AN EVALUATION OF FUNCTIONAL ANALYSIS METHODOLOGY FOR PLAY BEHAVIORS IN CHILDREN DIAGNOSED WITH AUTISM SPECTRUM DISORDER

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by

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The undersigned, approved by the dean of the Graduate School, have examined the thesis entitled

AN EVALUATION OF FUNCTIONAL ANALYSIS METHODOLOGY FOR PLAY BEHAVIORS IN CHILDREN DIAGNOSED WITH AUTISM SPECTRUM DISORDER

presented by Simone Light,

a candidate for the degree of Master of Science, and hereby certify that, in their opinion, it is worthy of acceptance.

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Abstract

Deficits in play skills are common among children diagnosed with autism spectrum disorder (ASD). The importance of play in educational settings provides opportunities to build relationships and social interactions in those contexts. To facilitate play, the environment can be altered to isolate reinforcing variables that specifically increase the occurrence of the target behavior. One method to assess those variables is using a functional analysis. Although commonly used to assess the occurrence of challenging behavior, the current study offers a methodology for identifying environmental conditions that support increased levels of functional play. A multi-element experimental design assessed the environmental contexts which promoted functional play across three young children diagnosed with ASD. Results from this study indicated the potential for using functional analysis as a tool to identify environmental variables that promote increased durations and variability of functional play for all three participants. Additionally, for one participant, a social validity assessment was completed to determine his preferred condition. The most selected condition did not align with the condition that reinforced the most functional play. A review of limitations and future extensions are discussed.

Key words: functional analysis, functional play, play, autism spectrum disorder, environmental impacts

Introduction

Play is significant in a child's life and has a large impact on environmental engagement in young children (DiCarlo & Reid, 2004). Play time provides an opportunity for young children in early childhood educational settings to interact with same-aged peers who help shape their educational experience as well as their social-emotional, cognitive, and academic development (Yoder et al., 2019).

However, when a child with autism spectrum disorder (ASD) is engaging in restricted, repetitive patterns of behavior, interests, or activities, these behaviors may significantly impact the child's engagement with appropriate play behaviors. Importantly, there are applied behavior analytic (ABA) evidence-based interventions that help children with ASD learn a variety of play skills and improve their communication (Pivotal Response Training [PRT]; Koegol & Koegol 1996, Discrete Trial Training [DTT]; Lovaas, 1981/1987).

PRT is based on the principles of ABA and occurs in a naturalistic setting. This procedure includes specific guidelines for arranging the teaching environment to promote opportunities to engage in the target skills. As described by Stahmer and colleagues (2010), the process begins by gaining the child's attention then providing the child with choices and shared control for items that interest them. During this time, the therapist intersperses maintenance tasks, which are targets the child has mastered. After the therapist provides contingent consequences, such as praise or access to a preferred item, for correct responding. Finally, this is an effective method of maintaining the interest of the child by reinforcing attempts with direct and natural reinforcers. Research on PRT

focuses on expanding communication skills while simultaneously increasing play behaviors. Play skills can also be taught in an analogue setting, such as, discrete trial teaching [DTT]; Lovaas, 1981, 1987). DTT involves breaking down complex skills into smaller components and teaching each component within a highly structured environment controlled by the therapist (Stahmer et al., 2003).

ASD is commonly a comorbid diagnosis with other developmental disorders (Mannion & Leader, 2013) and often associated with learning disabilities (Barnard et al., 2008). A diagnosis of ASD includes social/emotional difficulties; language/ communication difficulties; and difficulties with flexibility of thought (American Psychiatric Association [APA], 1994). Impairments of this disorder focus on two main areas; social communication and interaction; and restricted, repetitive patterns of behavior, interest, or activities (APA, 2013). Additionally, a lack of varied, spontaneous, make-believe play or social imitative play appropriate to the developmental level, is one of the indicators for the DSM-IV's diagnosis of ASD (APA, 2013).

Teaching play skills to children diagnosed with ASD has resulted in improved play skills, an increase in positive social interactions, and a decrease in problem behaviors (Jung & Sainato, 2013). Williams et al. (1996) identified different types of functional play through the development of categorization schemes in typically developed children, children diagnosed with ASD, and children with Down Syndrome. Video recordings of the children were gathered during home visits where a set of toys were positioned in differing orders in front of the child. The videotapes were then watched, analyzed, and scored using the categorization schemes to indicate subgroups of

functional play acts among the children. Williams et al. found that children with ASD produced fewer different functional acts and spent less time in functional play than the children of typical development and children with Down Syndrome.

When compared to their typically developing peers, children with ASD commonly engage in more limited and repetitive play (Thomas & Smith, 2004). Functional play skills serve many important roles in a child's learning and development, such as providing a context for social interactions with peers (McConnell, 2002), increasing the child's ability to learn in natural settings (Buysse et al., 1996), and laying the foundation for developing leisure skills (Barton & Wolery, 2008). The development of play skills has also been linked to the development of language (McCune, 1995).

Given the importance of developing functional play skills, researchers must determine which methods maintain functional play behaviors. It may be necessary to not only teach new play skills but also to assess the variables that maintain and reinforce these play skills, before implementing a play intervention. One method to determine maintaining variables of behavior is a functional analysis (FA). An FA is important for the development and implementation of treatments for individuals with ASD (Cooper et al., 2014).

Functional Analysis for Problem Behavior

In the influential Iwata et al. (1982/1994) study, environmental events were assessed to differentially affect the incidence of self-injurious behaviors. The participants were exposed to different experimental conditions where altered establishing operations and consequences were arranged and reinforced, contingent on observed self-injurious

behavior. Results from Iwata et al. study indicated different participants engaging in self-injurious behavior in the occurrence of different environmental conditions. Therefore, providing evidence that self-injurious behavior was a function for various types of reinforcement. Iwata et al. findings were immensely influential to the field of ABA thus becoming a core aspect in the present-day methodology of the science, known as the FA.

It is well documented throughout the literature that researchers can identify controlling antecedent and consequent variables in the environment for specified behaviors through direct assessment. However, most FA literature focuses on problem behaviors; specifically, self-injurious or aggressive behaviors (Cooper et al., 1990). While FAs have shown to be an effective standard when discovering functions of problem behavior, there is a major lack of research on the effects of FAs to assess appropriate behaviors. Possibly, these deficits could be addressed by conducting functional analysis for play appropriate behaviors, given the lack of play behaviors exhibited by children with ASD.

Literature Review

To investigate the utility of functional analysis methodology to assess the variables maintaining functional play in children diagnosed with ASD, the researchers conducted an informal literature review on functional analysis for appropriate behavior. The review was conducted through *The Journal of Applied Behavior Analysis*. The search terms included: (a) functional analysis + autism spectrum disorder, (b) functional play + autism spectrum disorder, (c) appropriate behavior + autism spectrum disorder, (d) play +

autism spectrum disorder. After removing duplicates, this search produced five articles that met criteria for inclusion in this literature review.

Functional Analysis for Appropriate Behavior

After a brief review of the literature pertaining to functional analysis for appropriate behavior, there have been few studies that assess the antecedent and consequence variables that maintain appropriate behavior. Reviewing these studies is informative to determine the efficacy of functional analysis methodology to assess appropriate behavior. Although there has been extensive research conducted using FAs to assess problem behavior, more research is needed to validate the FA methodology for assessment of appropriate behavior.

In addition, FAs for appropriate behavior may also assist clinicians in determining the function of problem behavior for the same individual (Lambert et al., 2019). New clinicians might also utilize FAs for appropriate behavior before implementing an FA for challenging behavior in order to acclimate themselves to the FA procedures and the child to the FA conditions. The FA for appropriate behavior may address some limitations of the FA for problem behavior. For example, it could be dangerous to the child or result in self-harm when evoking a problem behavior. Furthermore, it may be difficult for the therapist/staff to react and ensure safety to themselves in response to the child's evoked problem behavior. Lastly, it may be difficult for caregivers to watch their child's problem behavior being evoked during these assessments. However, conducting an FA for appropriate behavior may circumvent many of these concerns by evoking appropriate responses. may circumvent many of these concerns by evoking appropriate responses.

Furthermore, when a problem behavior is detected using an FA, it could be challenging to implement treatment. For example, placing an extremely dangerous behavior on extinction and withholding previous reinforcement can lead to more severe challenging behavior (Holden, 2002). Yet, when conducting an FA on appropriate behaviors, not only is problem behavior no longer evoked, but it also shows insight into other responses a child exhibits utilizing the same controlled environmental conditions. FAs for appropriate behaviors could limit some of the unease associated with evoking problem behavior, as well as offer more information on some of the more appropriate behaviors a child may exhibit in various controlled environments.

Lambert and colleagues (2019) argued that it is reasonable to conduct FAs of appropriate behaviors in conjunction with FAs of problem behaviors. The authors explained that perhaps appropriate behaviors and problem behaviors may be maintained by the same function. An example of this scenario could include a child with an attention function being taught to mand for attention instead of engaging in problem behavior (e.g., "talk to me") to access attention.

As communication is one of the main deficits for children with ASD, assessing language behavior was one of the first uses of functional analysis for appropriate behaviors. Language delays are a primary concern for caregivers and teachers of children with ASD (Lerman et al., 2005). A child's acquired speech prior to age five is considered a good indicator for later outcomes such as functional adaptive skills and academic achievement. Thus, researchers must understand efficient methods for children with ASD

to acquire speech. However, less is known about why some children with ASD are unable to acquire some form of vocal speech.

Lerman and colleagues (2005) were the first to report on an assessment using the same methodology described for problem behavior. The purpose of the study was to identify the conditions under which the verbal response occurs. The assessment determined four verbal operants, echoics, mands, tacts, and intraverbals, which maintain the child's everyday verbal repertoires. Echoic imitation behaviors such as an echo typically function to receive some kind of general reinforcement, such as praise. Mand behaviors are typically requests which specify the speakers wants or needs. Tact behaviors are generally labels for items in the environment. Intraverbal behaviors are typically conversations, such as a response to a previous verbal statement. Each verbal operant was tested in a specific condition where an establishing operation was present for the current verbal operant. Additionally, each verbal operant was tested in a control condition, where a specific establishing operation for that verbal operant was not arranged. Sessions for each verbal operant were 10 min in duration. For example, in the mand test condition, the therapist would restrict a preferred item from the participant 60 min prior to the onset of the session. After the 60 min, the participant would be shown the item by the therapist followed by the therapist placing it inside a bag. If the participant engaged in the correct mand, (e.g., "baby doll,") the participant would be given the item for 20 s. After the 20s, the therapist would place the item back into the bag with the participant watching. Contingent on the participant engaging in the correct mand, the therapist would give the participant access to the item for 20 s again. During the mand

control condition, the participant interacted with the specific item 60 min prior to the onset of the session. During the session, the therapist allowed the participant access to the item freely. For a function to be identified, the participant required repeatably higher responding in the test condition compared to the control condition for each verbal operant. The results identified one or more functions for at least one vocal response for each participant. These findings support the limited research on the efficacy of FAs for appropriate behaviors. In addition to this being the first verbal behavior FA used to evaluate emerging speech for young children, the successful results provided an avenue for more research to be conducted using FA methodology with regard to verbal behavior and increasing language in young children.

Kelley et al. (2007) observed differential verbal responding across conditions while extending the verbal FA procedures. Similar to Lerman et al. (2005), each participant partook in a verbal behavior assessment in which controlling variables for either echoic, mand, tact, or intraverbal behaviors were manipulated. The participants were enrolled in a language-training program at centers for children with developmental disabilities. The function of the participant's vocalizations was unknown prior to the onset of the study and could function as a mand, tact, echoic, or intraverbal. A test and a control condition were included for each verbal operant in order to observe differential responding. Sessions mimicked participants' discrete trial format and consisted of 10 trials. Additionally, two test conditions were conducted for every one control condition. Lastly, differing from Lerman et al. (2005), participants were restricted or given access to the item 5 min prior to the onset of sessions instead of 60 min. The time was modified to

5 min to better suit discrete trial format of the study. Similar to the procedures in Lerman et al. the establishing operation was manipulated for each verbal operant condition. Overall, results from Kelley et al. demonstrated that this method was useful for identifying the functions of vocal behaviors across all participants. Future research should extend these findings by basing the training solely on the experimental results.

Findings from Kelley et al. (2007) and Lerman et al. (2005) help support that the verbal behavior FA could identify functions of verbal operants in emerging speakers. Even more importantly, the differentiation in responding across experimental conditions when compared to control conditions demonstrates results consistent with FAs of problem behaviors. These findings emphasize the idea of FA methodology as an effective tool for behaviors other than problem behaviors (Plavnick & Normad, 2013). Overall, verbal behavior FAs demonstrated support for further extensions of FA research with a variety of different skills and areas. One extension includes utilizing FA methodology to combat health concerns in young children.

Larson et al. (2014) presented FA methodology to increase moderate-to-vigorous physical activity (MVPA) with different environmental contingencies. The following conditions were conducted: naturalistic baseline, interactive play, attention, escape, alone, and control. The conditions were conducted on a playground and the participating children were given the contingency, “If you run, jump, or climb…” then the specific rule for the current condition., “If you run, jump, or climb…” then the specific rule for the current condition.

The naturalistic baseline consisted of three five min sessions of the child's typical recess and data were collected on MVPA with no programmed consequences for engaging or not engaging in MVPA behaviors. The interactive play condition included a contingency review describing the programmed consequences for the child contingent on MVPA. The contingency review stated, "If you run, jump, or climb, I'll play with you, but if you don't run, jump, or climb, I have to do some work." Contingent on the child running, jumping, or climbing, the therapist would deliver the specified consequence of interactive play. This condition tested for MVPA being sensitive to positive reinforcement in the form of adult engagement and an adult playing with them. After the interactive attention condition, an attention condition was conducted. The attention condition consisted of the contingency review, "If you run, jump, or climb, I'll watch you and I'll talk to you. If you don't run, jump, or climb, I have to do some work." Contingent on the participant engaging in MVPA behaviors, attention in the form of eye contact and specific praise was delivered (i.e., "I love how you're running"). Following the attention condition, an escape condition was conducted. In the escape condition, the child was told the contingency review, "It's time to clean up the playground. If you don't want to clean or you get tired of cleaning, you can go run, jump, or climb. If you stop running, jumping, or climbing, you have to come back and help me." The therapist presented the child with cleaning demands until MVPA behavior was observed; this condition tested whether MVPA was sensitive to negative reinforcement in the form of escape from non-play activities. Following the escape condition, an alone condition was conducted. The child was provided the contingency review, "I have to go inside and do

some work; play out here for a little bit," and walked 10 m away from the child and out of sight; no programmed consequences were in place. The alone condition tested whether MVPA was sensitive to potential automatic reinforcement from engagement in MVPA. Lastly, a control condition was conducted, this consisted of the child being sat at the play table with a therapist 3 m away with the instruction, "Let's color," and provided coloring materials. The control assessed other possible variables throughout the study such as therapist presence, attention, interaction, and task demands.

The results from this study showed a low level of MVPA in the children's naturalistic baseline and varied levels of MVPA contingent on the specified environment. All children engaged in varying levels of MVPA across conditions. The results in Larson et al. (2014) highlighted similar results observed in FA methodology for problem behaviors. However, one limitation of this work was the population included participants who were of typically development. Thus, the vocal contingencies may have facilitated behavior change given the delivery of the rule. Furthermore, a lack of social validity measurement prevented the assessment of the participant's preference for each setting.

Purpose Statement and Research Questions

Researchers have not yet investigated the utility of FA methodology to assess the effects of antecedent and consequent variables on the occurrence of functional play. Therefore, the purpose of this present study was to extend the previous literature on FAs for appropriate behavior by evaluating FA methodology to assess play behavior in children diagnosed with ASD. Specifically, research questions were as follows:

1. To what extent was differential play responding observed across conditions as measured by a partial interval percentage measure?

2. To what extent was the variability of play actions demonstrated across conditions as measured by a frequency count?

3. Which condition did the participant select as most preferred as measured by a cumulative selection in a choice assessment?

Method

Participants and Setting

The participants in this study included three children with the assigned pseudonyms, Wyatt, Ava, and Randall, who were diagnosed with ASD enrolled in a university-affiliated Early Intensive Behavior Intervention (EIBI) clinic. Wyatt was eight years old; Ava was four years old, and Randall was five years old at the time of the study. Participants in this study were referred by their Board-Certified Behavior Analyst (BCBA) who oversaw their clinical programming. Participants were referred because they demonstrated limited functional play engagement skills with play sets. All experimental sessions were conducted in a 3 m by 3 m therapy room equipped with a video camera and one-way mirror.

All participants demonstrated prerequisite skills in simple imitation and receptive actions. All participants engaged in 20 simple motor imitation skills (e.g., fine motor, gross motor, imitation with objects) described in the Verbal Behavior Milestones and Placement Program (VB-MAPP; Sundberg, 2008). Additionally, all participants demonstrated basic receptive skills described in the VB-MAPP, specifically, five motor movements of any type following a receptive instruction (e.g., touch your head, clap your hands). Participants were required to demonstrate these basic skills to be included due to aspects noted in our procedures.

Materials

Five playsets and their corresponding figurines (see appendix A) were included to assess functional play behaviors across each participant. The playsets included: a school-

themed playset, a pink and purple themed pretend-house playset, a car-themed play set, a blue and green themed pretend-house playset, and a barn-house themed playset. All playsets were accompanied by four various Little People figurines. Play sets were selected after researchers assessed preference, the procedure to select these play sets is described in greater detail in the Preference Assessment section. For Wyatt, the pink and purple play set was used throughout sessions and for Ava and Randall, the farm themed play set was used throughout sessions. Pictures of the playset and figurine groupings are located in Appendix A. Six 3 x 3 in. laminated colored cards and six colored t-shirts that corresponded with the colored cards were included in sessions. Additionally, one high-preferred toy item, that differed from the playsets or figurines, was used throughout tangible and control conditions. To replicate the distance variable presented in the Lerman et al. study during the control condition, a small shelf was present in the corner of the room within the control condition.

Materials for data collections included the data collection app, *Insight: Observation Timer* (Radloff, 2019), ceiling mounted video-recording system, and paper and pen. Additionally, researchers used paper and pen throughout the study to collect treatment integrity and procedural fidelity.

Work Task Selection

One-or-two step receptive actions were chosen by researchers for each participant to be utilized during the escape condition. Examples of these tasks included: “clap your hands,” “point to what you smell with,” and “clap your hands then blow a kiss.” Researchers selected these tasks based on mastery as depicted by participant’s VB-MAPP

scores, the differences in topography from the target responses, as well as the ease of implementation for researchers.

Response Measurement

All sessions were recorded, and trained observers collected data using the recorded videos. Observers collected data using the *Insight: Observation Timer* (Radloff, 2019) application and via paper and pen. The primary dependent variable was functional use of multiple objects (Williams et al., 1996). Functional play actions were defined as any motor movements (e.g., jumping) of a figurine (e.g., baby) interacting with other parts of the play set (e.g., living room). Appropriate play actions included three components; (1) a figurine, (2) movement of the figurine, (3) location with respect to the play set or other figurines. Movement was defined as the participant holding the figure between their fingers and moving it. Examples of this included: driving the bus on the playset, flying the person across the house, walking the person up the stairs, jumping the person on the fence. Researchers measured the primary dependent variable, functional play, using a 5 s partial interval (Cooper et al., 2014) scoring.

The secondary dependent variable was the variability of functional play throughout the session as measured by the number of different play actions by one or more components (i.e., figurine, movement, or location). Variability of functional play was defined as each new instance of using an item in a different way (e.g., jump the person on the bed then walk the person up the stairs).

Functional play data were collected using a 5 s partial interval recording method. Specifically, if any type of functional play was observed in the 5 s interval, the interval

was scored as functional play engagement which produced a percentage of engagement in play. Variation of functional play was collected utilizing a frequency measurement. Each new instance of functional play was scored as a new instance within the session, as long as it differed from the immediate action, location, or figurine prior to it.

In addition to the functional play engagement and variation of functional play measurements, problem behavior was collected for social validity and later clinical application purposes. For example, clinicians could choose to reinforce play using results from this study within their typical EIBI session. For Wyatt, problem behavior data were collected on screaming, aggression, flopping, and self-injurious behavior (SIB). For Ava, problem behavior data were collected on screaming and pica. Lastly, for Randall, problem behavior data were collected on aggression, SIB, elopement, property destruction, and flopping. Operational definitions for each problem behavior are shown in Appendix B.

Interobserver Agreement and Procedural Fidelity

A secondary researcher collected interval-by-interval interobserver agreement (IOA) for each participant via the recorded videos. Researchers calculated IOA for functional play by dividing the total observation period into 5-s intervals. Then, two researchers compared the agreements across each interval. The number of intervals with agreements divided by the total number of intervals were multiplied by 100 to yield a percentage. For problem behavior and varied play, IOA was calculated by taking the total occurrences scored by the primary researcher divided by the total occurrences scored by the secondary researcher and multiplied by 100. This yielded a percentage of agreements.

Researchers collected IOA for 45%, 48%, and 42% of sessions for Wyatt, Ava, and Randall, respectively. The average IOA for Wyatt was 97% (range, 91%-100%). The average IOA for Ava was 97% (range, 79%-100%) and the average IOA for Randall was 90% (range, 66%-100%).

Treatment Integrity. Treatment integrity was also collected on the researcher's behavior by an independent secondary researcher from a recorded video. These behaviors were critical to the implementation of the research protocol and are described in further detail within the procedures section. Treatment integrity included: (a) the researcher wore the correct colored shirt, (b) the researcher had colored card present in room, (c) the researcher had participant match the colored cards, (d) the researcher provided forced exposure/did not provide forced exposure in ignore and control condition, I the researcher provided pre-session exposure, (f) the researcher provided correct randomized forced exposure, (g) the researcher provided correct consequence for observed functional play, (h) the researcher ignored problem behaviors, (i) the researcher had playset within arm's reach of child (except control and ignore conditions), (j) the researcher utilized three-step prompting procedure in the escape condition, (k) the researcher had preferred toy present in tangible condition, (l) the researcher had playset on shelf and highly preferred toy present in control condition, and (m) the researcher did not place any demands in control condition. Researchers collected treatment integrity for an average of 42% of Wyatt's sessions, which produced an average of 99% (range, 85.7%-100%). For Ava, 37.04% of sessions had treatment integrity which produced an average of 100%. For Randall,

researchers collected treatment integrity for 38.46% of sessions which produced an average of 100%.

Procedural Fidelity. Procedural fidelity was collected on sessions across conditions and participants. Data for procedural fidelity were collected by examining different variables throughout the assessment to ensure the procedure was conducted as written in the proposed protocol. The procedural fidelity was measured by a secondary data collector answering 'yes' or 'no' to the following three questions: (1) Was the correct condition conducted as indicated from the session sheet? (2) Was the correct colored shirt and card present as indicated from the session sheet? (3) Did the correct randomized modeled action occur as indicated from the session sheet? The number of 'yes' responses were divided by the total number of variables being assessed to yield a percentage of correct procedural fidelity. For Wyatt, 39% of sessions had procedural fidelity. The average procedural fidelity was 98% (range, 75%-100%). For Ava, 44% of sessions had procedural fidelity. The average procedural fidelity was 100%, (range, 100%-100%). For Randall, researchers collected procedural fidelity for 38.46% of sessions. The average procedural fidelity was 100% (range, 100%-100%). It should be noted that for Wyatt, a technical error occurred on session seven that may have hindered additional procedural fidelity. A detailed description of this error is listed in the limitations within the discussion section.

Experimental Design

Researchers used a multielement experimental design (Cooper et al., 2014) to evaluate the specific antecedent and consequence maintaining functional play

engagement. A minimum of three series of each condition (i.e., ignore, attention, tangible, control, escape, engaged attention) within the functional analysis was conducted for each participant. Sessions were conducted until differentiated responding was observed or until the participants stopped attending the clinic for their regularly scheduled therapy sessions due to the mandated clinic closure and stay-at-home order. Three series of each condition were conducted for Wyatt, four series of each condition were conducted for Ava, and three complete series and one incomplete series (did not include a tangible condition) were conducted for Randall.

Procedures

Preference Assessment

Two Brief Multiple-stimulus Without Replacement (MSWO) preferences assessments (Carr et al., 2000) were conducted prior to the onset of the FA. The first MSWO preference assessment was conducted to determine which play set was included across all conditions within the functional analysis for each participant. The second MSWO preference assessment was conducted to identify a highly preferred item that was included in the tangible and control condition of the FA.

During the MSWO, five items were placed in an array before the participant. Toys selected to be used in the preference assessment were based on reported preferences by case managers. Toys were placed in front of the participant and the researcher stated, "pick one." The item the participant vocally labeled or touched with their hand was delivered for 20 s. The selected item was then recorded as chosen and removed from subsequent presentations following the 20 s of exposure. The remaining items were

rearranged and then presented to the participant in the same manner as above. The procedure was repeated until all items had been selected by the participant. The MSWO was conducted at three times to demonstrate a hierarchy of preferences. For all three participants, an iPad was identified as their most preferred toy.

Color Preference Assessment

Colored cards were used to differentiate conditions and reinforcement for participants. A color preference assessment was conducted prior to treatment as described by Luczynski and Hanley (2010). This was conducted to eliminate possible biases among colors for participants prior to assigning colors to each condition. The color preference assessment was conducted identical to the toy MSWO. All of the colors presented in the MSWO array were identical in size and laminated to ensure durability. For Wyatt, the MSWO did not indicate a preference hierarchy, so a paired-stimulus preference assessment (Cooper et al., 2014) was conducted. Following the color preference assessment, six colors that were not indicated as most preferred or least preferred were chosen to be used throughout the assessment. Colors that were selected as moderately preferred for each participant can be noted in Appendix C.

General Procedure

Sessions took place in a separate therapy room than their typical instructional area. Sessions began with three consecutive sessions of the ignore condition to establish a baseline measurement. Ignore conditions consisted of the participant not receiving any consequence for the presence or absence of functional play. Throughout ignore

conditions, a researcher was present in the room but did not interact or make eye contact with the participant. All instances of problem behavior were ignored.

Following three consecutive sessions of the ignore condition, sessions were conducted in the following sequential order: attention, ignore, engaged attention, escape, control, and tangible. The series of conditions were conducted across days, therefore the following condition resumed wherever it ended in the previous sequential order. Wyatt's sessions occurred across eight different days, averaging 2.6 sessions per day (range, 1-3). Ava's sessions occurred across six different days, averaging 4.5 sessions per day (range, 3-9). Lastly, Randall's sessions occurred across ten different days, averaging 2.6 sessions per day (range, 1-5). After each session, brief breaks were provided to allow a break for the participant and to allow researchers to prepare for the next condition. No programmed consequences were delivered for problem behavior across all conditions for Wyatt and Ava. However, for Randall, if flopping was observed across any condition, the researcher placed a mat between Randall's body and any hard surface.

All conditions were 5 min in duration. Sessions were conducted with only the participant and researcher present. If the participant attempted to leave the room by pulling the handle of the session room's door, an independent secondary observer behind the one-way mirror activated the door-button-tool which temporarily locked the door from within the observation room. The activation of the door-button locked the door and prevented the participant from exiting the room. Each condition began with a prompted observing response, which ensured the participant was attending to the materials. The observing response was accompanied by a designated color for participants to engage in

discriminated responding of the different conditions. During the observing response procedure, the colored card for the session was affixed to the door along with the other colored cards. Prior to the start of each session, the researcher prompted the participant to match the colored card affixed outside of the therapy room to the color affixed to the wall inside the therapy room. Following the observing color response, the researcher immediately put on the corresponding colored shirt.

Forced Exposure. Researchers started sessions by modeling one example of a functional play action with a selected figurine and delivered the corresponding reinforcement. The modeled action met the definition of functional play and were semi-randomized to counterbalanced actions across conditions. In order to ensure randomization, each action was assigned a number and all numbers were entered into an online number generator. The order of actions was decided prior to the start of the FA. The purpose of the forced exposure was to expose the participant to the reinforcement contingency within that condition.

Attention Condition. In this condition a researcher and playset were present. This condition tested for engagement of functional play behavior maintained by access to adult attention. Each session began with the researcher conducting the observing response procedure with the corresponding colored card. Before entering the room, the researcher prompted the participant to select the correct corresponding colored card from outside the session room and place it inside the room. The researcher then put on a corresponding colored shirt once in the room. The condition began with 30 s of high-quality pre-session attention from the researcher. After the 30 s, the researcher provided the pre-determined

randomized forced exposure. Immediately following the modeled action, the researcher full-physically prompted the participant to engage in the modeled action. Full-physical prompt was defined as the researcher gently placing their hand over the hand of the participant and guiding the participant to engage in the required response. Upon completion of the full-physical prompt, the researcher provided attention in the form of brief praise, such as, “You played with your toys! Nice work!” After the forced exposure, the researcher removed attention from the participant and stated, “I’m busy,” while positioning their body and attention away from the participant. Contingent on the participant engaging in functional play, the researcher provided high-quality attention, this repeated for every instance of functional play. After providing the brief attention, the researcher removed their attention until another instance of functional play was observed. No programmed consequences were delivered for non-target behaviors.

Ignore Condition. This condition tested for functional play maintained and reinforced by potential automatic reinforcement. This condition allowed researchers to observe if functional play became more automatically reinforcing to the participant as functional play began to contact reinforcement in different environmental conditions, and compared to their baseline engagement levels. Each session began with the researcher conducting the observing response procedure with the corresponding colored card in the identical manner as described in the previous condition. Once the researcher and participant entered the room, the researcher did not provide attention to the participant. The session researcher did not interact with the participant throughout the entire

condition. In order to ensure participant safety, independent observers watched the session through the one-way mirror.

Engaged Attention Condition. This condition tested for functional play maintained and reinforced by access to adult engaged attention. Each session began with the researcher conducting the observing response procedure with the corresponding colored card in the identical manner as the previous conditions. The condition began with 30 s of high-quality engaged attention from the researcher. Engaged attention was defined as providing vocal and physical attention that involved playing with the toys and the participant that lasted at least 10 s in duration. Examples of this included, flying the person to the house or driving the car and crashing into the participant. After the 30 s, the researcher provided the pre-determined randomized forced exposure. Immediately following the modeled action, the researcher physically prompted the participant to engage in the modeled action. Upon completion of the full-physical prompt, the researcher provided engaged attention, such as, “I’m going to make your pig jump to the barn, oink, oink!” while modeling the action. Afterwards, the researcher stated, “I’m busy,” and removed all engaged attention. The researcher provided engaged attention again contingent on observed functional play from the participant. The researcher removed their engaged attention until another instance of functional play was observed. Every instance of functional play resulted in 10 s of additional engaged attention. Specifically, when functional play was observed while engaged attention was being provided, the 10 s engaged attention duration restarted.

Escape Condition. This condition tested for functional play maintained and reinforced by escape from receptive one-or-two step demands. Each session began with the researcher conducting the observing response procedure with the corresponding colored card in the identical manner as the previous conditions. Following the observing color response procedure, forced exposure took place. For all the forced exposure in escape conditions, two researchers were present, the primary researcher and a secondary researcher. The forced exposure began with the primary researcher giving the participant a receptive action demand (e.g., "touch your nose"). If the participant engaged in the demand with 3-5 s, the primary researcher provided brief praise (e.g., "that's right") and moved on to the next demand. For the next demand, the primary researcher presented another one- or two-step receptive action (e.g., clap your hands"). Immediately after delivering the demand, but before the participant could engage in the correct response, the primary researcher modeled the pre-determined randomized play action. The secondary researcher blocked the participant from completing the demand and then physically prompted the participant to engage in the modeled action. After the participant completed the prompted modeled action from the secondary researcher, the primary researcher stated, "You don't have to...(complete the action)" for example, "You don't have to clap your hands," and provided a 30-s break from receptive action demands and researcher attention. During the 30-s break from demands, the secondary researcher was no longer present in the room. After the 30-s break, the researcher began to present receptive action demands.

As the researcher delivered receptive action demands, they used a three-step prompting sequence to ensure the participant completed the instructed action. If the participant did not engage in the action after the verbal instruction, the researcher redelivered the instruction and provide a model of the action (e.g., “clap your hands like this, you do it” while researcher clapped their hands). If the participant did not engage in the correct response with the model prompt, then a light physical prompt was delivered by the researcher (e.g., “this is clapping,” while researcher full-physically prompted the participant to clap). The demand was removed and a 30 s break from further demands was delivered to the participant contingent on functional play. When the researcher delivered the break, they stated, “You don’t have to... (engage in the action)” with whatever the specific demand was to complete. After the 30 s elapsed, the researcher re-presented demands utilizing the three-step prompting procedure when needed. This process continued until the session duration elapsed and the session was terminated.

Control Condition. The session room was arranged to include a small shelf in the corner of the session room where the playset and figurines were placed. Additionally, the participant was given free access to the highly preferred tangible. During this condition, no demands were placed and engaged attention was delivered approximately every 10 s or after every instance that the participant-initiated conversation with the researcher throughout the session. There were no programmed consequences throughout the session for functional play or challenging behavior. This condition served as the control for the variables present in the other conditions, such as therapist attention, work demands, access to tangibles, etc. Because this condition arranged the environment to deliver free

access including attention, avoidance of work demands, and access to a high-preferred tangible to the participant, there was likely to be little to no motivation to engage in functional play to access those reinforcers. Thus, researchers compared low responding in this condition to increased responding in all the other conditions.

Tangible Condition. This condition tested for functional play maintained and reinforced by access to tangibles. Researchers presented the participant's high preferred item inside the room. Each session began with the researcher conducting the observing response procedure with the corresponding colored card identical as described in the previous conditions. Prior to the start of the session, the participant was given free access to their highly preferred toy for 30 s. After the 30 s the researcher removed the preferred toy and provided the forced exposure by modeling an action using the figurine and playset. The researcher then immediately full-physically prompting the participant to complete the modeled action and quickly delivered access to the high-preferred toy for 30 s. After the 30 s had elapsed, the researcher stated, "I want it," and removed the highly preferred toy from the participant. The researcher returned access to the participant's preferred toy for 30 s contingent on observed functional play. After 30 s had elapsed the researcher removed the high preferred toy and recited the same statement as noted above. This process continued until the session duration elapsed and no programmed consequences were delivered for any other response.

Choice Assessment

After differential responding across conditions was determined from the FA, a social validity measure was conducted. The social validity assessment measured the

extent to which correspondence between the condition that evoked the highest percent of responding was also the participant's preferred condition (Luczynski & Hanley, 2009). Every condition was made available via the colored cards during the choice assessment except for the control condition. The control condition was not included since it did not arrange the environment to reinforce or maintain functional play. The choice procedure was conducted across ten opportunities for each participant.

The choice procedure began by presenting the participant with all the available colored cards in an array taped outside the session room door. The researcher stated, "Pick your favorite," to the participant. After the participant touched the color, labeled the color, or pointed at the color, the researcher led the participant into the session room to match the selected card. Following this, the researcher put on the colored shirt and began a shortened session (2.5 min) that corresponded with the color that was selected by the participant. If the participant did not select a color after 5 s, the researcher restated the instruction and rearranged the array of colored cards and represented the instruction, "Pick the one you want." If the participant did not pick a color after the third verbal instruction, the session was terminated and recorded as 'No Selection.

Results

All participants engaged in zero or near-zero levels of functional play during the baseline conditions. Figures 1, 2, and 3 depicts the percentage of intervals with functional play and varied play across baseline and experimental conditions for Wyatt, Ava, and Randall respectively. As represented in Figure 1, Wyatt engaged in zero levels of functional play across the first three baseline sessions. Ava engaged in an average of 5.56% (range, 3.33%-6.67%) of intervals with functional play across the first three baseline sessions. Randall engaged in an average of 1.67% (range, 0%-5%) of intervals with functional play across the first three baseline sessions. For all three participants, no functional play was observed during the control conditions. However, the percentage of intervals with functional play varied across conditions for all three participants.

Wyatt engaged in the most functional play during the engaged attention condition. Specifically, Wyatt's average engagement in functional play during each experimental condition is as follows: 43% of intervals during attention (range, 0%-71%), 32.8% of intervals during ignore (range, 20%-51.70%), 56.67% of intervals during engaged attention (range, 33%-75%), 18.89% of intervals during escape (range, 6.67%-36.67%), 1.7% of intervals during tangible (range, 1.70%-1.70%), and 0% of intervals during control. Wyatt engaged in the most varied play in the engaged attention condition. Specifically, Wyatt's average engagement in varied play during each experimental condition is as follows: 18.67 play actions during attention (range, 0-29), 10.67 play actions during ignore (range, 5-19), 20.33 play actions during engaged attention (range, 24-26), 6.67 play actions during escape (range, 14-26), and 0 play actions during the

tangible and control conditions. Lastly, the asterisk above session seven of Wyatt's graph denotes a technical error in which only the first 3.5 min of the session was recorded for primary data. Therefore, the responses which occurred in the last 1.5 min of the session were not recorded. Although Wyatt was the only participant who did not engage in any functional play throughout baseline conditions, he exhibited the most functional play during the assessment phases relative to the other two participants.

Ava engaged in the most functional play during the attention condition. Specifically, Ava's average engagement in functional play during each experimental condition is as follows: 10% of intervals in the attention condition (range, 5%-20%), 4.60% of intervals during ignore (range, 0%-15%), 6.66% of intervals during engaged attention (range, 0%-13.33%), 8% of intervals in the escape (range, 1.70%-15%), 1% of intervals in the tangible (range, 0%-3%), and 0% of intervals during control. Ava engaged in the most varied play in the attention condition. Specifically, Ava's average engagement in varied play during each experimental condition is as follows: 1.25 play actions in ignore (range, 0-3), 3.75 play actions during attention (range, 2-9), 3.25 play actions in engaged attention (range, 0-9), 2.5 play actions in escape (range, 0-5), and 0 play actions in the tangible and control conditions.

Randall engaged in the most functional play during the attention condition. Specifically, Randall's average engagement in functional play during each experimental condition is as follows: 4.18% of intervals during attention (range, 0%-10%), .43% of intervals during ignore (range, 0%-1.70%), 2.93% of interval during engaged attention (range, 0%-5%), 3.73% of intervals during escape (range, 0%-8.30%), 2.93% of intervals

during tangible (range, 0%-11.70%), and 0% of intervals during control. Randall engaged in the most varied play in the attention condition. Specifically, Randall's average engagement in varied play during each experimental condition is as follows: .5 play actions during ignore (range, 0-2), 1.5 play actions during attention (range, 0-4), .75 play actions during engaged attention (range, 0-2), 1 play action in the escape condition (range, 0-3), 1 play action in the tangible condition (range, 0-4), and 0 play actions in the control.

Additionally, all participants responded most in sessions that included some form of attention. Wyatt averaged the most functional and varied play in the engaged attention conditions, while Ava and Randall engaged in the most functional and varied play in the attention conditions. Another interesting finding to note across all three participants were the low levels of responding during tangible conditions. Although attention, engaged attention, and tangible conditions all consisted of access to social positive reinforcement, the participant's responding differed based on which kind of social positive reinforcement was provided.

Choice Assessment

As demonstrated in Figure 4, Wyatt was the only participant who completed the choice assessment, due to the required clinic closure (Coronavirus Disease, 2020). Wyatt selected the ignore most frequently (five selections) and averaged 37.37% of intervals with functional play in the ignore condition (range, 0%-80%). The engaged attention condition (three selections) and the tangible condition (two selections) were the next two conditions selected most often. He engaged in 60.03% of intervals with functional play

during the engaged attention condition (range, 46.67%-76.7%), however, he did not engage in any functional play in the tangible condition.

Problem Behavior

As noted earlier, problem behavior data were collected during sessions for each participant. Wyatt and Ava engaged in low to zero levels of problem behavior across baseline and treatment conditions. Randall engaged in the most problem behavior among the three participants. As defined by his BCBA, his problem behaviors included aggression, flopping, elopement, property destruction, and screaming. During baseline, Randall engaged in an average of 54.67 (range, 25-78) problem behaviors per session. Randall did not engage in problem behavior during the control conditions. During the FA, Randall engaged in an average of 62 (range, 22-125) instances of problem behavior during the ignore condition. Instances of this behavior were reduced across the attention (M=45.5; range, 7 to 64), tangible (M=36.33; range, 7 to 66), engaged attention (M=18.5; range, 0 to 64), escape (M=18.5; range, 0 to 64) conditions, respectively. Randall averaged fewer problem behaviors in the escape and attention conditions relative to baseline conditions.

Discussion

Although FAs are commonly used to assess the function of problem behavior, there is evidence to suggest the utility of evaluating relevant variables to maintain appropriate behavior (Larson et al., 2014). The present study provides insight to the limited research on conducting FAs for appropriate behaviors. Increasingly, researchers have begun assessing the utility of FAs for non-problematic behaviors (Verbal Behavior FA; Lerman et al., 2005; Kelly et al., 2007; MVPA FA; Larson et al., 2014). However, this research offers the first reported FA for functional play behaviors utilizing figurines and play sets for children diagnosed with ASD. Specifically, Wyatt, Ava, and Randall engaged in the most functional play during the engaged attention, attention, and attention conditions, respectively.

Notably more than one condition produced increased levels of functional play compared to the control for all participants. The variability in responding across participants indicates the necessity of FAs for appropriate behavior within clinical and educational settings. Whereas an educator could arbitrarily select a reinforcer to deliver for engagement in play, conducting an FA may produce information to select a more efficient reinforcer.

Across participants, researchers observed zero levels of responding during the control conditions, but elevated responding in more than one other condition. This differentiation depicts the fundamental concept of motivation to engage in a response in relation to acquiring the skills to engage in a response (Friman & Poling, 1995). Although participants were selected for the study contingent on having the necessary skills to

engage in functional play, it was unclear if the participants had motivation to engage in functional play during baseline conditions. Due to the consistently low levels of responding during the control condition and elevated levels of responding in one or more other conditions, researchers have reason to believe an FA was effective to increase motivation to engage in functional and varied play. Conducting an FA of functional play may circumvent the need for more effortful and complex trainings to produce increases in play behavior. By further understanding the motivation required for increased levels of functional play, clinicians can appropriately reinforce play behavior during individual programming. Interestingly, without providing explicit rules or contingencies for varied responses, researchers observed increases in variability for participants across conditions. For all participants, the condition that reinforced the largest percentage of intervals with functional play also produced the most varied play actions. The corresponding increases between percentage of engagement and number of varied play actions demonstrates the utility of the FA to measure different dimensions of play behavior simultaneously. Relative to an FA for problem behavior in which more rigid and repetitive behavior is reinforced, researchers did not observe increases in repetitive play, which would have met the definition for reinforcement. Given that the current target behavior only required functional play and thereby the potential to reinforce repetitive actions, future research may extend the current assessment by conducting an FA for varied functional play actions.

With respect to the participants' problem behavior, this study suggests that conducting an FA on an appropriate behavior, such as play, can have a corresponding

decreasing effect on the occurrence of inappropriate behavior. Randall engaged in fewer problem behaviors during conditions that reinforced functional play. Given the topography of Randall's elopement, aggression, and property destruction, it is possible that Randall's problem behaviors were incompatible with functional play. Another possibility is that his problem behaviors were maintained by the same function as his appropriate behaviors. Similar to Lambert et al. (2019), results from this study create the possibility of an FA on functional play sharing the same function as an FA on problem behavior. Thus, future research should examine the correspondence between an FA on functional play and an FA on problem behavior. If this were to be the case, Randall no longer had to engage in problem behavior to receive reinforcement, rather, he could contact reinforcement by engaging in an appropriate behavior instead. Therefore, by conducting an FA to increase an appropriate behavior, clinicians might find that the subsequent decrease in problem behavior may reduce the need for an FA of problem behavior. In this case, decreases in problem behaviors may be observed prior to even implementing a play intervention or a behavior reduction plan.

Interestingly, while baseline conditions were identical to ignore conditions, functional play occurred more in some ignore conditions than baseline conditions. Specifically, this is notable for Wyatt, who did not engage in any functional play during baseline conditions. However, Wyatt engaged in functional play an average of 32.8% of intervals throughout the subsequent ignore conditions during the FA. Additionally, he selected the ignore condition five out of the ten opportunities provided to him and engaged in functional play an average of 37.37% of those choice assessment intervals.

The increase in functional play throughout ignore conditions as well as his preference for the ignore condition could suggest an acquired automatic function. Alternatively, it is possible that the rotation of conditions functioned as intermittent reinforcement, which produced sustained engagement during the ignore condition when no consequences were programmed for the functional play behavior. This is a valuable finding, especially for this population. Most typically developed children engage with play materials and play behaviors without programming arbitrary consequences (Jung & Sainato, 2013). However, this is not always observed for children diagnosed with ASD (DiCarlo & Reid, 2004). Future research should explore this theory by conducting a series of sustained ignore conditions after the completion of the FA and choice assessment.

Wyatt engaged in much higher levels of responding throughout his FA compared to both Ava and Randall. Additionally, his data path all followed an extremely similar pattern. This may be due to various reasons. First, it seemed likely that Wyatt engaged in higher responding because he contacted reinforcement much quicker than the other participants. Second, Wyatt also had the longest history with ABA as well as with the primary researcher. Perhaps, Wyatt's history with both the setting and researcher effected his responding. Furthermore, Wyatt's data ultimately followed the same pattern across the three series. (low, high, and lower responding compared to the previous series). Wyatt's responding seemed to stabilize over time, while Ava and Randall's did not. Wyatt's stable responding leaves reason to believe that Wyatt would engage in functional play outside the therapy room setting as well. In this case, information on the

reinforcement provided during Wyatt's FA sessions could then be implemented during his IBI sessions to reinforce and maintain stable levels of functional play.

Although the results of this study suggest that conducting an FA for play behavior is a promising approach to identifying ways to arrange the environment to reinforce and maintain appropriate behaviors for children diagnosed with ASD, there were several limitations that should be noted. First, the study was ended abruptly due to clinic closure during the mandated stay-at-home order (COVID-19). Because the research was paused earlier than anticipated, stable responding was not obtained before terminating the FA. Furthermore, the choice assessment was not conducted for Ava and Randall. A second limitation was that the forced exposure within this study did not include delivery of a rule about the contingency in the same manner as previous research had included (Larson et al. 2014). Forced exposure through physical prompting was designed to better suit the target population who may have deficits in verbal language. However, the absence of the contingency rule may not have allowed participants to contact contingencies for each condition as rapidly as observed in previous research. Perhaps, by providing a contingency review such as, "When you play with your toys, I can play with you but, when you don't play with toys, I have to be busy," then providing the prompted forced exposure, it would have produced quicker differentiated responding across participants. Future research should compare the forced exposure approach with and without the contingency review for children diagnosed with ASD.

A third limitation included a technical error occurred during Wyatt's seventh session as denoted by the asterisk on his graph. During session seven, 1.5 min of his

session did not video-record for researchers to score. However, after observing his responding during the following two escape conditions, researchers concluded the initial condition was representative of Wyatt's functional play behavior during an escape contingency. Although researchers determined it as representative, it is still a noteworthy limitation and should be considered while interpreting the results.

A final limitation included the difference in the environmental arrangement during the control conditions than from the remainder of the experimental conditions. During the control conditions, a small shelf was placed in the corner of the room with the playset and figurines on top of it. The shelf was included to create a similar distance arrangement to the MVPA functional analysis conducted by Larson et al. (2014) on the playground. Anecdotally, the participants interacted with the playset and figurines throughout control conditions where the shelf was present. However, it is possible that the different arrangement in the environment and participants' learning history with the shelf within instructional time reduced the occurrence their play behavior.

Deficits in play skills are a problem for many individuals with ASD. At the same time, play is a common environmental context to strengthen other defining deficits in ASD such as social and communicative behaviors (Jung & Sainato, 2013). It is also well understood that the nature of the environment has a large impact on the type of behavior occurring in it (Horner, 1980). Functional play is a massive component of a young child's life for many reasons, such as education, development, and language. Therefore, it is beneficial for researchers, teachers, therapists, and caregivers to assess which environmental context promotes play behaviors for individuals with ASD. This study

manipulated the antecedents and consequences in different controlled conditions to reinforce functional play behavior for children diagnosed with ASD who currently did not exhibit functional play. Findings from this study suggest that utilizing an FA for functional play can help to identify the type of reinforcement that supports an increase of functional play for children with ASD within an inside play setting.

References

American Psychiatric Association (APA). (1994). *Diagnostic and statistical manual of mental disorders* (4th ed.). Washington, DC: Author. doi:10.1176/ajp.152.8.1228

American Psychiatric Association (APA). (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Washington, DC: Author. doi:10.4103/00195545.117131

Barnard, L., Muldoon, K., Hasan, R., O'Brien, G., & Stewart, M. (2008). Profiling executive dysfunction in adults with autism and comorbid learning disability. *Autism*, 12, 125-141. doi:10.1177/1362361307088486

Barton, E. E. & Wolery, M. (2008). Teaching pretend play to children with disabilities: A review of the literature. *Topics in Early Childhood Special Education,* 28*(2),* 109-125. doi:10.1177/0271121408318799

Carr J.E, Nicolson A.C, & Higbee T.S. (2000). Evaluation of a brief multiple-stimulus preference assessment in a naturalistic context. *Journal of Applied Behavior Analysis*, 33(*3)* 353–357. doi:10.1901/jaba.2000.33-353

Cooper, J. O., Heron, T., E., & Heward, W., L. (2014). *Applied behavior analysis*. Pearson.

Cooper, L. J., Wacker, D. P., Sasso, G. M., Reimers, T. M., & Donn, L. K. (1990). Using parents as therapists to evaluate appropriate behavior of their children: application to a tertiary diagnostic clinic. *Journal of Applied Behavior Analysis*, *23*(3*),* 285–296. doi:10.1901/jaba.1990.23-285

Coronavirus Disease 2019 (COVID-19). (2020, March 27). Retrieved from https://www.cdc.gov/coronavirus/2019-ncov/index.html

DiCarlo, C. E., & Reid, D. H. (2004). Increasing pretend toy play of toddlers with disabilities in an inclusive setting. *Journal of Applied Behavior Analysis,37*(2), 197-207. doi:10.1901/jaba.2004.37-197

Diagnostic and Statistical Manual of Mental Disorders ... (n.d.).

Friman, P. C., & Poling, A. (1995). Making life easier with effort: Basic findings and applied research on response effort. *Journal of Applied Behavior Analysis*, *28*(4), 583–590. doi:10.1901/jaba.1995.28-583

Holden, B. R. (2002). Some limitations of functional analyses: treatment of problem behavior based on the study of alternative responses. *Behavioral Interventions*, *17*(4), 191–209. doi:10.1002/bin.118

Horner, D. R. (1980). Effects of an environmental “enrichment” program on the behavior of institutionalized profoundly retarded children. *Journal of Applied Behavior Analysis*, *13*(3) 473-491. doi:10.1901/jaba.1980.13-473

Ingersoll, B. & Schreibman, L. (2006). Teaching reciprocal imitation skills to young children with autism using a naturalistic behavioral approach: Effects on language, pretend play, and joint attention. *Journal of Autism and Developmental Disorders*, *36*(4), 487–505. doi:10.1007/s10803-006-0089-y

Iwata, B. A., Dorsey, M. F., Slifer, K. J., Bauman, K. E., & Richman, G. S. (1994). Toward a functional analysis of self-injury. *Journal of Applied Behavior Analysis*, *27*(2), 197–209. doi:10.1901/jaba.1994.27-197

Kelley, M. E., Shillingsburg, M. A., Castro, M. J., Addison, L. R., Larue, R. H., &

Martins, M. P. (2007). Assessment of the functions of vocal behavior in children with developmental disabilities: a replication. *Journal of Applied Behavior Analysis*, *40*(3), 571–576. doi: 10.1901/jaba.2007.40-571

Koegel, R. L., Bimbela, A., & Schreibman, L. (1996a). Collateral effects of parent training on family interactions. *Journal of Autism and Developmental Disorders*, 26(3), 347–359. doi:10.1007/BF02172479

Larson, T. A., Normand, M. P., Morley, A. J., & Miller, B. G. (2014). Further evaluation of a functional analysis of moderate-to-vigorous physical activity in young Children. *Journal of Applied Behavior Analysis*, *47*(2), 219–230. doi:10.1002/jaba.8

Lambert, J. M., Bloom, S. E., Kunnavatana, S. S., Boyle, M. A., & Samaha, A. L. (2019). Correspondence between functional analyses of mands and functional analyses of problem behavior. *European Journal of Behavior Analysis*, *20*(1), 69–83. doi:10.1080/15021149.2018.1535162

Lerman, D. C., Parten, M., Addison, L. R., Vorndran, C. M., Volkert, V. M., & Kodak, T. (2005). A methodology for assessing the functions of emerging speech in children with developmental disabilities. *Journal of Applied Behavior Analysis*, *38*(3), 303–316. doi:10.1901/jaba.2005.106-04

Luczynski, K. C., & Hanley, G. P. (2010). Examining the generality of children's preference for contingent reinforcement via extension to different responses, reinforcers, and schedules. *Journal of Applied Behavior Analysis,* 43, 397-409. doi:10.1901/jaba.2010.43-397

Mannion, A. & Leader, G. (2013). Comorbidity in autism spectrum disorder: A literature

review. *Research in Autism Spectrum Disorders, 7,* 1595-1616. doi:0.1016/j.rasd.2013.09.006

McConnell, S. R. (2002). Interventions to facilitate social interaction for young children with autism: Review of available research and recommendations for educational intervention and future research. *Journal of Autism and Developmental Disorders, 32*(5), 351-372. doi:10.1023/a:1020537805154

Plavnick, J. B. & Normand, M. P. (2013). Functional analysis of verbal behavior: A brief review. *Journal of Applied Behavior Analysis*, *46*(1), 349–353. doi:10.1002/jaba.1

Radloff, L. (2019). *Insight: observation timer*. (1.3.2) [Mobile app.] App Store. http://www.insightapp.net

Sundberg, M. L. (2008) VB-MAPP: Verbal behavior mile-stones assessment and placement program (2nd ed.). Concord, CA: AVB Press.

Thomas*, N., & Smith, C. (2004). Developing play skills in children with autistic spectrum disorders. *Educational Psychology in Practice, 20*(3), 195–206. doi: 10.1080/0266736042000251781

Williams, E., Reddy, V., & Costall, A. (2001). Taking a closer look at functional play in children with autism. *Journal of Autism and Developmental Disorders, 31*(1). doi:10.1023/a:1005665714197

Yoder, M. L., Williford, A. P., & Vitiello, V. E. (2019). Observed quality of classroom peer engagement in a sample of preschoolers displaying disruptive behaviors. *Early Childhood Research Quarterly,47,* 206-217. doi:10.1080/10409289.2019.1594531

Youth Physical Activity Guidelines. (2019, May 29). Retrieved from

https://www.cdc.gov/healthyschools/physicalactivity/guidelines.htm

Figures

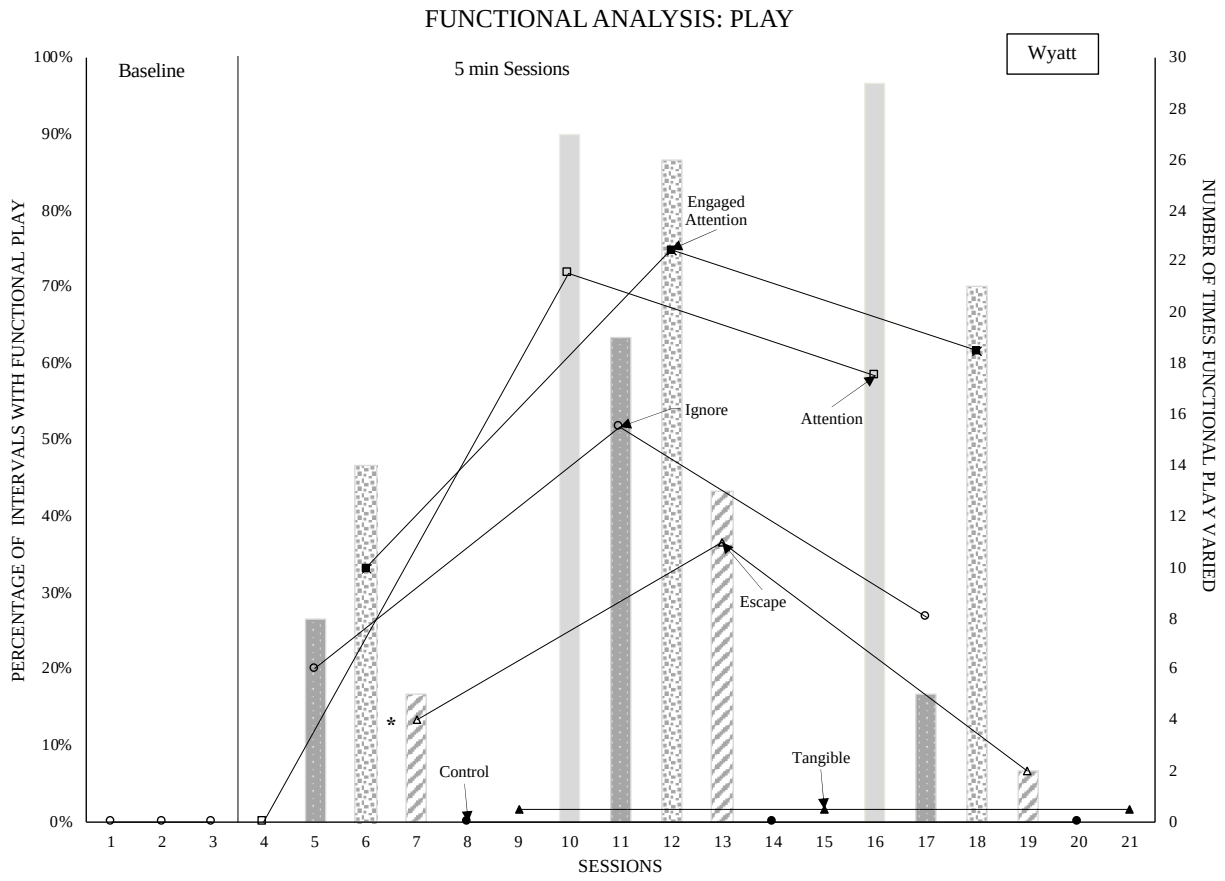


Figure 1. *Wyatt's functional analysis of play depicting the percentage of intervals with functional play across the baseline/ignore (open circles), attention (open squares), engaged attention (closed squares), escape (open triangles), tangible (closed triangle), and control (closed circles) conditions. Number of instances functional play varied within each session is depicted on the secondary y-axis.*

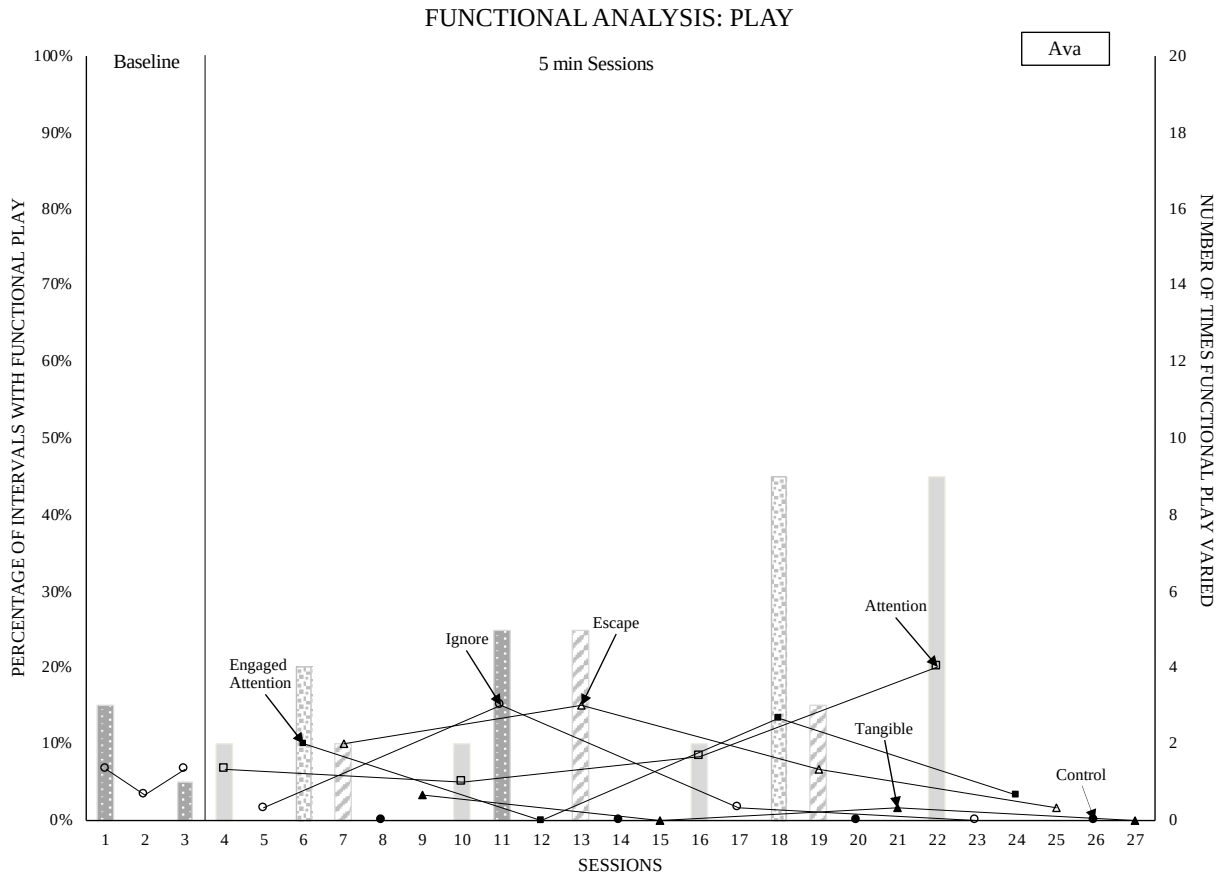


Figure 2. *Ava's functional analysis of play depicting the percentage of intervals with functional play across the baseline/ignore (open circles), attention (open squares), engaged attention (closed squares), escape (open triangles), tangible (closed triangle), and control (closed circles) conditions. Number of instances functional play varied within each session is depicted on the secondary y-axis.*

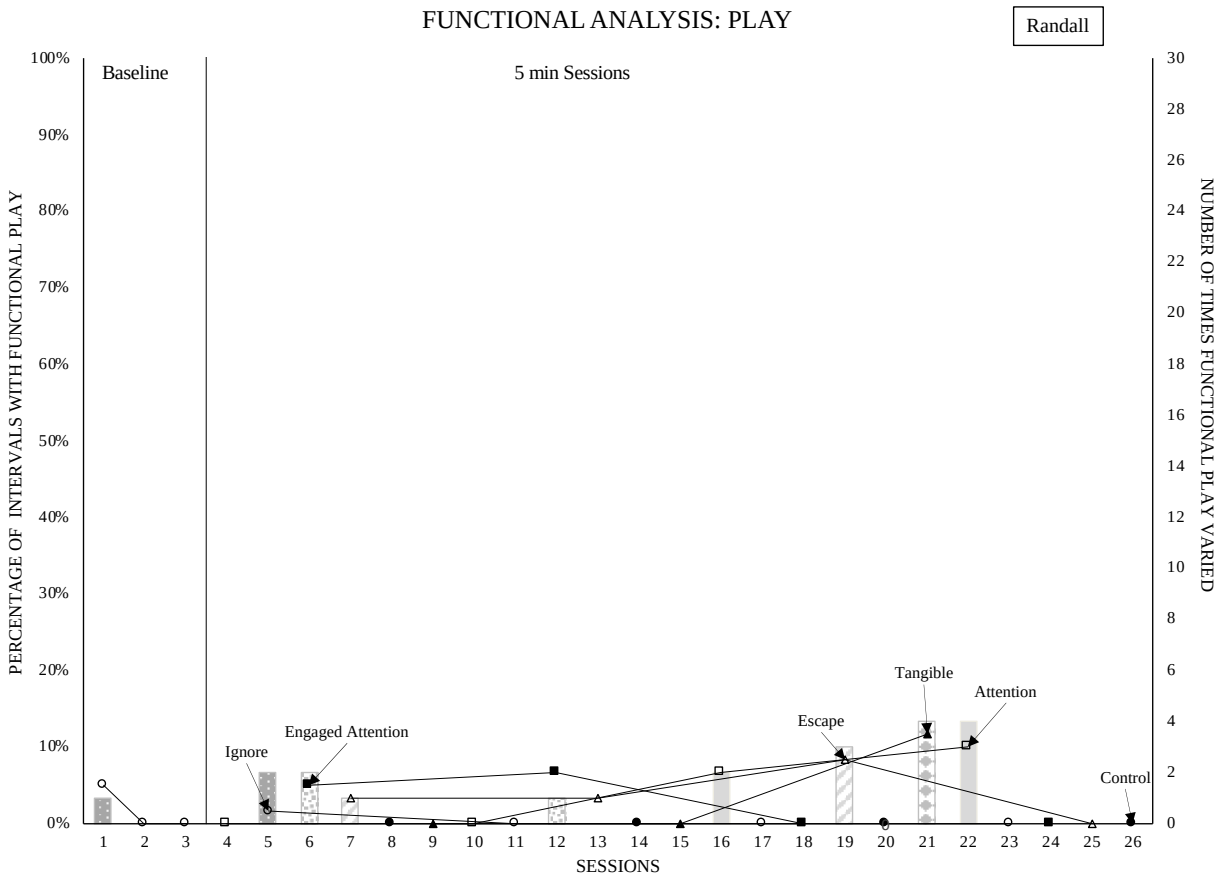


Figure 3. *Randall's functional analysis of play depicting the percentage of intervals with functional play across the baseline/ignore (open circles), attention (open squares), engaged attention (closed squares), escape (open triangles), tangible (closed triangle), and control (closed circles) conditions. Number of instances functional play varied within each session is depicted on the secondary y-axis.*

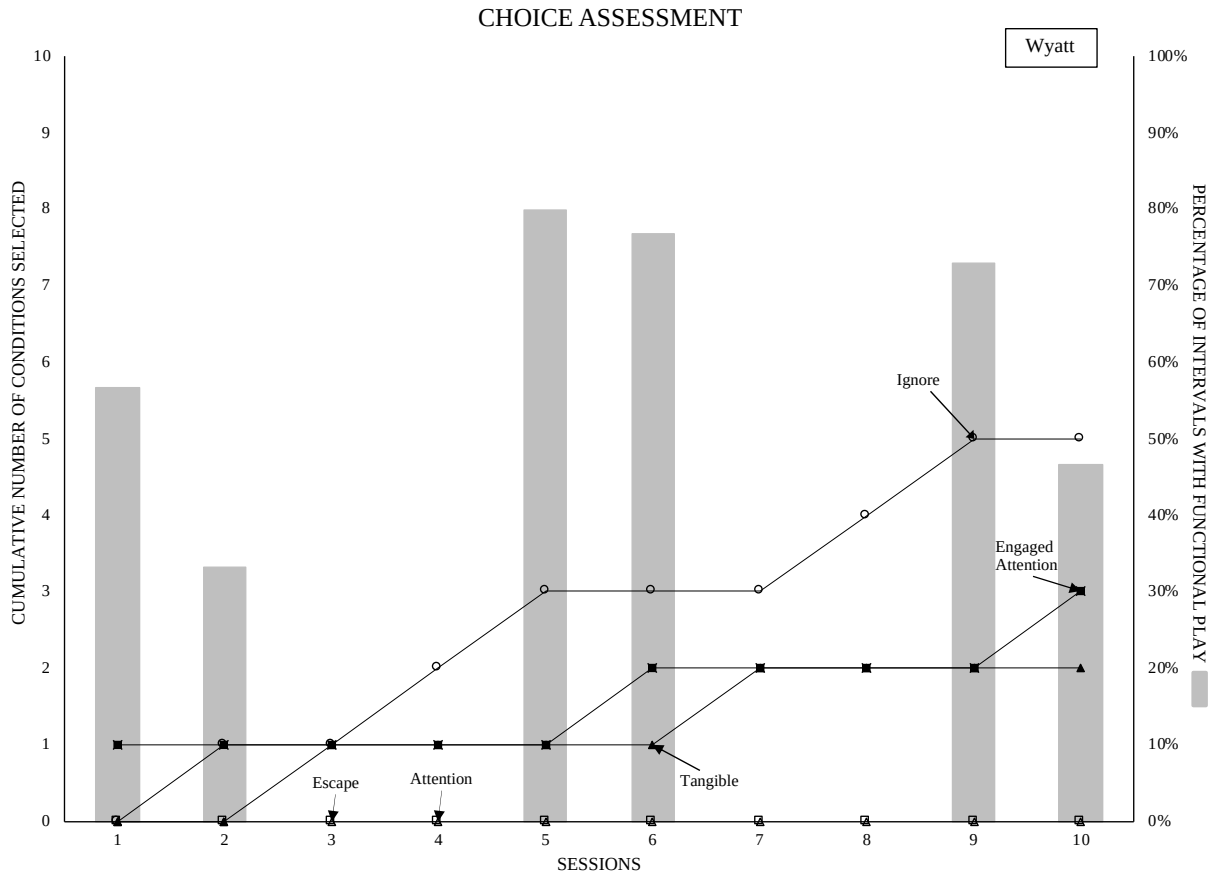
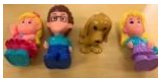


Figure 4. *Wyatt's choice assessment depicting the cumulative number of selected conditions across the escape, attention, tangible, ignore, and engaged attention conditions. Percentage of intervals demonstrating functional play is depicted on the secondary Y-axis*

Appendix

Play set	Figurines	Pictures	
School Themed	Baby Puppy Girl Older Woman		
Car Themed	Bus driver Car Truck Little boy		
Blue/green House	Alien Man Buzz Lightyear Girl		
Farm Themed	Pig Cow Chicken Farmer		
Pink/purple House	Girl Man Dog Woman		

Appendix A. *Play sets and figurines for preference assessment*

Table 2

Operational Definitions

Participant	Behavior	Operational definition
Wyatt	Aggression	Any attempt or follow through of a strike, kick or head butt, directed towards therapist
	Self-injurious behavior	Banging head on a surface, an open palm or closed fist contacting his own body using a back and forth motion or using an object to contact his own body using a back and forth motion
	Screaming/crying	Vocalizations at a volume above normal conversational level for any period of time; occurrence of vocalization accompained by facial contraction with or without tears for any period of time
	Flopping	Any instance of falling to the floor with no visible cause to fall (i.e. tripping)
Ava	Pica	Any instance of placing an inedible item past the plane of her lips. Includes edible items from the floor and edible items for lesiure (e.g., beans or rice)
	Crying	Any occurrence of a vocalization louder than a conversational level with an onset/offset of 2 s. Does not include laughing. AND/OR any occurrence of the presentation of tears with an offset of wiping the tears
Randall	Aggression	Hitting: using any part of his body to make forceful physical contact with another person. Pushing: using his body or hands to propel an using a back and forth motion. Pinching: using a pincer grasp or grab with hands to forcefully grasp another person's skin or clothing. Biting: open mouth and teeth coming into contact with another person's mouth and teeth coming into contact with another person's body with his skin between his teeth
	Self-injurious behavior	Any instance of contacting body with force that causes or has the potential to cause bodily harm. Hitting, kicking, scratching, biting, pulling hair, hitting ears
	Screaming/crying	Raising his voice above appropriate level for the environment
	Elopement	Any instance of leaving the table during work time, or attempts to leave the therapy room without an adult within 3 feet
	Flopping	Any instance of forcefully falling to the floor from a standing position or a sitting position, without obvious cause (i.e. tripping)
	Property Destruction	Swiping, throwing, or ripping materials (includes work materials, books

Appendix B. *Problem behavior operational definitions*

Table 3

Color Preference Assessments

Participant	Preference Assessment	Colors Used in Study
Wyatt	Paired-stimulus	Gray, purple, yellow, green, blue, orange
Ava	Multiple-stimulus without replacement	Brown, red, pink, yellow blue, black
Randall	Multiple-stimulus without replacement	Gray, purple, yellow, green black, blue

Appendix C. *Color Preference Assessment*