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An Examination of the Effects of the Presentation of Preferred Items on Frequency of Stereotypy in Children with Autism Spectrum Disorder

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An Examination of the Effects of the Presentation of Preferred Items on Frequency of
Stereotypy in Children with Autism Spectrum Disorder

by

Shauna Blady

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We the undersigned committee hereby approve the attached thesis,
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Abstract

Title: An Examination of the Effects of the Presentation of Preferred Items on Frequency of Stereotypy in Children with Autism Spectrum Disorder

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Stereotypy is a restricted, repetitive behavior that features rigidity and invariance. Approximately 88% of individuals with Autism Spectrum Disorder (ASD) exhibit some form of stereotypy (Chebli et al., 2016). Although it often occurs under conditions of stimulus deprivation, stereotypy may also occur under other environmental conditions. The purpose of this study was to evaluate the occurrence of stereotypy when preferred items are available noncontingently. Three participants were exposed to a baseline condition in which they had no access to items, followed by conditions in which high and low preferred items were delivered noncontingently to investigate whether automatically-maintained stereotypy was likely to increase during access to preferred items. Results showed that all three participants exhibited increased levels of stereotypy when they had access to high preference items. Implications and further research suggestions are discussed.

Table of Contents

Abstract	iii
List of Figures	vi
Chapter 1 : Introduction.....	1
<i>Theories of Stereotypy</i>	<i>5</i>
<i>Tangible Items and Stereotypy</i>	<i>9</i>
Chapter 2 : Method	13
<i>Participants</i>	<i>13</i>
<i>Setting and Materials</i>	<i>13</i>
<i>Measures.....</i>	<i>13</i>
Interobserver Agreement.....	14
Treatment Integrity.....	14
<i>Design and Procedure</i>	<i>14</i>
Baseline Condition	16
High Preferred Stimulus Condition	17
Low Preferred Stimulus Condition.....	17
Choice Condition.....	17
Chapter 3 : Results.....	18
<i>Stimulus Preference Assessment.....</i>	<i>18</i>
Extended Alone Condition	18
Extended Alone with Preferred Item.....	18

Reversal Design.....	19
Choice Condition.....	19
Chapter 4 : Discussion	21
<i>Limitations</i>	23
<i>Future Directions</i>	25
<i>Implications</i>	27
References	28

List of Figures

Figure 1.....	31
Figure 2.....	33
Figure 3.....	35
Figure 4.....	37

Chapter 1 : Introduction

Autism Spectrum Disorder (ASD) is a developmental disability that is defined by its diagnostic criteria in the Diagnostic and Statistical Manual of Mental Disorders, Fifth edition (DSM-5). There are three areas of deficits and four areas of restricted, repetitive behaviors in the diagnostic criteria (American Psychiatric Association, 2013). For a child to meet the criteria for an ASD diagnosis, he or she must have deficits in each of the three areas as well as at least two of the restricted, repetitive behaviors (American Psychiatric Association, 2013). Persistent deficits in social-emotional reciprocity, nonverbal communicative behaviors, and a deficit in developing, maintaining, and understanding relationships must be present (American Psychiatric Association, 2013). Severity of the diagnosis is specified by social communication impairments and restricted, repetitive patterns of behavior. These include stereotyped or repetitive motor movements, insistence on sameness, inflexible adherence to routines, ritualized patterns of verbal or nonverbal behavior, fixated interests that are abnormal in intensity or focus, and hyper- or hyporeactivity to sensory input or unusual interest in sensory aspects of the environment (American Psychiatric Association, 2013). The diagnosis should be specified with or without accompanying intellectual impairment and with or without accompanying language impairment (American Psychiatric Association, 2013).

The Centers for Disease Control and Prevention (CDC) published a report in 2020 with data collected in 2016 regarding the prevalence of ASD in the United States. The Autism and Developmental Disabilities Monitoring (ADDM) Network has 11 sites in the United States in order to estimate the prevalence of ASD in 8-year-old children. The report found that the prevalence of ASD was one in 54 and that it was 4.3 times more prevalent in boys than girls (Maenner et al., 2020). It is worth noting that the prevalence estimates from the ADDM were one in 150 in the first surveillance year of 2000, while the previous surveillance year estimate in 2014 was one in 59 (Maenner et al., 2020).

Sipes et al. (2011) examined gender differences in symptoms of toddlers with ASD. This was done in order to provide information that will assist in diagnosing ASD at a young age and in turn allow these young children to get treatment early on in their

development. The study looked at toddlers ages 17 months through 36 months who were diagnosed with ASD and enrolled in an early intervention program. Regarding gender differences, the study found that the only difference in toddlers with ASD is in restricted and repetitive behaviors (Sipes et al., 2011).

More recently, Beggiato et al. (2015) investigated the gender differences in a diagnostic tool called the Autism Diagnostic Interview – Revised (ADI-R). It looked at whether the symptom profiles of the diagnostic tool could discriminate between males and females in a sample of people with ASD (Beggiato et al., 2015). The study found that males and females score differently on six items of the ADI-R, four of which are used in the diagnostic algorithm, including range of facial expressions used to communicate, imaginative play, circumscribed interests, and unusual preoccupations (Beggiato et al., 2015). Girls with ASD tended to score higher than boys with ASD on the range of facial expressions used to communicate as well as with imaginative play. Girls with ASD scored lower than boys with ASD on circumscribed interests and unusual preoccupations (Beggiato et al., 2015). These results mean that these differences should be taken into account on diagnostic tools so there is no gender bias in diagnosing ASD. According to this study, ASD symptoms express themselves differently between boys and girls and diagnostic tests should fully account for that to ensure that girls and boys with ASD are all getting diagnosed as they should. The study suggests that there is a gender bias in ASD diagnoses, specifically against females (Beggiato et al., 2015).

There are two major areas of behavioral concerns in ASD: behavioral deficits and behavioral excesses. Behavioral deficits can be seen in several different areas. One area in which deficits can be seen is in social skills. Deficits in this area can lead to limited relationships with peers and family and are often a focus of intervention for children with ASD (Kodak & Bergmann, 2020). Another area is language impairment, which can vary in severity and can affect one's ability to communicate wants and needs as well as communicate with others. One third of children with ASD are said to have deficits in adaptive or daily living skills (Kodak & Bergmann, 2020). This can include skills like toileting, grooming, hygiene, and dressing. Deficits in this area can greatly affect children

with ASD socially because it is socially unacceptable to lack these skills. It also means decreased independence in the individual's daily life.

Another area of behavior not included as a core diagnostic feature in ASD is behavioral excesses, such as problem behavior. Even though problem behaviors are not required for the diagnostic criteria for ASD, they are the reason many children are referred for intervention. This is often due to the danger of the behavior or that the behaviors are socially unacceptable and need to be replaced with functional skills (Kodak & Bergmann, 2020). Problem behaviors can include aggression, self-injurious behavior, stereotypy, tantrums, property destruction, and elopement.

Function, or the reason the behavioral excess occurs, is assessed through functional assessments in order to help create more effective treatments. According to Hanley et al. (2003), the term "function" has two core parts. It can refer to the purpose the behavior has for an individual or the relationship between an environmental event and a behavior. There are four functions of behavior. The first is social-positive reinforcement which usually takes the form of receiving attention or tangible items contingent on behavior (Hanley et al., 2003). The second is social-negative reinforcement which is behavior that is maintained by escape or avoidance contingencies. The third possible function is automatic positive reinforcement and occurs when a problem behavior produces its own reinforcement (e.g., when hand flapping is maintained by the visual stimulation it produces). The fourth function is automatic negative reinforcement, in which problem behavior serves to avoid or escape an unpleasant condition of the body (e.g., a headache) (Hanley et al., 2003).

A functional analysis is a type of functional assessment that involves direct observation of a targeted problem behavior and manipulation of variables in different conditions to determine the function of the behavior. Hanley et al. (2003) reviewed functional analysis methodology for assessing problem behavior in 277 studies. Functional analyses include test conditions in which independent variables are manipulated and a control condition in which those independent variables are absent. The conditions that are typically tested as maintaining variables are social positive reinforcement in the form of

attention and tangibles, and social negative reinforcement in the form of escape or avoidance. The last condition that is tested, which was tested in 59.6% of studies in the review, is the automatic function which is often examined in a barren environment (Hanley et al., 2003). A control condition should be included which is often labeled as a play condition and eliminates establishing operations for other sources of reinforcement because the environment is enriched and no demands are delivered (Hanley et al., 2003).

Some individuals with ASD exhibit restricted, repetitive behaviors (RRB). According to Boyd et. al (2011), RRBs can be divided into two main subtypes: lower order motor actions and higher order cognitive behaviors. Lower order motor actions include stereotyped movements, repetitive manipulation of objects and repetitive forms of self-injurious behavior. They tend to center around the repetition of movement. Higher order cognitive behaviors include compulsions, rituals and routines, insistence on sameness, and circumscribed interests. These tend to involve the rigid following of some rule (Boyd et al., 2011). There is limited research on repetitive behaviors compared to behavioral deficits. This is partly due to the primacy of social deficits over repetitive behaviors. It could also be that RRBs tend to be heterogeneous, meaning that even though it is suggested that there are two main subtypes, there may be more than this and RRBs can have different topographies unique to each individual (Boyd et al., 2011). There is also overlap of RRBs with other symptoms of ASD as well as symptoms of other diagnoses. Boyd et al. (2011) proposed that the overlap with other symptoms of ASD is due to atypical sensory processing that can lead to arousal states that RRBs then respond to and compensate for. However, research has shown that RRBs are only moderately correlated with sensory deficits (Boyd et al., 2011). In relation to other diagnoses, RRBs can be seen as symptoms in diagnoses like Obsessive-Compulsive Disorder (OCD) or Tourette's Syndrome, so they are not necessarily unique to an ASD diagnosis. Comorbid diagnoses such as anxiety or Attention-Deficit/Hyperactivity Disorder (ADHD) could also lead to RRBs as a symptom, but there is no clear evidence of a link between these diagnoses and RRBs in ASD (Boyd et al., 2011). Overall, there is a need to research RRBs in ASD and intervention strategies for them.

Theories of Stereotypy

Stereotypy is an RRB that is exhibited by many children with ASD. The main features of stereotypy are said to be repetition, rigidity, and invariance (Turner, 1999). Stereotypy is not unique to ASD, but stereotypy that is seen in people with ASD tends to be more varied in topography, is more severe, and occurs at a higher frequency than stereotypy in people without ASD (Turner, 1999). It should be noted that an intervention to decrease stereotypy is appropriate only when stereotypy is dangerous or interferes with learning. Turner presented two theories that have been used to explain the occurrence of stereotypy in individuals with ASD and emphasized that any theory attempting to explain stereotypy must be able to explain its characteristics including that it is highly repetitive, heterogenous, sometimes inappropriate, and enduring. The first theory presented was that stereotypy is used as a coping mechanism to return levels of arousal to homeostasis. When individuals with ASD are over aroused by the environment, they may engage in stereotypic movements to displace the sensory input that is arousing them (Turner, 1999). Furthermore, it was suggested that novel objects and situations can also be arousing which may lead these objects to be avoided, which encourages the rigidity and sameness that is seen in many stereotypies since new situations or objects are not being explored. Overall, this first theory suggested that highly arousing situations will increase the frequency of stereotypy while the opposite, situations that are anxiety-reducing, will decrease stereotypy, but to date there is no evidence that stereotypy actually decreases arousal levels in individuals with ASD (Turner, 1999). The second theory discussed stereotypy in regards to operant terms meaning that stereotypy is an operant behavior affected by the consequences that maintain it. Therefore, stereotypy may be maintained by the reinforcement that is produced by it whether that is automatic or social. Turner (1999) specifically pointed out that the most popular variation of this theory is that stereotypy is maintained by automatic or sensory reinforcement. This could be a weakness to the theory because stereotypy is not necessarily always maintained by sensory consequences; this is further supported in that sensory extinction does not always effectively reduce stereotypy.

The other major disadvantage to this second theory was that it does not explain how the behavior develops, only how it is maintained (Turner, 1999).

Cunningham and Schreibman (2008) reviewed the diagnostic definition for stereotypy and argued that other considerations should be included when defining stereotypy. They also acknowledge that the topography is often heterogenous meaning that it can be verbal, non-verbal, fine-motor-oriented, gross-motor-oriented, simple, complex, with or without objects, and so on. Some examples of stereotypy include hand flapping, body rocking, toe walking, spinning objects, immediate and delayed echolalia, running objects across one's peripheral vision, and restricted patterns of interest (Cunningham & Schreibman, 2008). Stereotypy tends to be less socially and developmentally appropriate when it occurs in people with ASD (Cunningham & Schreibman, 2008). Because of the social stigma surrounding stereotypy, people with ASD who engage in it may have restricted opportunities to form peer relationships or be integrated into the community. Stereotypy that is severe enough has been shown to directly impact learning as well, but there is some contradiction in the way it impacts learning. It has been shown to negatively interfere with learning, although some vocal stereotypy has been shown to have a facilitative effect on learning, so more research should be done on this to examine the effects certain forms of stereotypy have on learning (Cunningham & Schreibman, 2008).

Cunningham and Schreibman (2008) focused on the different aspects of the definition of stereotypy, pointing out that it is defined solely on the physical form it takes and does not consider function as a part of its definition. The most common function of stereotypy in the literature is automatic, but there is also a growing body of literature that suggests it can be maintained by multiple functions or reinforcement contingencies (Cunningham & Schreibman, 2008). Stereotypy is an operant behavior that is maintained by reinforcing stimuli. When it is maintained by an automatic function, it produces its own reinforcement and it is resistant to social consequences. To treat automatically maintained stereotypy, sensory extinction has been found to be effective as well as noncontingent access to stimuli that compete with the sensory reinforcement provided by the stereotypy (Cunningham & Schreibman, 2008). Other studies have found that some stereotypy is

maintained by social and external forms of reinforcement, specifically attention and escape from task demands. Cunningham and Schreibman (2008) first argued that the term self-stimulatory behavior should not be used interchangeably with the term stereotypy. It is often referred to as self-stimulatory behavior without ever evaluating its function, which means this term may not always be correctly used if the function of some forms of stereotypy is not automatic. Their second argument was that the operant definition of stereotypy should take function into consideration and acknowledge that function may not always be automatic. Future research should therefore look further into the functions of stereotypy and acknowledge its heterogeneity.

In a review of functional analyses, Hanley et al. (2003) found that 9% of functional analysis studies evaluated stereotypy. In 6 of the studies, stereotypy was maintained by social negative reinforcement in the form of escape, in 19 studies stereotypy was maintained by automatic reinforcement, in 5 studies stereotypy was multiply maintained and in 1 study stereotypy was undifferentiated (Hanley et al., 2003). This further supports the notion that stereotypy is most commonly maintained by automatic reinforcement, but not always. One suggestion made following this study was to first observe the client's behavior in the natural environment to look for any idiosyncratic occurrences that can be used to customize the functional analysis to the client relevant to the variables that may be maintaining the behavior.

Beavers et al. (2013) published an updated review of studies on the functional analysis of problem behavior to build on the work of Hanley et al. (2003). Hanley et al. (2003) looked at studies published up until 2000, but Beavers et al. looked at studies between 2000 and 2012 and reviewed any new trends in the literature regarding the functional analysis of problem behavior. The inclusion criteria was the same across both reviews and required studies to include a pretreatment assessment, direct observation and measurement of problem behavior, manipulation of an environmental variable in at least 2 different conditions, and attempt to demonstrate a relationship between the environment and the behavior (Beavers et al., 2013). A total of 158 studies were reviewed compared to the 277 in the previous review. Additionally, there were 12 studies (7.6%) assessing the

function of stereotypy compared to 37 (8.5%) in the previous review. Beavers et al. found that stereotypy was most often maintained by automatic reinforcement. Specifically, the maintaining variables were as follows: 1 instance of stereotypy maintained by escape, 0 maintained by attention, 0 maintained by tangibles, 14 maintained by automatic and 1 was multiply controlled (Beavers et al., 2013). Even though fewer studies on stereotypy were evaluated in this review, the results continued to suggest that automatic reinforcement is the most common function of stereotypic behavior.

Querim et al. (2013) added a screening condition before a typical functional analysis in an attempt to conclude a behavior was automatically maintained before the remainder of the functional analysis was conducted. The screening was a 5 minute alone or no interaction condition (Querim et al., 2013). When compared with the subsequent functional analysis results, the screening condition was found to accurately predict the function of behavior, between automatic reinforcement and social reinforcement, for 28 out of 30 cases (Querim et al., 2013). This study established the promising use of an extended alone condition to assess behavior that is hypothesized to be maintained by automatic reinforcement due to preliminary evidence. Applying the extended alone condition to assess stereotypy is a good use of the screening procedure since stereotypy is most frequently shown to be maintained by automatic reinforcement. This reduces the need to conduct an entire functional analysis if the extended alone results support that it is maintained by automatic reinforcement.

Wilke et al. (2012) assessed stereotypy with an indirect assessment rather than direct assessments such as functional analyses. The study was done on 53 children with ASD. The indirect method used was the Questions About Behavioral Function (QABF) assessment which asks a series of questions and scores them in a way to identify which function(s) maintain the problem behavior. It consists of 25 questions and the functions it identifies are attention, escape, tangible, automatic positive reinforcement, and automatic negative reinforcement (Wilke et al., 2012). The QABF was completed by the participants' parents and it was found that the results from the QABF in this study were comparable to results that were found using other forms of functional assessment in the literature.

Specifically, in this study, 90% of the stereotypy was maintained by automatic reinforcement (Wilke et al., 2012). This study provided further support that a majority of stereotypy is maintained by automatic reinforcement. Also, it suggested that an indirect functional assessment may be a viable method to assess stereotypy. This would save resources at schools and clinics when trying to develop a treatment plan. It is both a quicker and less costly method than running a direct functional analysis to assess the function.

Tangible Items and Stereotypy

A study conducted by Morrison and Rosales-Ruiz (1997) looked at the effects of object preferences on task performances and stereotypy. They categorized objects into low, medium and high preference objects and conducted a multielement design with a counting task alternating the objects. The study was done with one child with Autism and found that stereotypy occurred at higher rates with the high preference items than the other items and that task performance suffered the most with the highest preferred items. Morrison and Rosales-Ruiz (1997) theorized that some characteristics of items might evoke more stereotypy, specifically softer items over harder items. They also wrote that a major limitation is that there was only one participant in this study, so further research should be done to increase the generality of the results.

A study done by Kang et al. (2013) compared the rates of stereotypy when participants had access to tangible versus social reinforcers. The study used both forms of reinforcers to look at the effects they had on stereotypy, skill acquisition, and task engagement. Using three children with ASD as participants, a multiple stimulus without replacement preference assessment was conducted to identify possible preferred tangible and social reinforcers. The assessment identified toys for tangible reinforcers and social reinforcers including a game in which the adult pretends to be asleep, and tickling (Kang et al., 2013). Then a reinforcer assessment was conducted to compare the two types of reinforcement amongst the three dependent variables (e.g., stereotypy, skill acquisition, task engagement).

Kang et al. (2013) found that the reinforcers were equally effective in terms of skill acquisition and task engagement, but that higher levels of stereotypy occurred while participants accessed tangible reinforcers compared to when they accessed social reinforcers. Specifically, the mean levels of stereotypy while accessing tangible reinforcers were 94% for Gabe, 74% for Victor, and 88% for Emma compared to the mean levels of stereotypy for accessing social reinforcers of 7.5%, 0%, and 3.3%, respectively (Kang et al., 2013). This is an important finding because it suggests that tangible reinforcers could enable or encourage stereotypy while social reinforcers may not. Also, social reinforcers had the same effectiveness when using them to teach skills. This means that during therapy, programs might be taught as effectively using only social reinforcers which could be better for many reasons. Social reinforcers have no cost compared to tangible reinforcers. Also, one of the defining skill deficits in the ASD diagnosis is in social skills, so using social reinforcers more often could help build these skills while providing reinforcement at the same time. The study suggested that social reinforcers might be just as effective without the side effects on stereotypy that tangible reinforcers have and that preference assessments with tangibles should not necessarily be the first choice when looking for preferred items for kids with ASD. A limitation discussed was that all the reinforcers in the study were presented on a fixed ratio 1 schedule (Kang et al., 2013). This schedule is difficult to maintain so future research should examine the effects that tangible and social reinforcers have on learner reinforcement schedules.

Kang et al. (2013) did not speculate why tangible reinforcers might increase the occurrence of stereotypy. One possibility is that the tangible items that were used could be easily incorporated into the stereotypic movements and possibly made these movements more reinforcing. For example, the study used crayons and colored letters for one participant and his topography of stereotypy was lining up the crayons and staring at the letters from a distance (Kang et al., 2013). Another participant was given strings of beads and her topography of stereotypy was shaking the string while staring at it (Kang et al., 2013). These reinforcers may have enabled stereotypy while other tangible items could be incompatible with the topography of stereotypy the participants engage in. Also, both of these examples involve visual stereotypy and there is not much of an opportunity for that to

occur with social reinforcement when there are no tangibles around to stare at. It is possible that combining tangible items with stereotypy is more reinforcing than engaging in stereotypy alone and that social reinforcers do not provide as much opportunity for stereotypy to occur.

Frewing et al. (2015) looked at a contradictory effect that tangible items had on stereotypy. They extended previous research on competing stimulus assessments (CSAs) to assess simultaneous engagement in stereotypy with tangible items during a free operant stimulus preference assessment. More specifically, they compared the time spent engaged in stereotypy alone versus simultaneous engagement in stereotypy with a tangible item during each session (Frewing et al., 2015). Then, the predictive validity of the CSA was assessed by conducting a formal treatment evaluation with the items from the CSA. First, a baseline was conducted in the form of a no interaction phase followed by the CSA in a free operant stimulus preference assessment (Frewing et al., 2015). Following the CSA, the items were categorized into four groups: high preference-low stereotypy (HP-LS), high preference-high stereotypy (HP-HS), low preference-low stereotypy (LP-LS), and low preference-high stereotypy (LP-HS). These categories were used in order to present the items in each category on their own to determine the predictive validity of the CSA regarding if it accurately predicted the effects of each item on stereotypy. The results showed that the CSA method did accurately predict the effects of each item, but it was extremely time-consuming and not realistic for a clinician to run because of the time it took.

A second experiment was added to the study in order to try to decrease the amount of time the CSA method took while getting the same predictive results. Overall, the goal was to identify HP-LS items with briefer or fewer sessions (Frewing et al., 2015). This was tested with a within-session and between-session analysis to see if the same overall HP-LS item identified for each participant in the first experiment would be identified with a single extended session of 30 minutes or multiple brief sessions. The first 30 minute session was evaluated to see if the overall HP-LS item was identified during it and then data from individual sessions was evaluated to determine if the item was identified during the first 5,

10 or 15 minutes of the CSAs (Frewing et al., 2015). The results showed that the overall HP-LS items were either identified with one 30 minute session or from combined data from three 10 minute sessions (Frewing et al., 2015). This study used tangible items in a different way than Kang et al. (2013) to influence stereotypy. Rather than evaluating increasing effects on stereotypy, the study sought to determine a quick way competing high preference items could be identified to decrease stereotypy.

Stereotypy has been studied in relation to tangible items in various ways. It has both been shown that high preferred tangible items can compete with stereotypy and therefore decrease it, but also can enable stereotypy and increase its occurrence. Kang et al. (2013) compared social reinforcers with high preferred tangible reinforcers and showed that tangible reinforcers can increase stereotypy when accessed through a reinforcer assessment. There has been no further research on this phenomenon of increased stereotypy in the presence of preferred items. The purpose of the current study is to further this research by primarily comparing access to high preferred and low preferred tangible items using a reversal design to evaluate their effects on stereotypy. Specifically, the purpose is to evaluate whether some automatically-maintained stereotypy occurs more in the presence of preferred tangible items. Additionally, each high-preferred and low-preferred condition will be signaled with an auditory and visual stimulus in order to determine if stereotypy occurs between the signal and the presentation of the preferred or non-preferred item.

Chapter 2 : Method

Participants

Participants included three children who received services at an early intervention clinic. Two of the participants (Mike and Noah) were twins who were 3 years old, and the third (John) was a 4-year-old child. All three participants engaged in stereotypy on a daily basis that interfered with daily learning. Staff at the chosen clinic were interviewed to identify the different environments in which stereotypy occurred and to define the topographies of the stereotypy. The participants engaged in high rates of stereotypy each day and staff reported that participants engaged in stereotypy when accessing preferred items.

Setting and Materials

This study took place in a room designed for functional assessments at the center that the participants attended for services. Stimuli were selected for each participant for a paired stimulus preference assessment (Fisher et al., 1992) in order to obtain a hierarchy of preferred items. For two of the participants (Mike and John), a multiple stimulus without replacement preference assessment (MSWO) was conducted in addition to the paired preference assessment because a clear hierarchy was not established. The stimuli identified as the highest preferred items according to the stimulus preference assessment were used in the treatment conditions. Additionally, colored signal cards and an auditory stimulus were paired with each condition.

Measures

The dependent variables were the percentage of 10 second intervals in which stereotypy occurred during each session. Data were recorded on all topographies of stereotypy that occurred. Before the initial session with each participant, a list was created of the different topographies of stereotypy each person exhibited to ensure all topographies

were represented. The topographies of stereotypy included jumping, hand flapping, spinning, body rocking, and looking closely at an object or out of the side of the eye for Mike. For Noah, the topographies included head shaking, hand flapping, body tensing and looking closely at an object. For John, the topographies included speaking noncontextual words, often gibberish, and stomping. Ten second partial interval recording was used to collect data on stereotypy.

Interobserver Agreement

Interobserver agreement (IOA) data were collected for each session. This involved having a second observer collect data on the defined variables in addition to the primary observer. Interval by interval IOA was calculated. This was calculated by comparing the data collected in each interval for both data collectors and dividing the number of intervals of agreement by the total number of intervals. IOA was collected for 34% of sessions for Mike, 33% of sessions for Noah, and 37% of sessions for John. For Mike, the mean IOA across sessions was 96% (range, 83% to 100%). For Noah, the mean IOA across sessions was 95% (range, 83% to 100%). For John, the mean IOA was 93% (range, 85% to 100%).

Treatment Integrity

Treatment integrity data were collected by the same observers who collected IOA data. A checklist of the treatment procedures for each condition was provided to the observer and the observer checked off each step on the list that was completed according to its written description. Treatment integrity data were collected for 32% of sessions for Mike, 39% of sessions for Noah, and 38% of sessions for John. Treatment integrity across all sessions, for all participants, was found to be at 100

Design and Procedure

This study consisted of four phases. Phase 1 consisted of a stimulus preference assessment. A paired choice preference assessment (Fisher et al., 1992) was completed by presenting each possible combination of items in pairs and asking the participant to choose

one each time. This process was repeated until a preference hierarchy was obtained. For Noah, the paired choice preference assessment did not produce a clear hierarchy, so an MSWO preference assessment was also conducted. John's preferences appeared to change during the study, so an MSWO was conducted to establish a new hierarchy. Results from the preference assessments were used to identify the highest and lowest preferred item for each participant to be used in the study.

The first part of Phase 2 consisted of an automatic reinforcement screening procedure, which included an extended alone condition of a functional analysis. This condition was void of any social interaction and was conducted in an austere environment. Participants were placed in a room completely alone and exposed to a series of alone condition sessions, each 10 minutes in duration. The purpose of this phase was to establish that the stereotypy exhibited by each participant likely had an automatic function. If moderate to high levels of stereotypy occurred during each alone session, it is likely that the stereotypic behavior was maintained by automatic reinforcement.

The second part of Phase 2 consisted of an altered alone condition with access to a tangible item. It was a second test for automatic reinforcement, but with the addition of a preferred item to see if the automatically-maintained stereotypy occurred with the item. The participants were given access to their highest preferred tangible item (identified via the preference assessment) in this condition for 10 minutes and data were collected on stereotypy in the presence of the item. The purpose of this part of Phase 2 was to determine if stereotypy occurred in the presence of preferred items.

Phase 3 consisted of a pre-treatment condition in which auditory and visual stimuli were paired with each treatment condition. A different colored card and a different sound were paired with each condition with the presentation of either the high or low preferred item following the signal card and sound. A purple card was presented before the high-preferred item was given to the participant and an orange card was presented before the low-preferred item was presented. Different auditory stimuli were paired in addition to the cards. The auditory stimulus for the high preferred condition was an instrumental tune and the auditory stimulus for the low preferred condition was heavy storm sounds. The card and the sound were then presented prior to the introduction of the condition during the reversal design (phase 4). This pairing was repeated 30 times. Once John's highest

preferred item changed during the study, the pairing was not repeated with it due to time constraints. The purpose of this phase was to pair a signal with each condition so that the signals became correlated with access to preferred items. In this way, stereotypy occurring between the presentation of the signal and the presentation of the item it signaled could be measured.

Phase 4 consisted of three conditions in a reversal design. The conditions included a baseline alternated with a high preference item condition and a low preference item condition. The paired signal card and auditory stimulus were presented for the low-preferred tangible condition. A period of 10 seconds between the presentation of the signal stimuli and the presentation of the item were observed and data were recorded on whether or not stereotypy occurred during this period. Then, the participant was able to freely engage with the item and stereotypy was recorded. The same procedure was used for the high preferred tangible condition. A series of choices using the paired signal cards and auditory stimuli were presented following the reversal design to offer insight into why stereotypy occurred when accessing high-preferred items if that is what participants consistently chose. Each session was 5 minutes in duration. A detailed description of each condition in phase 4 is provided below. A series of choices using the paired signal cards were presented following the reversal design to offer insight into why stereotypy occurred when accessing high-preferred items if that is what participants consistently chose.

Baseline Condition

This condition was similar to the extended alone condition of Phase 1 in which the participant was placed in an austere environment. No people or tangible items were present in the room with the participant. However, a table and a chair were in the room so that this condition resembled in the room in the other conditions of the reversal design. The baseline condition served as a control condition to compare the levels of stereotypy that occurred in it to the other conditions.

High Preferred Stimulus Condition

The participant's highest preferred item from the stimulus preference assessment was presented noncontingently in this condition. This condition was paired with a signal card that was the color purple and an auditory stimulus (instrumental tune). The purple card was presented to the participant and data were collected on whether stereotypy occurred between the presentation of the card and the presentation of the highest preferred item as well as during noncontingent access to the item. The participant was able to engage freely with the item for the duration of the session while data were taken on stereotypy that occurred during the session.

Low Preferred Stimulus Condition

A low preferred item was presented in this condition based on the stimulus preference assessment results. This condition was paired with an orange signal card and an auditory stimulus of heavy storm sounds and data were collected on whether stereotypy occurred between the presentation of the card and sound and the presentation of the item that followed as well as during access to the item. Participants were able to engage freely with the item for the duration of the session while data were recorded on stereotypy that occurred within the session.

Choice Condition

This condition allowed the participant to choose which environment they preferred during the session. The participant was presented with the colored signal cards that were previously paired with each condition and were able to select the card that corresponded to either the high preference item or low preference item condition. John was able to vocally request which condition he wanted while the cards were presented, while Noah and Mike only selected the cards. Both the purple and orange card were placed on the table in front of the participant, and the participant was told to pick one. After choosing the card, the participant was given the item corresponding to the card for a brief amount of time. The item was then removed, and this process was repeated two more times.

Chapter 3 : Results

Stimulus Preference Assessment

Figure 1 depicts the results from the stimulus preference assessment (Phase 1). For Mike, the doll was the highest preferred item and was chosen 62.5% of opportunities presented while the abacus was the lowest preferred item and was chosen 20% of opportunities. For Noah, the iPad™ was the highest preferred item, chosen during 100% of opportunities and the bead maze was the lowest preferred item, chosen during 0% of opportunities. For John, the iPad™ was the highest preferred item, chosen during 100% of opportunities and a book was the lowest preferred item chosen during 20% of opportunities.

Extended Alone Condition

Figure 2 depicts the results for the extended alone condition (Phase 2). For Mike, the mean percentage of intervals that stereotypy occurred was 25.99% (range, 13.33 to 43.33). For Noah, the mean percentage of intervals that stereotypy occurred was 3.01% (range 0% to 6.67%). For John, the mean percentage of intervals that stereotypy occurred was 63.33% (range, 38.33% to 76.67%).

Extended Alone with Preferred Item

Figure 3 shows the extended alone conditions with the preferred item present (Phase 2, part 2). For Mike, the mean percentage of intervals in which stereotypy occurred was 50% (range, 45% to 58.33%). Based on these results, we hypothesized that stereotypy was automatically-maintained and was particularly likely to occur in the presence of a preferred item. For Noah, the mean percentage of intervals in which stereotypy occurred was 37.78% (range, 16.67% to 56.67%). Due to the higher level of stereotypy during the extended alone with the preferred item condition, we hypothesized that it was automatically-maintained, and particularly likely to occur in the presence of preferred items. For John, the mean percentage of intervals in which stereotypy occurred was

60.27% (range, 21.67% to 81.67%). Based on these results, we hypothesized that his stereotypy was automatically-maintained and also likely to occur in the presence of preferred items.

Reversal Design

Figure 4 depicts the results of the reversal design (Phase 4). For Mike, the mean percentage of intervals that stereotypy occurred was 53.33% (range, 40% to 70%) during the first baseline condition, 30% (range, 3.33% to 70%) during the first low preference condition, 84.44% (range, 63.33% to 93.33%) in the first high preference condition, 27.79% (range, 16.67% to 53.33%) during the second low preference condition, 70% (range, 56.67% to 80%) in the second high preference condition, and 51.67% (range, 26.67% to 83.33%) in the second baseline condition. For Noah, the mean percentage of intervals that stereotypy occurred was 6.67% in the first baseline phase (range, 0% to 20%), 47.52% (range, 23.33% to 66.67%) in the first high preference condition, 11.33% (range, 0% to 16.67%) in the first low preference condition, 38.57% (range, 23.33% to 53.33%) in the second high preference condition, 2% (range, 0% to 6.67%) in the second low preference condition, and 2% (range, 0% to 6.67%) in the second baseline condition. For John, the mean percentage of intervals that stereotypy occurred was 53.33% (range, 43.33% to 63.33%) for the first baseline condition, 80% (range, 73.33% to 90%) for the first high preference condition, 27.77% (range, 10% to 40%) for the first low preference condition, 77.77% (range, 70% to 90%) for the second high preference condition, 24.44% (range, 13.33% to 33.33%) for the second low preference condition, and 44.44% (range, 30% to 56.67%) for the second baseline condition.

Choice Condition

Data were collected on whether stereotypy occurred between the presentation of the signal stimuli and the presentation of the tangible item. For Mike, stereotypy occurred before 36% of low preference sessions and 45% of high preference sessions. For Noah, stereotypy occurred before 10% of low preference sessions and 43% of high preference

sessions. For John, stereotypy occurred before 50% of low preference sessions and 100% of high preference sessions. A series of three choices were presented to each participant at the end of the study. Mike chose the high preference condition for 66% of opportunities and both Noah and John chose the high preference condition for 100% of opportunities.

Chapter 4 : Discussion

The purpose of this study was to examine if stereotypy occurs more in some children with ASD immediately before access to and during noncontingent access to preferred items. Preference assessments were conducted to determine the highest and lowest preferred item for each participant. After concluding that stereotypy was automatically-maintained for each participant, a reversal design was conducted alternating between a baseline condition, a high-preferred item condition, and a low-preferred item condition. We hypothesized that stereotypy would occur at higher levels during the high-preferred item condition than during the low-preferred item condition and the baseline condition. Our results showed that higher levels of stereotypy did occur during each high-preferred item condition than during the other conditions for all three participants. Each participant also engaged in stereotypy more immediately before high preference conditions than low preference conditions.

There were significant differences in levels of stereotypy between the high and low preference conditions for each participant. Mike's mean levels of stereotypy in both low preference conditions (30 and 27.79) were lower than the means for both of his baseline conditions (53.33 and 51.67) and high preference conditions (84.44 and 70). This provides evidence that for Mike, stereotypy does not occur at higher levels for all tangible items, but only specific, high preferred items. Noah's mean levels of stereotypy during the low preference conditions (11.33 and 2) were higher or the same as the mean levels for the baseline conditions (6.67 and 2) and significantly lower than the mean levels of the high preference conditions (47.52 and 38.57). This suggests that stereotypy occurs more in the presence of high preferred items, but might occur at similar levels when he has no items relative to when he has access to a low preferred item. John's stereotypy occurred at the highest levels during the high preference item conditions (means of 80 and 77.77) and at the lowest levels during the low preferred item conditions (means of 27.77 and 24.44) with levels during the baseline conditions in the middle (53.33 and 44.44). Like Mike, this suggests that John's stereotypy does not occur at high levels with all tangible items, but specifically high preferred items.

Mike showed slight differences in levels of stereotypy before the high preference (45%) and low preference conditions (36%). Noah also showed differences in stereotypy before the high preference (43%) and low preference conditions (10%). Stereotypy occurred before 100% of high preference conditions for John and before 50% of low preference conditions for John. Thus, for all three participants, upcoming access to preferred stimuli produced increases in stereotypy. This suggests that the colored card and sound enabled the participants to discriminate which item (low or high preferred) was about to be delivered. This also suggests that the occurrence of stereotypy before access to preferred items could have been an "anticipatory response".

There is little research regarding stereotypy occurring more in the presence of tangible items. Kang et. al (2013) compared the effects of tangible and social reinforcers on stereotypy, skill acquisition, and task engagement. The results showed significantly higher levels of stereotypy with the tangible reinforcers than the social reinforcers. While the current study did not compare reinforcers, it looked to further the research on the effects of tangible items on stereotypy. Our results provide further evidence that tangible items can produce higher levels of stereotypy than occurs in conditions without the items, at least for some individuals. Specifically, we looked at the effects of the highest preferred item for each participant. We compared levels of stereotypy to a condition where the participants were given a low preferred item and a condition where they were placed in an austere environment and found that the highest levels of stereotypy occurred when given access to the high-preferred item.

Kang et al. (2013) did not speculate why the tangible reinforcers might have produced higher levels of stereotypy, and it is possible that the types of stereotypy occurring with the tangible reinforcers did not have the opportunity to occur with the social reinforcers. In the present study, the topographies of stereotypy could have occurred without access to the preferred items. However, stereotypy still occurred more with the items. Mike mainly engaged in hand flapping and visual stereotypy, which increased significantly when he was given noncontingent access to a doll. Specifically, he incorporated the doll into his hand flapping and also engaged in visual stereotypy with it by holding it at certain angles in front of his eyes. Noah primarily engaged in visual stereotypy and body tensing with videos on the iPad™. John primarily engaged in vocal

stereotypy which occurred at much higher levels while watching videos on the iPad™ even if the vocalizations were completely unrelated to the videos. One possible explanation is that the high preferred tangible item in combination with stereotypy is more reinforcing than either the item or engaging in the stereotypy alone. This is supported by the theory that stereotypy is an operant behavior affected by the consequences that maintain it (Turner, 1999). An alternative explanation is that stereotypy is respondent behavior in the form of emotional responding. The participants Noah and John did not always incorporate the tangible item into the stereotypic movements, yet still engaged in higher levels of stereotypy in the presence of the high preferred item. The presentation of the item could therefore elicit the stereotypic behavior as an emotional response, much like smiling is elicited by a favorite song coming on to the radio.

Frewing et al. (2015) identified a contradictory effect of tangible items on stereotypy. These researchers used a competing stimulus assessment (CSA) to identify different categories of items, and were able to identify both high preference high stereotypy items as well as high preference low stereotypy items. The goal of the study was to use high preference items to decrease stereotypy, rather than show increases which was the purpose of the current study. Since research has shown that high preference items can both increase and decrease stereotypy, further research should be done to identify what leads to these different results. Currently, we can only speculate why the current study produced the results with the high-preferred items. The participants were chosen because of anecdotal evidence of stereotypy that occurred more with specific preferred items. This is obviously not the case with all children with ASD or with all preferred items.

Limitations

Thirty pre-session pairings were done with colored poster boards, colored signal cards, and auditory stimuli immediately before access to low and high preferred items. For the high-preferred item, a purple poster board was taped to the table in the FA room and a purple signal card was handed to the participant and then removed while simultaneously playing an instrumental tune. Following the tune and the removal of the signal card, the high preferred item was then handed to the client to freely interact with for thirty seconds.

The same process was completed for the low-preferred item, but with an orange poster board, an orange stimulus card, and a distinct auditory stimulus (storm sounds). Over a week passed between these pairings and the initial sessions of the reversal design, so the pairings were repeated again 15 times each before the first high preference and low preference condition in phase 4. There were a few possible limitations that occurred with the pairings. Mike was extremely interested in the poster board and signal card at first to the point where he would engage in stereotypy with the stimulus card and tear up the poster board that was taped to the table. Adjustments needed to be made for him by taping the poster board to the wall where he could not reach it and only allowing him very brief access to the signal card before the session began. It is possible that with these adjustments, the relationships were less salient for Mike. The pairings with the remaining two participants went smoothly; they did not get distracted by any of the stimuli.

Several issues arose when conducting research with John. The pairings were done based off of initial preference assessments that identified coloring as his highest preferred item. Both his extended alone condition and extended alone with preferred item had similar means (63.33; 60.27), but during his reversal baseline sessions the mean was higher. This created a ceiling effect once we moved on to the first high preference condition. That is, there was not much opportunity for John to display higher levels of stereotypy in the high preference condition. His preference also seemed to change, according to his therapists, and he did not seem to prefer coloring to the extent that he did when the preference assessment was conducted. Because of these factors, a new preference assessment was conducted and the results showed that iPad™ was his highest preferred item, which aligned with the anecdotal accounts of when his stereotypy occurs the most. The reversal design was restarted and baseline levels were closer to the levels that appeared in his alone conditions. Data on John's vocal stereotypy is highly variable according to his graphs from his ABA sessions, which could explain why his baseline levels were unusually high during the first reversal sessions. The data using the iPad™ as the highest preferred item produced much clearer differences in his stereotypy between the high preference item conditions and the low preferred item conditions and baseline conditions.

Due to time constraints after restarting the reversal sessions with John, the pairings with the purple signal card, purple poster board, and auditory stimulus were not repeated

with the iPad™ even though they were previously done with the coloring sheets. His lowest preferred item did not change so the pairings with the orange stimuli were done with the books that were used in the restarted reversal design. John has a good listener repertoire, so he likely understood when he was verbally told before the sessions which item he was going to be receiving that day. Also, due to time constraints after starting over the reversal, each phase of the design was shortened. Presenting 5 or more stable data points in each phase would have produced stronger data, but 3-4 data points were collected in each phase instead.

Another limitation with John is that he began to participate in another research study while the current study was ongoing. The other research study intentionally evoked problem behavior by removing preferred items that he was engaging with in order to teach him to identify feeling angry. Once this research study began, he engaged in more problem behavior when walking over to the research room regardless of if he was being given access to his high preferred or low preferred item. Participating in both studies during the same time frame may have had an effect on his behavior and produced different results regarding stereotypy than if he was only participating in one at a time.

Future Directions

The current study attempted to gather data on a type of stereotypy that has not been studied thoroughly. The study did not implement any treatment, but merely observed the stereotypic behaviors of each participant. It should be noted that stereotypy does not always need to be treated. Many instances of stereotypy are harmless and have little negative effect on the person, but these participants were chosen specifically because their stereotypy interfered with their learning. Noah was the possible exception as his levels of stereotypy were typically low unless he was given the iPad™, but his therapists did report that he is solely motivated for the iPad™ during sessions, which is problematic when trying to vary reinforcers or other items for him to interact with. Both Mike and John engage in stereotypy that interferes with their learning, especially when working for the reinforcers that were used as high preferred items in the current study. Research from Morrison and Rosales-Ruiz (1997) supports the idea that stereotypy with high preferred

items can negatively affect task performance. They found that task performance was most affected when given access to high preferred items and that stereotypy occurred most with the high preferred items over the low and medium preferred items.

Although no intervention for stereotypy was included in the current study, future research should examine potential interventions. Only one participant from the current study had an intervention in place for his stereotypy, and it merely involved blocking any stereotypy that occurs with objects during his ABA sessions. This intervention was implemented with Mike following the current study. Based on the results of the present research, one potential intervention that could be tested is eliminating access to the high preferred items altogether and finding replacement items that do not lead to similar levels of stereotypy, but that are still effective as reinforcers. To test this, researchers could use moderately preferred items from a stimulus preference assessment and measure stereotypy during engagement with these items. A reinforcer assessment could then be conducted to test if stereotypy was low, but the items were still reinforcing.

Another possible intervention that could be studied in the future is delineating specific times to engage in stereotypy with the high preferred item either noncontingently or as a reinforcer. Charlop et al. (1990) examined using aberrant behaviors including stereotypy as a reinforcer for children with ASD and found that this could be a successful intervention with no increases in stereotypy. Researchers could examine if doing this decreases stereotypy during the nondesignated times. Participants could be given multiple periods a day to freely engage in stereotypy with their high preferred item while having restricted access to that item at all other times of the day. Participants could also work for the high preferred item as a reinforcer to engage in stereotypy with after completing a specified amount of work.

To address other limitations, future research should run several preference assessments throughout the study in order to ensure that preferences do not change like they did with John. This would ensure accurate data on the highest and lowest preferred item for each session. Another suggestion for future research is to specify which topography of stereotypy is occurring when collecting data during each session. This could provide further information regarding whether specific topographies occur more in certain

phases. For example, if visual stereotypy occurred most with iPad™, but hand flapping occurred more in baseline sessions.

Implications

The results of the current study provide insight into why stereotypy occurs in some children with ASD. Many have theorized why stereotypy occurs (Turner, 1999), but no one theory has been widely accepted. By identifying that stereotypy occurs significantly more with access to high preferred tangible items in some children, the behavior can be more easily studied by creating these conditions in the environment. It allows researchers and practitioners to be able to isolate specific variables that can evoke the stereotypy to be studied.

Another implication is the potential creation of sub-categories of automatically-maintained stereotypy. Hagopian et al. (2015) was able to delineate subtypes of automatically-maintained self-injurious behavior based on different patterns of responding. This led to the ability to create individualized interventions for the sub-types. The current results could imply that one sub-category might be stereotypy that occurs more often in the absence of other people but in the presence of preferred items. Future research could seek to examine about the aspects of this sub-category as well as identify other sub-categories of automatically-maintained stereotypy. Once sub-categories are created, this would create an opportunity to begin researching individualized interventions for the different subtypes of automatically-maintained stereotypy when they occur at levels that interfere with the individual's learning.

Overall, the results of this study suggest that stereotypy in some individuals can occur at higher levels when given access to high preferred items than under other conditions. This provides insight into why stereotypy occurs and creates opportunities for a deeper level of understanding of the occurrence of stereotypy in children with ASD. The suggestion of a sub-type of stereotypy could lead to additional sub-types and individualized interventions.

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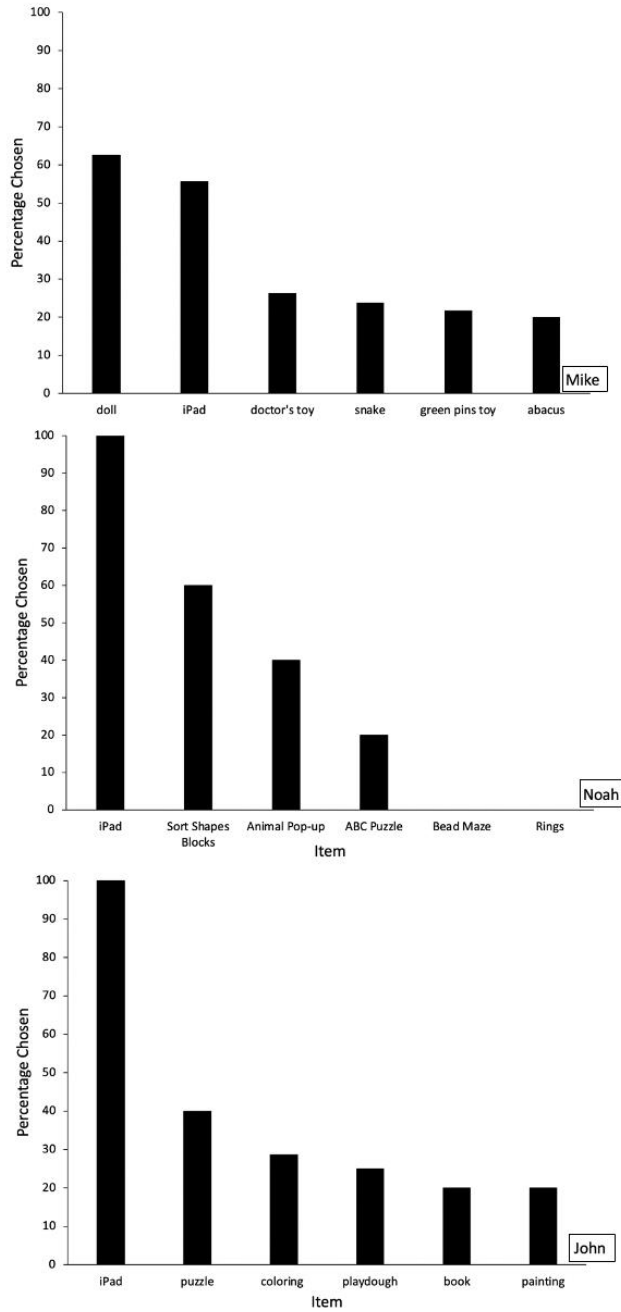
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Figure 1

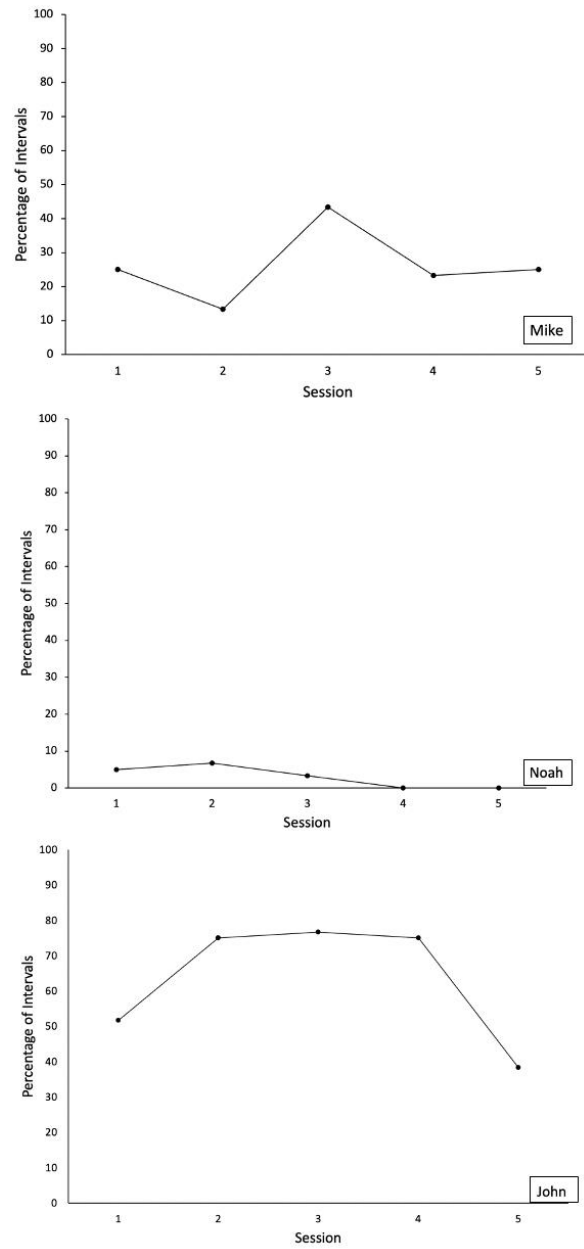
Phase 1: Stimulus Preference Assessment



Note. The top panel depicts results for Mike. The middle panel depicts results for Noah. The bottom panel depicts results for John.

Figure 2

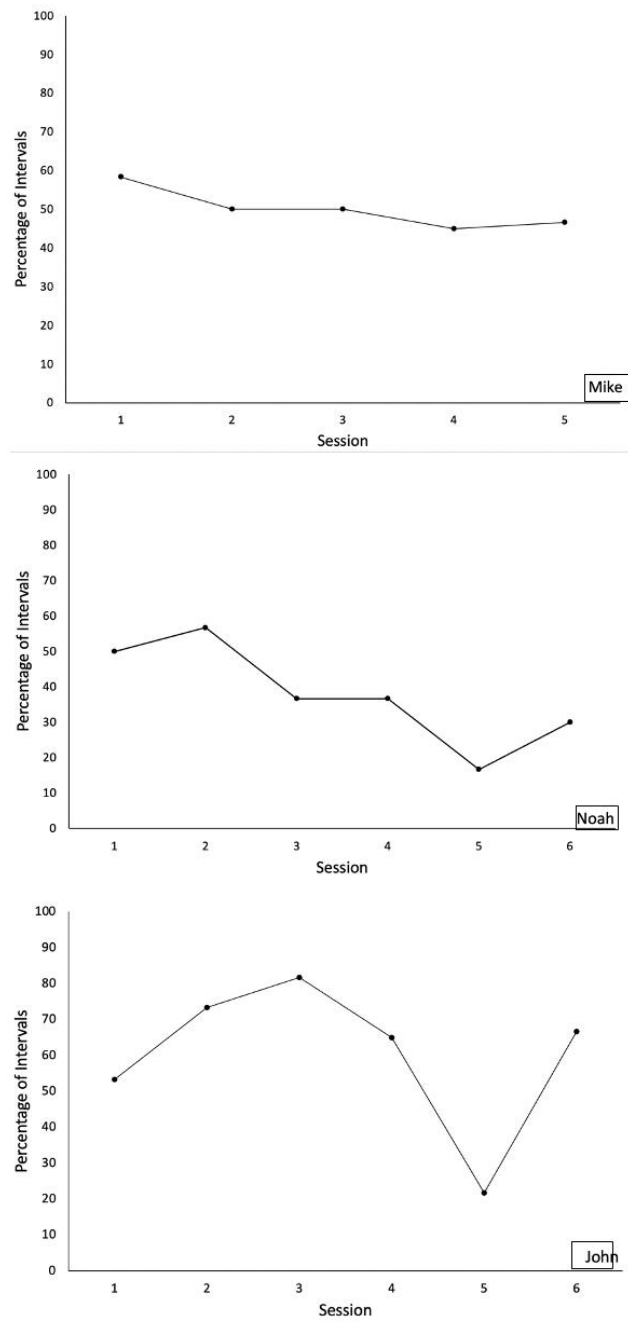
Phase 2: Extended Alone Condition



Note. The top panel depicts results for Mike. The middle panel depicts results for Noah. The bottom panel depicts results for John.

Figure 3

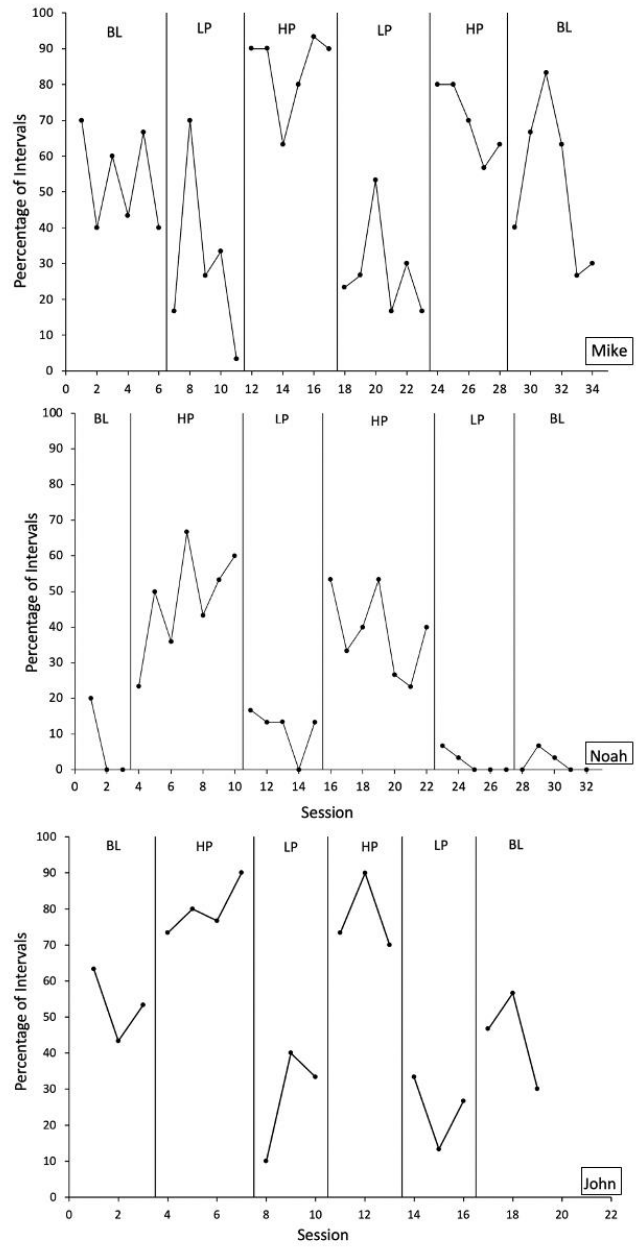
Phase 2 Part 2: An Extended Alone Condition with a Preferred Item:



Note. The top panel depicts results for Mike. The middle panel depicts results for Noah. The bottom panel depicts results for John.

Figure 4

Phase 4: Reversal Design



Note. The top panel depicts results for Mike. The middle panel depicts results for Noah. The bottom panel depicts results for John.