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An Analysis of Variability of Play Behavior with Preschool Children with Autism

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AN ANALYSIS OF VARIABILITY OF PLAY BEHAVIOR WITH PRESCHOOL CHILDREN WITH AUTISM

by

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ABSTRACT

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Utah State University, 2016

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Research has demonstrated that when response variability is treated as a behavioral operant, it can be increased by implementing a reinforcement contingency on a lag schedule. A multiple baseline across participants was used to evaluate the effectiveness of a lag schedule and manual prompting procedure on the play behavior of three children with autism. The intervention procedure was used to evaluate response variability while probes were conducted to see if variability generalized to two other similar play sets. All three participants demonstrated varied play actions in the presence of the lag schedule and prompting procedure. When the lag schedule was removed in a 2-week maintenance check, responding remained at high rates but stereotypical patterns were observed.

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PUBLIC ABSTRACT

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Mary Katherine Endicott Harris

Children with autism often display repetitive, stereotypical movements with toys in lieu of appropriate play skills. Unlike typically developing children, they do not vary their play with toys. Therefore, the purpose of this study was to determine whether three preschoolers with autism would vary their play actions when exposed to a lag schedule of reinforcement and physical prompting procedure. All three participants demonstrated varied play actions with the lag schedule and prompting procedure in place. These behaviors maintained when a probe was conducted two weeks later in the absence of the lag schedule. Although responding was high in the 2-week probes, participants demonstrated stereotypical patterns of behavior. This indicates a lag schedule and prompting procedure may be effective for evoking varied behavior in play.

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Mary Katherine Endicott Harris

CONTENTS

Page

LIST OF TABLES

LIST OF FIGURES

CHAPTER I

INTRODUCTION

Autism spectrum disorder (ASD) is a pervasive developmental disorder, affecting 1 in approximately 68 children (Centers for Disease Control and Prevention, 2015). Autism is characterized by severe impairments in social and language development, as well as delays in a variety of other skill domains. Autism diagnoses are based solely on observation; there is no genetic test or medical test at this time to provide a diagnosis. After careful observations are conducted, if certain behavioral criteria are met, a diagnosis is given. These criteria can be found in the *Diagnostic and Statistical Manual of Mental Disorders-Fifth Edition* (DSM-V; American Psychiatric Association [APA], 2013). Many children who are eventually diagnosed with autism display a pattern of typical development until the age of 18 months, demonstrating some functional language as well as social and play skills. Skills then begin to deteriorate, and the child begins to display the marked deficits in social and language skills characteristic of the disorder. At this time, there is no known cause for the disorder. It is only known that autism is a pervasive developmental disorder of suspected neurobiological origin.

Play skills are considered an important hallmark of development and typically developing children learn as they explore their environment through play. As these play skills develop, typically developing children then contact social reinforcement and begin to build social skills. Children with autism, however, often demonstrate stereotypical and rigid behaviors when presented with toys. These excessive behaviors can severely impair or prevent play skills from developing. These stereotypical behaviors can be defined as

"restricted, repetitive patterns of behavior, interests, or activities. Stereotyped or repetitive motor movements, use of objects, or speech (e.g., simple motor stereotypies, lining up toys or flipping objects, echolalia, idiosyncratic phrases)" (APA, 2013). Children with autism can, therefore, benefit from instruction on how to appropriately engage with toys, and the teaching of play skills can be approached as in any other skill acquisition program. This can be done through prompting procedures and reinforcement. Children with autism can then acquire the skills necessary to access those social and communicative opportunities afforded by a successful play repertoire. Play skills have value in that they do the following: set the occasion for having social and communicative interactions with peers, increase the likelihood of learning in natural and inclusive settings, and offer a foundation for developing leisure skills (Barton & Wolery, 2008.)

Play is a complex repertoire, composed of many different behaviors. In order to effectively teach a play repertoire, it is important to replace the stereotypical and repetitive behaviors with varied play behavior. It is also valuable to apply techniques of teaching variable behavior to the area of play. Many researchers have addressed the utility of teaching variable behavior (Neuringer, 2002.). Variability, or response variation, is defined broadly as the extent to which responses in a response class differ from one another along any dimension (Neuringer, 2002). Varied responses allow more opportunities for reinforcement, and, therefore, allow individuals to more effectively learn from their environments (Neuringer, 2002). Individuals with autism display invariant behavior due to a limited skill repertoire, or environmental contingencies may not support varied responses even though they have been emitted (Lee, Sturmey, &

Fields, 2007, as cited in Wolfe, Slocum, & Kunnavatana, 2014.) Recently, researchers addressed invariant behavior by treating variability as a reinforceable dimension of behavior, using a variety of contingencies to treat response variability as an operant. Other researchers do not manipulate variability as an operant but assess the difference between children with autism and their typically developing peers.

Williams, Reddy, and Costall (2001) examined the functional play of 15 typically developing infants and 15 children with autism. Williams et al. visited each child in their home and placed a set of toys in front of the child, then recorded the interactions with toys for a 15-minute interval. The children with autism demonstrated acts of functional play (defined as functionally using an object [e.g., pushing a car, stirring with a spoon, in the way it is meant to be used]), but less time engaged in functional play and demonstrated fewer functional acts than the typically developing children. The children with autism demonstrated less diverse play actions as well. This once more emphasizes what we know about children with autism: because they are more likely to display invariant responding (Baron-Cohen, 1992) they must be taught to play appropriately with toys and to specifically vary their responses in any skill domain, including play.

In the previous studies, researchers evaluated the behavior of individuals with autism and found first that individuals with autism have a decreased level of variance when compared to typical peers. Second, in order for participants to vary their behavior, specific procedures must be in place. When specific reinforcement contingencies are applied, variance of behavior can be increased in a manner similar to any other skill-building program. This is also relevant to the applications of acquisition of play behavior.

CHAPTER II

LITERATURE REVIEW

Research Supporting the Existence of Invariant Responding

In this chapter, I provide a brief summary of the relevant research on applied variability studies, the relevant research on lag reinforcement contingencies, and the studies that assess effective techniques for teaching play skills to children with autism. I will then review studies that applied techniques to evoke varied responding in the area of play for children with autism.

In one of the first studies of invariant responding, Frith (1972) compared the varied selections of 50 children in color and tone tasks. Of the participants, 20 had a diagnosis of autism, 20 were typically developing, and 10 were children of atypical development matched for mental age. Two different tasks were presented: one involving color with stamps and one involving tones on a xylophone. In the color task, participants were asked to stamp 16 squares on a piece of paper. In the first trials, only two colors were made available. In the last four trials, four colors were available. This was similar to the tonal task: children were presented with a xylophone. In the first trial presented, only two tones were available. During the second trial, four tones were available. Results indicate children with autism rarely created a sequence of color on the paper or tone on the xylophone that had not been used in one of the previous trials, compared to the typically developing children who created novel sequences approximately half of the time. In addition, children with autism were less likely to use all of the materials or tones

available.

Boucher (1977) conducted a similar study by assessing variance through play with 21 children with autism and 21 typically developing children (matched for sex, age, and nonverbal ability). Participants were presented with a toy car and a choice of three garages and three separate pathways leading to those garages. During the first 10 trials, only two routes were available. During the next three trials, all three routes were available. Children with autism were less likely to utilize all three routes, compared to the typically developing children. Only 12 out of the 21 children with autism used the new pathway, compared to all 21 of the typically developing children.

Frith (1972) and Boucher (1977) confirmed that children with autism display invariant responding compared to their typically developing peers through the use of play materials. Although both researchers confirmed the lack of variability, there was no reinforcement of varied responses. Children with autism can gain play skills through a variety of methods when specific behaviors are targeted, but that does not ensure variability.

Research Supporting Variability as an Operant

In one of the first applied studies to manipulate response variability, Goetz and Baer (1973) analyzed the block building behavior of three neurotypical 4-year-old girls. The authors defined measurable behaviors by block forms, or structures. Twenty block forms were commonly observed in block play, and were arbitrarily defined as the basic forms to measure. A form diversity score was defined as the number of these 20 forms

appearing at least once in a session. A "new forms" score was defined as the number of any of the 20 forms appearing in a session that had not appeared in any prior session of block building. Duration of sessions were defined as beginning with the first block being set down, and ended when the child said they were finished or when a teacher asked if the child was finished and they responded with an affirmation. Under a condition in which researchers delivered reinforcement for different block forms, that had not previously appeared in that particular session each participant constructed new forms of block design. One participant showed 9 new forms, another displayed 14, and another 16. On the average across all participants during periods of reinforcement, there were 1.5 new forms per session. Although the participants in this study did not have a disability, this application of reinforcement of varied responding is relevant to play behaviors of children with autism who demonstrate skill deficits in play similar to the three preschool girls.

Goetz and Baer (1973) established a criterion that to receive praise or enthusiastic remarks from an adult staff member, the participants had to build a new creation that had not been constructed during that particular session. Through the application of praise and a requirement to construct something new, they increased varied play behavior. Neuringer (2002) suggested that varied behavior could be established through the establishment of a lag schedule, similar to Goetz and Baer's session criterion. During a lag schedule, reinforcement is delivered contingent on a response that differs from responding emitted on a specified number of previous opportunities. A lag schedule establishes the contingency: *Do something new every x number of responses.* Lag

schedules have been implemented in many studies with individuals with autism to increase appropriate behaviors, primarily responses to social questions.

Research that Supports the Use of Extinction to Induce Variability

Extinction induced variability is supported by natural contingencies. If I am trying to get into my house and have forgotten my key and know the door is locked, it would be an exercise in futility to keep trying to open the door repeatedly. Door opening would be extinguished while I tried other means of getting into the house. This principle could be applied to any behavior—it is likely that through the of use basic principles of behavior varied responding could be reinforced and repetition extinguished. Lalli, Zanolli, and Wohn (1994) used extinction and positive reinforcement to vary the play behavior of two participants. Helen was a 4-year-old girl and James was a 5-year-old boy, both with developmental delays. Researchers selected three toys (airplane, doll, animal) and described all possible appropriate topographies for each toy behavior. Examples include: takeoffs, landings, spinning the propeller for the airplane, and walking, dancing, feeding, or grooming the doll or animal.

During the training condition the therapist physically prompted a horizontal movement for the airplane and walking the doll or animal. Probes were started the next day, during which the therapist provided praise for the trained behavior and after three instances, placed the behavior on extinction. The therapist then repeated these steps for each untrained topography (reinforce three times, then place behavior on extinction). Basically, trained, then untrained topographies were put on extinction to assess whether

the participants emitted a different topographical behavior. Helen emitted the trained response and one novel response in the first extinction session. Untrained airplane topographies were observed in extinction sessions 5, 6, 8, 11, 14, and 16 (two topographies). Helen's novel doll topographies were observed in extinction sessions 4, 6, 7, 10, 12, and 14. James demonstrated untrained topographies with the animal in extinction sessions 12, 15, 17, 18 (two topographies), 19, and 20, and untrained topographies with the airplane in extinction sessions 13, 16 (two topographies), 17, 18, 21 (two topographies), 23, and 25. By placing trained play behaviors on extinction, untrained topographies were demonstrated by both participants.

Extinction can be a useful method for evoking varied behavior, but sometimes the addition of other techniques can prove beneficial as well. Betz, Higbee, Kelley, Sellers, and Pollard (2011) applied extinction procedures with the addition of script training to increase variability of mand frames for three preschoolers with autism. Jill, Travis, and Drew were all 3 or 4 years old. Each used a minimum of three-word-phrases, and one or two mand frames (defined as the beginning of a request, such as “I want ____” or “I need _____”). Mand frames had to contain a subject, verb, and relevant noun (snack item). Experimenters defined a novel mand as one that varied from any other mand in the session beyond adding or subtracting articles, conjunctions, the word please, or the instructor’s name. Scripts were delivered through the use of voice recorders sessions began with a modified preference assessment of 10 snack items. The first three items chosen were then used in the snack session. During baseline, experimenters reinforced all mand frames by providing access to the snack item. During the extinction phase

experimenters reinforced a mand frame the first time it was spoken. After the first occurrence, that frame was no longer reinforced. In the script training phase, participants were taught to emit three mand frames using the voice recorders, which initially contained the full script (i.e., “I would like ____”). The phrase was systematically faded to “I would ___” and then “I _____” when participants followed the script for 90% of opportunities for one session. One participant (Drew) required an additional intervention when he did not respond to the initial script-training procedure. An intervention was implemented in which all three auditory scripts were present, and then faded according to the initial criterion of 90%.

Results indicate all participants emitted an increased number of mand frames after multiple script-training conditions. In the final extinction condition, Jill increased her repertoire of novel mand frames to four, and Travis increased his repertoire to five novel mand frames. These behaviors maintained during a 2-week follow up and a generalization probe snack session with other peers or family members present. During the additional intervention, Drew emitted up to five novel frames during a session but only three trained scripts maintained during maintenance and generalization. An important finding of this study is that neither extinction alone nor script training alone was sufficient to teach variability of mand frames. However, combining both procedures resulted in the variability of participant’s behaviors.

Research that Supports the Use of Lag Reinforcement Schedules

Although in Lalli et al. (1994) and Betz et al. (2011), extinction and extinction

with scripts proved to be effective methods for evoking varied behavior, many of the more recent applied variability studies involve the addition of a specified schedule of reinforcement, also known as a lag schedule. A lag schedule is a schedule of reinforcement that stipulates a behavior must differ from a certain number of responses that were demonstrated prior to a specified response. In the applied literature, a common thread of application was the use of lag schedules to increase vocal production in children with autism who had limited verbal repertoires. Lag schedules were effective in shaping new or varied responses in children with autism who produce very few phonemes or sounds. Although vocal production is very different than actions or play behavior, the following studies have merit in that they support the implementation of the lag schedule to increase variability of responding with individuals with autism.

Three studies implemented lag schedules of reinforcement to increase specific components of language. Esch, Esch, and Love (2009) assessed vocal response variability with two nonverbal children with autism. Randall was 7 years old and Chandler was 2 years old; both emitted infrequent repetitive sounds. Vocal variability was defined as: "any vocalization whose phonemes differed in topography (lee, mop) or in sequence (ub, buh) from those uttered in the previous trial." Prior to intervention, brief Multiple Stimulus Without Replacement (MSWO; Carr, Nicolson, & Higbee, 2000) procedures were conducted and the three highest ranking items were used as preferred items for the Lag 1 condition. A nonconcurrent multiple baseline across participants with a reversal was used to assess vocal variability (novel phonemes) as the dependent variable.

During the Lag 1 condition, the child was given access to a preferred item, which

was then removed and put out of reach. Vocal models were presented as in baseline. A vocal response that varied from the last was reinforced with access to the preferred item.

Results indicate the lag schedule was effective in increasing vocal variability for both participants. For Randall, his varied responses ranged from 0 to 8, and for Chandler the range was 0 to 5. This extends the work of Lee, McComas, and Jawor (2002) but further highlights the limitations of a lag 1. The authors mention further research should be conducted evaluating lag 2 and lag 3 schedules of reinforcement to provide extinction resistant behaviors, and that further research should more clearly define vocal variability in order to produce more functional speed (the authors feared the sounds reinforced may have limited opportunities for the participants to emit other sounds required for future speech production).

Koehler-Platten, Grow, Schulze, and Bertone (2013) extended the research of Esch et al. (2009) by limiting the vocal variability of responses to those that included a novel phoneme. Three children with autism participated: Chloe was 2 years old, Ari was 6 years old, and Lily was 5 years old. All participants were assessed using the Verbal Behavior Milestones Assessment & Placement Program or VB-MAPP (Sundberg, 2008). Similar to Esch et al., the dependent variable was the cumulative number of novel phonemes. Procedures were similar to Esch et al. but the first condition was a continuous reinforcement schedule, prior to the Lag 1 condition. However, results in this study were inconclusive as, initially, the production of novel sounds increased but as the continuous reinforcement schedule continued, the variability of responses actually decreased. The participants demonstrated a plateau of responding prior to the Lag 1 schedule being

implemented.

Lee et al. (2002) demonstrated that variability is a reinforceable dimension of behavior by implementing a lag schedule with two 7-year-old boys and a 27-year-old man. This study has applications in social validity as it addressed the need for varied responding in conversation, which can then increase reinforcement opportunities in social contexts. The participants were diagnosed with autism and could speak in full sentences. However, each participant routinely responded with a rote response for certain questions. For the two 7-year-old participants, the question was" What do you like to do?" For the 27-year-old participant, the question was" How are you?" Sessions were conducted in the after school cafeteria for the children, and in the rehabilitation center for the adult. The dependent variable was the percentage of varied appropriate verbal responding to a social question. For each session, the examiner sat across the table from the participant and asked the target question. The response was recorded, then the question was asked an additional ten times. This allowed 10 opportunities for varied responding.

The reinforcement schedule was delivered contingent on responses that fulfilled the lag requirement of 1 (responses had to differ from the last response). For one of the 7-year-old participants, responding varied between 40% and 70% when the lag requirement was in place. For the other 7-year-old participant, variability of responses increased and remained stable between 50% and 70%. For the adult participant, variability in the lag condition only reached 30%. Thus, for two of the three participants, a lag schedule was effective in increasing variability of responses to social questions.

A limitation that must be mentioned was that participants were allowed to gain

access to reinforcement by alternating between two responses for every session. The authors mention that this might have inadvertently established a higher order stereotypical pattern of behavior, and that in future studies researchers should evaluate the role of prompting procedures to establish variable and socially meaningful behaviors in natural settings. This is a risk of setting the lag schedule at a low response rate, especially since children with autism often demonstrate stereotypical behaviors in a repetitive and rigid manner.

Susa and Schlinger (2012) continued to investigate the use of lag schedules on verbal behavior but in a more functional extension of Lee et al. (2002). They replicated Lee's procedures with Jack, a 7-year-old boy with autism. Jack had a fairly well-established mand repertoire and could tact 200 items and respond to approximately 30 social questions. However, whenever Jack was asked "How are you?" he always responded with the rigid response "Fine." Jack's caregiver selected items to be used as reinforcers throughout the study. The question, "How are you?" was always presented.

When the first condition (lag 1) went into effect, echoic prompts were provided for incorrect responses or responses that did not meet the lag criterion. Initial prompted sessions were followed by sessions in which incorrect responses were consequated by a brief (3 second) extinction period. This was to teach Jack new responses, since he had only ever responded with "Fine." A changing criterion design was used to evaluate different lag schedules of vocal responses. Results of this study indicate Jack's variability of responses increased as the lag schedule increased. The authors suggest that as variability is established as a reinforceable dimension of behavior, further research needs

to be conducted to increase variability of verbal responses so individuals with autism may acquire more socially fluid conversation skills.

Lee and Sturmey (2006) also examined the effects of lag schedules on conversational responses, but examined answers to the social question, "What do you like to do?" Participants were three teenage males, each diagnosed with autism. All had expressive verbal skills and could mand for a variety of items. The authors measured the percentage of appropriate and varied responses to the question "What do you like to do?" the cumulative number of novel responses, and the number of different vocal responses each session. Intervention consisted of an MSWO preference assessment (DeLeon & Iwata, 1996) to determine which items would be present during the sessions. Depending on the condition the number of items preferred by the participant varied. There were either 0, 5, or 10 preferred items used. (This was to control for the presence of preferred tangible stimuli during the training sessions.) The experimenter would then ask the question "What do you like to do?" If the participant responded with a socially acceptable response, reinforcement was delivered. If the participant responded incorrectly, a correction was delivered and the experimenter turned away. During the Lag 1 condition, reinforcement was contingent on the participant giving a response that varied from the previous trial. Results indicate the Lag 1 schedule was sufficient to increase variations to the social question for two of the three participants.

Lee and Sturmey (2014) continued to explore this line of research by applying a lag reinforcement schedule to conversation training for three children with autism with the addition of a script fading procedure. The script component was added to address

weaknesses in the previous studies; lack of variability of responses could be attributed to a limited verbal repertoire. A language training procedure that precedes a lag requirement could result in more possible responses to reinforce in the lag schedule. A multiple-baseline across participants' design was used to assess varied responding.

Participants were a 6-year-old girl (Chely), a 6-year-old boy (Alan), and an 11-year-old boy (Bernard). All had diagnoses of autism and well-established verbal repertoires. For the basic procedure, the experimenter initiated a conversation made up of alternating turns with the participant until each speaker emitted three statements. Five conversations were conducted each session, which equaled 15 trials. Dependent variables included percentage of trials with appropriate responding, varied responding, and appropriate and varied responding (both criteria). During the script condition, 27 possible scripts were trained using combinations selected from a random number generator. These scripts included a variety of greetings, descriptions of activities, and questions involving the seeking of further information from the conversation partner. The script condition preceded the Lag-0 condition, and scripts were trained using a Language Master machine in order to teach all 27 phrases, which were each comprised of 4 words.

During the Lag-0 condition, participants received tokens on a previously established token board for responding to an initial question. If participants gave an inappropriate response, the experimenter said "No" and skipped to the next part of the conversation. If the participant gave an approximation, the experimenter modeled the correct response. During the next phase, scripts and the Language Master machine were placed in between the participant and experimenter. Physical prompts were used to guide

the participant to use the scripts. If the participant echoed the script, he or she received praise and a token. If no response was given, physical prompts were provided until the participant emitted the response. A spatial-fading procedure was used to systematically fade physical prompts, as words were removed from the ends of the scripts until each script consisted of only one word. All script materials were then removed for a return to Lag-0. The next condition then began with the implementation of a Lag-1 contingency. If the participant responded incorrectly, the experimenter repeated the first conversational statement until a varied response was given or five trials went by without variation.

Results indicate language training with scripts was very effective for increasing varied responding in all three participants. The authors reported mean variability scores for each participant for the Lag-0, Scripting, Lag-0, and Lag-1 conditions. For Chely, these were 2.12, 3.38, 4.19, and 5.54. For Alan, these were 2.87, 3.22, 1.32, and 5.41. For Bernard, these were 1.83, 3.86, 1.17, and 1.98. The authors report that although variability did occur, the conversational skills of the participants were lacking compared to their neurotypical peers. Generalization to a new instructor in a new setting did not occur, so further research should be conducted on the relationship between response variability and response generalization in relation to the number of exemplars used in training. The authors also suggest analyzing response variations (or frames) in the presence and absence of a script.

Lag Schedules to Evoke Leisure and Play Behaviors

The previous studies demonstrated the effectiveness of the application of lag

studies to increase response variability of components of language (either increasing vocalizations or entire conversational exchanges). Lag schedules have also been implemented to increase response variability in the areas of play skills with materials and in computer games, but there are a limited number of studies. Napolitano, Smith, Zarcone, Goodkin, and McAdam (2010) extended the work of Goetz and Baer's (1973) block building study by adding a Lag 1 reinforcement schedule to teach six children with autism to vary their block structures in play. During baseline, participants were given blocks and told, "Build something." Praise was delivered by the experimenter intermittently and at least once per session for building behavior. In the Lag 1 schedule condition, the experimenter delivered tangible reinforcers for 30-second durations or edible reinforcers for using a colored block that differed from the last color used. For four of the six participants, the experimenter had to implement teaching trials because the Lag 1 schedule was not sufficient in increasing variability in play. The teaching trials consisted of the experimenter modeling a different structure and saying, "Now you build something different." Overall, the Lag 1 schedule and additional prompted teaching trials were effective in teaching the participants to vary their block-building behavior.

Murray and Healy (2013) continued to investigate the operant nature of variability by implementing lag schedules of reinforcement in a computer-based task with children with autism. Participants were ten children with autism and ten neurotypical children ranging in age from 5 years old to 15 years old. The authors of this study hypothesized that variability of responses is higher when reinforcement is contingent on higher variability. The computer-based task involved a game that required participants to fulfill

a lag criterion to progress through the levels. To make the character move in the game, participants pressed a sequence of keys. When participants varied the key sequence, the character moved forward and written feedback appeared on the computer screen. Results indicate the neurotypical group varied their responses in both the non-lag criterion setting and the lag-criterion setting. The children with autism did not vary their sequences as much without the lag-criterion in place, but once it was required, variability of responding increased. However, the children with autism demonstrated lower rates in responding in general. The authors suggest pursuing the use of lag schedules of reinforcement with children with autism, as it can yield encouraging outcomes in the area of variability.

Baruni, Rapp, Lipe, and Novotny (2014) applied a lag schedule to toy play. Participants in this study were a 6-year-old boy with autism (Brian), an 8-year-old boy with autism (Jeremy), and a 12-year-old girl with cerebral palsy and an intellectual disability (Tina). Dependent measures were the cumulative number of novel toy play responses across sessions and the percent of time with toy engagement within each session.

The procedure began with a brief, modified MSWO. During the Lag 1 Schedule, the experimenter provided the toy and the instruction “play” but delivered a preferred edible after the first observed play response of the session. After the delivery of the edible, the experimenter continued to deliver edibles for responses that met the requirement of the lag schedule (any response that differed from the preceding response.) Participants could repeat a behavior within the session, but to receive an edible the

response had to differ than the previous one. This phase was terminated when the participant did not emit a novel toy play response for seven consecutive sessions. A new condition was then introduced with a lag 2 schedule, with the exact procedure but with new reinforcement contingency. Edibles were only delivered if the toy response differed from the previous two responses. After seven consecutive sessions devoid of novel responses, this phase was terminated.

Brian displayed nine novel car play responses in baseline, but over four sessions his engagement with the car decreased (mean of 88%). When the lag 1 schedule was in effect, the cumulative number of play responses increased to 20 across 13 sessions. Engagement time varied (mean of 61.2%). When the lag 2 schedule was implemented, Brian's cumulative car responses increased to 21 during eight sessions but engagement time continued to be variable (mean of 69.5%). Jeremy displayed six cumulative train responses and an increasing trend in engagement (mean of 75.5%) during baseline. During the lag 1 schedule, train play increased to 12 responses, but engagement was variable (mean of 53%). During the lag 2 schedule, cumulative responses increased to 13 across ten sessions, but engagement continued to be variable (mean of 33.5%). Tina displayed nine cumulative airplane play responses across seven sessions and toy engagement remained high (mean of 86.4%). In the lag 1 schedule, cumulative airplane responses increased to 26 in 24 sessions with toy engagement remaining high (mean of 72.8%).

An interesting find of this study was although implementing a lag schedule increased the cumulative number of toy responses for each participant, it resulted in a

decrease in toy engagement across sessions. For Brian and Jeremy, the lag 2 schedule produced only one novel response while engagement remained relatively unchanged or decreased. Baruni et al. (2014) suggested that future research should evaluate procedures for delivering a consequence without interfering with the participant's responding, as well as investigating whether increasing variability with one toy generalizes to different toys.

Baruni et al. (2014) specifically addressed variability in play, but did not specifically address teaching play: responses were reinforced on a lag schedule, but these could have been inappropriate or stereotypical responses. This is the only applied study that specifically addresses the application of a lag schedule in functional play with children with autism, but does not address empirical methods of skill acquisition in the area of play. This then warrants a brief review of what effective tools are currently being used to teach play to children with autism, and if there are ways to incorporate the use of operant variability techniques into those current practices.

Research On Play Skills for Children with Autism

Play is complex—it includes many dimensions and is a valuable conduit for the acquisition of other developmental skills. Play typically begins with solitary play, and children with autism have difficulty with even this first step (Terpstra, Higgins, & Pierce, 2002). With the right intervention, children with autism can demonstrate effective play skills. Methods that researchers have demonstrated to be effective in teaching play skills to children with autism include systematic prompting, pivotal response training, activity

schedules, and video modeling. A brief review is provided for each of these methods.

Systematic Prompting

For teaching play in isolation, a systematic prompting method can be effective whether it is least-to-most or simultaneous. These procedures include a model and prompt in order for the child to use the toy in the manner for which it was designed. This is effective for children who are receptive to prompts and lack the skill of how to appropriately interact with a toy in the manner it was designed. Researchers have demonstrated the efficacy of prompting to teach social play (Liber et al., 2008) and appropriate actions with a play activity (Lifter et al., 2005) but without an emphasis specifically on varied play.

Pivotal Response Training

Pivotal response training is a naturalistic technique incorporating the child's interests into discrete trials, while following the child's lead. This technique has been proven effective in teaching symbolic play (Stahmer, 1995) and sociodramatic play (Thorp et al., 1995) but is more effective for children who show interest in object manipulation, have imitation skills, and do not exhibit self-stimulatory behaviors. Both of the studies cited reported modest or variable generalization to different toys, but did not program for variability of behavior.

Activity Schedules

Activity schedules have been shown to be effective in promoting independent on task behavior, and in recent years have been shown to be just as effective in promoting

play. Betz, Higbee, and Reagon (2008) used a joint activity schedule (used by two peers, both with autism) to facilitate interactions in a board game. Brodhead. Higbee, Pollard, Akers, and Gerencser (2014) expanded on the application of the activity schedule to instruct preschoolers with autism to engage in a game of hide-and-seek, all through the use of the visual prompts and textual scripts included in the schedule. It is important to note that when the schedule was removed, responding returned to baseline levels, suggesting behavior was controlled by the schedule. Although the results of the intervention were successful in teaching children with autism to engage in hide-and-seek without adults intervening, the schedule was systematic and did not vary.

Video Modeling

Just as activity schedules provide a visual script of sorts for appropriate models of behavior, video modeling is another strategy utilizing visual prompts that can be an effective method to teach play skills. In recent years, researchers have begun to investigate the use of video modeling strategies to program for variability. Two studies have implemented video modeling as a technique for teaching varied play strategies.

Dupere, MacDonald, and Ahearn (2013) used video modeling to teach three children with autism to engage in varied pretend play. Two 6-year-olds and one 5-year-old participated, and had all received 6-36 months of intensive behavior intervention that included the use of video modeling to teach social skills. Three play sets were used (Noah's ark, a train, and a zoo) each with seven characters: one that was central to the scripts, three that were trained, and three untrained. Videos were then made that contained an adult acting out pretend-play sequences from the child's point of view. Each

video included approximately 15 actions and vocalizations. Each play set was the content of three videos, each showing a different character engaging in the actions and vocalizations. All seven characters for each set were visible in each video.

Researchers scored scripted actions and vocalizations, defined as motor actions and vocal statements matching the actions and statements modeled in the video. They then measured the trained and untrained characters used. In baseline, materials were present. In the video modeling condition, the participants watched the video twice before accessing the play materials. Training in the video modeling condition continued until each participant performed 80% of the scripted vocalizations and 80% of the scripted actions. Post training was then conducted, identical to baseline. Results indicate all three participants incorporated more untrained characters into play during the training condition than in baseline, but the number varied. The authors stated that further research should be conducted with a control condition in which videos are shown without varied characters to see if the participants would use untrained characters in that condition as well.

MacManus, MacDonald, and Ahearn (2015) further investigated variable play through the use of video modeling by applying it to matrix training with children with autism. Two 5-year-olds and a 6-year-old participated, all diagnosed with autism. They all attended an intensive early intervention program. Materials included three play sets (a bank, a mansion, and a castle) with two characters, one object, and one vehicle. Video models included 30-40 scripted actions and 30 scripted vocalizations based on the three-dimensional model used in Goldstein and Mousetis (1989). Researchers trained on one

set (e.g., the bank) and would then probe with the alternative sets of materials (mansion with castle materials) to see if participants demonstrated generalized play actions and vocalizations.

Researchers defined the dependent variable as percentages of actions and vocalizations completed in the response chain for each set. They did not need to be in a certain order. Scripted action was defined as any action similar to the model, and scripted vocalizations were any vocal statement that was similar to the model in the video. Recombined actions were those identical to the action in the video but with a substitution of character, object, or vehicle because the original was unavailable. Recombined vocalizations were defined as vocal statements that matched or were similar to the modeled statement in the video involving an appropriate character instead of an unavailable character in the probes after training. Unscripted vocalization was those that were not scripted from the video model but were contextually appropriate.

In baseline, the sets were presented with the materials. In the training session, the participant watched the video specific to the play set two times, then were allowed access to the set. When participants could demonstrate 80% of scripted actions and vocalizations, mastery probes were conducted (identical to baseline.)

Results demonstrate that video modeling was successful in substantially increasing target responding for each participant. The matrix training protocol produced generalization of scripted vocalizations and actions across all three play sets. With exposure to additional video modeling scripted play, generative responding increased in alternative probe sessions. This demonstrates that when exposed to multiple exemplars of

actions and vocalizations, participants demonstrated increased combinations of play.

The results of these last two studies highlight the effectiveness of one method of increasing varied responding in play for children with autism. This is valuable, as it is important for children with autism to learn how and when to vary their behavior in the area of play. What these studies have demonstrated is that there is knowledge on increasing behavior through the application of lag reinforcement schedules, and that is it effective for certain skill sets for individuals with autism. We have also reviewed studies on methods of play that have increased variability and generative behaviors.

These studies have demonstrated that children with autism can emit varied responses when lag schedules of reinforcement are established and systematic procedures put in place. Because studies that evaluated lag schedules have already demonstrated efficacy in increasing variance, it is a natural extension of the research to apply these methods to play behavior. Although there are effective methods to teach play to children with autism, the lack of variability in play studies warrants a further investigation. The purpose of the present study was to combine the demonstrated effectiveness of the lag schedules and prompting procedures in order to increase variance of play behavior in play sets. If the procedures can effectively increase other topographies of responses, they may then be an effective method to teach play variability.

Research questions were as follows.

1. To what extent will a lag reinforcement schedule and prompting procedure increase variability of toy play in children with autism as measured by:

    a) The frequency of different play actions?

b) The total number of responses per session that met the lag schedule requirement?

c) The total number of responses per session?

2. To what extent will these play skills generalize to two new sets of stimuli as measured by frequency of varied play actions?

3. To what extent will participants demonstrate combinations of play that have not been taught/prompted within a session?

4. If variability of play behavior is established, to what extent will variability of play actions maintain with the removal of the lag reinforcement schedule?

Secondary measures were as follows.

a. To what extent will spontaneous play actions emerge before the prompt sequence is initiated? (Will participants engage in play when the set is presented, or will they wait for the prompt?)

b. To what extent will independent responses have on the prompt sequence? If there is an established increase in responding, will that affect the number of within-session prompt sequences conducted?

CHAPTER III

METHOD

Participants

Three children, ages 3 to 5 years, enrolled in a university-based intensive-behavioral intervention program for participants with ASD served as participants. All had received independent diagnoses of ASD by outside agencies or physicians, according to DSM-V criteria. All participants attended a university-based intensive-behavioral intervention preschool for approximately 20 hours per week, during which they received instruction on a 1:1 basis in a discrete trial format with paraprofessionals under the supervision of a certified teacher or behavior analyst. Each had attended the intensive preschool for at least three months. All participants used speech as their primary form of communication. Each possessed an extensive imitative repertoire when adults delivered an instruction to imitate a physical action. Upon entering the intensive behavioral program, the VB-MAPP (Sundberg, 2008) was administered to each participant. To be eligible to participate in this study, participants demonstrated three or fewer different play actions within a toy set within a duration of five minutes over three sessions with that particular play set. If a child demonstrated more than five different actions within the 5-minute interval, they were not eligible for participation.

Warren

Warren was a 5-year-old Caucasian male from the U.S., and English was the primary language spoken in his home. He was diagnosed with autism by an outside

agency. He consistently showed little interest in play sets. If he did interact with components from a set, he engaged in repetitive self-stimulatory or stereotypical behaviors involving those components. Warren could imitate gross motor actions, and was receptive to hand-over-hand prompts. He was described at a Level 1 in the VB-MAPP in that he demonstrated some receptive skills, some matching skills, and established manding skills through the use of visual prompts. He was beginning to emit vocalizations at the time of the study, but they were approximations.

Aaron

Aaron was a 4-year-old Caucasian male from the U.S., and English was the primary language spoken in his home. He was diagnosed with autism by an outside agency. He demonstrated very few appropriate play actions with play sets, and would engage in self-stimulatory behaviors when presented with a set. Aaron could imitate gross motor actions and was receptive to hand-over-hand prompting. He was also considered a Level 1 learner according to the VB-MAPP. He receptively identified and expressively labeled basic vocabulary, and requested multiple items using a picture system. He demonstrated very little spontaneous language.

Evan

Evan was a 3-year-old Caucasian male from the U.S., and English was the primary language spoken in his home. He was diagnosed with autism by an outside agency. Prior to the beginning of the study, Evan stared at toys without engaging in any play actions. He was considered a Level 1/Level 2 learner on the VB-MAPP, in that he

responded vocally to many different questions but would not initiate any conversation. He possessed solid academic skills but was heavily prompt dependent.

Setting

We conducted all sessions in a small research room in the preschool (approximately 5’ x 6’).

Materials

We conducted research sessions at a small table. Chairs were available but participants stood at the table during each session in order to access both sides of the play set. Researchers had data collection materials (e.g. data sheet and pencil) available, along with a timer, a flip camera, and a visual timer Generalization probe sessions were conducted in the same research room. Play materials consisted of five play sets of equivalent detail (see Figure 1). Three play sets were used for each participant. Edible items were delivered directly on the table or in the participant’s hand for Warren and Aaron. Song clips were delivered for Evan on a phone via a music application.

During each session, the designated play set was placed in front of the participant. The three play sets used for each participant were determined prior to the study. See Table 1 for a list of what play set was used for each participant.

Table 1

The Designated Intervention and Generalization Probe Play Sets for Each Participant

Participant	Intervention set or generalization probe	Play set
Warren	Intervention	Treehouse zoo
	Generalization probe	Castle
	Generalization probe	Farm
Aaron	Intervention	Treehouse zoo
	Generalization probe	Disneyland set
	Generalization probe	Farm
Evan	Intervention	House
	Generalization probe	Treehouse zoo
	Generalization probe	Farm

Figure 1. An example of a play set.

Response Definition and Measurement

Measuring Variability of Play Actions

We defined play actions as any appropriate motor movement involving a character of the play set interacting with the actual set (e.g., the treehouse or house.). Play sets were defined as an entire toy set, such as a farm complete with silo, moving gates, farmer, and farm animals. Play actions were defined as any socially appropriate toy

action within the set. In order for play actions to be considered different from other actions, the action had to vary by one factor: either the character, action of the character, or the terminal location of that character. In order for play actions to meet the lag reinforcement schedule, the action had to vary by two factors. See Table 2 for examples of possible appropriate play actions and/or possible prompts provided.

Stereotypical behavior was not included as a play action. Stereotypical behavior was defined as repetitive, non-functional actions such as sliding a character along the wall of the research room, or dropping a character on the table repeatedly. To avoid reinforcing stereotypic patterned responding (e.g., place the monkey in the tree, then place the parrot in the tree, then place the girl in the tree), more than just the character had to vary since both Warren and Aaron demonstrated the same action with each of the different characters in a stereotypical sequence. For Warren, stereotypical behaviors involved picking up each character, turning it over in his hands, and then placing it back on the table or swiping it along the wooden edging in the research room, then returning it to the table and repeating the sequence with the next character. For Aaron, stereotypical

Table 2

Example of Characters, Actions, And Locations for an Intervention Play Set and Prompt

Character	Action	Location
Girl	Sits/teeters in slides	Tree nest 1 tree nest 2
Boy	Rides rolls balls down	Swing brown ramp
Parrot	Measures eats	Yellow slide arch
Monkey	Push stands on	Scale food cart
	Walks through	Blue food tray binoculars
	Looks through	Balcony elephant back
		Elephant trunk

behaviors demonstrated were picking up more than one character at a time and crashing them all on the table at once, or launching them up into the air and allowing them to fall to the ground. For Evan, stereotypical behaviors involved placing a character horizontally on the table and pushing it back and forth with one finger in a rolling motion.

Research assistants transcribed all play actions using a paper data sheet and pencil. At the end of each session, the research assistant recorded the total number of responses, the total number of different play actions and the total number of play actions that met the lag reinforcement schedule (see Appendix).

Measuring Variability of Play

In addition to measuring different play actions, total number of responses, and total actions that met the lag reinforcement schedule, we measured the frequency of play actions that were not prompted within each session. These play actions may have been observed in a previous session, but were not prompted within that particular session. As additional information, we also measured the number of play actions demonstrated within the first interval prior to any prompt sequence being delivered. This was to assess whether the participants were waiting for prompts to engage in appropriate play actions, or whether spontaneous play actions would occur.

Reliability and Treatment Integrity Measures

Research assistants scored interobserver agreement (IOA) for at least 30% of the sessions in each condition for all participants. We collected IOA by separately counting the total number of agreements for play actions that occur during the session. We defined

agreements as each instance where the primary data collector's transcription contained point to point correspondence with the IOA collector's transcription. Then, we divided the total number of agreements by the total number of agreements plus disagreements.

Research assistants also scored measures of treatment integrity for at least 40% of each condition for each participant. We calculated the total number of correctly implemented components and divided it by the total number of components. Then, we multiplied it by 100% to obtain the treatment integrity score. Treatment integrity components included whether or not: (a) the correct play set was presented, (b) the researcher said "Time to play," (c) the timer was set, (d) the prompting procedure was initiated within 30 seconds if no behavior occurred, (e) if the participant did demonstrate an appropriate play action within the first 30 seconds the timer was extended, (f) responses that met the lag reinforcement criteria were reinforced (per opportunity measure), (g) responses that did not meet the lag reinforcement criteria were ignored (per opportunity measure), (h) during prompt sequences there were three prompts delivered with reinforcement between each, and (i) and whether time was extended if behavior that met the lag reinforcement schedule was demonstrated after a prompt sequence.

Experimental Design

We used a nonconcurrent multiple baseline across participants design to measure the effect of the lag reinforcement schedules on variability of play actions. Reference for design is needed

Experimental Procedures and Conditions

To identify which play set functioned as the most preferred, we conducted a MSWO preference assessment (Carr et al., 2000) to rank the play sets in order of preference from the most preferred to least preferred. Five play sets were selected with similar amounts of play components and moving parts. Each set contained four characters. If there was a musical or sound feature, it was disabled. All five sets were placed in random order around a kidney-shaped table. The participant was let into the room, and the researcher demonstrated each component of each set for the participant (showed them each character, each moving part). The researcher then said, "Choose the one you want" and the participant had 10 seconds to select which play set he wanted. He was allowed 10 seconds to interact with the set, then it was removed and the sets were rearranged and presented again. This procedure was conducted three separate times with each participant to identify the top three sets with which to engage during the experimental sessions. The most highly ranked set was determined as the intervention set for each participant, and the second and third sets served as generalization probe sets.

During intervention, a different preference procedure was conducted to identify reinforcers to be delivered for behaviors that met the lag reinforcement schedule. For Warren and Aaron, a snack tray with multiple items was presented to each, and each participant was told "Pick the one you want." After a selection was made, that was the edible that was used in the intervention session.

All sessions were 5 minutes in length for Warren and Aaron, but because Evan's reinforcer differed from the other two participants, his sessions were approximately seven

minutes. Research assistants conducted one to four sessions per day. Because of intensive feeding issues, Evan did not ingest solid edibles; so his reinforcement delivery was different than other participants. Evan typically earned tokens on a token economy system for instructional trials at the university preschool. After earning tokens for appropriate responses in his daily instruction, Evan earned time listening to a preferred song of his choice. So, prior to each intervention session the research assistant asked, "What song do you want?" and he vocally requested a specific song.

Baseline

The purpose of this phase was to measure responding prior to each participant's exposure to the intervention. In the baseline condition, each participant was presented with a play set for five minutes. All manipulatives associated with the play set were present. The experimenter said, "Time to play" and started the timer. All play actions were recorded. The researcher and research assistant did not interact with the participant in any way. No prompting or corrective procedures were provided during baseline. No reinforcement was delivered during baseline.

Generalization Probes

Every third session, a generalization probe was conducted with the other two play sets selected from the toy set preference assessment. The procedures were identical to the baseline procedures. The play set with all components was placed on the table. The researcher said, "Time to play" and the timer was set for 5 minutes. The researcher and research assistant did not interact with the participant in any way.

Intervention: Lag X with Intervention
Play Set

The purpose of the lag reinforcement condition was to establish varied behavior with the designated play set. The Lag schedule of reinforcement was determined after totaling the average number of appropriate play actions per session displayed in baseline excluding repetitive or stereotypical behaviors. For all three participants, since the average number of appropriate play actions with the designated intervention set was zero, the lag reinforcement schedule was set at a Lag1.

In the Lag condition, the research assistant presented the participant with the identified reinforcer (tray of edibles for Warren and Aaron; asked which song Evan wanted). The researcher then presented the targeted intervention play set and said, "Time to play." The timer was set for 5 minutes.

An additional timer app was started on the iPhone for the first 30 s of the session. This initial "probe" at the beginning of each session was used to test the effects of the intervention from the previous session and to see if varied responding carried over to the next session. Participants who engaged in spontaneous appropriate play actions were given edibles or music. If a participant demonstrated an appropriate play action within the first 30 s of the presentation of the play set, the timer was then extended for another 30 s duration. The purpose of this was to assess whether the participant would engage in varied behavior without further intervention. If the participant did not demonstrate any play behaviors that met the lag reinforcement schedule or engaged in stereotypical behavior, after the 30 s duration, the research assistant initiated the prompt sequence.

The prompt sequence consisted of three prompted actions, each differing by

character, action, and location. For a step-by-step order of the prompt sequence, refer to Table 3. The prompts were delivered using hand-over-hand physical prompting. For example, the research assistant would take the participant's hand and guide him to place the parrot in the tree top and teeter, then deliver the designated reinforcing item or activity. She would then take the participant's hand and guide him to put the boy in the swing and push, then deliver the edible or music. Finally, she would guide the participant's hand to make the monkey slide down the elephant's trunk, then deliver the edible or music. If the participant demonstrated an appropriate play action before the prompt sequence, the research assistant delivered a prompt that did not involve the same character, action, or location that was demonstrated earlier.

After the sequence of three prompts was completed, another 30 s probe interval was initiated to provide an opportunity for the participant to demonstrate appropriate play actions. If the play actions met the lag schedule, reinforcement was delivered. If the

Table 3

The Basic Steps of the Prompting Procedure

Step	Prompting procedure
1	Play set is presented, session timer is started for 5 min. timer is started for 30 s.
2	Participant demonstrated appropriate play action in first 30 s.-yes? Extend timer after 30 s. Participant demonstrated appropriate play action-no? Begin prompting sequence below.
3	Prompt hand over hand character, action, location. Deliver reinforcement. Prompt hand over hand second combination of different character, different action, different location. Deliver reinforcement. Prompt third combination of different character, different action, different location.
4	Set Time Timer for 30 s. If participant demonstrates play action that was different from last prompted action, reinforce. If it is the same, no reinforcement delivered. After 30 s. if play actions have been demonstrated that are different from the previous, extend timer another 30 s. If not, begin prompt sequence again with different combinations of character, action, and location.

participant demonstrated any appropriate behaviors that met the lag schedule of reinforcement the 30 s the time would be extended for another 30 s. This procedure continued for the 5-minute session. If the participant did not demonstrate behaviors that met the lag schedule, the prompting sequence was delivered again. Due to the 5 min limit for sessions, the prompting sequence was delivered a maximum of four times per session. Due to Evan's unique preferred activity (music) the session timers were stopped during music delivery, then restarted after the 5 s of music was delivered.

Evan's procedures required altering regarding the delivery of reinforcement two sessions into the intervention phase. After two sessions of delivering tokens after prompts (sessions 17 and 18) Evan still demonstrated zero independent play actions. We then consulted his clinical team at the university preschool, and were informed that Evan typically was given praise with the delivery of tokens. We delivered praise and tokens in session 21 but responding remained at zero, and Evan continued to engage in high rates of stereotypical behaviors (rolling the characters back and forth on the table.) In session 22, in addition to delivery of verbal praise and tokens, every time he would engage in stereotypy the research assistant would provide the verbal instruction, "Do something else." Evan continued to demonstrate zero appropriate play actions. We then made the realization that although the other two participants were being immediately reinforced for appropriate play actions, Evan was experiencing a delay in accessing the primary reinforcer (music back in the instructional cubby after the research session) through the conditioned reinforcer (tokens received in the research session.) In session 23, instead of the tokens and praise Evan accessed 5 s of music immediately after each prompt and after

each independent play action that met the lag reinforcement criteria.

During intervention sessions, all stereotypical behavior was blocked. If a participant began to engage in an inappropriate repetitive movement that was not part of engaging with the play set, the research assistant stopped the action by placing her hand on the participant's hand. If the stereotypical behavior involved moving away from the table to spin in a circle or jump up and down while flapping his hands (Aaron would do this on occasion), the participant was guided back to the table. Warren often picked up a character, turned it upside down then put his finger in the hole at the bottom. He was then guided to orient the character in the right way and place it on the table. When Evan attempted to roll a character back and forth on the table, the research assistant initially stood the character up near the play set. We then realized we were minimizing opportunities to respond by actually removing the character from Evan's grasp, so after two sessions of standing the character up, we then implemented a process in which the research assistant placed her hand on his and held the character immobile.

Generalization Probes

The two remaining play sets identified from the initial preference assessment remained as control sets. Every third session, a probe session was conducted with each of the two sets that were not the intervention set. For the control sets, the procedures remained identical to baseline procedures. The designated control play set was placed in front of the participant. The experimenter or research assistant said, "Time to play" and the timer was started. No corrective feedback, prompting, or reinforcement was delivered. Sessions were terminated in the generalization probe conditions after 5 min.

Maintenance

One day after the final session, we conducted a session without the lag reinforcement schedule in place. This was to assess the effects of the lag schedule and to observe rates of variability when the lag contingency was not present. Two weeks later, we conducted another session to assess whether responding would maintain over time. During these two sessions, every appropriate play action (defined as a character interacting with the play set) the participant demonstrated received reinforcement whether it varied or was repetitive.

CHAPTER IV

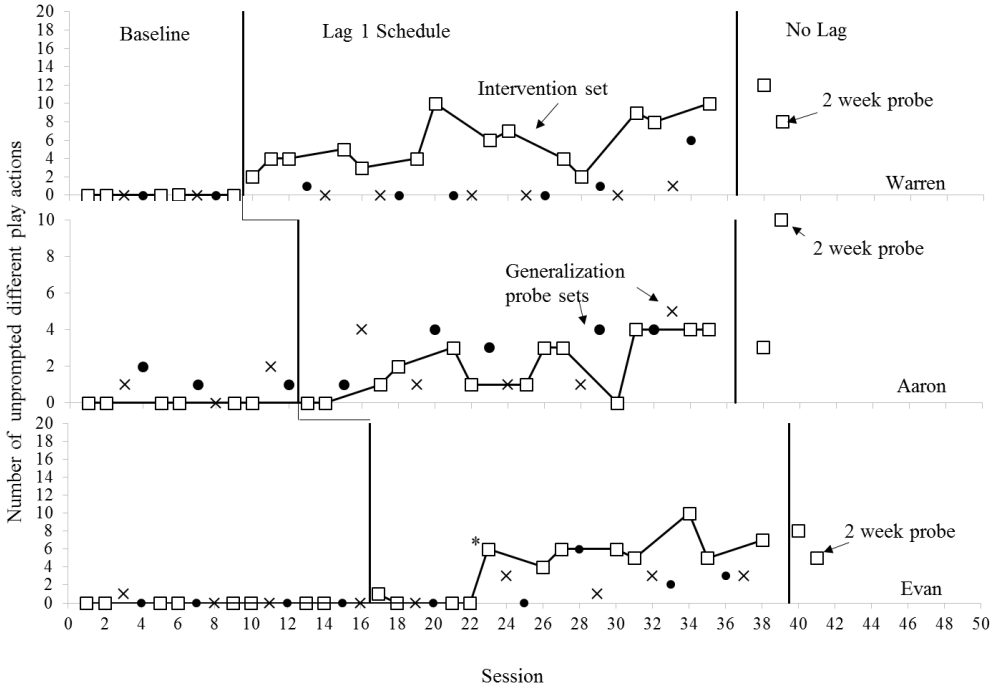
RESULTS

Experimental Sessions

Descriptions are provided for multiple data sets. Each visual display will be discussed individually.

Frequency of Different Play Actions

Warren. Data are displayed in Figure 2. During the baseline phase, Warren demonstrated no instances of appropriate play behavior with all three play sets (intervention set and two generalization



* Indicates when music began to be delivered as a reinforcer for Evan.

Figure 2. The number of different play behaviors each session for Warren, Aaron, and Evan.

probe sets.) He instead engaged in high rates of stereotypical behavior with the play objects. He typically bounced two plastic balls on the table repeatedly, or lined the characters up in an order and picked up one at a time. He then either put the character back on the table and picked up the next in the line, or removed it from the table and walked it around the room and then returned it to the table. He then repeated this behavior with the next character. During intervention, he demonstrated from 2 to 10 different play actions within a session. He continued to demonstrate low rates of different behavior with the generalization play sets: on one occasion he demonstrated one play action of placing a character down a slide, and on another he used a character to push part of the play set. On the second to last session in the intervention phase, he demonstrated six play actions and utilized all four characters in the generalization play set.

Aaron. Aaron demonstrated no appropriate play actions during baseline with the target intervention set (treehouse zoo.) In the first baseline session, he attempted to place the elephant in the tree but was unsuccessful. He also tried to make the elephant walk, but this was not a designated action because the character was not interacting with the physical structure of the set, or an object from the set. That is, simply making an animal walk did not meet our operational definition for a play action. Often Aaron held onto a particular character and turned it over in his hand, or launched a character into the air. During baseline with the generalization probe sets, he demonstrated one different play action in three sessions and two different play actions in two sessions. All of these actions were topographically similar in that they involved sliding a variety of characters down a slide or ramp.

During the first two intervention sessions with the target intervention set, Aaron engaged only with one particular part of the set: the plastic hose. He picked up a character from the set and placed it next to the hose mid-air. He then tried to pull the hose to disconnect it from the set. This appeared to be a stereotypical behavior, and therapists from his preschool instructional team reported that he engaged in stereotypical behavior when provided access to anything similar to a string or rope. In order to prevent the stereotypical behavior, the rope was permanently removed from the play set. After the first two intervention sessions when he demonstrated no appropriate play actions and the removal of the plastic hose, Aaron then demonstrated a within-session range of 0 to up to 4 different play behaviors within a session. After the implementation of the lag schedule and prompting procedure with the intervention set, Aaron continued to engage in topographically similar behaviors involving different characters and different slides/ramps in the generalization probe sets for a range of 1-6 different behaviors. It should be noted that between sessions 25 and 26, Aaron did not attend the university preschool for one and a half weeks due to an illness.

Evan. Evan demonstrated no instances of appropriate play behaviors in baseline with the targeted intervention set. Instead he engaged in high rates of stereotypical behaviors by rolling a character back and forth horizontally on the table. He did this with all three play sets. He varied the character, and even attempted to engage in the rolling behavior with characters that did not roll. On one occasion with a generalization probe set (farm) he placed an animal in the silo, but that was the only appropriate play action in baseline.

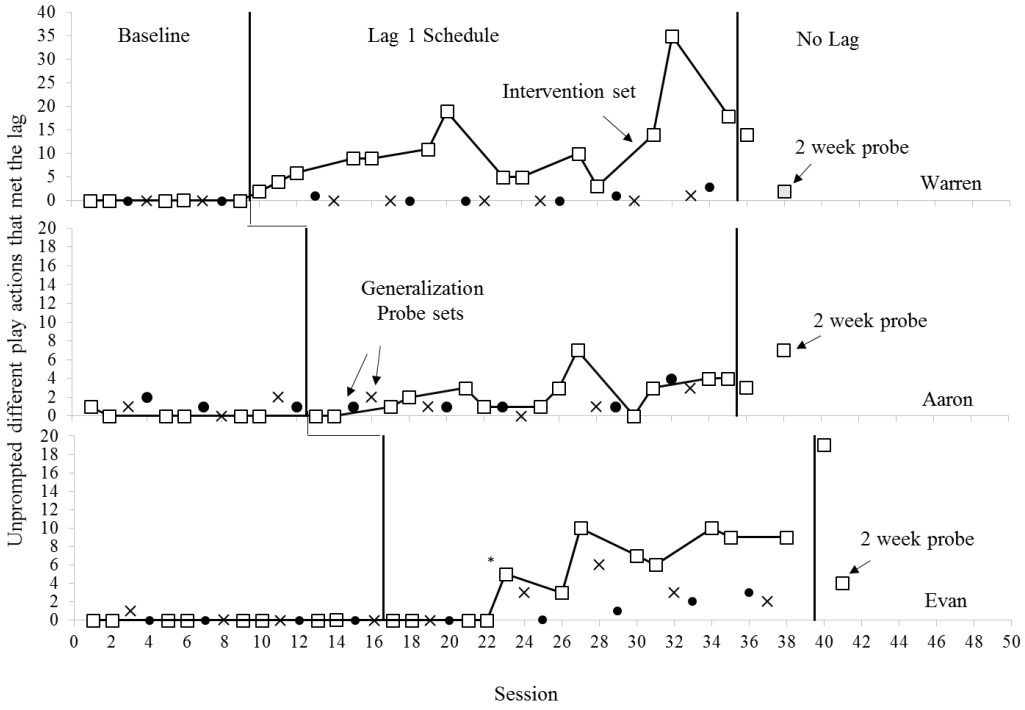
During the intervention phase, Evan's different responses ranged from 0 to up to 10 within a session. During the first intervention session, Evan demonstrated one appropriate play action. For this action and after the hand-over-hand prompt he received a token, which the research assistant placed in a bowl on the table next to the play set. The tokens were not a powerful enough consequence and did not increase appropriate play actions. Following session 20, Evan's clinical supervisor indicated that Evan typically received praise upon delivery of a token. In sessions 21 and 22 praise and tokens were provided for the prompted responses. However, Evan continued to engage in stereotypical behaviors with the play characters. After assessing the power of the reinforcement delivery we realized the other two participants were receiving primary reinforcers that they were able to select after a choice procedure, while Evan was receiving a conditioned reinforcer (i.e., token) and was required to wait until after the session to access the primary reinforcer (i.e., music). We decided to alter the reinforcement strategy and ask Evan which song he would like to earn, then deliver five seconds of music immediately upon demonstration of a play action that (1) was demonstrated in the first 30 second interval, (2) met the lag reinforcement schedule, or (3) was prompted in the hand-over-hand prompt procedure. This procedure was implemented beginning in Session 23. With the music reinforcement in place, Evan's different behaviors increased and remained consistently between 4 and 10 per session.

For the generalization probe sessions, his responding stayed at zero until the music was implemented in the intervention set. Even though he received no reinforcement in the generalization probe session, he demonstrated 3 different play

actions in Session 24. Evan then demonstrated a range of 0 to 6 actions with one generalization set, and 1 to 3 with the remaining generalization set.

Number of Unprompted Play Actions Within a Session that Met the Lag Schedule

Warren. Data for number of play actions that met the lag reinforcement schedule are referenced in Figure 3. Warren's number of play actions that met the lag reinforcement schedule ranged from 2 to 35. In Session 32 he began to demonstrate an alternating pattern: one character in treetop 1, a different character in treetop 2. This met the lag criterion of a different character in a different location, which earned him a delivery of an edible after each behavior. Throughout the intervention sessions, Warren



* Indicates when reinforcer delivery was changed to music for Evan.

Figure 3. The number of different play actions that met the lag reinforcement schedule for Warren, Aaron, and Evan per session.

would frequently demonstrate a play action and reach his hand out for an edible. If the behavior did not meet the lag, he would immediately engage in a different play action that did meet the lag requirement. For the generalization sets, he completed zero behaviors that would have met the lag until the second to last session, during which he demonstrated one behavior.

Aaron. During the intervention phase, Aaron's play actions that met the lag ranged from 1 to 7. He did not demonstrate high numbers of behavior as Warren did. He took longer to consume the edible delivered after the prompt sequence, and would often take a character in his hand and look at it for long durations of time. Although there was no prompting procedure or lag reinforcement schedule in place for generalization sessions, there were twelve sessions in which he demonstrated 1 or 2 behaviors that would have met the lag. In the third and fourth to last sessions, he demonstrated four and three appropriate actions with the generalization sets.

Evan. Evan demonstrated zero behaviors that met the lag schedule for the first six sessions of the intervention phase (four with the targeted intervention set, two generalization probe sessions.) When music was introduced as the reinforcing activity, his behaviors that met the lag schedule increased to 5. With the exception of one session in which he only had three behaviors that met the lag, after Session 23 he engaged in 6 to 10 play behaviors that met the lag.

Total Responses Per Session

Warren. Data is displayed in Figure 4 for total number of responses. Warren demonstrated a range of 2 to a high of 53 responses per session. Not all of those

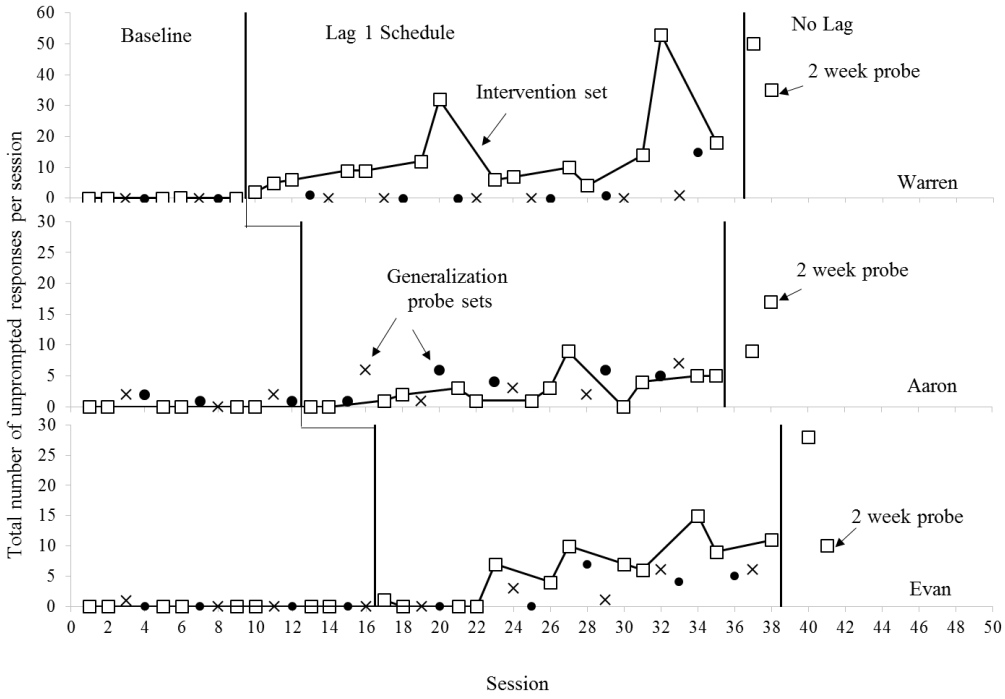


Figure 4. Total number of responses per session for Warren, Aaron, and Evan per session.

responses met the lag, so this number reflects repetition of responses. This was still a difference from zero levels of responding in baseline sessions. His responding continued on an upward trend, dropped down for one session, then continued on another upward trend. He demonstrated the one very high level of responding, when he repeatedly alternated between two locations. Responding then dropped back to 18. This was right after a probe generalization probe during which Warren responded in one of the generalization sets for the first time. The very last session was conducted without a lag, so every play action that met the operational definition of "appropriate" was reinforced. Warren demonstrated 50 appropriate responses in this session.

Aaron. Aaron's responding was consistently at much lower levels than those of

the other two participants. During baseline, he demonstrated zero appropriate play responses with the intervention set, and no more than 2 appropriate responses for the generalization probe sets. Again, the occasional response in the generalization set was always the completion of a character sliding down a slide or ramp. For total responses in the intervention phase, Aaron's range of different behaviors for the target intervention set within any session was 0-9. After the initiation of the prompting procedure, total responses increased for the generalization set to up to seven responses (with no reinforcement delivery as it was in a generalization probe session.) For the last session with no lag reinforcement schedule in place, Aaron demonstrated nine appropriate play responses.

Evan. During baseline (which lasted 16 sessions) Evan demonstrated only one appropriate response, and that was with a generalization probe set. After the implementation of delivery of music as a reinforcer, Evan demonstrated a range of 0-15 total responses. He also began to engage in appropriate responses with the generalization probe sets, even though there was an absence of reinforcement in those sessions. He demonstrated up to 6 total responses with one generalization set, and up to 7 with the remaining set. Upon removal of the lag schedule in the last session, Evan demonstrated 28 total responses.

Removal of the Lag Schedule and Maintenance

These data were reflected in Figures 2, 3, and 4 displaying total unprompted different responses, total unprompted responses that met the lag schedule, and total

unprompted responses per session. One day after the last intervention session, we conducted a session with the intervention set with each participant without the lag schedule of reinforcement in place. We then conducted a probe 2 weeks later to assess maintenance of play responses, and to analyze variability of those responses. Without the lag in place, every play action that met the operational definition of "appropriate" was reinforced (a character interacting with the play set).

Warren. Warren demonstrated 50 appropriate responses in the first session without the lag, but 14 would still have met the criteria for the lag had it been in place. Twelve of those 50 responses qualified as different. For the maintenance session conducted two weeks later, he demonstrated 35 total play actions. However, only eight of those qualified as different and only two would have actually met the lag had it been in place. This was a result of stereotypical sequences with the characters Warren demonstrated. He engaged in the repetitive play and still received reinforcement because of the absence of the lag contingency. His responding remained high, and constant. There were zero prompt sequences conducted because he was responding the entire session.

Aaron. Without the lag in place for the first session conducted after the cessation of intervention, Aaron responded nine times. Three were different, and three would have met the lag had it been in place. Two weeks later, Aaron demonstrated spontaneity and increased responding. He immediately began engaging with the play set and responded the entire time. Similar to Warren, there was no opportunity to prompt as it was never required. He responded 17 times, which is the highest number of responses in any session. Ten of those were different, and seven would have met the lag had it been in

place. Aaron repeated one action five times in a row and another three times in a row.

Evan. Without the lag in place for the first session Evan responded 28 times. Eight of these were different, and 19 would have met the lag had it been in place. For the 2-week maintenance session, his responding dropped slightly to 10 total responses. Five of these were different, and four would have met the lag had it been in place. He also demonstrated alternating play actions without the lag in place. For six responses he alternated between two characters in the same location.

Actions Not Prompted Within the Session (Intervention Set Data)

We wanted to measure how many actions were not prompted within a session. Were the participants only demonstrating actions that had been used in the hand-over-hand prompting procedure within that session, or were they demonstrating behaviors from previous sessions? It is likely that with the lag procedure in place, the behavior would have to alter from the last behavior sequence provided in the hand-over-hand prompt procedure, but the results indicate the participants actually demonstrated behaviors that had not been prompted at all within that session (see Figure 5).

Warren. Warren demonstrated a range of 1-10 behaviors that were not prompted at all within the session.

Aaron. Aaron demonstrated a range of 0-4 behaviors that were not prompted within a session, but he demonstrated lower rates of responding overall.

Evan. Evan demonstrated a range of 0-10 behaviors that were not prompted within the session.

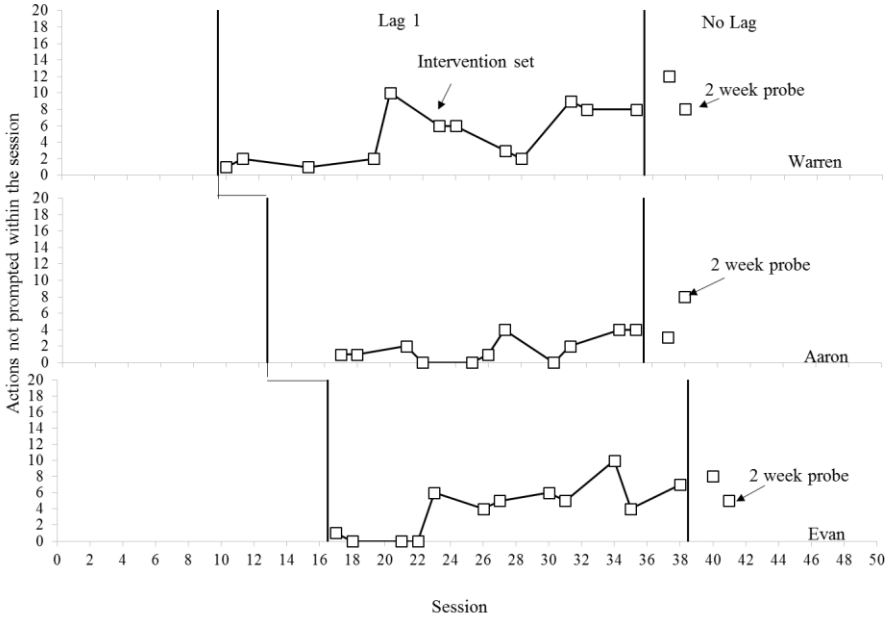
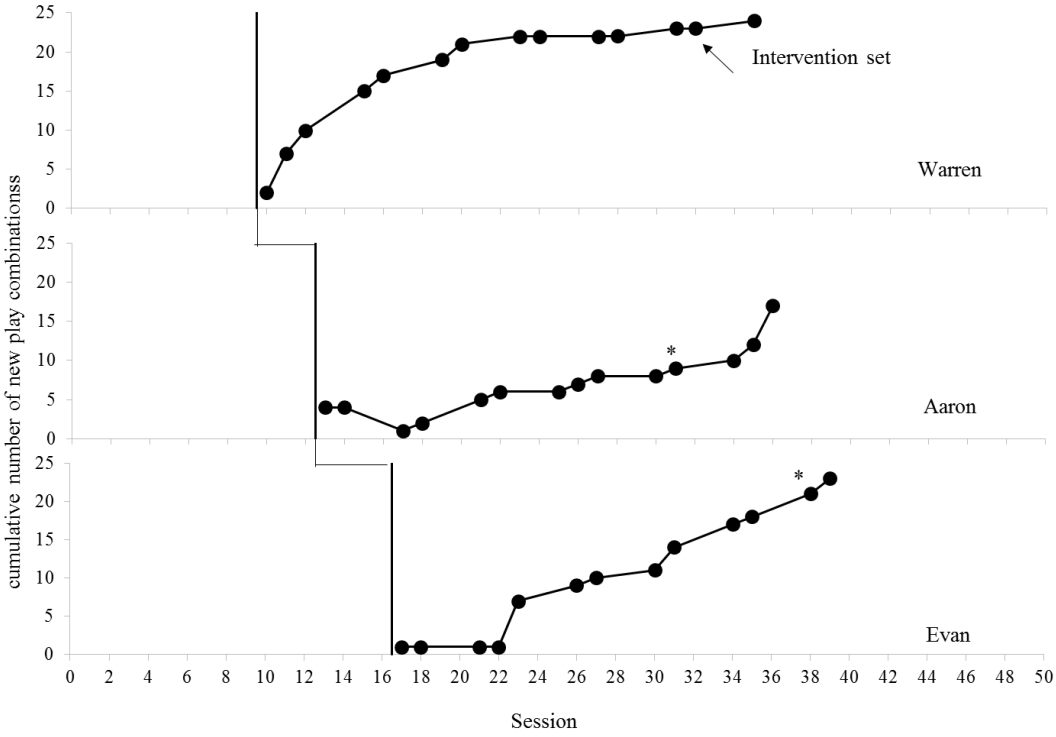


Figure 5. Actions not prompted within the session for the target intervention set for Warren, Aaron, and Evan.

Cumulative Number of New Play Actions

In addition to the number of actions not prompted within a session, it is valuable to measure how many play combinations each participant demonstrated throughout the entire intervention phase. Participants could have been demonstrating the same few play actions during sessions and still accessing reinforcement. These data (displayed in Figure 6) reflect that over weeks and session, each participant demonstrated varied combinations of characters, actions, and locations. These two measures validate that even though prompts were provided in the hand-over-hand sequences, the participants demonstrated new combinations of character, action, and location.

I like this presentation better than the previous presentation because it depicts a relative rate of new play actions across sessions that is more difficult to detect in the previous graph.



* Denotes when a novel behavior was demonstrated that had never been previously prompted.

Figure 6. Cumulative number of new play combinations for target intervention set for Warren, Aaron, and Evan.

Data are representative for the intervention set only, since that was the only set in which the prompted procedure was in place.

Warren. Warren demonstrated a cumulative number of 24 different combinations of character, action, and location throughout the intervention sessions (see Table 4).

Aaron. Aaron demonstrated a cumulative number of 17 different combinations throughout the intervention sessions (see Table 5).

Evan. Evan demonstrated a cumulative total of 23 different combinations of character, action, and location throughout the intervention phase (see Table 6).

Table 4

Play Action Combinations for Warren (Treehouse Zoo)

Session #	Character	Action	Location
10	Parrot	Sits in	tree top
	Parrot	Slides down	elephant trunk
11	Girl	Slides down	elephant trunk
	Boy	Rides	Elephant
	Parrot	Pushes balls down	Brown ramp
	Boy	Sits on	Swing
	Parrot	Sits on	Swing
12	Girl	Sits on	Swing
	Boy	Goes through	Arch
	Parrot	Slides down	Brown ramp
15	Boy	Sits in	Tree top
	Boy	Slides down	Brown ramp
	Girl	Sits in	Tree top
	Monkey	Sits in	Tree top
	Boy	Eats from	Food cart
16	Girl	Pushes balls down	Brown ramp
	Boy	Pushes balls down	Brown ramp
19	Parrot	Goes through	Arch
	Girl	Slides down	Brown ramp
20	Girl	Looks through	Binoculars
	Boy	Looks through	Binoculars
23	Monkey	Goes through	Arch
31	Monkey	Slides down	Elephant trunk
35	Boy	Slides down	Elephant trunk

Total different combinations: 24

Table 5

Play Action Combinations for Aaron

Session #	Character	Action	Location
17	Parrot	Slides down	Elephant trunk
18	Monkey	Sits in	Tree top
21	Parrot	Sits on	Scale
	Monkey	Sits on	Scale
	Girl	Slides down	Elephant trunk
22	Girl	Slides down	Brown ramp
26	Parrot	Goes through	Arch
27	Parrot	Sits in	Tree top
31	Monkey	Sits in	Swing
34	Elephant	*eats	Food ball
35	Boy	Slides down	Brown ramp
	Parrot	Slides down	Brown ramp
36	Girl	Eats	Food
	Boy, girl, monkey, parrot	Eat	Food
37	Monkey	Slides down	Elephant trunk
	Boy	Slides down	Elephant trunk
	Boy	Sits on	Scale
Total different combinations: 17			

Play Actions Demonstrated Before the Prompt Sequence and Number of Prompt Sequences

It was also of interest to measure any play actions demonstrated prior to the first prompt sequence. As the intervention sessions progressed and the participants came in contact with the lag reinforcement schedule, they began to demonstrate play actions immediately as the play set was placed in front of them. This was in contrast to waiting until after the first 30 s of the session when the prompt sequence went into effect. Data are displayed in Figure 7. The number of prompt sequences is displayed in Figure 8 and discussed for each participant.

Table 6

Play Action Combinations for Evan

Session #	Character	Action	Location
17	Mom	Lays down in	Bottom bunk bed
23	Dad	Sits on	Toilet
	Mom	Lays down in	Top bunk bed
	Mom	Sits on	Toilet
	Mom	Lays down in	Queen bed
	Girl	Sits on	Toilet
	Girl	Sits on	Couch
26	Baby	Sits in	High chair
	Boy	Sits on	Toilet
27	Dad	Sits on	Couch
30	Dad	Lays down in	Top bunk bed
31	Baby	Lays down in	Top bunk bed
	Mom	Goes through	Front door
	Baby	Lays down in	Bottom bunk bed
34	Girl	Lays down in	Bottom bunk bed
	Dad	Eats	Food on table
	Girl	Lays down in	Queen bed
35	Mom	Lays down in	Bottom bunk bed
38	Dad	Sit in	Chair at table
	Mom	*stands at	Sink
	Mom	Eats	Food on table
39	Dad	Lays down in	Queen bed
	Dad	Lays down in	Bottom bunk bed
Total different combinations: 23			

Warren. Warren did not begin demonstrating play actions before the prompt until the sixth intervention session. His spontaneous, unprompted behaviors then ranged from 0-53. During the last two sessions with the intervention set, the prompt sequence was not even implemented due to Warren's continuous play actions. There was never a 30-second interval in which a behavior did not occur, much less one that did not meet the lag

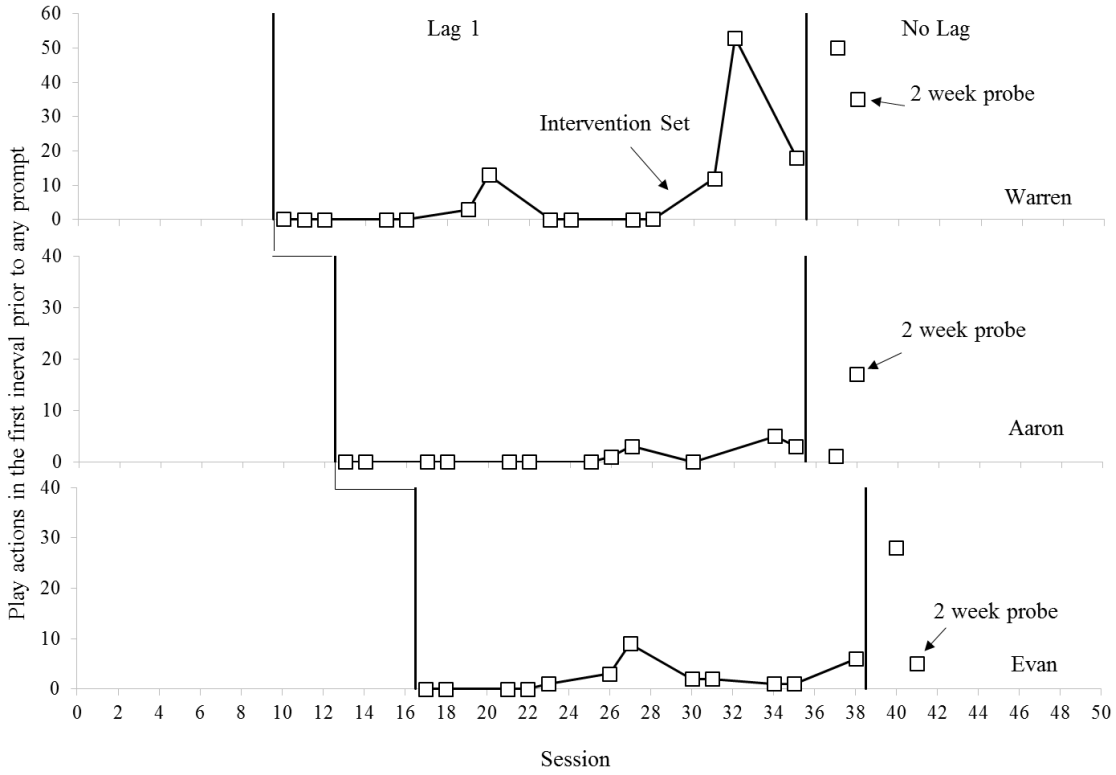


Figure 7. Play actions demonstrated prior to any initial prompt sequence (intervention set data only) for Warren, Aaron, and Evan.

schedule. The last two sessions are the sessions conducted without a lag contingency in effect. Because each response was reinforced, he constantly responded. It is not surprising his total responses during the last two sessions were 50 and 35. With such high numbers of responses, there was no opportunity provide the prompt sequence. His last three sessions (one with the lag in place and 2 without the lag) brought the prompt sequence opportunity to zero levels.

Aaron. On the eighth session with the intervention play set, Aaron demonstrated a behavior prior to the prompt sequence. This behavior then increased to a high of five spontaneous behaviors, then began a downward trend. Aaron continued to require between three and four prompt sequences per session. However, once the lag was

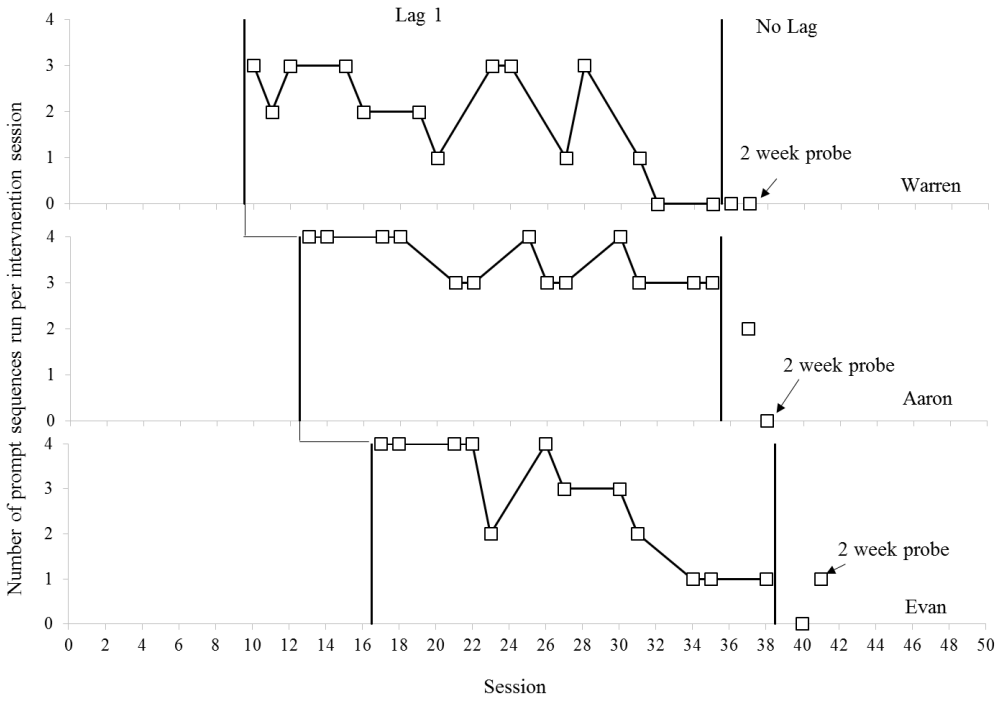


Figure 8. Number of prompt sequences run per session for target intervention set for Warren, Aaron, and Evan.

removed Aaron only required two prompt sequences. During the 2-week maintenance check without the lag, he required zero prompts, as he continually responded.

Evan. On the fifth session of intervention, Evan demonstrated the first play action prior to the prompting sequence. He then demonstrated a range of 1-9, and then one session at 28. Similar to Warren, this was demonstrated in the last session without a lag schedule of reinforcement in place. As Evan continued to engage in play actions, he was reinforced. The prompt sequence was run only once in this last session, so there was only one duration of 30 s in which he did not actively demonstrate a play action. This was the same for the two intervention sessions prior to the last: the prompt sequence was only run once in those last three sessions. As Evan's responses per session increased, the number of opportunities to conduct the prompt sequence decreased.

Reliability and Treatment Integrity Measures

Treatment Integrity

Treatment integrity was collected for 40% of intervention sessions for each participant. For Warren, the average was 97.6% (range 91-100%). For Aaron, the average was 99% (range 98-100%). For Evan, the average was 96% (range 89-100%).

Interobserver Agreement

IOA was collected for at least 40% of each condition for each participant. IOA was collected for 40% of Warren's baseline sessions and intervention sessions, with IOA of 100% for total responses in baseline and an average of 95.9% (range of 85.7-100%). for intervention sessions. IOA was collected for 40% of Aaron's sessions, with an average of 90% in baseline (range 50-100%) and average of 91.7% (range 50-100%) for intervention sessions. IOA was collected for 40% of Evan's sessions, with IOA of 100% for baseline sessions and 100% for intervention sessions.

CHAPTER V

DISCUSSION

Lag reinforcement schedules have been effective in teaching variability in a variety of different skill areas. The purpose of this study was to assess the effects of a lag reinforcement schedule with the addition of a manual prompting procedure on (a) the number of different play actions, (b) the number of play actions that would meet that specific reinforcement schedule, (c) the combination of play actions demonstrated (prompted or unprompted), (d) generalization and maintenance of variable play skills, (e) play actions that are demonstrated without the lag contingency in place. Below, the study is discussed in relation to these objectives. Implications for future research are also discussed.

Variability of Play Actions

Variability was established for all three participants when the lag schedule of reinforcement was in place and the prompting procedure was implemented. This is supported by the low levels of baseline responding when there was no prompting procedure or lag contingency, and the increase in responding once the prompting procedure and lag was implemented. Levels of varied responding were low initially, but this is not surprising when baseline levels of any responses were so low. However, as sessions progressed, all participants' varied behaviors increased. Frequency of behaviors that met the lag was always higher than the actual number of different behaviors for all three participants, because behaviors could be repeated within a session, yet still meet the

lag reinforcement contingency.

The increase in responding in general could be attributed to the fact that participants were exposed to the prompting procedure and contacted reinforcement throughout the intervention sessions. If the low baseline behavior was attributed to a skill deficit, the prompts provided ample models of appropriate behaviors from which to then demonstrate independently. This does not account for the number of different behaviors, as the participants could easily have demonstrated the same behaviors across sessions in order to receive reinforcement. Instead, we can observe two measures: the number of behaviors that were not yet prompted in that particular session, and the different combinations throughout the intervention sessions that the participants demonstrated. Even when specific behaviors were prompted by the research assistant, the participants came up with different within-session play combinations. This supports the generative play behavior research by MacManus et al. (2015).

Play Behaviors that Met the Specified Reinforcement Schedule

Warren demonstrated the highest levels of responses of the three participants. He demonstrated a play behavior and hold out his hand to the research assistant to receive an edible. If the behavior was not different from the last independent behavior or last prompted behavior (it did not meet the lag requirement) and was therefore not reinforced, he would immediately engage in a different behavior. During one session he began to alternate in a pattern: one character in one location (tree top 1), then a different character in tree top 2. In this particular session he had his highest rate of responding. If that had

continued in the next session, we would have changed the requirement in order to receive reinforcement, as one of the risks of a lag 1 schedule is the inadvertent reinforcement of an alternating sequence. Although this only happened once, he was prone to other stereotypical sequences of behavior. At one point he lined all four characters in a line, and systematically demonstrated play actions with each one in certain locations of the play set. He only did this for one session. Warren also adapted his stereotypical behaviors to subtler behaviors than the overt ones he had demonstrated in baseline. During baseline sessions, he actually removed the characters and took them to the wall of the research room and ran them along a wooden edge along the wall. When the intervention sessions began, we no longer saw this behavior. He replaced it with a behavior in which he turned characters upside down and stuck his finger in the hole at the bottom. It is interesting to note that once intervention sessions started, he never left the table when the intervention set was presented and was actively engaged the entire session.

Aaron demonstrated low rates of behavior even with the lag reinforcement schedule in place, compared to the other two participants. In his second to last session, he repeated play actions for the first time, which then did not receive reinforcement (they did not meet the lag). He continued to engage in stereotypical behavior of crashing characters together on the table. This was difficult to block with the typical procedure of placing a hand on his, as it would happen quickly and we did not want to block the possibility of an appropriate play action if he was holding a character. He often picked up a character and stared at it, turning it around and upside down.

Evan demonstrated high rates of varied behavior when the lag reinforcement

schedule was in place. Twice he demonstrated the same behavior three times in a row, but did not receive reinforcement. He quickly changed his play actions to demonstrate a different action and come in contact with the lag. Need to discuss the potential interaction between the prompting sequence and the initial blocking procedure with Evan

Analysis of Prompted/Unprompted Responses

We made an assumption that due to low behavior rates in baseline sessions, most of the independent play actions would be those that were prompted either in the prompt sequence prior to the independent action or prompted within the session. This was not the case. Warren and Evan demonstrated up to 10 different play actions that were not prompted within a session, and Aaron demonstrated up to four. This could be attributed to the fact that there were only four characters per play set, and a limited amount of locations/actions. They may have generalized the effects of the lag to interpret their responses as needing to be different by three components instead of two. All three participants displayed different combinations over the course of the intervention, when a limited amount of responding could have earned the reinforcer. Both Aaron and Evan demonstrated a novel response once during the intervention phase, which was a response that had never before been prompted during any of the prompt sequences. One plausible explanation is that after multiple topographies of behavior were reinforced, both participants tried a new behavior to obtain access to the preferred item/activity. Another explanation may be that they were finally exploring the play set in a typical manner, similar to the way a typically developing child might explore a set. Neurotypical children

do not require modeling to interact appropriately with a play set. Exploration and play happens naturally, without prompting and a lag schedule in place. The exact reasons for Aaron and Evan are unknown.

Generalization and Maintenance of Responding

We saw relatively little varied responding during the generalization probes. In the second to last session of intervention, Warren demonstrated six appropriate and different play actions with a generalization set (farm). In the last session conducted with the remaining generalization set (castle), he demonstrated his first appropriate action with that set. Up until that point, he only engaged in inappropriate stereotypical behaviors. Evan sporadically demonstrated different and appropriate behaviors with the generalization sets when varied responding increased with the target intervention set. Aaron consistently demonstrated different actions within sessions for the generalization sets, but they were of similar topographies.

It is of interest that when the lag was removed, all three participants continued to demonstrate varied behavior. Without the lag in place, 14 of Warren's 50 play actions would have met the lag. Three of Aaron's 9 behaviors would have met the lag. 19 of Evan's 28 responses would have met the lag. Two weeks later, responding remained high. Aaron demonstrated the highest number of play behaviors for any session. He demonstrated 17 responses, seven of which would have met the lag had it been in place. Warren and Evan's responding remained high. Warren demonstrated 35 responses, but these were stereotypical actions in repetitive sequences, only two of which would have

met the lag. Evan demonstrated 10 actions, and four of those would have met the lag. We can conclude that initially, variability maintained without the lag, but two weeks later the lag schedule induced variability decreased for Warren and Evan, but increased for Aaron. This demonstrates robust effects of the lag schedule, and demonstrates that each participant acquired a solid play repertoire with the intervention set. When the lag schedule was not in place, both Warren and Evan continuously engaged in play actions for the first nonlag session, and for the 2-week follow up Warren and Aaron engaged in continuous play actions with the set for the duration of the entire session. It is important to note that during the 2-week maintenance session, all three participants immediately began to interact with the play set when it was placed in front of them. This was in contrast to the first few intervention sessions when all would wait to be prompted through the play action sequence.

Emission of Spontaneous Behaviors

Spontaneity was an additional behavior we began to observe. After five sessions with the intervention set, both Warren and Evan spontaneously engaged with the set when it was placed in front of them. No prompt was necessary—they began to appropriately engage with the characters by placing them in the play set immediately. For Aaron, this happened in the eighth intervention session. Although it took more sessions for Aaron to demonstrate this spontaneous play, he was the only one who spontaneous tacted the items in all three play sets throughout baseline and intervention. He would name the items as he picked them up, saying “Elephant!” or “Mickey!” He would often

have two characters interact by kissing each other or talking to each other, but these did not meet the operational definition of appropriate play for this study.

Limitations and Future Directions

There are multiple limitations of this study that are worth noting. We only conducted a single probe session and one maintenance session without the lag schedule in place. It would have been a more powerful demonstration if we had conducted multiple sessions without the lag reinforcement schedule in place to examine response frequency. It would also have been interesting to see the effects of increasing the lag schedule requirement on variability, which we did not do. Future researchers may consider examining the effects of increasing the lag schedule. Although we examined generalization to other sets, it would have increased social validity to generalize to other environments or to typical peers or incorporate a more systematic investigation of generalization. Our study was run in a controlled, isolated research room where just the presence of the materials and research assistant could have been a potential discriminative stimulus for responding variably. It would have been valuable to add a social validity component to assess the responses of caregivers. Future researchers may wish to address these issues.

One additional limitation is reflected in a minor way in the interobserver agreement. For two sessions for Warren when he was demonstrating high levels of responses, it should be noted that the person coding the videos for IOA recorded behaviors that the in-vivo research assistant had failed to record during the live session.

This is understandable, as the play responses occurred so rapidly and in succession. While coding from a video it is possible to start and stop the video to get accurate reliability. While recording on a paper sheet during a live session, it is possible to miss a behavior as it is happening while the previous behavior is being recorded on the sheet. It should be noted that in future research of this type, primary data should be in the form of video recorded session in order to prevent the omission of responses. This may be reflected as an underrepresentation in the total number of responses for Warren in those sessions in which he demonstrated high numbers of responses. This would not have occurred while responding was low, and being this may have occurred in less than 20% of sessions in which responding was high, this does not affect the data in a way that would minimize the overall effect.

There are many other options for future research and follow up studies. Researchers may want to evaluate whether a model prompt compared to a hand-over-hand prompt is effective for participants who are receptive to modeling. As video modeling increases variability of play (MacDonald et al., 2013; MacManus et al., 2015) there may be utility in less intrusive prompting measures. Researchers also may want to evaluate additional components of the play repertoire. Aaron emitted spontaneous tacts during the play sessions: a verbal behavior component may merit an investigation. Typically developing children rarely play silently. Play usually involves narration and conversation on the part of characters. This study focused on the physical actions in isolated play, but it would be reasonable to add a scripted vocalization component as in the video modeling studies. It may also be reasonable to add an animation of character

component, in which characters in the play set demonstrate pretend actions. Expanding the operational definition of play could open the door to the empirical analysis of many other play components. This moves away from isolated, functional play to more symbolic play. Researchers may also want to investigate training caregivers to implement the procedure in order to facilitate play in the home or other environments (daycare, church, etc.). This aligns with teaching in naturalistic settings and the pivotal response training literature that embeds discrete trial teaching but allows the child's interest to take priority. Because of the simplicity of this procedure this would merit investigation.

It is also worth analyzing the number of prompt sequences required to evoke a certain number of play combinations. This aligns with the recombinative generalization research (MacManus et al., 2015). Because children with autism must often be taught directly to acquire skills, it is potentially beneficial to use the principles of derived stimulus responding and matrix training to evoke generative play behaviors. A more systematic prompt analysis merits investigation, or incorporating a new prompted play action into each session to see if that is then demonstrated independently.

In summary, this study contributes to the variability literature by expanding the use of a lag schedule of reinforcement to the area of play for children with autism. Through a simple prompting sequence and application of a lag contingency, all participants demonstrated varied play actions and maintenance of the variability with the removal of the lag schedule.

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APPENDIX

Treatment Integrity Data Sheet

Date: _____ Data Collector: _____ Participant: _____

Session Number: _____

Directions: Mark whether or not each component occurred.

1) Correct play set presented Y N

2) Researcher said, "Time to play" to start research session Y N

3) Timer was set Y N

4) Prompting procedure initiated if no responding occurred after first 30-s Y N

5) If participant displayed play action in **first** 30 seconds of session, time was extended Y N

6) Responses that met reinforcement criteria were reinforced throughout session

Per opportunity measure: circle number if response 1)met lag 2) was reinforced																								
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N

Total: ____/_____

7) Responses that did not meet reinforcement criteria were ignored throughout session:

Per opportunity measure: circle number if response 1) did not meet lag 2) was not reinforced/ignored																								
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N

Total: ____/_____

8) Initial and additional prompt sequences:

	Additional Prompt sequence initiated after 30 seconds	Prompt three times in a row	Reinforcement delivered after each prompt		
1	Y N	Y N	Y N	Y N	Y N
2	Y N	Y N	Y N	Y N	Y N
3	Y N	Y N	Y N	Y N	Y N
4	Y N	Y N	Y N	Y N	Y N
5	Y N	Y N	Y N	Y N	Y N
6	Y N	Y N	Y N	Y N	Y N
7	Y N	Y N	Y N	Y N	Y N
	Total : ___/ ____	Total : ___/ ____	Total : ___/ ____		

Total of all table components: _____/ _____

9) Additional extension:

	Participant displays play action that met the lag in between prompt sequences	Time is extended
1	Y N	Y N
2	Y N	Y N
3	Y N	Y N
4	Y N	Y N
5	Y N	Y N
6	Y N	Y N
7	Y N	Y N
8	Y N	Y N
9	Y N	Y N
10	Y N	Y N
	Total: /	Total: /

Total (add two columns together): _____/ _____

Total for 1-5: _____/_____

Total for 6: _____/_____

Total for 7: _____/_____

Total for 8: _____/_____

Total for 9: _____/_____

→

Score:

____/____

X 100% =

_____

Baseline Condition

Participant: _____ **Play Set:** _____

Date: _____ **Instructor:** _____**Session Number:** _____ **Primary/Reliability**

Session Instructions: Place designated play set in front of participant with all materials present. Say, "Time to play." Set timer for 5 minutes. Set MotivAider for one minute, and after each minute move to the next row. Do not react unless student initiates; then respond with neutral statement.

Data Collection Instructions: Write each play action demonstrated. Do this for every action, even if it not complete (holds horse, sets horse down.

Minute	Play Action	# of blocks	Tally
1			
2			
3			
4			
5			
	Total Play Actions		
	Total DIFFERENT Play Actions		

- ***Total play actions is the number of play actions demonstrated. A participant may repeat the same action four or five times; this would result in 4 or five play actions.***
- ***Different Play Actions: action differing by character, action, or location. If the participant puts the king on the throne, and then places the queen on the throne, those are different actions as the character differed.***
- ***A participant may have ten total play actions, but only two different play actions if they repeated the same action numerous times.***

Intervention Condition

Play Set: Treehouse Zoo

Participant: _____ **Lag Schedule:** _____

Date: _____ **Instructor:** _____**Session Number:** _____ **Primary/Reliability**

Session Instructions: *Place designated play set in front of participant with all materials present. Say, "Time to play." Set timer for 5 minutes. Do not react unless student initiates; then respond with neutral statement. Deliver edible (determined by SPA) after every appropriate play action that* ***meets the lag.*** *If no action occurs after 30 seconds, initiate prompt sequence. After sequence, allow 30 seconds for independent response, then repeat. If appropriate play action occurs that meets the lag, start 30 sec. interval over, then begin prompt sequence. Do this until session is over. When timer goes off, if you are in the middle of the prompt sequence or participant is in the middle of a play action, terminate after prompt sequence or play action.*

Edible determined from SPA: _____

30 second duration	Description of play behavior
# of different play actions:	

Prompt sequence #1:

#	Character	Action	Location	Sr+
1	Girl monkey Boy parrot	Sits/teeters in slides rides Eats rolls balls down measures push stands on walks through looks through	Tree nest 1 Tree nest 2 Swing Brown Ramp Yellow slide Arch Scale Food cart Blue Food tray binoculars Balcony Elephant back elephant trunk	Edible
2	Girl monkey Boy parrot	Sits/teeters in slides rides Eats rolls balls down measures push stands on walks through looks through	Tree nest 1 Tree nest 2 Swing Brown Ramp Yellow slide Arch Scale Food cart Blue Food tray binoculars Balcony Elephant back elephant trunk	Edible
3	Girl monkey Boy parrot	Sits/teeters in slides rides Eats rolls balls down measures push stands on walks through looks through	Tree nest 1 Tree nest 2 Swing Brown Ramp Yellow slide Arch Scale Food cart Blue Food tray binoculars Balcony Elephant back Elephant trunk	Edible

30 second duration	Description of play behavior
# of different play actions:	

Prompt sequence #2:

#	Character	Action	Location	Sr+
1	Girl monkey Boy parrot	Sits/teeters in slides rides Eats rolls balls down measures push stands on walks through looks through	Tree nest 1 Tree nest 2 Swing Brown Ramp Yellow slide Arch Scale Food cart Blue Food tray binoculars Balcony Elephant back elephant trunk	Edible
2	Girl monkey Boy parrot	Sits/teeters in slides rides Eats rolls balls down measures push stands on walks through looks through	Tree nest 1 Tree nest 2 Swing Brown Ramp Yellow slide Arch Scale Food cart Blue Food tray binoculars Balcony Elephant back elephant trunk	Edible
3	Girl monkey Boy parrot	Sits/teeters in slides rides Eats rolls balls down measures push stands on walks through looks through	Tree nest 1 Tree nest 2 Swing Brown Ramp Yellow slide Arch Scale Food cart Blue Food tray binoculars Balcony Elephant back Elephant trunk	Edible

30 second duration	Description of play behavior
# of different play actions:	

Prompt sequence #3:

#	Character	Action	Location	Sr+
1	Girl monkey Boy parrot	Sits/teeters in slides rides Eats rolls balls down measures push stands on walks through looks through	Tree nest 1 Tree nest 2 Swing Brown Ramp Yellow slide Arch Scale Food cart Blue Food tray binoculars Balcony Elephant back elephant trunk	Edible
2	Girl monkey Boy parrot	Sits/teeters in slides rides Eats rolls balls down measures push stands on walks through looks through	Tree nest 1 Tree nest 2 Swing Brown Ramp Yellow slide Arch Scale Food cart Blue Food tray binoculars Balcony Elephant back elephant trunk	Edible
3	Girl monkey Boy parrot	Sits/teeters in slides rides Eats rolls balls down measures push stands on walks through looks through	Tree nest 1 Tree nest 2 Swing Brown Ramp Yellow slide Arch Scale Food cart Blue Food tray binoculars Balcony Elephant back Elephant trunk	Edible

30 second duration	Description of play behavior
# of different play actions:	

Prompt sequence #4:

#	Character	Action	Location	Sr+
1	Girl monkey Boy parrot	Sits/teeters in slides rides Eats rolls balls down measures push stands on walks through looks through	Tree nest 1 Tree nest 2 Swing Brown Ramp Yellow slide Arch Scale Food cart Blue Food tray binoculars Balcony Elephant back elephant trunk	Edible
2	Girl monkey Boy parrot	Sits/teeters in slides rides Eats rolls balls down measures push stands on walks through looks through	Tree nest 1 Tree nest 2 Swing Brown Ramp Yellow slide Arch Scale Food cart Blue Food tray binoculars Balcony Elephant back elephant trunk	Edible
3	Girl monkey Boy parrot	Sits/teeters in slides rides Eats rolls balls down measures push stands on walks through looks through	Tree nest 1 Tree nest 2 Swing Brown Ramp Yellow slide Arch Scale Food cart Blue Food tray binoculars Balcony Elephant back Elephant trunk	Edible

30 second duration	Description of play behavior
# of different play actions:	

30 second duration	Description of play behavior
After prompt sequence 1 2 3 4:	
# of different play actions:	

30 second duration	Description of play behavior
After prompt sequence 1 2 3 4:	
# of different play actions:	

30 second duration	Description of play behavior
After prompt sequence 1 2 3 4:	
# of different play actions:	

30 second duration	Description of play behavior
After prompt sequence 1 2 3 4:	
# of different play actions:	

30 second duration	Description of play behavior
After prompt sequence 1 2 3 4:	
# of different play actions:	

30 second duration	Description of play behavior
After prompt sequence 1 2 3 4:	
# of different play actions:	

30 second duration	Description of play behavior
After prompt sequence 1 2 3 4:	
# of different play actions:	

Total different play actions for session: _____

Intervention Condition
Play Set: House

Participant: _____ **Lag Schedule:** _____

Date: _____ **Instructor:** _____ **Session Number:** _____ **Primary/Reliability**

Session Instructions: *Place designated play set in front of participant with all materials present. Say, "Time to play." Set timer for 5 minutes. Do not react unless student initiates; then respond with neutral statement. Deliver edible (determined by SPA) after every appropriate play action that* ***meets the lag****.. If no action occurs after 30 seconds, initiate prompt sequence. After sequence, allow 30 seconds for independent response, then repeat. If appropriate play action occurs that meets the lag, start 30 sec. interval over, then begin prompt sequence. Do this until session is over. When timer goes off, if you are in the middle of the prompt sequence or participant is in the middle of a play action, terminate after session or play action.*

Song selection of choice: _____

30 second duration	Description of play behavior
# of different play actions:	

Prompt sequence #1:

#	Character	Action	Location	Sr+
1	Mom Dad Girl baby	Opens Sits on/in Goes through Lays down in/sleeps Falls out of eats	Front door couch Fridge high chair Oven food on table Toilet blue chair 1 Queen bed blue chair 2 Top bunk bed blue chair 3 Bottom bunk bed	music
2	Mom Dad Girl baby	Opens Sits on/in Goes through Lays down in/sleeps Falls out of eats	Front door couch Fridge high chair Oven food on table Toilet blue chair 1 Queen bed blue chair 2 Top bunk bed blue chair 3 Bottom bunk bed	music
3	Mom Dad Girl baby	Opens Sits on/in Goes through Lays down in/sleeps Falls out of eats	Front door couch Fridge high chair Oven food on table Toilet blue chair 1 Queen bed blue chair 2 Top bunk bed blue chair 3 Bottom bunk bed	music

30 second duration	Description of play behavior
# of different play actions:	

Prompt sequence #2:

#	Character	Action	Location	Sr+
1	Mom Dad Girl baby	Opens Sits on/in Goes through Lays down in/sleeps Falls out of eats	Front door couch Fridge high chair Oven food on table Toilet blue chair 1 Queen bed blue chair 2 Top bunk bed blue chair 3 Bottom bunk bed	music
2	Mom Dad Girl baby	Opens Sits on/in Goes through Lays down in/sleeps Falls out of eats	Front door couch Fridge high chair Oven food on table Toilet blue chair 1 Queen bed blue chair 2 Top bunk bed blue chair 3 Bottom bunk bed	music
3	Mom Dad Girl baby	Opens Sits on/in Goes through Lays down in/sleeps Falls out of eats	Front door couch Fridge high chair Oven food on table Toilet blue chair 1 Queen bed blue chair 2 Top bunk bed blue chair 3 Bottom bunk bed	music

30 second duration	Description of play behavior
# of different play actions:	

Prompt sequence #3:

#	Character	Action	Location	Sr+
1	Mom Dad Girl baby	Opens Sits on/in Goes through Lays down in/sleeps Falls out of eats	Front door couch Fridge high chair Oven food on table Toilet blue chair 1 Queen bed blue chair 2 Top bunk bed blue chair 3 Bottom bunk bed	music
2	Mom Dad Girl baby	Opens Sits on/in Goes through Lays down in/sleeps Falls out of eats	Front door couch Fridge high chair Oven food on table Toilet blue chair 1 Queen bed blue chair 2 Top bunk bed blue chair 3 Bottom bunk bed	music
3	Mom Dad Girl baby	Opens Sits on/in Goes through Lays down in/sleeps Falls out of eats	Front door couch Fridge high chair Oven food on table Toilet blue chair 1 Queen bed blue chair 2 Top bunk bed blue chair 3 Bottom bunk bed	music

30 second duration	Description of play behavior
# of different play actions:	

Prompt sequence #4:

#	Character	Action	Location	Sr+
1	Mom Dad Girl baby	Opens Sits on/in Goes through Lays down in/sleeps Falls out of eats	Front door couch Fridge high chair Oven food on table Toilet blue chair 1 Queen bed blue chair 2 Top bunk bed blue chair 3 Bottom bunk bed	star
2	Mom Dad Girl baby	Opens Sits on/in Goes through Lays down in/sleeps Falls out of eats	Front door couch Fridge high chair Oven food on table Toilet blue chair 1 Queen bed blue chair 2 Top bunk bed blue chair 3 Bottom bunk bed	star
3	Mom Dad Girl baby	Opens Sits on/in Goes through Lays down in/sleeps Falls out of eats	Front door couch Fridge high chair Oven food on table Toilet blue chair 1 Queen bed blue chair 2 Top bunk bed blue chair 3 Bottom bunk bed	star

30 second duration	Description of play behavior
# of different play actions:	

30 second duration	Description of play behavior
After prompt sequence 1 2 3 4:	
# of different play actions:	

30 second duration	Description of play behavior
After prompt sequence 1 2 3 4:	
# of different play actions:	

30 second duration	Description of play behavior
After prompt sequence 1 2 3 4:	
# of different play actions:	

30 second duration	Description of play behavior
After prompt sequence 1 2 3 4:	
# of different play actions:	

30 second duration	Description of play behavior
After prompt sequence 1 2 3 4:	
# of different play actions:	

30 second duration	Description of play behavior
After prompt sequence 1 2 3 4:	
# of different play actions:	

30 second duration	Description of play behavior
After prompt sequence 1 2 3 4:	
# of different play actions:	

Total different play actions for session: _____

CURRICULUM VITAE

MARY KATHERINE ENDICOTT HARRIS

EDUCATION HISTORY

May 2016 **Student, Doctor of Philosophy in Disability Disciplines**
Department of Special Education & Rehabilitation
Emphasis: Applied Behavior Analysis
Utah State University, Logan, Utah
Advisor: Thomas S. Higbee, Ph.D.

August 2014 **Special Education Credential, Level 2**
Mild to Moderate
Moderate to Severe
Utah Office of Education

August 2001 **Special Education Credential,** Moderate to Severe Disabilities
Chapman University, Concord, CA
Advisor: Keith Storey, Ph.D.

Dec. 1995 **Bachelor of Arts, Psychology**
University of California at Berkeley, Berkeley, CA
Advisor: Dan Slobin, Ph.D.

CERTIFICATIONS HELD

January 2016 Aspen Trainer
April 2014 Safety Care Trainer
June 2011 Professional Educator License, Level 2, State of Utah
August 2001 Special Education Credential, Moderate to Severe, State of California
June 2000 Board Certified Assistant Behavior Analyst # 0-14-0085

WORK HISTORY: ACADEMIC

Fall 2006 Strategies for Teaching Young Children w/Disabilities (Teaching Assistant)
Spring 2006 Advanced Applied Behavior Analysis (Instructor)
Fall 2005 Teaching Exceptional Children (Teaching Assistant)
Summer 2005 Advanced Behavior Analysis (Teaching Assistant)
Fall 2004 Single Subject Design (Teaching Assistant)

WORK HISTORY: CLINICAL

August 2008- July 2015 **Elementary Life Skills Coordinator, Cache County School District**
Provide support (behavior and curriculum) for elementary severe teachers in ten schools. Responsibilities include but are not limited to:

- Serve as LEA at Individual Education Program Meetings
- Provide training and coach new teachers in delivery of programming, implementation of curricula and goals, implementation of behavior intervention plans
- Assist in the implementation of classroom management techniques, assessment and data collection, effective instruction
- Develop topics for professional learning community events
- Provide behavioral training and feedback for paraprofessional staff

August 2003- 2008 **Assistant Program Director, ASSERT Program**, Utah State University, Logan,
Provide supervision for children with autism at university based program providing instruction through the principles of Applied Behavior Analysis and empirically based approaches. Responsibilities include, but were not limited to:

- Supervise and train undergraduate and graduate students
- Supervise therapists working 1:1 with students
- Develop curriculum
- Lead team meetings
- Communicate with parents; conduct visits in the home to ensure consistency
- Train local agencies in order to provide systematic replication of technology
- Participate in and develop materials for teacher training institutes
- Conduct assessments and complete monthly progress reports
- Conduct research to develop innovative methods of teaching

July 2005- July 2006 **Consultant:** Weber County School District, Ogden, Utah
Set up intensive intervention preschool classroom for children with autism. Provided ongoing training for teachers and parents, curriculum support, and behavioral interventions

August 2004- June 2005 **Consultant**: Lincoln County School District #2, Afton, Wyoming
Provided behavioral interventions for students ages 6-14, as well as training, and curriculum support for educators throughout the district

August 2004- August 2005 **Consultant**: Heber City and Alpine Unified School Districts
Provided behavioral interventions for students ages 3-5 as well as training, and curriculum support for preschool teachers. Funding provided through the Utah Department of Education

May 2003- August 2007 **Consultant, private**: Switzerland, Scotland, & Bermuda
Provided initial assessments, analysis and development of program and curricula for children with autism. Provide training for educators, paraprofessionals, & parents, both in the home environment and in general education settings.

August 2001- May 2003 **Director, TCLC Texas Behavior Clinic**, Houston, Texas
Planned, taught, and supervised in a center-based program for children with autism and developmental delays using principles of Applied Behavior Analysis, B. F. Skinner's Analysis of Verbal Behavior, naturalistic language opportunities and discrete trials. Responsibilities included, but were not limited to:

- Initial hiring and training of personnel
- Providing four-day intensive interventions for clients out of catchment area
- Conducting initial assessment of individual student's basic skills
- Writing and implementing Individualized Education Plans
- Conducting functional analyses and implementing behavior plans
- Completion of progress reports and exit reports
- Communicating with parents on a consistent basis
- Provide ongoing training and feedback for support staff
- Conduct interviews for new staff/supervise all personnel paperwork
- Lead morning curriculum reviews and clinical meetings
- Present information in community outreach meetings
- Provide support for local districts through trainings

August 1997- **Special Education Teacher, STARS School/Behavior Analysts, Inc**. Walnut Creek, CA

August 2001 Planned, taught, and oversaw the daily classroom programs for children with Autism and severe language delays using principles of Applied Behavior Analysis.

January 1996- June 1997 **Paraprofessional, Spectrum In Class Support Services**, Berkeley, CA
Full-time aide for a child with severe behavioral needs in a full inclusion environment. Implemented behavior plans, increased social and language skills, adapted academic curriculum to suit the needs of the student and ensure success. Participated in team clinical meetings.

PUBLICATIONS: PEER REVIEWED

Endicott, K., & Higbee, T.S. (2007). Contriving motivating operations to evoke mands for information in preschoolers with autism. *Research in Autism Spectrum Disorders,* 1, 210-217.

Reagon, K.A., Higbee, T.S., & Endicott, K. (2007). Using video instruction procedures with and without embedded text to teach object labeling to preschoolers with autism: A preliminary investigation. *Journal of Special Education Technology, 22,* 1, 13-20.

Reagon, K.A., Higbee, T.S., & Endicott, K. (2006). Teaching pretend play skills to a student with autism using video modeling with a sibling as model and play partner. *Education and Treatment of Children,* 29, 517-528.

Higbee, T.S., Chang, S., & Endicott, K**.** (2005). Non-contingent access to preferred sensory stimuli as a treatment for automatically reinforced stereotypy. *Behavioral Interventions,* 20, 177-184

Sundberg, Mark L., Endicott, K., & Eigenheer, P. (2000). Using Intraverbal Prompts to Establish Tacts for Children with Autism, *The Analysis of Verbal Behavior,* 17, 89-104

PUBLICATIONS: OTHER

Endicott, K. & Reagon, K.A. Empowering parents to promote language in youngsters with autism. (2006). *Early Childhood Report,* 17: 11, 7.

Higbee, Thomas S., Endicott, M.K., & Reagon, Kara A. (2003-2004). Autism Support Services: Education, Research, and Training (ASSERT) Program at Utah State University, *Center for Persons with Disabilities News,* 27, 1-10.

PROFESSIONAL PRESENTATIONS (state and national)

Endicott, K. (2007, May). Clinical applications of *Language for Learning* with preschoolers with autism. Paper presented at the 33rd Annual Convention of the Association for Behavior Analysis. San Diego, CA.

Endicott, K. & Reagon, K.A. (2006, October). *Strategies to promote language in preschoolers with autism.* Paper presented at the 22nd Annual International Conference of the Division of Early Childhood. Little Rock, AK.

Endicott, K. & Higbee, T.S. (2006, May). *Teaching children with autism to mand for information by contriving motivating operations.* Paper presented at the 32nd Annual Convention of the Association for Behavior Analysis. Atlanta, GA.

Endicott, K. & Higbee, T.S. (2006, February). *Contriving motivating operations to teach children with autism to mand for information.* Paper presented at the 24th Annual Western Regional Conference on Behavior Analysis of the California Association for Behavior Analysis. San Francisco, CA.

Higbee, T.S., Endicott, K., Reagon, K. (2005, January). *Technology-Mediated Instructional Strategies for Students with Autism.* Presentation presented at the 2005 ATIA Conference and Exhibition, Orlando, FL.

Higbee, T.S., Endicott, K., Reagon, K. (2004, October). *Recent Research in Behavioral Interventions for Young Children with Autism.* Presentation presented Utah's Early Childhood Special Education Conference, Provo, UT.

Higbee, T.S., Endicott, K., Reagon, K. (2004, June). *Current Research in Instructional Strategies for Young Children with Autism.* Paper presentation presented at the 2nd Annual Utah Conference on Effective Practices in Special Education & Rehabilitation, Salt Lake City, UT.

Higbee, T.S., Endicott, K., Reagon, K. (2004, May). *Reinforcer Identification for Students with Autism and Other Disabilities.* Workshop presented at the 30th Annual Convention for the Association for Behavior Analysis International, Boston, MA

Endicott, K., Reagon, K., & Higbee, T.S. (2004, May). *An Analysis of the Effects of Response Repetition on Teaching Language to Children with Autism.* Poster presented at the 30th Annual Convention for the Association for Behavior Analysis International, Boston, MA.

Reagon, K., Endicott, K., & Higbee, T. S. (2004, May). *Video Instruction with and Without Embedded Text to Teach Tacts to Children with Autism.* Poster presented at the 30th Annual Convention for the Association for Behavior Analysis International, Boston, MA.

Reagon, K., Endicott, K., & Higbee, T.S. (2004, May). *Sequential Use of Video Modeling and Audio Scripts to Teach Pretend Play to Preschoolers with Autism.* Poster presented at the 30th Annual Convention for the Association for Behavior Analysis International, Boston, MA.

Endicott, K., Reagon, K., & Higbee, T.S. (2004, February). *Response repetition in language instruction for children with autism.* Poster presented at the 22nd Annual Conference of the California Association for Behavior Analysis, San Francisco, CA.

Reagon, K., Endicott, K., & Higbee, T.S. (2004, February). *Teaching tacts to children with autism through video instruction with embedded text.* Poster presented at the 22nd Annual Conference of the California Association for Behavior Analysis, San Francisco, CA.

Reagon, K., Endicott, K., & Higbee, T.S. (2004, February). *Video modeling and audio scripts: Teaching play components then contextual language.* Poster presented at the 22nd Annual Conference of the California Association for Behavior Analysis, San Francisco, CA.

Sundberg, M. L., Endicott, K., & Opheikens, R. (2001, February). *Teaching Intraverbal Behavior to Children with Autism.* Symposium, presented at the 19th Annual Conference of the California Association for Behavior Analysis, Redondo Beach, CA.

Sundberg, M. L. Endicott, K., Kaplan, B. (2000, February*). Matching to Sample and its Relation to Receptive Language and Tacts.* Poster, presented at the 18th Annual Conference of the California Association for Behavior Analysis, San Francisco, CA.

Sundberg, M. L. Endicott, K., Kaplan, B. (2000, March*). Matching to Sample and its Relation to Receptive Language and Tacts.* Poster presented at the 14th Annual Conference for the Behavior Analysis Association of Michigan, Ypsilanti, MI.

Sundberg, M. L., Endicott, K., & Eigenheer, P. (1999, May). *Using Intraverbal Prompts to Establish Tacts for Nonverbal Children with Autism.* Paper, presented at the Annual Convention for the Association for Behavior Analysis, Chicago, IL.

Sundberg, M. L., & Endicott, K. (1999, March). *Using Intraverbal Prompts to Establish Tacts for Children Who Fail to Acquire Sign Language.* Paper session, presented at the 13th Annual Conference for the Behavior Analysis Association of Michigan, Ypsilanti, MI.

Sundberg, M. L., Endicott, K., & Eigenheer, P. (1999, February). *Using Intraverbal Prompts to Establish Tacts for Children with Autism.* Poster, presented at the 17th Annual Conference of the California Association for Behavior Analysis, San Francisco, CA.

Judd, N. D., Endicott, K. & Sundberg, M. L. (1997, February). *Using Written Stimuli as Prompts for the Early Language Acquisition of a Child with Autism.* Poster, presented at the 15th Annual Conference of the Northern California Association for Behavior Analysis, Oakland, CA

WORKSHOPS

Higbee, T.S., Endicott, M.K. & Reagon, K.A. (2004, June). *Educational and behavioral intervention strategies for students with autism.* Two-week workshop presented to special education teachers and speech pathologists from various Utah school districts, Logan, UT. Total participants=8.

Higbee, T.S., Endicott, M.K. & Reagon, K.A. (2004, May). *Reinforcer identification for students with autism and other disabilities.* Half-day workshop presented at the Association for Behavior Analysis annual conference, Boston, MA. Total participants=5.

EDITORIAL

- 2011 Guest Reviewer for *Analysis of Verbal Behavior*
- 2007 Guest Reviewer for *Journal of Direct Instruction*
- 2005 Guest Reviewer for *Topics in Early Childhood Special Education*
- 2004 Guest Reviewer for *Education and Treatment of Children*

AWARDS

- Bill Jenson Related Service Provider Award 2012
- First place winner, College of Education Graduate Student Symposium, 2005

MEMBERSHIP IN PROFESSIONAL ORGANIZATIONS

- Association for Professional Behavior Analysts 2013-Present
- Council for Exceptional Children 2006-2007
- Division of Early Childhood 2006-2007
- Association for Behavior Analysis International (ABAI) 1996-2009, 2015-present
- California Association of Behavior Analysis (Cal-ABA), 1996-2001, 2004-2009, 2015-present
- Nevada Association for Behavior Analysis (NABA) January 2004-2005
- Texas Association for Behavior Analysis (TxABA) 2001-2003
- California Association of Behavior Analysis Board of Directors, 1999-2001
- Utah Association for Behavior Analysis 2014-present

OTHER ACTIVITIES

- College of Education Graduate Student Senator, 2006-2007
- Association for Behavior Analysis Student Representative, 2006
- Doctoral Student Representative, Department of Special Education 2005-2006
- Sigma Kappa Sorority President January- December 1995
- Circle of Friends, The Family Place June 2016-
- Volunteer, Loaves & Fishes
- Volunteer, Make-a-Wish Foundation