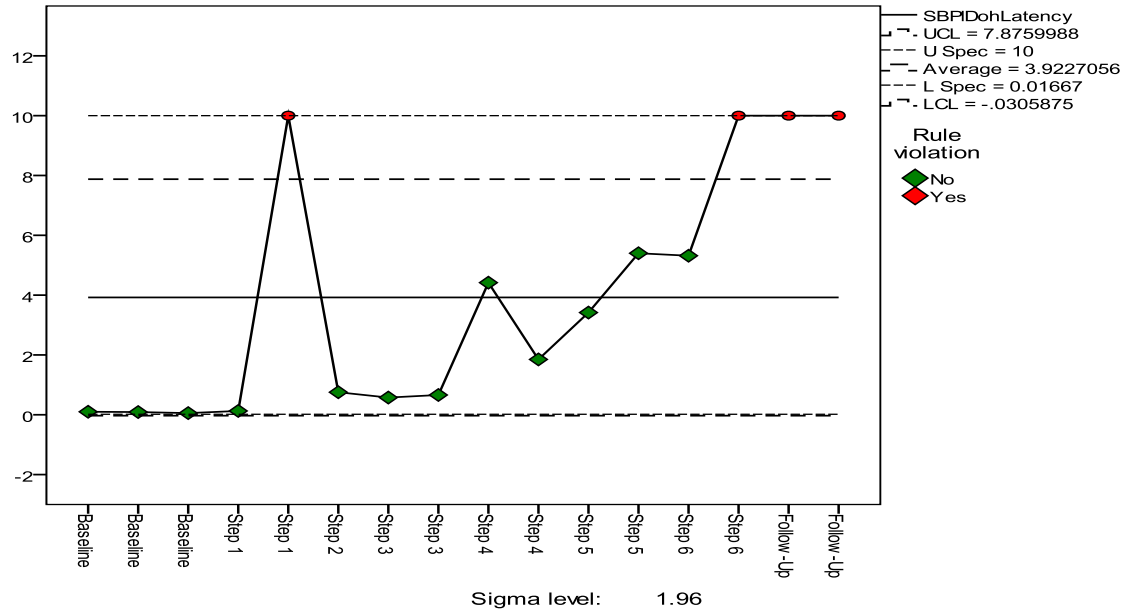


*Figure 45. S*B's Average Latency of Repetitive Play with Play-Doh (Behavior 1) during Response Blocking Sessions.

Frequency data.

Visual inspections of the frequency of repetitive play with Play-Doh and alternative behavior during response blocking sessions revealed some instability at baseline followed by a decrease in frequency over time and variability in alternative behavior during the intervention (see Figure 46). During intervention the frequency initially dropped to a mean of 3 during Step 1, rose again during Step 2, and then dropped through Step 6 to a mean of .50 (z = 1.64, *ns*). Gains were maintained during follow-up with a mean of 0 (z = 1.81, *ns*).

The frequency of alternative behaviors during session began during baseline with a mean of .33 (*SD* = .58) then rose during Step 1 to a mean of 5. The frequency of alternative behaviors fluctuated throughout the intervention with no statistical significance noted. The frequency of alternative behaviors during follow-up was a mean of 5.5 (z = 1.91, *ns*). SPC of the frequency of repetitive play with Play-Doh revealed that the behavior remained in

statistical control throughout the intervention (see Figure 47; $p > .05$). SPC of alternative behavior during response blocking session revealed the frequency of alternative behavior was out of statistical control during the second session of Step 2 ($p < .05$), but remained in statistical control for the rest of the sessions (see Figure 48).

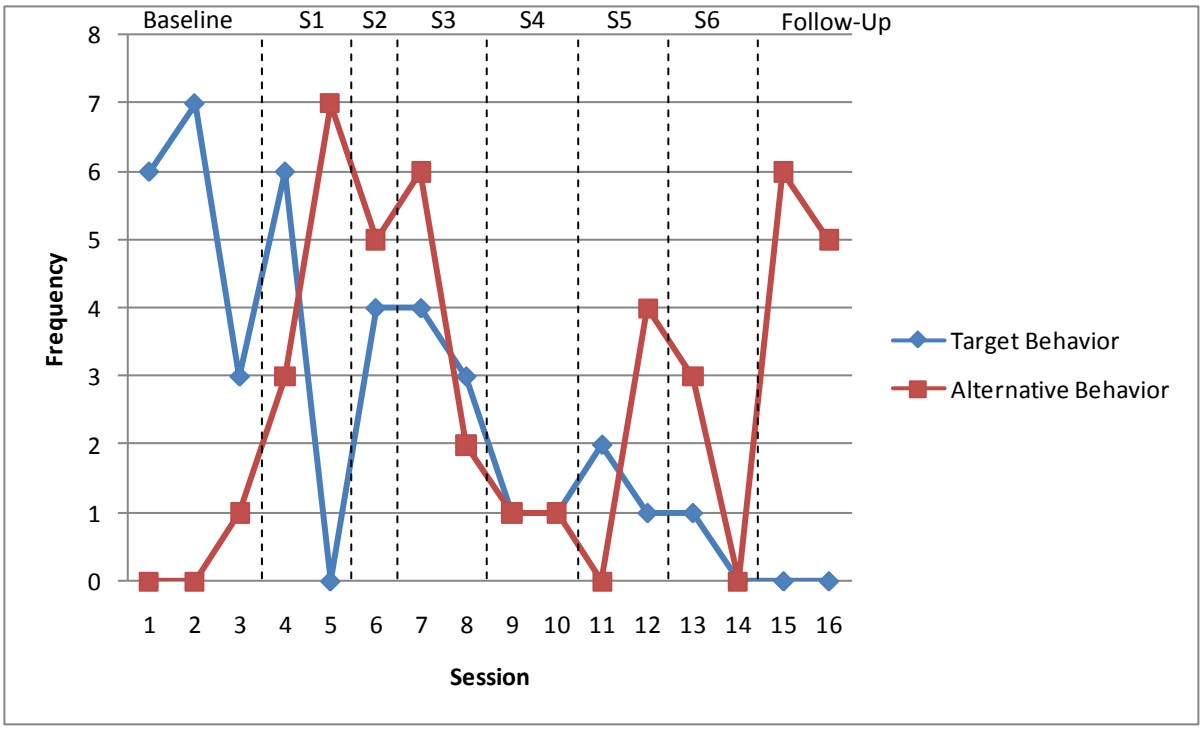


Figure 46. SB's Frequency of Repetitive Play with Play-Doh (Behavior 1) and Alternative Behavior during Response Blocking Sessions.

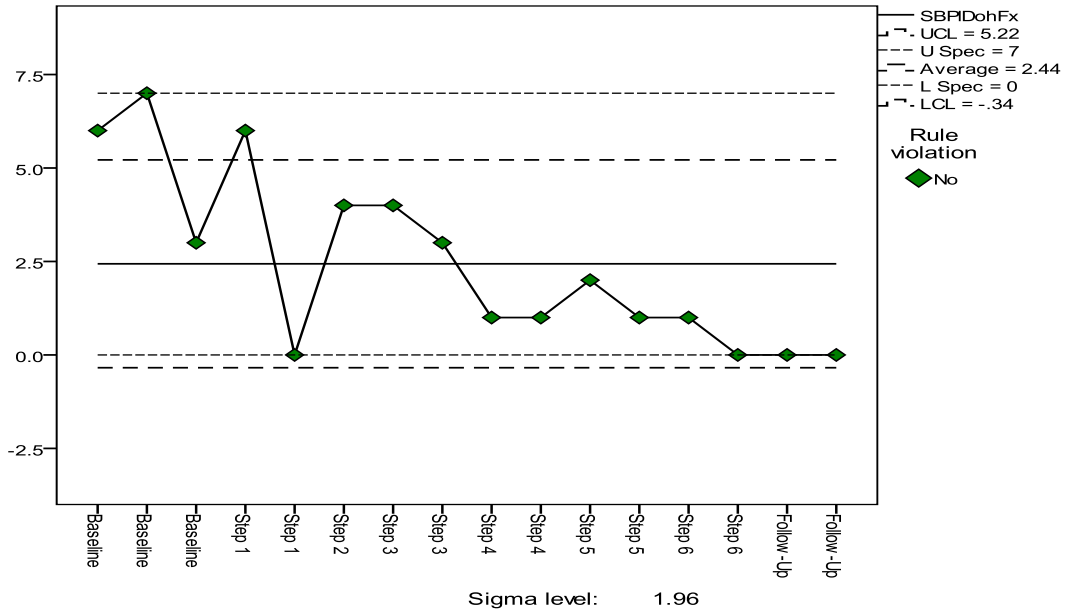


Figure 47. SB's Frequency of Repetitive Play with Play-Doh (Behavior 1) during Response Blocking Sessions.

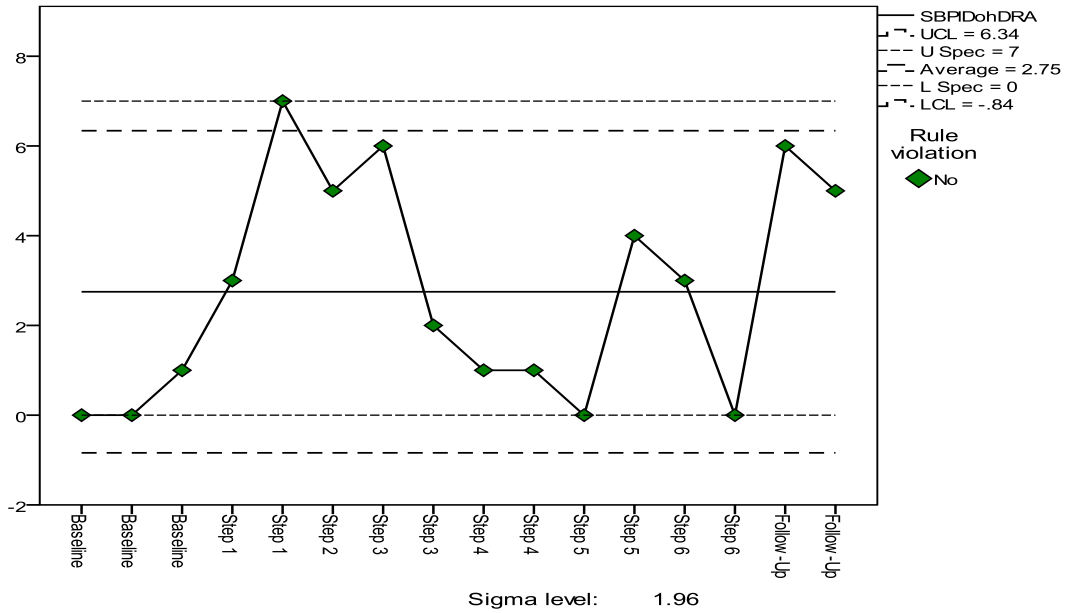


Figure 48. SB's Frequency of Alternative Behavior during Response Blocking Sessions.

Behavior 2

Latency data.

Visual inspections of SB's latency data for arranging/ordering figurines during sessions revealed stability at followed by the apparent lack of frequency of arranging/ordering figurines (see Figure 49). SPC of SB's latency of arranging/ordering figurines revealed that when the behavior did not occur, the latency of 10 minutes which was substituted violated the control rule ($p < .01$; see Figure 50). Baseline had a baseline mean of .17 min ($SD = .23$). The latency then increased during Step 1 to a mean of .23 min, and during Step 2 to a mean of 5.30 min, during one of the sessions no behavior occurred, and therefore 10 minutes was substituted for statistical analyses. During the remainder of intervention sessions no target behavior occurred, therefore each Step had a latency mean of 10 min, including Step 6 ($z = 1.91$, *ns*). Gains were maintained at follow-up, with only one occurrence of behavior recorded at 5.45 min, therefore the mean for all follow-up sessions was 7.73 min ($z = 1.47$, *ns*).

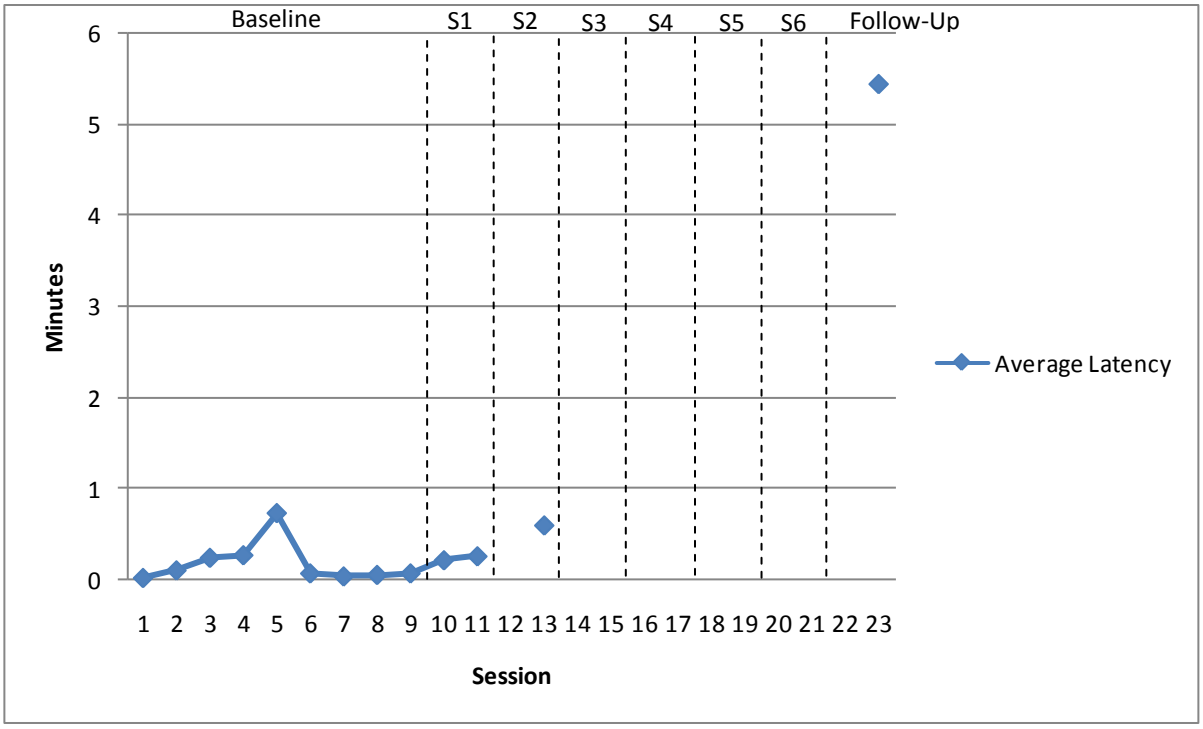


Figure 49. SB's Average Latency of Arranging/Ordering Figurines (Behavior 2) during Response Blocking Sessions.

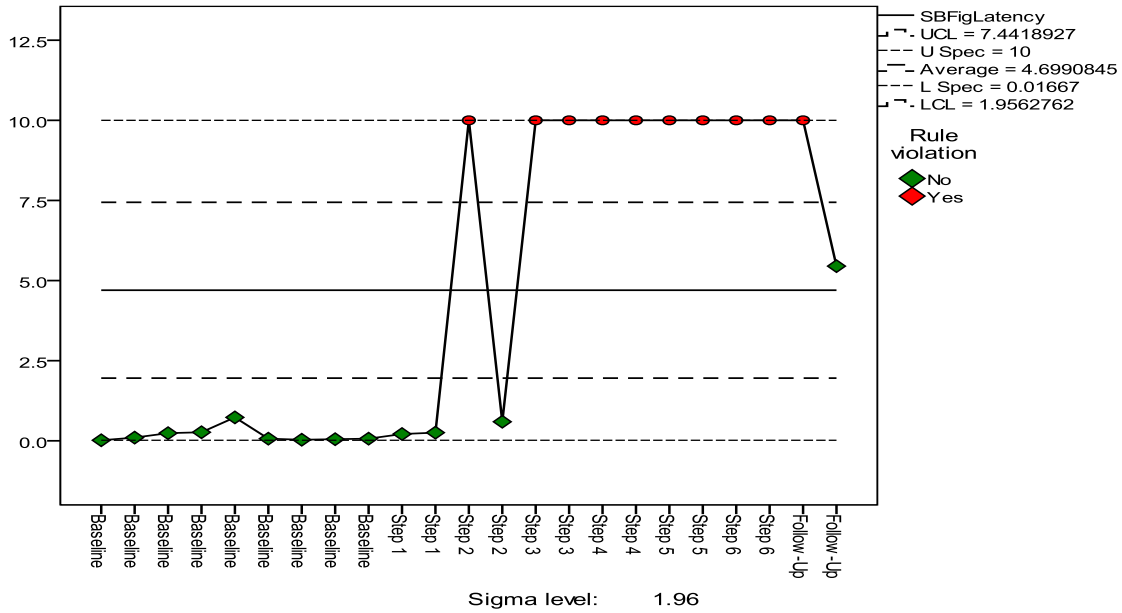


Figure 50. SB's Average Latency of Arranging/Ordering Figurines (Behavior 2) during Response Blocking Sessions.

Frequency data.

Visual inspections of the frequency of LS's arranging/ordering with figurines and alternative behavior during response blocking sessions revealed stability at baseline with a decrease in repetitive behavior during intervention to zero levels and a peak of alternative behavior during Step 2 of intervention followed by a gradual increase (see Figure 51). SPC of LS's arranging/ordering figurines during response blocking sessions revealed that the frequency of behavior remained in statistical control throughout intervention and follow-up ($p > .05$, *ns*; see Figure 52). Baseline had a mean of 4.22 ($SD = 1.56$), and an increase during Step 1 to a mean of 6.50. During the remainder of intervention the frequency decreased further, with Step 2 having a mean of 1.5, and the remaining steps (including Step 6) having no behavior observed during session ($z= 1.83$, *ns*). During follow-up only one behavior was observed during a session, therefore the mean was .50 ($z = 1.61$, *ns*).

Visual inspections of the frequency of alternative behaviors during sessions with figurines revealed stability at baseline with a mean of 0 ($SD=0$), and a sharp increase during Step 2 to a mean of 11. During the remainder of intervention alternative behaviors leveled off to a range of 4 to 9 behaviors per session observed. No statistical significance was obtained. Gains were maintained at follow-up with the frequency of alterative behaviors of a mean of 4.5 ($z= 1.12$, *ns*). SPC of alternative behavior during response blocking sessions revealed that during the first session of Step 2 the frequency of alternative behavior violated the control rule ($p < .01$) and the second session of Step 5 and first session of Step 6 the frequency was out of statistical control ($p < .05$; see Figure 53).

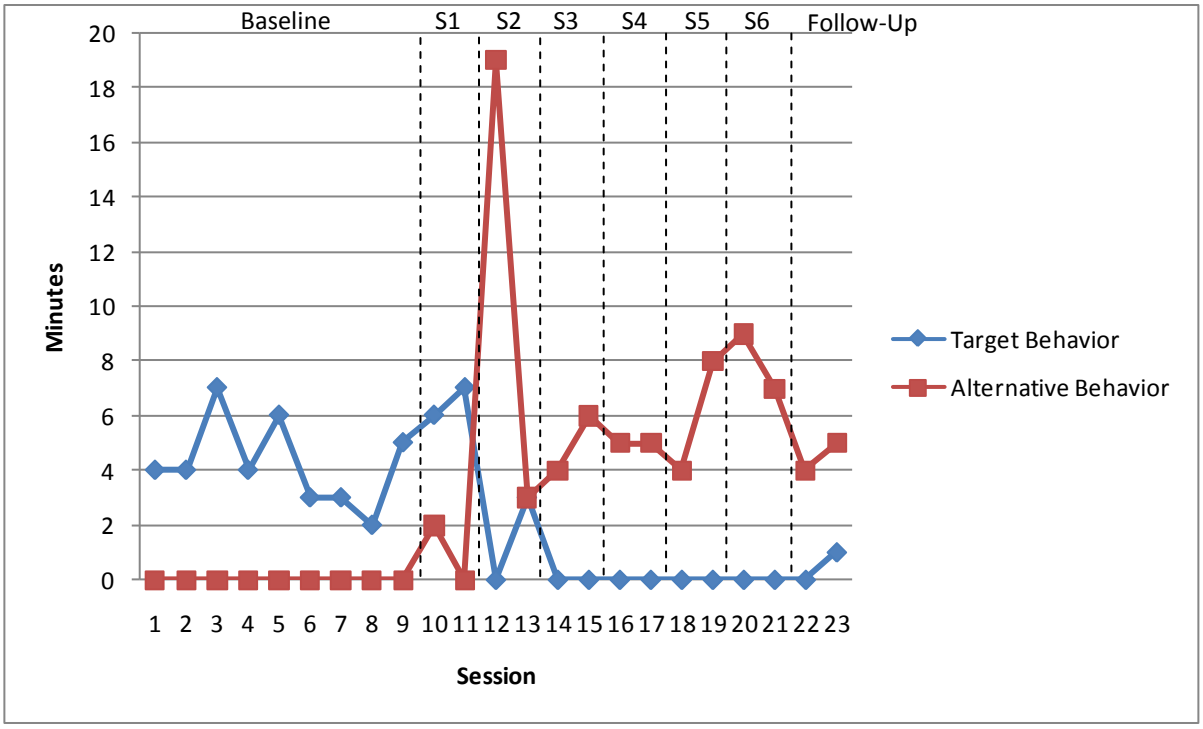


Figure 51. SB's Frequency of Arranging/Ordering Figurines (Behavior 2) and Alternative Behavior during Response Blocking Sessions.

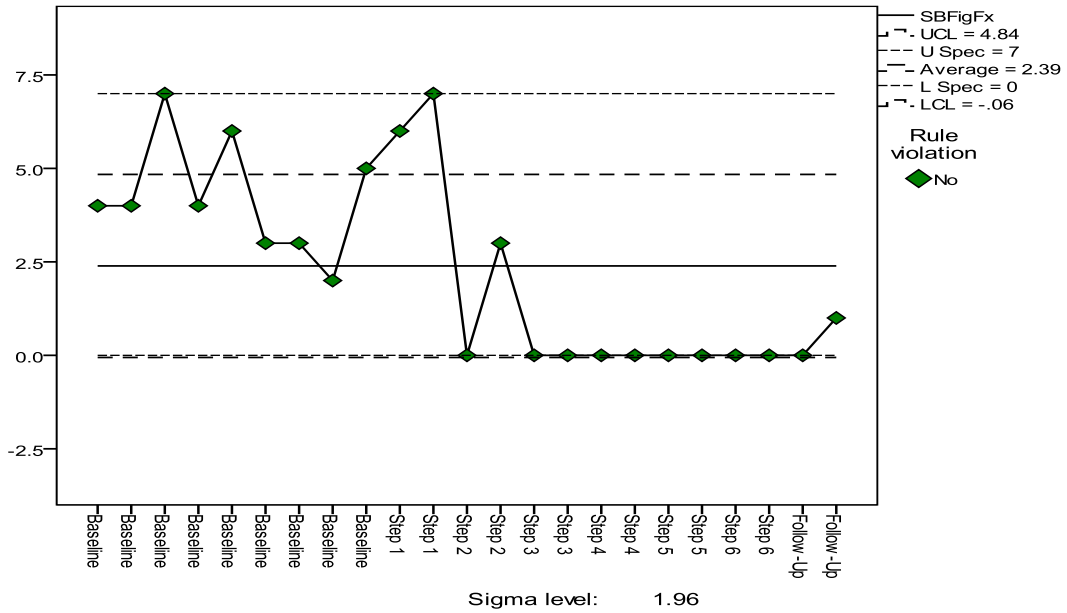


Figure 52. SB's Frequency of Arranging/Ordering Figurines (Behavior 2) during Response Blocking Sessions.

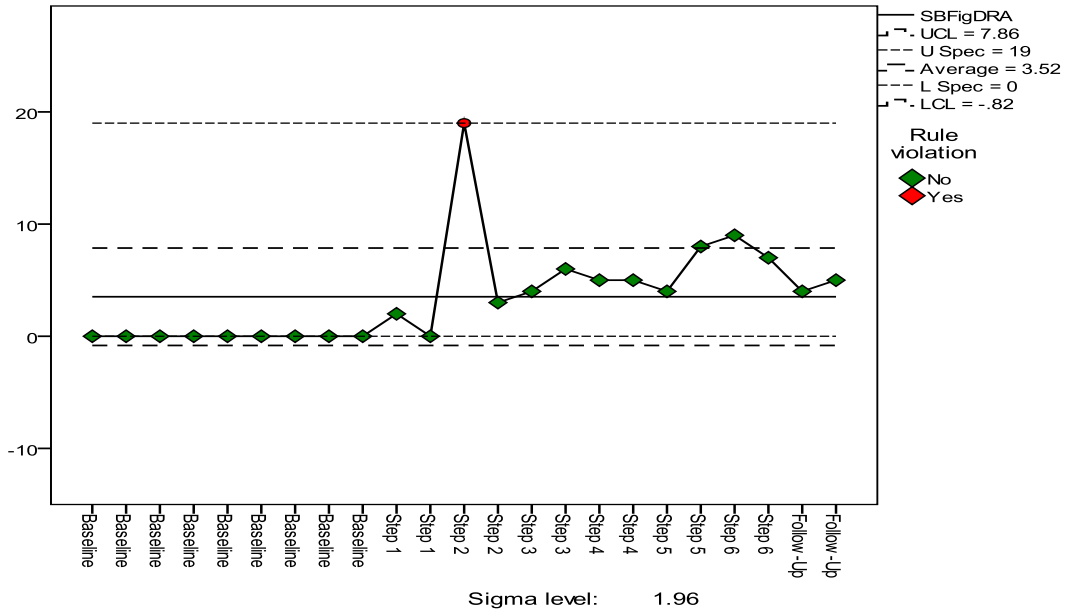


*Figure 53. S*B's Frequency of Arranging/Ordering Figurines (Behavior 2) during Response Blocking Sessions for Behavior 2.

School day data.

Data on frequency on the target behaviors and problem behavior for SB was only recorded for one week during, therefore no conclusions can be made (see Figure 54).

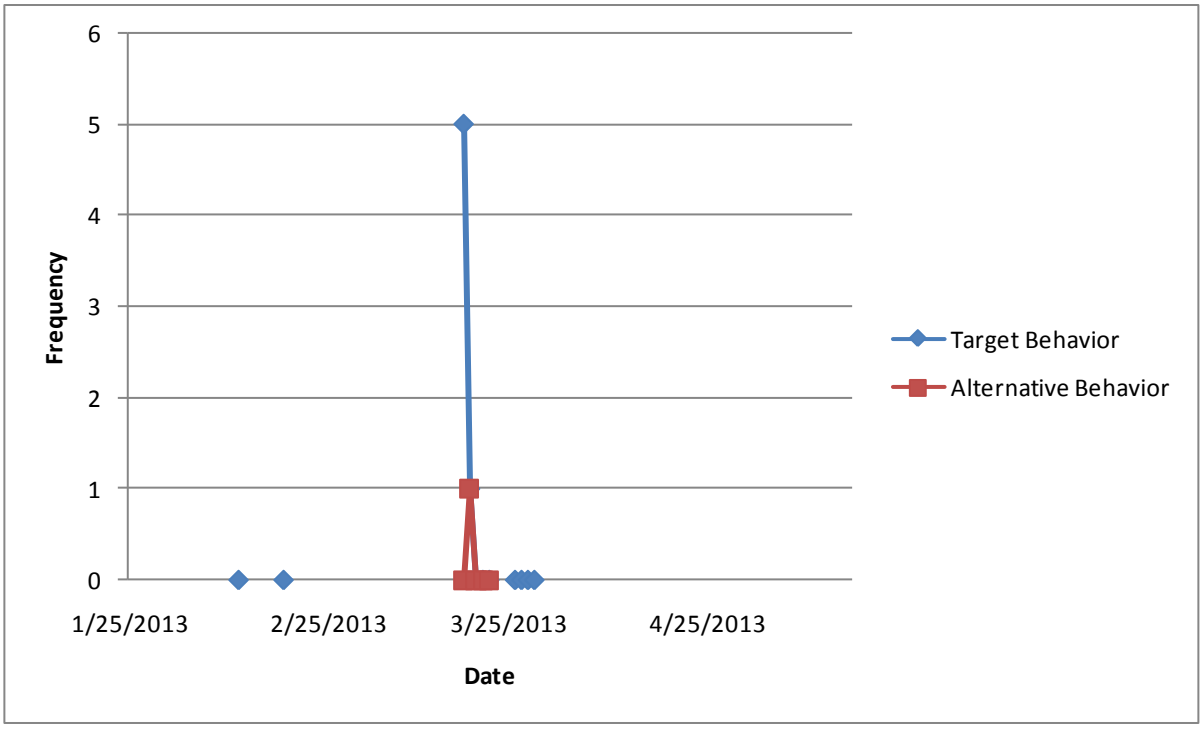


Figure 54. SB's Frequency of Repetitive Play and Problem Behavior during the School Day.

Inter-observer Agreement was reached at a level of 96.13% agreement between instructor and video coder for SB session data.

Participant 6 (SR)

SR was a 4-year-old Black male diagnosed with Pervasive Developmental Disorder, Not Otherwise Specified. SR was friendly and giggled often. SR was able to maintain short conversations with peers and adults. Spontaneous speech and conversation generally involved SR's interests. SR had a keen interest in letters which manifested in his preference for playing with a foam alphabet puzzle and writing letters. Teacher's noted that SR would repetitively spell out the names of two preferred television shows along with his own name with the foam alphabet puzzle. When SR had access to crayons he would also repetitively write letters and spell out his preferred television titles along with his name.

SR's parent and teacher completed the RBS-R. Under the Compulsive Behavior Subscale SR's parent indicated that he had a severe problem with arranging/ordering, completeness, washing/cleaning (excessively cleans certain body parts; picks at lint or loose threads), checking, counting (counts items or objects; counts to a certain number or in a certain way), and touch/tap. SR's teacher indicated that he had a moderate problem with arranging/order and hoarding/saving. For the Ritualistic Behavior Subscale SR's parent indicated that he had a severe problem with eating/mealtime, travel/transportation, and a moderate problem with self-care- bathroom and dressing (insists on specific order of activities or tasks related to using the bathroom, to washing, showering, bathing or dressing; arranges items in a certain way in the bathroom or insists that bathroom items not be moved; insists on wearing certain clothing items). Both SR's parent and teacher agree that he had a moderate problem with play/leisure. For the Sameness Behavior Subscale, SR's parent indicated that he had a severe problem with all of the items, including insisting that things remain in the same place, objecting to visiting new places, insisting on walking in a particular patter, insisting on sitting at the same place, disliking changes in appearance or behavior of the people around him, insisting on using a particular door, with liking the same media (CD, tape, record, music, or video) played continually, resisting changing activities (difficulty with transitions), insisting on the same routine, and insisting that specific things take place at specific times. SR's teacher indicated that he has a moderate problem with resisting changing activities. SR's teacher indicated that on a scale from 1-100 where 1= not a problem at all, and 100= as bad as you can image, SR's behaviors described in the questionnaire were at a 25, while SR's parent rated the severity to be a 70.

Based on results of the RBS-R and consultation with SR's teachers, his preoccupation with numbers as manifested by playing with a foam letter puzzle (Behavior 1) and drawing letters with crayons were targeted for intervention (Behavior 2).

SR's teacher completed the QABF for his arranging/ordering ABC puzzle and ritualized crayon play. For each behavior SR's teacher indicated that the function was nonsocial. SR's assessment of alternative behaviors indicated that he was capable of performing all five of the alternative behaviors when prompted. SR's preference assessment indicated that he preferred the mini M&Ms and key chain pulls.

Behavior 1

Latency data.

Visual inspections of the latency of SR's repetitive play with the ABC puzzle revealed a stable baseline with a mean of .03 min (*SD* = .01) with an upward trend demonstrated during intervention (see Figure 55). During sessions 10, and 14 to 18 no target behavior was observed, therefore both Step 6 and follow-up had a mean latency of 10 min ($z = 1.73$, *ns*). Despite this increase in latency over time, no statistical significance was found. SPC of latency of SR's repetitive play with the ABC puzzle revealed that when the behavior did not occur, (during the first session of Step 4 and the last session of Step 5, all of Step 6 and follow-up), the latency was out of statistical control ($p < .05$; see Figure 56).

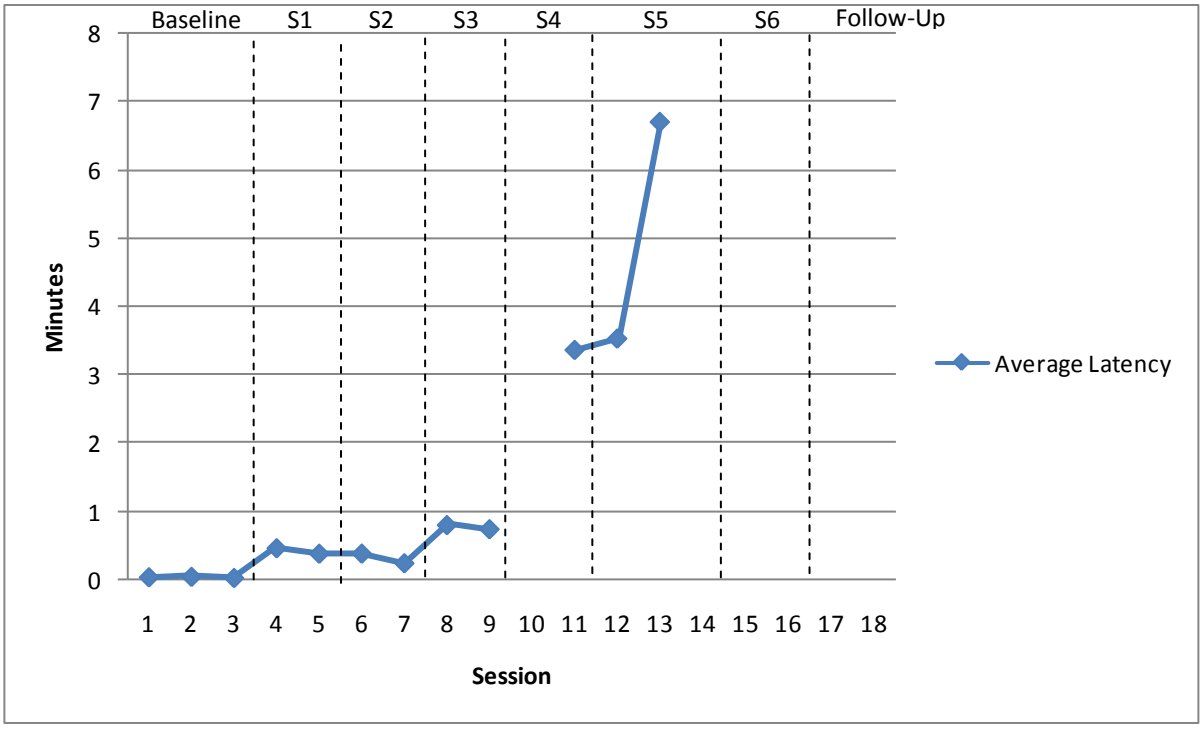


Figure 55. SR's Average Latency of Repetitive Play with ABC Puzzle (Behavior 1) during Response Blocking Sessions.

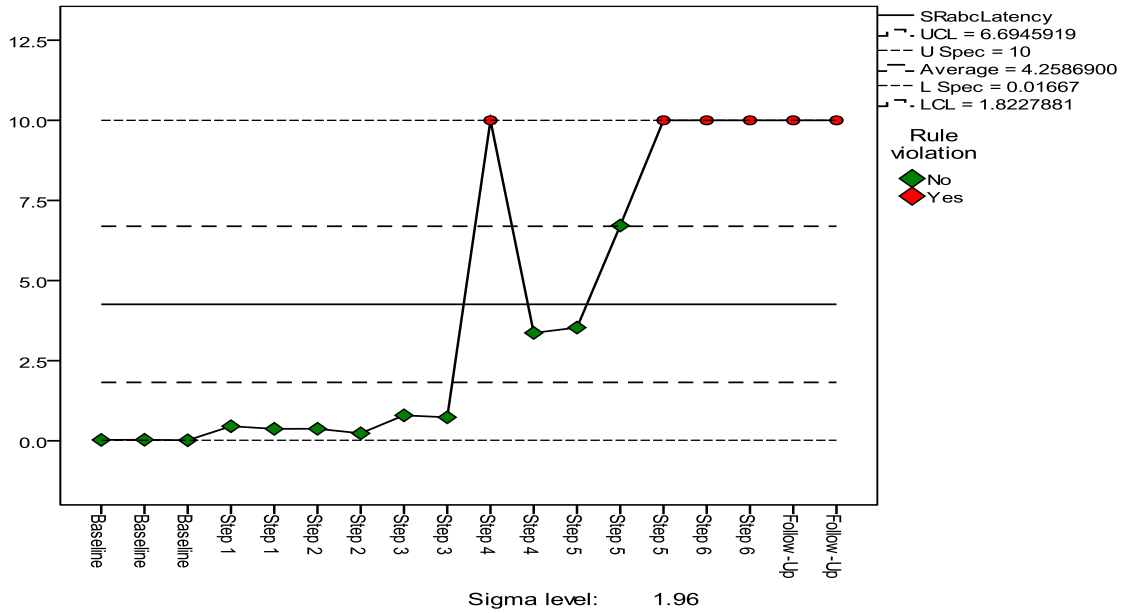


Figure 56. SR's Average Latency of Repetitive Play with ABC Puzzle (Behavior 1) during Response Blocking Sessions.

Frequency data.

Visual inspections of the frequency of SR's repetitive play with the ABC puzzle and alternative behavior during response blocking sessions revealed a baseline downward trend for repetitive behavior during baseline followed by an initial increase then decrease in repetitive behavior during intervention and follow-up (See Figure 57). SPC of SR's repetitive play with the ABC puzzle during response blocking sessions revealed that when the behavior did not occur during the first session of Step 4 and the last session of Step 5, all of Step 6 and follow-up the behavior was out of statistical control ($p < .05$; Figure 58). Baseline had a mean of 14.33 ($SD = 7.64$), which ranged from 6 to 21. The frequency then decreased further during intervention and by Step 6 reached a mean of 0 ($z = 1.73$, *ns*). Gains were maintained at follow-up with a mean frequency of 0.

SPC of alternative behavior during response blocking session revealed that during the first session of Step 6 the behavior was out of statistical control ($p < .05$). During all other sessions the behavior remained in statistical control (see Figure 59).

Alternative behaviors were stable during baseline with zero levels and variability with an upward trend during intervention and follow-up. The frequency of alternative behaviors showed an inverse relationship, with baseline levels with a mean of 0 ($SD = 0$) and an increase during Step 1 to a mean of 9. The frequency of alternative behaviors varied during intervention, with its height at Step six with a mean of 11 ($z = 1.94$, *ns*). Gains were maintained at follow-up with a mean of 8 ($z= 1.41$, *ns*).

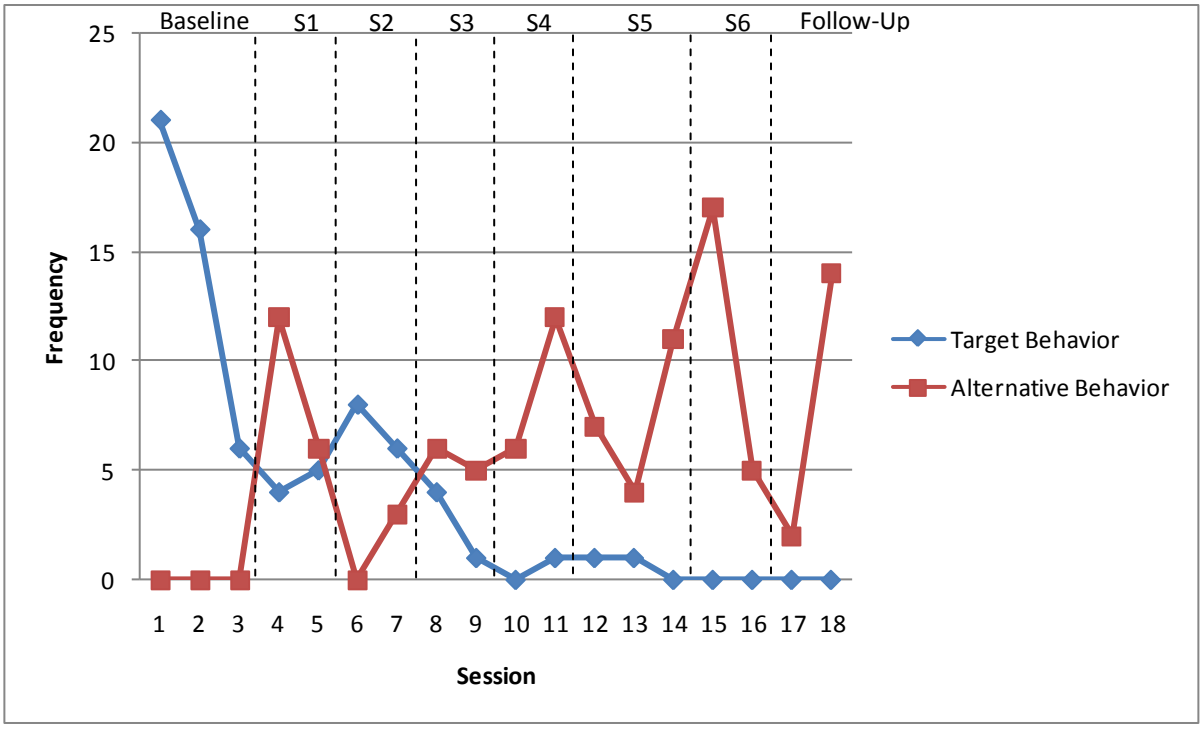


Figure 57. SR's Frequency of Repetitive Play with ABC Puzzle (Behavior 1) and Alternative Behavior during Response Blocking Sessions.

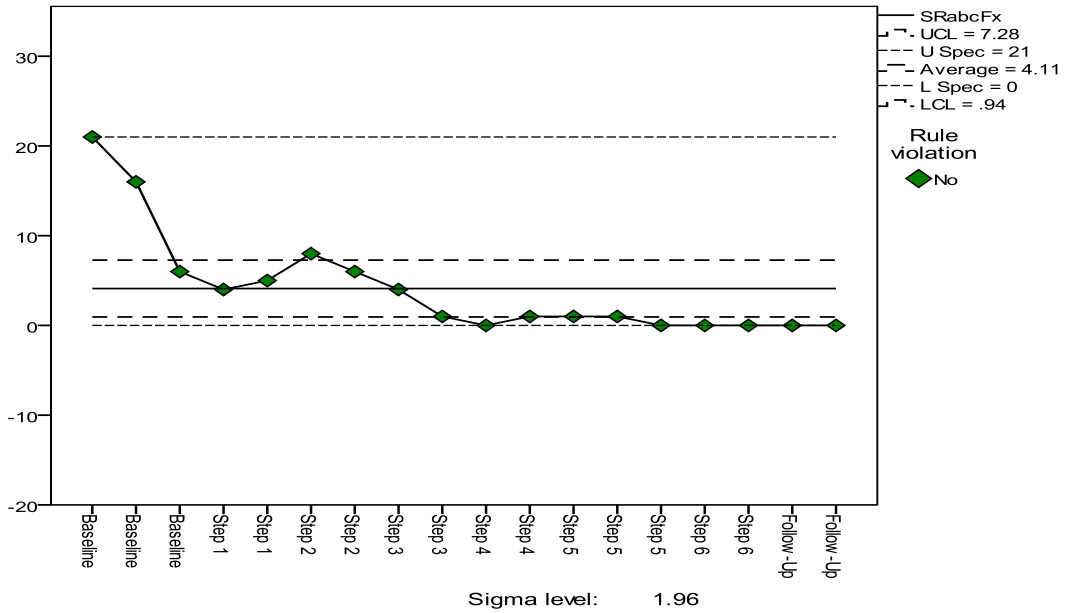


Figure 58. SR's Frequency of Repetitive Play with ABC Puzzle (Behavior 1) during Response Blocking Sessions.

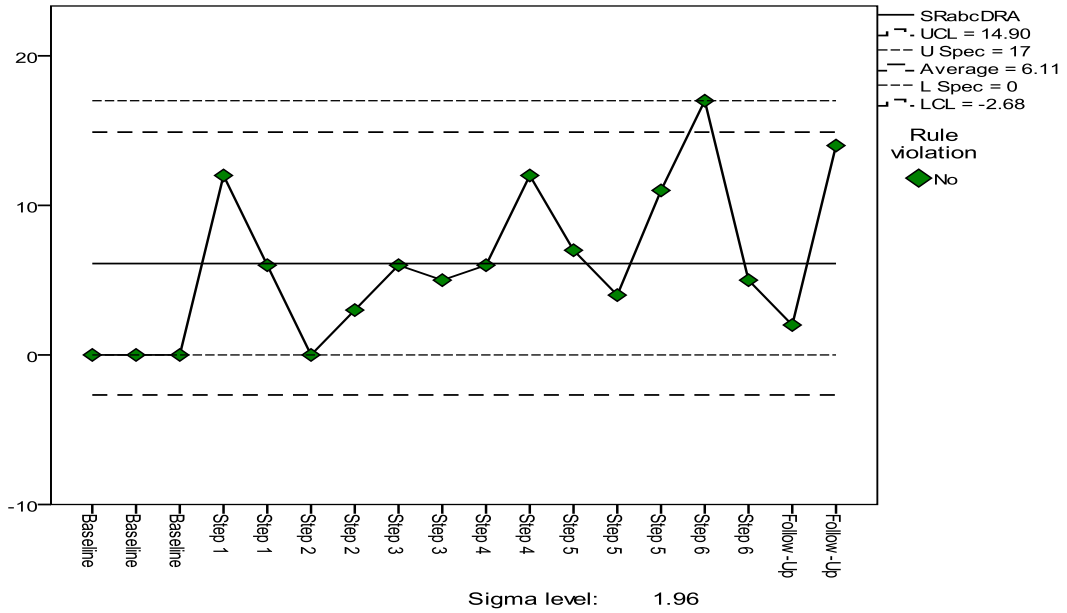


Figure 59. SR's Frequency of Alternative Behavior during Response Blocking Sessions.

Behavior 2

Latency data.

Visual inspections of the latency of repetitive play with crayons during intervention revealed the scarcity of target behavior, and therefore, lack of data points on the graph (see Figure 60). SPC of SR's latency of repetitive play with crayons revealed that the latency remained in statistical control during the intervention (see Figure 61). The average latency during baseline was 3.34 min (*SD* = 5.76). When substituting a 10 minute latency for 0 occurrences of behavior during session, despite the increase in latency apparent, no significance was obtained for Step 6 with a mean of 10 min ($z = 1.89$, *ns*). Gains were maintained at follow-up when only one occurrence of the behavior was observed with a latency of 7.42 min. Therefore the average latency during follow-up had a mean 8.71 min ($z = 1.52$, *ns*).

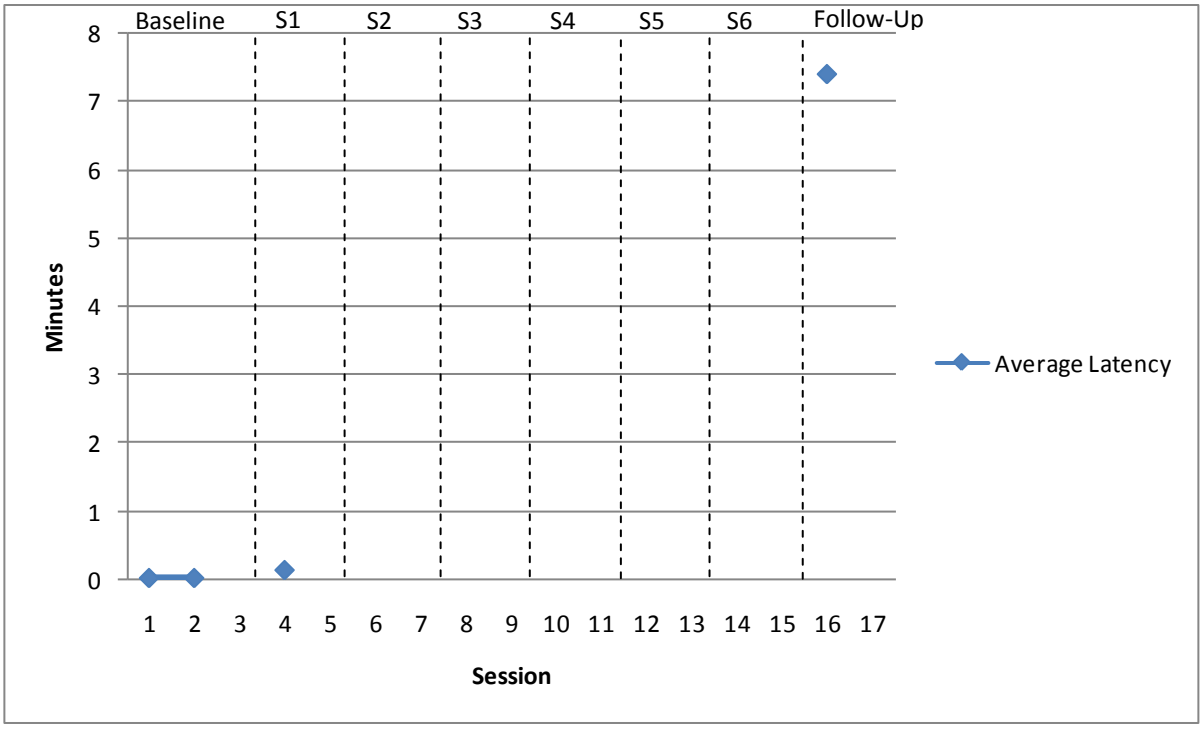


Figure 60. SR's Average Latency of Repetitive Play with Crayons (Behavior 2) during Response Blocking Sessions.

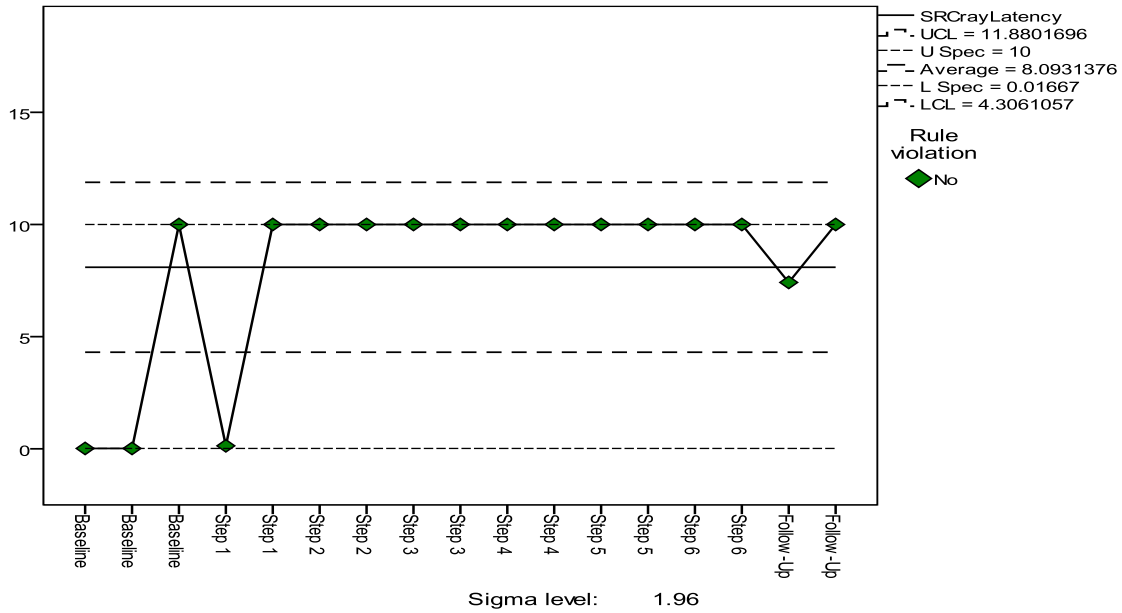


Figure 61. SR's Average Latency of Repetitive Play with Crayons (Behavior 2) during Response Blocking Sessions.

Frequency data.

Visual inspections of the frequency of SR's repetitive play with crayons and alternative behavior revealed the frequency of repetitive play had baseline with a downward trend followed by zero to near zero frequency during the rest of intervention and follow-up and alternative behavior was stable during baseline and varied throughout the intervention and follow-up (see Figure 62). SPC of SR's repetitive play with crayons revealed that the frequency remained in statistical control during intervention (see Figure 63). Baseline had a mean of 9.33 (*SD*=8.33), which ranged from 0 to 16. The frequency then decreased further during intervention when only two occurrences of the target behavior was observed, one during Step 1 and another during follow-up. Ipsative z analyses revealed no statistical significance was found between baseline and Steps 2 through 6, which each had a mean of 0 ($z = 1.78$, *ns*).

SPC of alternative behavior during response blocking sessions revealed that the frequency remained in statistical control during intervention (see Figure 64). The frequency of alternative behaviors showed an inverse relationship, baseline levels with a mean of .67 (*SD* = 1.16). Alternative behaviors then increased during Step 1 to a mean of 9.5. The frequency of alternative behaviors then decreased and varied during the intervention, ranging from 0 to 11, although ipsative z analyses revealed no statistical significance when intervention was compared to baseline.

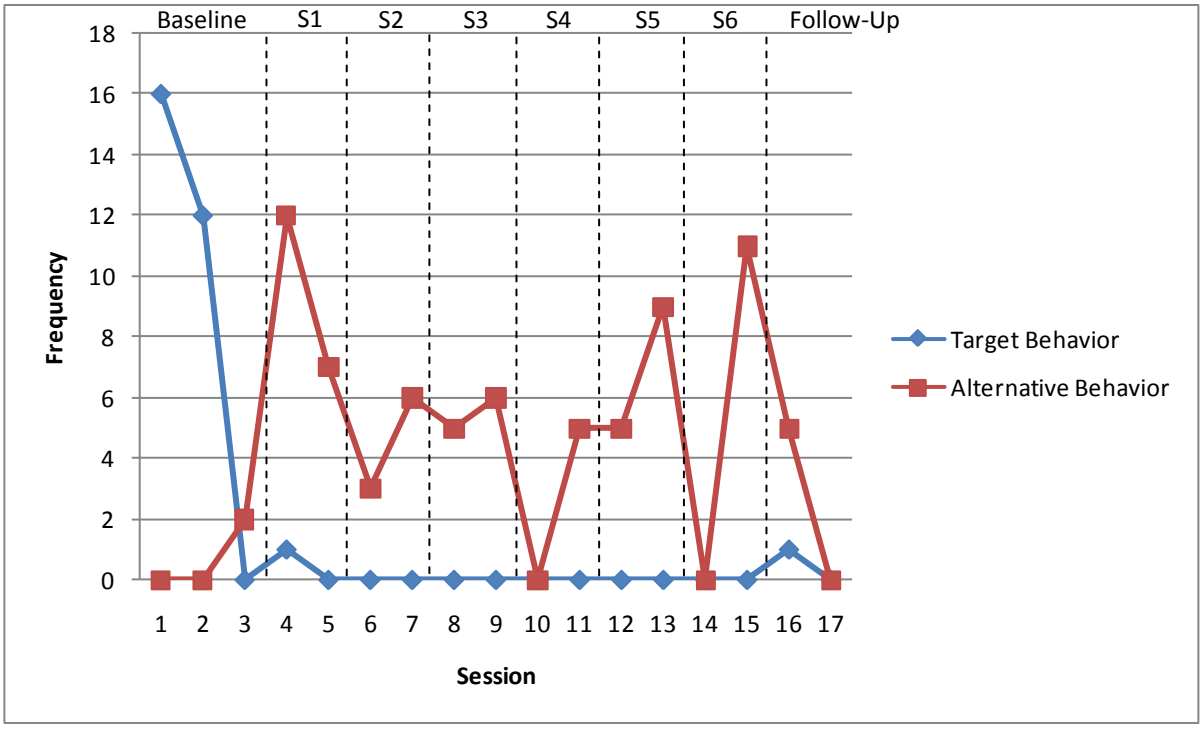


Figure 62. SR's Frequency of Repetitive Play with Crayons (Behavior 2) and Alternative Behavior during Response Blocking Sessions.

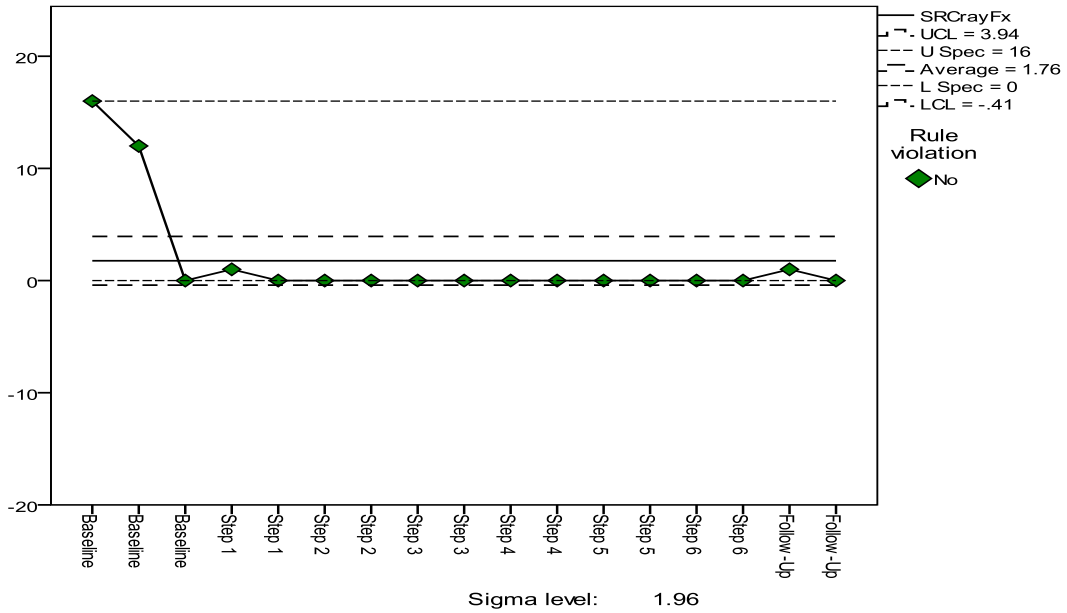


Figure 63. SR's Frequency of Repetitive Play with Crayons (Behavior 2) during Response Blocking Sessions.

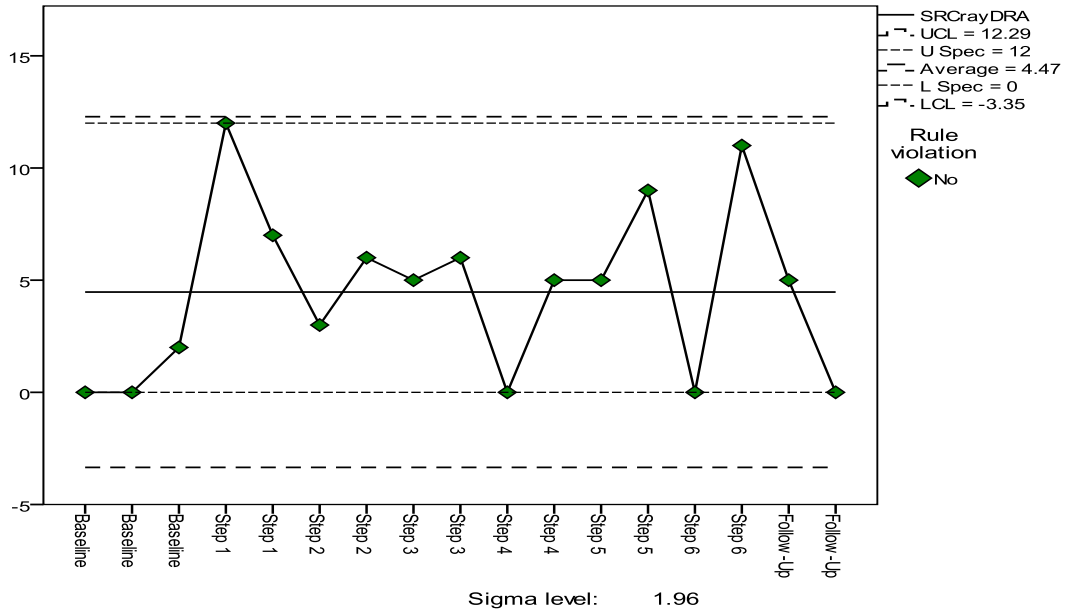


Figure 64. SR's Frequency of Repetitive Play with Crayons (Behavior 2) during Response Blocking Sessions.

Visual inspections of target behaviors and problem behavior for SR during the school day revealed low levels of all recorded behavior throughout the intervention with a range of 0 to 2 occurrences of behavior per day (see Figure 65).

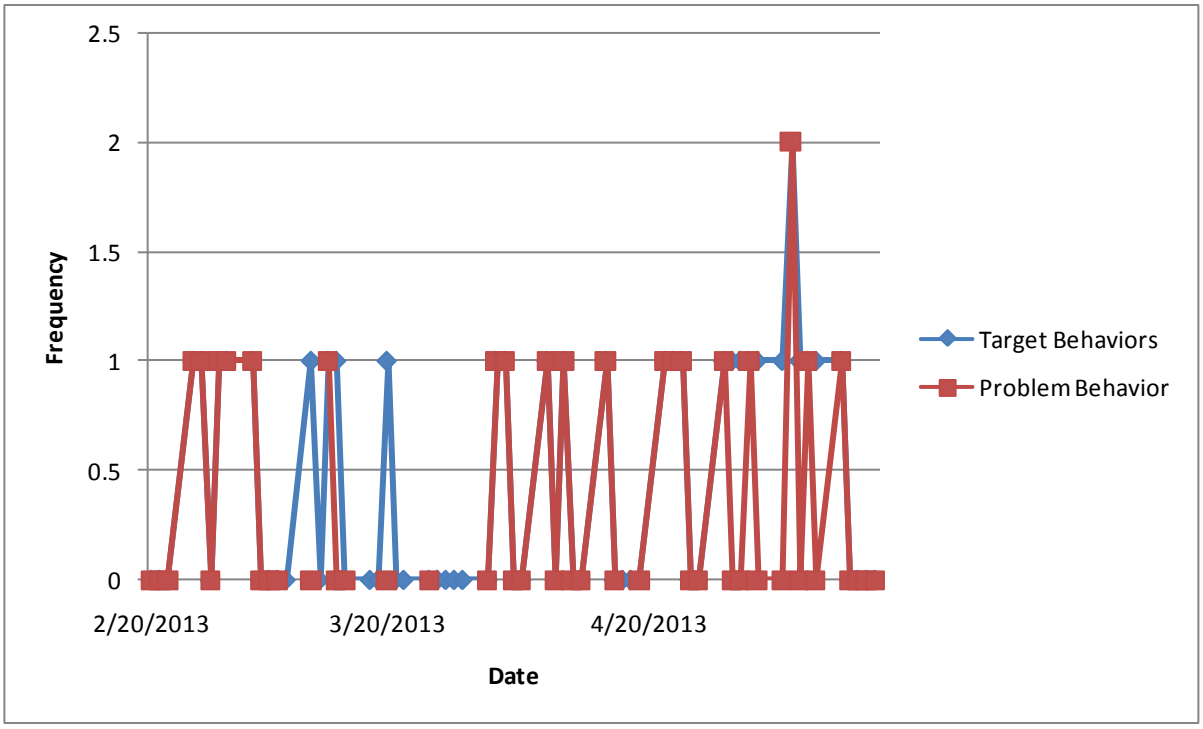


Figure 65. SR's Frequency of Repetitive Play with Alphabet and Problem Behavior during the School Day.

Inter-observer Agreement was reached at a level of 98.22% agreement between instructor and video coder for SR session data.

CHAPTER IV

Discussion

After an extensive literature review, this is the first study to be conducted utilizing response blocking sessions with the intention of increasing response latency with the autism population. This study focused on the treatment of repetitive behaviors in young children with an autism spectrum disorder in their school setting. Data were collected on the latency and frequency of the target repetitive behavior and alternative behaviors during response blocking sessions. Additionally, data were collected during the school day on the frequency of target repetitive behavior and associated problem behavior.

Hypothesis Testing

Overall, each participant increased the response latency for each of the repetitive behaviors targeted for intervention. All participants increased alternative behaviors during response blocking sessions. The frequency of target and problem behavior during the school day varied considerably and was recorded inconsistently, suggesting the need to consider methodological limitations.

Hypothesis 1.

The first hypothesis stated that the function of the repetitive behaviors chosen for intervention was nonsocial. The QABF was completed for each participant by teachers, parents, or both teachers and parents, to evaluate the function of each repetitive behavior targeted for intervention. All 13 of the QABFs completed indicated that the function of each repetitive behavior targeted for intervention was nonsocial. The nonsocial function of the behaviors lends support for the use of exposure and response prevention, due to the automatically reinforcing nature of the behavior (Stampfl & Levis, 1967). The distinctions

and subtypes of repetitive behaviors observed in individuals with autism spectrum disorders differ greatly in the literature (Curccaro et al., 2003; Lovaas et al., 1987; Bodfish et al., 2000, Carcani-Rathwell et al., 2006; Turner, 1999; Szatmari et al., 2006; Richler et al., 2010; Boyd et al., 2009). Similarly, the manifestation of these behaviors is idiosyncratic. Because the target repetitive behaviors varied widely across participants, the nonsocial function of each behavior was a common thread.

Hypothesis 2.

The second hypothesis stated the latency would increase during intervention. For each participant an increase in latency during intervention was observed. Increased latencies were maintained at follow-up, when many participants no longer engaged in the repetitive behaviors. During intervention sessions, many participants initially requested to engage in the repetitive behavior, agreed to wait, engaged in reinforced alternative behaviors, and ultimately did not engage in the repetitive behavior even after the expected latency passed. Participants who were quick to engage in repetitive behaviors (especially CB and LS) were able to wait a minimum of 5 minutes, when their average baseline was less than 4 seconds of waiting. The increase in latency over time resulted with many participants eventually no longer engaging in the repetitive behavior. This occurrence reflects the behavioral control participants gained over each target repetitive behavior.

BH's ritualized eating was the most difficult behavior to delay. In order to delay his insistence on eating a preferred food item after a bite of yogurt, BH needed to first eat a bite of yogurt. This was an aversive experience for BH. Once BH realized that he would have to wait for his preferred food item, it was more difficult to get him to eat yogurt. Despite these obstacles, BH consumed yogurt during every intervention session. During Step 6 of

intervention BH's latency significantly increased from the other intervention sessions. This is notable given BH consumed yogurt during the first session of Step 6 without any preferred food to follow.

CB's latency of ordering and arranging of pet figurines significantly increased when the behavior did not occur during one session of Step 3 and both follow-up sessions. This important change was replicated for CB's arranging and ordering figurines from home during Step 6 of intervention to the end of follow-up. Both behaviors had a stable short baseline latency which only increased during intervention sessions.

JS's latency of ritualistic play with Legos significantly increased when the behavior did not occur during a session of Step 6 and a session of follow-up. JS's latency of ritualistic play with the toy clock did not significantly increase during the intervention. During three baseline sessions JS did engage in ritualistic play with the clock. During eight more sessions of intervention JS also did not engage in ritualistic play with the clock. Considering that JS's ritualistic play with the toy clock was his Behavior 2, the lack of frequency and resulting lack of latency could be attributed to intervention of Behavior 1 effecting the baseline of Behavior 2.

LS's latency of repetitive play with the toy cash register significantly increased during the last six sessions of intervention, from Step 5 to follow-up. During the last three sessions no repetitive play occurred. LS's latency of repetitive play with a Magnadoodle increased significantly when the behavior did not occur during a session of Step 5, both session of Step 6 and both follow-up session. Although LS was very active during intervention sessions, he often asked if it was "time" to play with his cash register or Magnadoodle. When LS was told that it was not time, he would readily engage in an alternative behavior.

SB's latency of repetitive play with Play-Doh significantly increased during sessions when the behavior did not occur. Repetitive play with Play-Doh did not occur during one session of Step 1, one session of Step 6, and both follow-up sessions. Similarly, SB's latency of arranging/ordering figurines also significantly increased when the behavior did not occur. Arranging/ordering figurines did not occur during one session of Step 2, Step 3 to Step 6, and one session of follow-up. Although SB engaged in arranging/ordering figurines during baseline sessions, the behavior did not consistently occur during intervention. SB's lack of arranging/ordering during intervention could be attributed to the increase in alternative behavior that SB engaged in during those sessions.

SR's latency of repetitive play with the ABC puzzle significantly increased during sessions and the behavior did not occur. No repetitive play with the ABC puzzle occurred during one session of Step 4, one session of 5, and all of Step 6 and follow-up sessions. Similar to the second behavior of SB, during many intervention sessions and one baseline session SR did not engage in repetitive play with crayons (Behavior 2). The lack of repetitive play with crayons throughout the intervention likely contributed to the insignificant increase in latency observed. Also similar to SB, SR quickly learned to engage in alternative behaviors during intervention sessions. He had a strong preference for mini M&Ms throughout the intervention. His goal of obtaining as many mini M&Ms as possible often occupied his sessions. This was a time consuming tasks which most likely interfered with him engaging in repetitive play with crayons.

Hypothesis 3.

The third hypothesis stated that the intervention would decrease the frequency of the target repetitive behavior. It was hypothesized that the frequency of the target behavior would

initially increase to levels higher than baseline, and then decrease below baseline levels. Overall, results partially support this hypothesis. Decreases in frequency observed during baseline observed for many of the participants (JS Behavior 2, SB Behavior 1, SR Behavior 1, and SR Behavior 2) makes it difficult to attribute the overall decrease in frequency of target repetitive behavior to the intervention. The limited number of baseline sessions for Behavior 1 of most participants also limited the conclusions that could be made based on frequency data. There were significant decreases in frequency for several participants, specifically LS Behavior 1, LS Behavior 2 at the $< .001$ level and CB Behavior 1, CB Behavior 2, JS Behavior 1, SR Behavior 1 at the .05 level. These data provide support for the progressive decrease in frequency throughout the intervention for these participants.

Although every participant showed significant increases in latency (10 of 11 behaviors chosen for intervention), significant decreases were found in 6 of 11 target behaviors. Significant increases in latency without the accompaniment of significant decreases in frequency could be explained by the often low and/or decreasing frequency of behavior observed during baseline. Since baseline was considered stable if latency was consistent, the frequency varied.

The inconsistent frequency of target repetitive behavior during baseline and intervention mirrored the description of pattern of behavior observed by teachers and parents. The behavior did not always occur, but when it could not be accommodated there were often problems. At times interrupting or stopping the behavior would lead to the child crying, yelling, and being removed from the classroom. By extending the latency with response prevention the intention was to build in enough time for the participant to be able to tolerate interference or blocking of the behavior, no matter how often it occurred.

Since the rationale for utilizing a response blocking intervention was supported by the first hypothesis and the effect of response blocking was addressed in second and third hypotheses, the role of response blocking will be discussed. One consideration is that the intervention employed could have consisted of response blocking alone without the differential reinforcement of an alternative behavior. Unlike systematic desensitization, exposure therapy does not traditionally involve a gradual increase in exposure to anxiety provoking stimuli. Flooding is often used to facilitate extinction of avoidance and escape responding. It is the opinion of the author that using a flooding procedure with the participants in the current study would be impractical and potentially unethical. Given the young age and developmental limitations of the participants, it is unlikely they that would be able to understand the rationale for engaging in treatment. Without the understanding that the intervention was aimed to help them overcome the negative reinforcement cycle of these repetitive behaviors, they were likely to upset when their repetitive behaviors were blocked. Even though most of the participants would not likely achieve this level of understanding, they could understand the reinforcement contingency of differential reinforcement of alternative behavior. Additionally, the treatment was gradually implemented and differential reinforcement was incorporated in order to help make the intervention tolerable for the participants. The intervention appeared to be tolerable for the participants given the minimal problem behavior observed during intervention sessions. Additionally, each participant readily attended sessions daily. The willingness of the participants to engage in intervention sessions will be discussed more to follow.

Hypothesis 4.

The fourth hypothesis stated that the frequency of alternative behaviors would increase from baseline levels. With BH as the exception, all other participants engaged in few alternative behaviors during baseline, with an increase in frequency during intervention. This result was repeated for each participant's second targeted behavior. During these baseline sessions participants engaged in few alternative behaviors during the intervention phase of the first behavior. An increase was observed when the alternative behaviors were reinforced during intervention phases for the second target behavior. The data reflect the importance of reinforcing alternative behaviors when trying to decrease repetitive behaviors. BH excluded, the frequency of all participants showed an inverse relationship between target repetitive behavior and alternative behavior.

Differential reinforcement of alternative behaviors during intervention sessions could have strengthened the treatment in several ways. First, it could be that differential reinforcement of alternative behavior was the mechanism of action for the intervention. It is possible that differential reinforcement could have decreased the frequency of the target repetitive behavior because participants learned that the alternative behaviors would be reinforced and the target repetitive behavior would not be. Despite this possibility it is important to consider that the target repetitive behavior was presumed to be negatively reinforcing for the individual. Therefore the behavior would be maintained by reinforcing action of engaging in the behavior to escape or avoid the potential anxiety or aversive state which would occur due to not engaging in the behavior. Because of the negatively reinforcing property of the behavior it is unclear whether it would extinguish with response blocking.

Another explanation of the role of reinforcement of alternative behaviors is that the alternative behaviors were incompatible responses. If only one behavior can occur at any one time, then whenever the participant engaged in an alternative behavior, they could not engage in the target repetitive behavior. In all likelihood the behaviors were not incompatible. Some of the alternative behaviors did not require the use of hands, as in breathing and saying a positive self-statement, and other alternative behaviors could require the use of one hand, as in stretching or squeezing a stress ball.

A third explanation regarding the role of alternative behaviors is that the alternative behaviors helped the participants mediate the anxiety they experienced. The alternative behaviors could have helped them enough enable them to no longer feel the need to engage in the target repetitive behavior. This is a difficult point to support or reject in its entirety. The participants appeared to enjoy engaging in the alternative behaviors. This could be because they understand that the experimenter was pleased that they engaged in an alternative behavior. It is more likely that the participant happily anticipated their reinforcement while engaging in the alternative behavior. All of the alternative behaviors were designed to be easily understood by the participants. They were also chosen to be more adaptive responses to manage anxiety or distress. No matter the role of repetitive behavior during intervention sessions, participants appeared to enjoy the predictability of the alternative reinforcement contingency. Future research could aim to distinguish the role of response blocking versus differential reinforcement of alternative behavior for the intervention.

Hypothesis 5.

The final hypothesis stated that the frequency of the target repetitive behaviors and problem behavior would initially increase during the school day, and then decrease to below

baseline levels, indicating an extinction burst. No clear conclusions could be made based on school day data. This is due to many missing data points, and inconsistency among teachers and teaching assistants who collected data.

Similar Research

The current study contributed to the literature by utilizing a modified exposure and response prevention protocol. Prior research has scarcely used exposure and response prevention to treat repetitive behaviors as a core feature of autism (Matson & Dempsey, 2009; Wolff, 2010). The results of the current study support the use of shorter, multiple sessions in the school setting. This differs from previous research which consisted of one session of massed exposure (Davis et al., 2007; Öst, 1989). Similar to the previous work of Reaven and Hepburn (2003), the current study had modifications to a traditional exposure and response prevention protocol. The findings of the current study extend the efficacious results found in Reaven and Hepburn (2003) with an increased sample size. Additionally, participants in the current study were not dually diagnosed with autism and Obsessive-Compulsive Disorder. The intervention of the current study targeted repetitive behavior which was a symptom of their sole diagnosis of autism. Boyd et al. (2011) also targeted autism-typical repetitive behavior for intervention. Boyd et al. subjectively measured the therapist's rating of the participant's interest in repetitive behavior, distress when access to the repetitive behavior was blocked, and intensity of problem behavior. The current study recorded data on frequency and latency on the target repetitive behavior which showed observable changes in behavior over time.

Methodological Strengths

Differential reinforcement of alternative behaviors during response blocking sessions was a conscious methodological decision. Considering the age, developmental level, and diagnosis of each participant, alternative behaviors were reinforced in an effort to teach more adaptive responses. The inverse relationship between frequency of target repetitive behavior and alternative behavior demonstrated by five out of six participants (with BH as the exception) across two behaviors demonstrates the participant's ability to learn alternative behaviors. Participants engaged in reinforced alternative behaviors and abstained from target repetitive behaviors even when the choice was available to them.

Another methodological strength was that the intervention was designed to engage the participants in a preferred activity. During baseline sessions participants were able to freely engage in the target repetitive behavior. Participants were eager to attend baseline sessions, and this willingness to participate continued through the intervention and follow-up sessions. Upon entering a classroom to pick up students the experimenter was often greeted by participants who asked excitedly, "is it my turn?!" Students with less verbal ability would run over and grab the hand of the experimenter with a tug towards the door. Behavior specific praise, and reinforcing increasing latencies and alternative behaviors, all likely contributed to the students' willingness to participate over the four months of intervention. Additionally, the possibility of engaging in the target repetitive behavior during the intervention provided further incentive for participants to attend response blocking sessions. The design of the intervention as a preferred activity provided support for the paradigm of response blocking in combination with differential reinforcement of alternative behavior. As previously discussed, although there is a possibility that each aspect of the intervention could have been successful

alone, the participants appeared to enjoy response blocking in combination with differential reinforcement of alternative behaviors.

Feedback from administrators, school psychologists, and teachers regarding the intervention was overwhelmingly supportive. One advantage of the school setting was the expected attendance of the students. Most students attended school regularly and were regularly available for the intervention. Most teachers readily acknowledged the need for this intervention. The behaviors targeted were a disruption during the school day to the extent that toys had to be hidden, moved to other classrooms, and returned home. Teachers noted the enthusiasm of the students to participate. Several teachers reported that behaviors previously observed in the classroom were no longer present. The decrease of observed repetitive behavior in the classroom was the most exciting feedback from teachers.

Limitations

Implementing an intervention in the school setting presented challenges. Identifying students with the target repetitive behaviors suitable for intervention was relatively easy. There were many responses to the RBS-R. Obtaining responses from parents with children who exhibited the most behavior problems was more difficult. This was likely due to the time constraints posed by managing these and other behaviors. Consent for one participant required a home instructor to bring along the form during a home session, as the multiple consent forms previously sent home never returned to school. A participant who originally appeared to engage in the type of repetitive behavior targeted for intervention in the current study had to be eliminated from the study due to not engaging in any of this behavior during baseline sessions. This participant had cooperative parents who were eager to involve their child in this

intervention. Although levels of availability and responsiveness varied, all parents of participants were ultimately cooperative.

Similarly, students also had busy school schedules. Many students were scheduled for a variety of interventions during the school day. A great deal of flexibility was required in order to schedule and reschedule students in order to accommodate absences and other inflexible commitments.

The use of the QABF to determine the function of the target repetitive behavior was a limitation of the current study. With the convergent validity between the QABF and analog sessions at 56.3% it is clear that the QABF falls short of the gold standard for functional assessment (Paclawskyj et al., 2001).

The collection of data during the school day was a limitation of the current study. Teachers and aides had the responsibility of collecting extensive data on all of the students enrolled in their class. Teachers who had more support in the classroom with aides were better able to record data during the school day for the current study. Some teachers also stopped recording data after the treatment phase of the intervention was complete, but before follow-up.

Another limitation of the study was the multiple dimensions of observed behavior: frequency and latency of target repetitive behaviors, and frequency of alternative behaviors. The complexities of the behaviors were evident when the baseline was visually inspected. Stability of baseline was established by examining the latency for the target repetitive behaviors, not the frequency. The focus on latency for baseline stability presented an unanticipated issue when the latency remained consistent during baseline, but the frequency reduced drastically.

The possibility exists that the intervention for the first target behavior affected the outcome for the second targeted repetitive behavior. This pattern was a possibility for two of the participants (JS and SR). With the baseline latencies of the second target behaviors showing changes before the implementation of treatment, it is difficult to determine if the intervention increased the latency and reduced the frequency of the second target behaviors. As mentioned earlier, an increase in alternative behaviors was observed during treatment sessions across all participants, including JS and SR. This increase in alternative behaviors demonstrates that participants engaged in reinforced alternative behaviors instead of the repetitive behavior which was negatively reinforcing for them.

As previously mentioned, of the six participants BH was the outlier. Despite sharing the nonsocial function of behavior, BH's treatment outcomes differ considerably from the other participants. The function of BH's ritualized eating was nonsocial, although his behavior also had an oppositional flair. He often attempted to engage the experimenter verbally by stating that he was going to hit the experimenter and send the experimenter to jail. On several occasions he tossed smaller squeeze balls and reinforcers behind the padded walls of the movement room and laughed. BH's refusal to engage in alternative behaviors likely impacted his willingness to participate during the response blocking sessions. BH occasionally attempted to elope and requested to return to his classroom.

Future Research and Conclusions

The findings from this research suggest that future research in this area is warranted. Replication of these results with a larger sample size would provide more support for the use of exposure based interventions with the autism population. As mentioned previously, instability of frequency during baseline was a limitation of the current study. In order to

strengthen the quality of baseline data, all dimensions of the target behavior could have been considered. Extended baseline and withholding treatment until stability of latency and frequency were established would strengthen the design of future studies. Future studies could also aim to separate the effect of response blocking versus differential reinforcement. The use of analog sessions to determine the function of the target repetitive behavior instead of the QABF could have strengthened the validity of behavioral function. Data collection completed by teachers could have also been completed consistently. Adapting data collection during the school day from a running tally to fixed interval recording could help facilitate the consistent recording of data from teachers and staff. The current sample is also limited to young children, so including participants of different ages and cognitive ability would enhance the generalizability of these results.

The current study provides support for the use of an exposure based intervention for the treatment of repetitive behavior in children with an autism spectrum disorder. The implementation of the current study in the school setting exemplifies how an intervention targeting repetitive behavior can be incorporated into the educational planning of children. The current study provided support for a gradual increase in latency for the target repetitive behavior for young children with autism. The participants would have likely experienced significant distress if a traditional flooding exposure protocol was used. The intervention was largely enjoyed by the participants. The participants requested to attend sessions which sought to block the behavior they previously insisted on engaging. The positive feedback provided by school staff and teachers regarding the implementation of the intervention provided support for the staff and teachers of other schools to successfully accommodate this type of intervention into the educational planning of their students. Just as social skills and

communication are viewed as deficits which can be mediated by intervention, the treatment of repetitive behavior could be similarly conceptualized.

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Appendix A

HOFSTRA UNIVERSITY

Dear Parent or Guardian:

You and your child are invited to take part in a study named "Modified Exposure Protocol for the Reduction of Repetitive and Problem Behavior in Children with Autism," which evaluates an approach aimed to assist in helping your child tolerate changes to the environment throughout their school day.

This study will be conducted by Elizabeth Mansdorf, M.A., a doctoral candidate under the supervision of Dr. Mitchell Schare, Director of Ph.D. Clinical Psychology program of Hofstra University's Department of Psychology.

Background Information

Your child was chosen as a potential participant in this study based on your responses on The Repetitive Behavior Scale-Revised (RBS-R) which indicate that your child may have difficulty tolerating changes to the environment. If you choose to have your child participate in this study your child's teacher will be asked to complete the RBS-R and a few other brief questionnaires to identify behaviors that may interfere with your child's ability to learn during the school day. The principal investigator will then implement an intervention to help your child tolerate changes to the environment during their school day. The purpose of these measures is to establish how often these behaviors occur, while the goal of the intervention is to help your child tolerate changes to the environment and reduce consequent interruption to learning that your child experiences during the school day.

Procedure

Questionnaires and direct observation will be used to determine how often changes to the environment effect your child's ability to learn during the school day. A treatment protocol specific to your child's needs will be implemented with the goal of helping your child tolerate changes to the environment. We will share the behaviors that we identify and target for treatment with you. Participation will take place four to five times per week, for one 10 minute interval during the school day, integrated as part of your child's behavioral programming. Sessions will be video recorded to monitor your child's progress over time. Progress will also be monitored throughout the school day by your child's teachers.

Risks and Benefits of Participation

Risks associated with participation in this study include: Your child may experience some distress during the intervention when changes to the environment are implemented. This distress would not be more than normally experienced by your child during a typical school day. The intervention targets behaviors that already occur during the school day and the

intervention is specifically designed to address the needs of your child. We will apply the treatment gradually, based on your child's needs, to help ensure that we successfully promote toleration of changes to the environment.
Benefits associated with participation in this study include: The goal of the study is to treat behavior that is already interfering with your child's school day, and help your child tolerate changes to the environment.

Confidentiality
Confidentiality of your research records will be strictly maintained and will not include identifying information such as your name and your child's name. Video recording of sessions will remain confidential and only be used to monitor your child's progress. The data will be kept on computers and back-up storage, accessible to authorized investigators only, as will this consent form. Videos will be erased following completion of this study.

Voluntary Nature of the Study
Participation in this study is completely voluntary. Once you and your child start participating, you may withdraw at any time without penalty. A report explaining the results of your child's participation in the study can be provided to you after the completion of the study upon request.

Contact Information
If you would like a copy of this consent statement, please ask Dr. Jay Saul. You are encouraged to contact Dr. Jay Saul at Just Kids with any questions you may have regarding this study at (631) 924-0008. The principal investigator, Elizabeth Mansdorf, is also available to discuss questions at (516) 515-0135 or emansd1@pride.hofstra.edu. You may also contact the dissertation advisor, Dr. Mitchell Schare at 516-463-5662.

Sincerely,

Elizabeth Mansdorf, M.A.
Ph.D. Candidate, Clinical Psychology
Hofstra University

Statement of Consent
Please read the statement below and if you agree with it, sign on the signature line:

"I have read the preliminary description of this experiment and agree to participate. I understand that there are minimal risks and that I am free to discontinue my participation at any time without penalty."
Name of Child (printed)

_____

Name of Parent (printed) Signature of Parent

_____

Date _____

Appendix B

Rater's Name:_____ **Date:**_____

Student's Initials (Fi La): _____ **Student's DOB:** _____

REPETITIVE BEHAVIOR SCALE – Revised (RBS-R)

Instructions:

Please rate this person's behavior by reading each of the items listed and then choosing the score that best describes how much of a problem the item is for the person. Be sure to read and score all items listed. Make your ratings based on your observations and interactions with the person over the last month. Use the definitions in the box given below to score each item.

0 = behavior does not occur
1 = behavior occurs and is a mild problem
2 = behavior occurs and is a moderate problem
3 = behavior occurs and is a severe problem

At the end of each section, there will be three questions asking you to rate that section's behaviors in terms of (a) how frequently they occur, (b) how upset the person becomes when repetitive behaviors are interrupted, and (c) how much the behaviors interfere with ongoing events. You will indicate the score by marking along each line, which represents a range of frequencies and severities. For example, if this person does those behaviors many times a day you may put the mark quite close to the right side:

Never **Constantly**

I. Stereotyped Behavior Subscale

(DEFINITION: apparently purposeless movements or actions that are repeated in a similar manner)

1	WHOLE BODY (Body rocking, Body swaying)	0	1	2	3
2	HEAD (Rolls head, Nods head, Turns head)	0	1	2	3
3	HAND/FINGER (Flaps hands, Wiggles or flicks fingers, Claps hands, Waves or shakes hand or arm)	0	1	2	3
4	LOCOMOTION (Turns in circles, Whirls, Jumps, Bounces)	0	1	2	3
5	OBJECT USAGE (Spins or twirls objects, Twiddles or slaps or throws objects, Lets objects fall out of hands)	0	1	2	3
6	SENSORY (Covers eyes, Looks closely or gazes at hands or objects, Covers ears, Smells or sniffs items, Rubs surfaces)	0	1	2	3

Please answer the following questions about the behaviors described above (put a vertical mark (|) on the line to show your answer):

How **often** do they happen?
(If *Never, skip to Section II)*

Never **Constantly**

How **upset** does this person get when interrupted?

Not at all **Extremely**

How much do these behaviors **get in the way of ongoing events?**

Not at all **Severe interference**

II. Self-Injurious Behavior Subscale

0 = behavior does not occur
1 = behavior occurs and is a mild problem
2 = behavior occurs and is a moderate problem
3 = behavior occurs and is a severe problem

(DEFINITION: movement or actions that have the potential to cause redness, bruising, or other injury to the body, and that are repeated in a similar manner)

7	HITS SELF WITH BODY PART (Hits or slaps head, face, or other body area)	0	1	2	3
8	HITS SELF AGAINST SURFACE OR OBJECT (Hits or bangs head or other body part on table, floor or other surface)	0	1	2	3
9	HITS SELF WITH OBJECT (Hits or bangs head or other body area with objects)	0	1	2	3
10	BITES SELF (Bites hand, wrist, arm, lips or tongue)	0	1	2	3
11	PULLS (Pulls hair or skin)	0	1	2	3
12	RUBS OR SCRATCHES SELF (Rubs or scratches marks on arms, leg, face or torso)	0	1	2	3
13	INSERTS FINGER OR OBJECT (Eye-poking, Ear-poking)	0	1	2	3
14	SKIN PICKING (Picks at skin on face, hands, arms, legs or torso)	0	1	2	3

Please answer the following questions about the behaviors described above (put a vertical mark (/) on the line to show your answer):

How **often** do they happen?
(If *Never, skip to Section II)*

Never ——— **Constantly**

How **upset** does this person get when interrupted?

Not at all ——— **Extremely**

How much do these behaviors **get in the way of ongoing events?**

Not at all ——— **Severe interference**

0 = behavior does not occur
1 = behavior occurs and is a mild problem
2 = behavior occurs and is a moderate problem
3 = behavior occurs and is a severe problem

III. Compulsive Behavior Subscale

(DEFINITION: behavior that is repeated and is performed according to a rule, or involves things being done "just so")

15	ARRANGING / ORDERING (Arranges certain objects in a particular pattern or place; Need for things to be even or symmetrical)	0	1	2	3
16	COMPLETENESS (Must have doors opened or closed; Takes all items out of a container or area)	0	1	2	3
17	WASHING / CLEANING (Excessively cleans certain body parts; Picks at lint or loose threads)	0	1	2	3
18	CHECKING (Repeatedly checks doors, windows, drawers, appliances, clocks, locks, etc.)	0	1	2	3
19	COUNTING (Counts items or objects; Counts to a certain number or in a certain way)	0	1	2	3
20	HOARDING/SAVING (Collects, hoards or hides specific items)	0	1	2	3
21	REPEATING (Need to repeat routine events; In / out door, up / down from chair, clothing on/off)	0	1	2	3
22	TOUCH / TAP (Need to touch, tap, or rub items, surfaces, or people)	0	1	2	3

Please answer the following questions about the behaviors described above (put a vertical mark (/) on the line to show your answer):

How **often** do they happen?
(If *Never, skip to Section II)*

Never ——————————— **Constantly**

How **upset** does this person get when interrupted?

Not at all ——————————— **Extremely**

How much do these behaviors **get in the way of ongoing events?**

Not at all ——————————— **Severe interference**

0 = behavior does not occur 1 = behavior occurs and is a mild problem 2 = behavior occurs and is a moderate problem 3 = behavior occurs and is a severe problem

IV. Ritualistic Behavior Subscale

(DEFINITION: performing activities of daily living in a similar manner)

23	EATING / MEALTIME (Strongly prefers/insists on eating/drinking only certain things; Eats or drinks items in a set order; Insists that meal related items are arranged in a certain way)	0	1	2	3
24	SLEEPING / BEDTIME (Insists on certain pre-bedtime routines; Arranges items in room "just so" prior to bedtime; Insists that certain items be present with him/her during sleep; Insists that another person be present prior to or during sleep)	0	1	2	3
25	SELF-CARE – BATHROOM AND DRESSING (Insists on specific order of activities or tasks related to using the bathroom, to washing, showering, bathing or dressing; Arranges items in a certain way in the bathroom or insists that bathroom items not be moved; Insists on wearing certain clothing items)	0	1	2	3
26	TRAVEL / TRANSPORTATION (Insists on taking certain routes/paths; Must sit in specific location in vehicles; Insists that certain items be present during travel, e.g., toy or material; Insists on seeing or touching certain things or places during travel such as a sign or store)	0	1	2	3
27	PLAY / LEISURE (Insists on certain play activities; Follows a rigid routine during play / leisure; Insists that certain items be present/available during play/leisure; Insists that other persons do certain things during play)	0	1	2	3
28	COMMUNICATION / SOCIAL INTERACTIONS (Repeats same topic(s) during social interactions; Repetitive questioning; Insists on certain topics of conversation; Insists that others say certain things or respond in certain ways during interactions)	0	1	2	3

Please answer the following questions about the behaviors described above (put a vertical mark (/) on the line to show your answer):

How **often** do they happen?
(If *Never, skip to Section II)*

Never ——————————— **Constantly**

How **upset** does this person get when interrupted?

Not at all ——————————— **Extremely**

How much do these behaviors **get in the way of ongoing events?**

Not at all ——————————— **Severe interference**

0 = behavior does not occur
1 = behavior occurs and is a mild problem
2 = behavior occurs and is a moderate problem
3 = behavior occurs and is a severe problem

V. Sameness Behavior Subscale

(DEFINITION: (resistance to change, insisting that things stay the same)

29	Insists that things remain in the same place(s) (e.g. toys, supplies, furniture, pictures, etc.)	0	1	2	3
30	Objects to visiting new places	0	1	2	3
31	Becomes upset if interrupted in what he/she is doing	0	1	2	3
32	Insists on walking in a particular pattern (e.g., straight line)	0	1	2	3
33	Insists on sitting at the same place	0	1	2	3
34	Dislikes changes in appearance or behavior of the people around him/her	0	1	2	3
35	Insists on using a particular door	0	1	2	3
36	Likes the same CD, tape, record or piece of music played continually; Likes same movie / video or part of movie / video	0	1	2	3
37	Resists changing activities; Difficulty with transitions	0	1	2	3
38	Insists on same routine, household, school or work schedule everyday	0	1	2	3
39	Insists that specific things take place at specific times	0	1	2	3

Please answer the following questions about the behaviors described above (put a vertical mark (/) on the line to show your answer):

How **often** do they happen?
(If *Never, skip to Section II)*

Never ——————————— **Constantly**

How **upset** does this person get when interrupted?

Not at all ——————————— **Extremely**

How much do these behaviors **get in the way of ongoing events?**

Not at all ——————————— **Severe interference**

0 = behavior does not occur
1 = behavior occurs and is a mild problem
2 = behavior occurs and is a moderate problem
3 = behavior occurs and is a severe problem

VI. Restricted Behavior Subscale

(DEFINITION: Limited range of focus, interest or activity)

40	Fascination, preoccupation with one subject or activity (e.g., trains, computers, weather, dinosaurs)	0	1	2	3
41	Strongly attached to one specific object	0	1	2	3
42	Preoccupation with part(s) of object rather than the whole object (e.g., buttons on clothes, wheels on toy cars)	0	1	2	3
43	Fascination, preoccupation with movement / things that move (e.g., fans, clocks)	0	1	2	3

Please answer the following questions about the behaviors described above (put a vertical mark (/) on the line to show your answer):

How **often** do they happen?
(If *Never, skip to Section II)*

Never ——— **Constantly**

How **upset** does this person get when interrupted?

Not at all ——— **Extremely**

How much do these behaviors **get in the way** of ongoing events?

Not at all ——— **Severe interference**

FINAL QUESTION: Overall, if you "lump together" all of the behaviors described in this questionnaire, how much of a problem are these repetitive behaviors (both for the person with autism, as well as how they affect the people around them)? Please rate on a scale from 1 to 100, where 1 = not a problem at all, and 100 = as bad as you can imagine:

Score from 1-100: _____

Please return to Dr. Jay Saul at Just Kids ☺

Appendix C

QUESTIONS ABOUT BEHAVIORAL FUNCTION (QABF)

- Paclawskyj et al (2000)

Rate how often the student demonstrates the behaviors in situations where they might occur. Be sure to rate how often each behavior occurs, not what you think a good answer would be.

X = Doesn't apply 0 = Never 1 = Rarely 2 – Some 3 = Often

Score	Number	Behavior
	1.	Engages in the behavior to get attention.
	2.	Engages in the behavior to escape work or learning situations.
	3.	Engages in the behavior as a form of "self-stimulation".
	4.	Engages in the behavior because he/she is in pain.
	5.	Engages in the behavior to get access to items such as preferred toys, food, or beverages.
	6.	Engages in the behavior because he/she likes to be reprimanded.
	7.	Engages in the behavior when asked to do something (get dressed, brush teeth, work, etc.
	8.	Engages in the behavior even if he/she thinks no one is in the room.
	9.	Engages in the behavior more frequently when he/she is ill.
	10.	Engages in the behavior when you take something away from him/her.
	11.	Engages in the behavior to draw attention to himself/herself.
	12.	Engages in the behavior when he/she does not want to do something.
	13.	Engages in the behavior because there is nothing else to do.
	14.	Engages in the behavior when there is something bothering him/her physically.
	15.	Engages in the behavior when you have something that he/she wants.
	16.	Engages in the behavior to try to get a reaction from you.
	17.	Engages in the behavior to try to get people to leave him/her alone.
	18.	Engages in the behavior in a highly repetitive manner, ignoring his/her surroundings.
	19.	Engages in the behavior because he/she is physically uncomfortable.
	20.	Engages in the behavior when a peer has something that he/she wants.
	21.	Does he/she seem to be saying, "come see me" or "look at me" when engaging in the behavior?
	22.	Does he/she seem to be saying, "leave me alone" or "stop asking me to do this" when engaging in the behavior?
	23.	Does he/she seem to enjoy the behavior, even if no one is around?
	24.	Does the behavior seem to indicate to you that he/she is not feeling well?
	25.	Does he/she seem to be saying, "give me that (toy, food, item)" when engaging in the behavior?

Attention	Escape	Non-social	Physical	Tangible
1. Attention	2. Escape	3. Self-stim	4. In pain	5. Access to items
6. Reprimand	7. Do something	8. Thinks alone	9. When ill	10. Takes away
11. Draws	12. Not do	13. Nothing to do	14. Physical problem	15. You have
16. Reaction	17. Alone	18. Repetitive	19. Uncomfortable	20. Peer has
21. "Come see"	22. "Leave alone"	23. Enjoy by self	24. Not feeling well	25. "Give me that"
Total	Total	Total	Total	Total

QABF Scoring

Attention
1. Engages in the behavior to get attention.
6. Engages in the behavior because he/she likes to be reprimanded.
11. Engages in the behavior to draw attention to him/herself.
16. Engages in the behavior to try to get a reaction from you.
21. Does he/she seem to be saying "come see me" or "look at me" when engaging in the behavior?

Escape
2. Engages in the behavior to escape work or learning situations.
7. Engages in the behavior when asked to do something (brush teeth, work, etc.)
12. Engages in the behavior when he/she does not want to do something.
17. Engages in the behavior to try to get people to leave him/her alone.
22. Does he/she seem to be saying "leave me alone" or "stop asking me to do this" when engaging in the behavior?

Non-social
3. Engages in the behavior as a form of "self-stimulation".
8. Engages in the behavior even if he/she thinks no one is in the room.
13. Engages in the behavior because there is nothing else to do.
18. Engages in the behavior in a highly repetitive manner, ignoring this/her surroundings.
23. Does he/she seem to enjoy the behavior, even if no one is around?

Physical
4. Engages in the behavior because he/she is in pain.
9. Engages in the behavior more frequently when he/she is ill.
14. Engages in the behavior when there is something bothering her/him physically.
19. Engages in the behavior because she/he is physically uncomfortable.
24. Does the behavior seem to indicate to you that he/she is not feeling well?

Tangible
5. Engages in the behavior to get access to items such as preferred toys, food or beverages.
10. Engages in the behavior when you take something away from him/her.
15. Engages in the behavior when you have something he/she wants.
20. Engages in the behavior when a peer has something he/she wants.
25. Does he/she seem to be saying "give me that (toy, item, food)" when engaging in the behavior?

15	15	15	15	15
14	14	14	14	14
13	13	13	13	13
12	12	12	12	12
11	11	11	11	11
10	10	10	10	10
9	9	9	9	9
8	8	8	8	8
7	7	7	7	7
6	6	6	6	6
5	5	5	5	5
4	4	4	4	4
3	3	3	3	3
2	2	2	2	2
1	1	1	1	1
0	0	0	0	0
Attention	**Escape**	**Non-social**	**Physical**	**Tangible**
1. attention	2. escape	3. self stim	4. in pain	5. access to items
6. reprimand	7. do something	8. thinks alone	9. when ill	10. take away
11. draws	12. not do	13. nothing to do	14. physical prob	15. you have
16. reaction	17. alone	18. repetitive	19. uncomfortable	20. peers has
21. "come see"	22. "leave alone"	23. enjoy by self	24.not feel well	25. "give me that"

Appendix D
Brief Preference Assessment Data Form

Stimulus	Time Interval														
	10s	20s	30s	40s	50s	1m	1m10s	1m20s	1m30s	1m40s	1m50s	2m	2m10s	2m20s	2m30s
Mini M&Ms															
Thomas Train															
Lightning McQueen															
Stickers															
Wind Up Toy															
Shaking Eggs															
Silly Putty															
Sports Squeeze															
Link Chain															
Key Chain Pulls															

Stimulus	Time Interval														
	2m40s	2m50s	3m	3m10s	3m20s	3m30s	3m40s	3m50s	4m	4m10s	4m20s	4m30s	4m40s	4m50s	5 m
Mini M&Ms															
Thomas Train															
Lightning McQueen															
Stickers															
Wind Up Toy															
Shaking Eggs															
Silly Putty															
Sports Squeeze															
Link Chain															
Key Chain Pulls															

Appendix E
Assessment of Alternative Behaviors Data Form

Student ID #: _____

Date:_____

Recorder Name:_____

ASSESSMENT OF ALTERNATIVE BEHAVIORS DATA FORM

Behavior/Time Interval	**Approximation (A) Frequency Tally**	**Correct Response (C) Frequency Tally**
Breathe 0 min-2 min		
I am okay 2min-4min		
Run into Mat 4min-6min		
Stretch 6min-8min		
Squeeze 8min-10min		

Appendix F

Teaching Steps

1. Teach the learner to tolerate environmental change for 5 seconds.
2. Teach the learner to tolerate environmental change for 10 seconds
3. Teach the learner to tolerate environmental change for 30 seconds.
4. Teach the learner to tolerate environmental change for 1 minute 30 seconds.
5. Teach the learner to tolerate environmental change for 3 minutes.
6. Teach the learner to tolerate environmental change for 5 minutes.

Behavior	Approximation R+	Correct R+
Breathe		
I am okay		
Run into Mat		
Stretch		
Squeeze		

Appendix G

Response Blocking Session Data Form

Student ID #: _______ **Date:____________**

Session #:________

Recorder Initials:_________ **Circle One: Instructor Video Coder**

Target Behavior (Circle One): One Two Behavior: _____________________

Phase: (Circle One) Baseline Intervention Follow-up

Teaching Step (Latency Goal): ____________

TARGET BEHAVIOR DATA

Provide label praise (LP) for every correct response (C) ***Provide tangible reinforcer (R+) at FR3 for every correct response (C)***

TIME START	TIME STOP	Latency	Describe Behavior Instructor Prompt or Student Behavior? (Circle)	ATTEMPT/INC/CORR	LABEL PRAISE/ TANGLIBLE R+?
			Instructor Student	(A) (I) (C)	(LP) (R+)
			Instructor Student	(A) (I) (C)	(LP) (R+)
			Instructor Student	(A) (I) (C)	(LP) (R+)
			Instructor Student	(A) (I) (C)	(LP) (R+)
			Instructor Student	(A) (I) (C)	(LP) (R+)
			Instructor Student	(A) (I) (C)	(LP) (R+)
			Instructor Student	(A) (I) (C)	(LP) (R+)
			Instructor Student	(A) (I) (C)	(LP) (R+)
			Instructor Student	(A) (I) (C)	(LP) (R+)
			Instructor Student	(A) (I) (C)	(LP) (R+)
			Instructor Student	(A) (I) (C)	(LP) (R+)
			Instructor Student	(A) (I) (C)	(LP) (R+)

Start Time:______ End Time:______ Fx Target Behavior:_____ Fx Corr:_____Fx Inc:_____% Corr:_____ Avg Latency:_______

Appendix H
School Data Form

Student ID #: _____ **SCHOOL DATA FORM**

Week of: _____

DATE	**BEHAVIOR 1 Frequency (tally)** _____ _____	**BEHAVIOR 2 Frequency (tally)** _____ _____	**PROBLEM BEHAVIOR (If yes for behavior 1 or 2, briefly describe below) Include Frequency, Intensity, & Duration for each occurrence and if related to behavior 1, 2 or both**	**OBSERVER INITIALS**
Mon				
Tues				
Wed				
Thurs				
Fri				

Appendix I

Session Signal and Alternative Behavior Visual Prompts