An Evaluation of Reinforcement Effects of Preferred Items during Discrete-Trial Instruction

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This study compared the relative reinforcing efficacy of high-preferred and low-preferred stimuli, as determined by two types of preference assessments, on acquisition rates in three children diagnosed with an Autism Spectrum Disorder (ASD). The study also evaluated the indirect effects of preference on students' stereotypy and problem behavior during instructional periods. Participants were presented with a task and provided high or low-preferred stimuli contingent upon correct responding. Results showed that acquisition occurred more rapidly in the highly preferred condition for some participants. Higher rates of problem behavior occurred in the low preferred condition for all participants. These results highlight the importance of utilizing preference assessment procedures to identify and deliver high-preferred items in skill acquisition procedures for individuals with ASD.

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CHAPTER 1

INTRODUCTION

Research has shown that interventions based on the principles of behavior analysis are effective for remediating skill deficits associated with autism spectrum disorder (ASD) (Lovaas, 1987, Eikseth, Smith, Jahr, & Eldevik, 2002, Sallows & Graupner, 2005). Experimenters who achieved significant results, i.e. 48% of participants mainstreamed without support, employed a high-intensity program consisting of approximately 40 hours per week of discrete trial instruction (DTI) and naturalistic teaching procedures (Sallows & Graupner, 2005). Considering this oft-prescribed intensity of instruction, it is important to ensure that the learner is motivated to participate in continuous instructional opportunities.

A focus on motivation is a hallmark of Pivotal Response Training (PRT), an evidence based naturalistic intervention for individuals with ASD (Koegel, Koegel, Brookman, 2003; National Autism Center, 2009). For example, Koegel, Singh, and Koegel (2010) demonstrated that incorporating motivational techniques, such as providing choice, interspersing maintenance tasks, and using naturally occurring reinforcement, improves instructional performance. Specifically, academic interventions that included these motivational variables decreased participant's latency to responding and rates of problem behavior while increasing academic responding.

DTI and naturalistic procedures are both effective teaching techniques that comprise EIBI (Smith, 2001); however, they arrange for reinforcement in different ways. In naturalistic teaching strategies, preferred items are identified through observation of the child's engagement with items and activities. PRT addresses motivation by capitalizing on the child's interests. For example, if a child is playing with a baby doll, the instructor may withhold a baby bottle (a component of the activity of interest) until the child engages in a target response, such as asking

for the bottle. The therapist would then deliver the bottle contingent upon the child's appropriate request. In contrast, DTI often relies on the utilization of arbitrary reinforcers or reinforcers that are not related to the task. In DTI procedures, stimuli are typically identified a priori via a stimulus preference assessment. A number of studies have focused on assessing preference and there are several indirect and direct measures of preference available depending upon individual characteristics (Hagopian, Long, and Rush, 2014).

Indirect assessments, those in which preference for stimuli is not directly observed, rely on an assessor compiling a list of preferred items based upon caregiver report. One example of this is the Reinforcer Assessment for Individuals with Severe Disabilities or RAISD (Fisher et al., 1996). The RAISD is an interview-based assessment that obtains information from caregivers on individual interests across several categories of stimuli (e.g. visual, olfactory, and auditory). However, comparative evaluations show that there is low concordance between stimuli identified via the RAISD and those identified as preferred stimuli via direct assessments (Fisher et al., 1992). Therefore, indirect assessments are often useful for nominating stimuli to include in a direct assessment of preference, but not as a sole measure of preference. Similar efforts by Matson (1999) established a reliable choice assessment scale containing potentially reinforcing stimuli but actual reinforcement effects were not evaluated in that study.

Direct assessments involve systematic presentation of stimuli and the recording and comparison of approach responses to each item. Stimuli consist of items identified by caregivers or through observation of the individual in a free play setting. There are multiple methods to assess preference and those include single-stimulus (SS), single stimulus with engagement (SSE), paired-stimulus (PS), multiple-stimulus with replacement (MSW), multiple-stimulus without replacement (MSWO), and free-operant (FO).

Single Stimulus (SS) assessments consist of presenting one stimulus at a time and recording whether or not an approach to the item occurs, then calculating percentages of approach based on number of opportunities. Pace et al. (1985) conducted research on SS assessments and also assessed reinforcer effectiveness. Highly preferred stimuli, those stimuli that participants approached and engaged with, was found to have greater reinforcement value than that of low preferred or stimuli that was not approached.

Fisher et al. (1992) observed that the SS assessment, while effective, involved a limitation in that some individuals will approach all stimuli. They compared the SS assessment to a paired stimulus (PS) assessment in which participants were presented with a series of forced choice offerings. After pairing each item with every other item, they determined a ranking based on the percentage of selections for each stimulus. Experimenters then tested the reinforcing efficacy of identified highly preferred stimuli in a concurrent operant procedure that showed the high-high preferred stimuli, or those stimuli selected most frequently in both assessments, produced a greater amount of engagement in tasks associated with that consequence. Piazza, et.al.(1996) evaluated reinforcer strength more thoroughly by comparing duration of time that participants spent in a designated place to earn access to high, moderate or low preferred items previously identified through a PS preference assessment. Three chairs were available: One in which the high preferred item was available, one in which the low or moderate preferred item was available and one with no item which functioned as control. They found that highly preferred stimuli consistently functioned as a reinforcer for all participants. Moderate-preferred also functioned as reinforcers for some participants, but only when competing with the low preferred stimuli. The low preferred stimuli did not function as reinforcers in any condition.

While this study provided insight into the value of preference ranking, it also involved a minimally effortful response to assess reinforcer strength.

Windsor, Piche and Locke (1994) compared the PS preference assessment to a group presentation assessment or multiple stimuli with replacement (MSW). An array of preferred items was presented to the participant. Once an item was chosen it was returned to the array, allowing multiple opportunities for selection. Items were ranked by percentage of selections. Both assessments were found to identify similar preferences, however, the PS preference assessment took longer to administer.

Deleon and Iwata (1996) determined that the MSW obscured potential reinforcers because participants chose the highly preferred items so frequently that many items were never selected. This precluded establishing a hierarchy of preference based on that assessment. They found that conducting the MSW *without* replacing an item after selection, or a multiple stimulus without replacement (MSWO), resulted in a preference ranking that compared well to the PS. Additionally, the experimenters tested the reinforcing efficacy of four items that had not been selected at all in the MSW but had been ranked as low preferred via the PS and MSWO. Three out of 4 participants displayed an increase in responding with simple operant tasks (e.g. touching a panel) when the lower ranked items were delivered contingent on responding. A similar study extended this research by conducting a PS assessment initially, then conducting MSWO daily. When results differed from the PS the first item selected in the MSWO was compared to the top item in the PS for reinforcer efficacy. The test utilized a concurrent operant arrangement in which participants selected their task according to the consequence it provided. Tasks were already mastered but more complex than pressing a switch (e.g. folding a shirt, reading a word on a flash card, and completing single digit arithmetic problems). Findings indicated that the top

daily MSWO selection functioned more effectively as a reinforcer than the top PS item (DeLeon, et.al, 2001).

Call et al. (2012) examined responding under progressive ratio schedules as means of assessing how much work an individual is willing to do to access the item. Progressive ratio schedules provide a measure of sensitivity to reinforcer strength as responding is measured under increasing schedule requirements. In contrast, single-operant assessments may limit assessment of reinforcer strength due to ceiling effects (Roscoe, Iwata & Kahng, 1999). Once the PS assessment identified a highly preferred stimulus for each participant, daily MSWO assessments were conducted. Stimuli were then assessed for reinforcement strength in random order using a PR schedule in which the requirement doubled after every instance of delivery (i.e. FR 1, FR 2, FR 4, FR 8…). Break points were compared among MSWO selections. Results showed that the top choice in the PS assessment produced the highest break points, regardless of which item was selected first in the MSWO, indicating that the PS may be a more reliable means of identifying highly reinforcing stimuli.

Roane, Vollmer, Ringdahl and Marcus (1998) evaluated a brief free operant stimulus assessment (FO). This assessment measures engagement with selected stimuli. Experimenters observed 10 participants ranging in age from 3 to 37 during 5 minute intervals in which preferred items were freely accessible. Engagement with items during 10 second partial intervals served as the response measurement. They conducted two experiments; the first showed that the brief assessment could identify items that would function as reinforcers for simple operant behavior. A second experiment compared the brief stimulus assessment to the PS and found results comparable, while the former showed lower rates of problem behavior and took less time to complete. This variable may indicate the FO assessment as a more suitable option for individuals

who engage in high rates of problem behavior around removal of preferred items. Additionally, it would present a viable option for those who are unable to make choices or as an alternative when preferred stimuli cannot be displayed in a tabletop format. Where the brief assessment falters in comparison with other procedures is that, like the MSW, it does not give a systematic ranking of items. Additionally, the extended access to preferred items may increase the likelihood of satiation during teaching.

Previous studies determined that a PS or daily MSWO preference assessment are the most effective predictors of reinforcer strength and provide a hierarchy of preference (Kang, et.al. 2012). The MSWO takes less time to administer and can accommodate for fluctuations in preference. Tests of reinforcer effectiveness show that daily MSWO assessments are equal to PS preference assessments in predicting reinforcer strength when the target skill is a simple operant response. Additionally, Lee, Yu, Martin and Martin (2010) demonstrated that concordance held between stimuli identified as preferred and reinforcer effectiveness when testing for same occurred prior to assessing preference.

In sum, a fair amount of research has examined the ability of preferred items to function as reinforcers by looking at simple operant response strength or the number of simple responses performed under increasing schedule requirements. Research has not measured reinforcer efficacy by evaluating how preferred items affect rate of acquisition. In addition, research has not evaluated how the delivery of preferred items during discrete-trial instruction affect behavioral indicators of motivation such as short latencies to responding, problem behavior, and increased or decreased rates of stereotypy. Thus, the purpose of the current study was to evaluate acquisition rates in children with autism who receive a highly preferred stimulus for correct

responding in one condition and a low-preferred stimulus in another. We also evaluated these effects on two collateral measures of child responding: problem behavior and stereotypy.

CHAPTER 2

METHOD

Participants

Three children diagnosed with an ASD by an outside agency, based on the DSM-IV (American Psychological Association, 1994) criteria, participated in this study. Participants attended a day treatment facility that provided early intensive behavioral intervention for individuals with ASD. At the time of the study, Donald was a 2.5-year-old boy who communicated via one to three word requests, possessed generalized imitation skills and simple instruction following. Andrew was a 4-year-old boy with generalized motor imitation who could request in short phrases and used some sentences. Cody was a 2.5-year-old boy who spoke in short sentences, requested preferred items and activities and engaged in some rudimentary play behaviors. All participants demonstrated the requisite skill of responding during discrete-trial instruction for up to 15 minute periods. Two to four instructional sessions were conducted daily.

Setting

All sessions took place in small (8' x 8') treatment rooms or the children's classrooms. The treatment rooms contained a table, chairs, and a storage cabinet which held the child's preferred items and teaching materials. Teaching materials consisted of stimuli necessary for the task (i.e. picture cards), data sheets, a timer, and stimuli identified via the preference assessment. Classrooms typically accommodated 3-5 children, but during the time that sessions were held in the classroom other children were not present or only one other child was present.

Tasks

Tasks were selected based upon the goals specified in each child's intervention plan. Two sets of targets were taught to each child. Andrew was taught to expressively label food items, Cody's targets were expressive labels for food and common stimuli, and Donald learned to receptively identify pictures of common items (See table 1). For Donald, sessions consisted of 12 trials (3x4 targets), for Cody and Andrew sessions consisted of 15 trials (3x5 targets).

For each participant, Target Set 1 corresponded to the highly preferred (HP) condition and Set 2 to the less preferred (LP). The experimenters equated targets in each group by ensuring there were an equal number of syllables and initial letter sounds in each group. Laminated 4 x 6" cards were used for picture stimuli. The experimenter ensured that the target was the main element of the picture and there were minimal additional elements on the picture. For example, if the child was instructed to label "dog" the experimenter ensured that one dog was prominent in the picture and there were no other stimuli, such as a Frisbee or trees that were also present in the picture.

Experimental Design

We evaluated the effects of two instructional conditions, (Set 1 and Set 2) using an adapted-alternating treatments design (Sindelar, Rosenberg, & Wilson, 1985). We presented the conditions in a random, counter-balanced order and always conducted a pair of sessions within the same day, in other words, if we conducted a Set 1 session we also conducted a Set 2 session with a 10-15 minutes break between sessions. We set mastery criterion at two consecutive sessions with correct, unprompted responses at or above 90%. If mastery criterion was reached in only one experimental condition, instruction continued in both condition with the same contingencies in place until either: a) mastery criterion was reached or b) the total number of

instructional sessions reached twice that of the mastered condition. If, at the time of mastery in one condition, a stable or decreasing trend was observed in the other condition, we immediately discontinued that condition and taught all targets using the same consequence (that which produced mastery for the other targets) .

Response Measurement

The dependent variables were percentage of unprompted correct responses, percentage of trials in which problem behavior occurred, and percentage of trials in which stereotypy occurred. For Cody and Andrew, unprompted correct responses were defined as vocalization of the targeted response prior to the delivery of the model prompt. For Donald, an unprompted, correct response was defined as pointing to the correct stimulus within 5 s of the presentation of the auditory stimulus. Problem behavior was defined as the participant leaving the instructional setting (except during the inter-trial interval), failing to return to the teaching setting at the request of the experimenter, crying, screaming, throwing items, swiping materials off the table or striking materials when presented, and aggression in the form of hitting, kicking, biting, or pinching the experimenter. For Andrew, stereotypy was defined as repeating words, phrases, songs or nonsense words, visually fixating on objects, looking at objects with peripheral vision, and hand or arm posturing. Donald rarely engaged in stereotypy but when it was present it consisted primarily of vocal play.

Inter-observer Agreement and Procedural Integrity

Graduate students in behavior analysis collected inter-observer agreement data via pencil and paper during sessions or viewed videotapes of sessions to record data. A second observer collected reliability data on (33%) of sessions. Inter-observer agreement (IOA) was calculated on a trial-by-trial basis. For preference assessments, agreements were defined as both observers recording that the individual either selected or did not select each stimulus. For instructional sessions, agreement for correct unprompted responding was scored when both observers scored the response as either correct or incorrect unprompted responses. Agreements were also scored for problem behavior and stereotypy in which both observers scored the trial as characterized by one of the behaviors. Experimenters calculated inter-observer agreement by dividing agreements by agreements plus disagreements and multiplying by 100.

Treatment integrity data inter-observer agreement on child response was collected during all preference assessments and 33% of instructional sessions in order to assure that experimenters followed the written protocol for teaching. Experimenters were scored on nine behaviors: establishing ready behavior, presenting stimuli as specified, ensuring that the child attended to stimuli prior to delivering the S^D, delivering the correct S^D, delivering reinforcement within 3 seconds of a response, using the correct prompt type at the prescribed interval, recording data following each trial, removing and rearranging stimuli after each trial, and ignoring or blocking problem behavior upon occurrence. Treatment integrity IOA was collected in 25% of sessions.

Andrew's mean response IOA was 100.0 % with no session scored lower than 100.0 %. Mean problem behavior IOA was 99.6% (range, 93-100%) and stereotypy was 100% with no session lower than 100%. Treatment integrity for Andrew was 99.8% (range, 98-100%) and IOA

on treatment integrity was 99.8% (range, 97-100%). For Donald, IOA on responding was 99.9% (range, 99-100%). IOA on problem behavior was 93.6% (range, 82-100%). Donald did not display stereotypic behavior. Treatment integrity data for Donald was 99.8% (range, 98-100) and IOA on treatment integrity was 99.9% (range, 99-100%). Andrew's response IOA was 100% with no session scored lower than 100%. Problem behavior IOA was 99.6% (range, 93-100%) and stereotypy was 100% with no session lower. Treatment integrity for Andrew was 99.8% (range, 98-100%) and IOA on treatment integrity was 99.8% (range, 97-100%). For Cody, response IOA at the time of this writing was 100% with no session lower than 100%. 100%. Problem behavior IOA was 98% (range, 80-100%). Treatment integrity scores for Cody were 100% with no session lower than 100%. Treatment integrity IOA was also 100% with no scores lower. Preference assessment IOA and treatment integrity scores were 100% for all participants across all assessments with no scores lower than 100%.

Experimental Procedure

Preference assessment. Paired-stimulus preference assessments were initially conducted for each participant to identify a high and low-preference item. Table 2 shows the high and low preference items per participant. We selected 6 – 8 items to include in the preference assessment based on staff report and observations of the child's preferred activities during play time. For each participant at least one novel item was included in this initial preference assessment because unfamiliar items with qualities similar to a child's existing preferences have been shown to possess highly reinforcing properties (Kenzer, Bishop, Wilke & Tarbox, 2013).

As described in Fisher et al. (1992), experimenters placed two stimuli side by side on the table 10" apart and participants were instructed to "choose one." Selection resulted in removal of the non-chosen item and 30 seconds access to the chosen item or consumption of edible item and

attempts to select both items were blocked. If the participant failed to select either item after five seconds, the experimenter prompted the participant to sample each item for five seconds and then re-presented those stimuli. Each item was paired with every other item and results recorded on a data sheet via pen and pencil.

We included both edible and non-edible items in Donald's assessment as staff reported they delivered edible items as a preferred consequence frequently during instructional programs. We only included non-edible items for Andrew and Cody as this was consistent with consequences delivered during their instructional programs.

We also conducted MSWO preference assessments for Andrew and Cody. After the PS assessment we decided that for Andrew and Cody, an MSWO preference assessment would be conducted prior to each session in order to evaluate for vacillations in preference. Andrew demonstrated little differentiation in the first PS preference assessment so we conducted a second PS preference assessment. The second assessment produced similar results in regard to differentiation amongst items but there were some changes in preference rankings. We conducted a third PS preference assessment and Andrew showed a pronounced shift in preference in all assessments, including the highly preferred item (see Figures 2 through 4). Due to the lack of differentiation in the original assessment and fluctuations in preference from the first to the third assessment, we decided to conduct daily MSWO assessments as a measure of preference for Andrew. For Cody, we decided to conduct daily MSWO assessments because he often requested different items throughout the baseline phase. This was permitted in baseline and we felt that letting him choose on a session by session basis might reduce his tendency for preference vacillation once teaching began.

Similar to the procedures described in DeLeon and Iwata (1996), six items were placed on the floor or on the table in a straight line and the experimenter told the participant to pick something to play with. Choosing an item resulted in 15 s access to the item after which the item was removed from the array. The experimenter rearranged the other items and repeated the process until only one item remained. The first item selected was designated as the highly-preferred consequence for that session and the last item selected was designated the low-preferred item. An MSWO was conducted prior to running a set (one HP and one LP) of experimental conditions.

Reinforcer assessment. The relative effects of high and low preference consequences on acquisition were evaluated. We set mastery criterion at 90% across two consecutive sessions. Receptive targets were presented in a field of 4 for Donald. Following each trial, experimenters removed and rearranged the stimuli. For Andrew and Cody, expressive targets were held 12" from the participant at eye level. Targets were presented in a randomized order which differed for each session.

Following the PS preference assessment the most frequently chosen and least frequently chosen items or edibles were designated as highly preferred and low preferred respectively. Two teaching conditions, one featuring highly preferred consequences and the other, low preferred consequences, were conducted once or twice, 3-5 days per week, in a random order determined by a coin toss. Throughout each block of trials only the designated consequence was provided. If more than two sessions were conducted in the same day, a separate MSWO was conducted prior to the start of each pair of sessions. Experimenters restricted access to preferred stimuli to experimental sessions to control for the influence of deprivation/satiation conditions.

Participants sat at the table with the experimenter during teaching trials. Experimenters attempted to physically redirect elopement from the table, but if the child succeeded during a teaching trial the experimenter issued the instruction to return. After 5 s the therapist used gentle physical guidance to bring the child to the table. If the child resisted the physical guidance, the experimenter terminated guidance and ran the subsequent trial on the floor. Afterward, and prior to each trial, the experimenter repeated the sequence of requesting a return to the table and attempting to guide the child towards the instructional setting.

Baseline. The experimenter secured attending behavior prior to delivering the instruction, "What is it?" for Cody and Andrew or "Touch *item"* for Donald. If the participant did not orient to the materials during expressive identification trials the experimenter attempted to establish attending by lightly tapping the picture prior to delivering the S^D. During receptive trials the experimenter employed similar methods or verbally instructed the child to look at the materials. After presentation of the instruction the participant had 5 s to respond. No programmed consequences were delivered for correct or incorrect responses and no prompts were provided. The participant received vocal praise and access to an item identified as moderately-preferred on a VR 2 schedule for attending, compliance and performance of maintenance tasks.

HP Condition. The experimenter provided instruction using a progressive prompt delay to the controlling prompt. The controlling prompt was a vocal model for Andrew and Cody and a gestural prompt for Donald. We set prompt delays at 0 s, 2 s, 5 s, 7 s and 10 s. All participants experienced two instructional sessions with trials at a 0-s prompt delay, and the third instructional session introduced trials at a 2 s delay. We increased the prompt delay value (5 s, 7 s, 10 s) if at least 50% of the participant's unprompted incorrect responses were errors of

omission for two consecutive sessions. The experimenter delivered the stimuli identified as highly-preferred following both unprompted and prompted correct responses.

LP Condition. The LP condition was the same as the HP condition above except that the consequence for each response was 30 s access to the low preferred stimulus. In the event that the participant refused the low preferred stimulus, the therapist allowed the 30 s break period to elapse before initiating the next trial. In this way we avoided creating a negative reinforcement contingency in the form of early escape from the teaching setting.

CHAPTER 3

Results

Figures 1-5 show results of the paired stimulus preference assessments for each participant. Donald selected M&M's in 100% of trials and chose a baby doll in 16% of trials. These items were designated HP and LP respectively. Andrew's highly preferred item changed in each successive paired stimulus assessment. In the first assessment (Figure 2) Andrew chose the number puzzle and number tiles in 88% of trials and the cars in 16% of trials. An anecdotal report from an instructor revealed that Andrew especially enjoyed specific cars, so a second PS preference assessment was conducted to increase our confidence in the results. The second assessment (Figure 3) showed that Andrew chose the cars and the number tiles in 88% of trials. The number puzzle was chosen 25% of trials, tied with a V-tech toy (Text 'n Go) for least preferred of items chosen at least once. A prop from circle time was never chosen. Figure 4 shows that the Text 'n Go was chosen more than any other item, 88% of trials, and number tiles were chosen the least, 30% of trials. These results prompted our decision to perform daily MSWO preference assessments with Andrew throughout the instructional phase of the study. Andrew chose the V-tech toy first in 100% of MSWO assessments and vacillated between a book and foam letters as his LP item. Cody chose the Yo Gabba Gabba boombox in 100% of trials and four items were tied for least often selected (Figure 5). We decided to run daily MSWO preference assessments with Cody due to the fluctuations in preference that we observed during his baseline sessions. The boombox was highly preferred based on MSWO preference assessments in 75% of instructional sessions. He chose a piggy bank first in 12.5% of sessions and play dough first in 12.5% of sessions. The LP item vacillated between an electronic Elmo

toy (42%) and the V-tech toy (Text ‘n Go) (42%). In 6% of sessions, Cody chose a visually stimulating water and oil toy.

Donald’s performance under baseline condition was low (M = 12.5%) (Figure 6). This performance is consistent with chance responding during receptive identification tasks in which the participant has a 1 in 3 chance of correct responding (that is, by selecting a stimulus in a field of three). Mastery criterion was reached in the HP condition after 7 instructional sessions whereas mastery criterion was reached in the low-preferred condition after 21 instructional sessions. Thus, mastery criterion was reached in 14 fewer sessions in the high-preferred condition for Donald. Donald engaged in problem behavior for 3 of 15 sessions in the HP condition and in only 8% of those trials (Figure 7). Problem behavior in the LP condition occurred in 14 out of 15 sessions and ranged from 8 to 90% of trials. Once mastery occurred in the HP condition, contingencies were reversed in the LP condition so that Donald received the HP consequence for all correct responses.

For Andrew, in three baseline sessions no correct expressive labels were produced in response to any of the target stimuli. Following two sessions at a 0 second time delay, he correctly responded to seventy-three percent of trials in both conditions. Andrew mastered the Set 2 targets in six sessions which matched acquisition of the set 1 targets. (Figure 8) Problem behavior did not appear in either condition for this participant until session 8 where it occurred in twenty-six percent of trials in the low preferred condition (Figure 9). No problem behavior occurred at any time during the HP sessions, but it increased over the remaining low preferred sessions to sixty-six percent in the last and escalated from elopement in session 8 to crying and screaming in addition to elopement in session eighteen. Stereotypy was seen in both conditions but at low rates (6 to 26%) (Figure 10).

Cody did not respond correctly to any stimuli presented in baseline sessions. After the 0s time delay expired his correct responding was higher on the Set 2 targets in the LP condition (46%) as compared to 26% in the HP condition for the first two sessions with a 2 s time delay. Over the next several sessions, performance deteriorated in the LP condition accompanied by variable levels of problem behavior. The trend continued to be variable over the next 12 sessions and then increased to 86%. HP targets were close to mastery at 93%, then variable for the next several sessions before decreasing to 73%. At the time of this writing, his responding in both conditions averages 75% (Figure 11). Problem behavior occurred in 16/35 sessions in the HP condition and ranged from 6 to 46%. In the LP condition, problem behavior occurred in 32/35 sessions and ranged from 6 to 53% (Figure 12).

CHAPTER 4

Discussion

The findings show that the delivery of highly-preferred items functioned as a reinforcer as consistent with previous research (Call et al. 2012; Piazza et.al. 1996). However, we specifically evaluated these effects on the rate of acquisition (rather than response rate), as well as on behavioral indicators of motivation. Results indicate that, for one of three participants, providing high-preferred consequences identified by either a PS or MSWO preference assessment facilitated acquisition, as demonstrated through fewer instructional sessions required to reach mastery criterion. In addition, delivery of HP consequences resulted in conditions more conducive to teaching and learning, as evidenced by relatively low levels of problem behavior and/or stereotypy during the instructional period.

It is important to keep in mind the numerous variables that may contribute to acquisition aside from the type of consequence. These components of discrete-trial instruction include: securing participants' attending to instruction, giving clear and concise instructions, properly executing the controlling prompt, ignoring or blocking problem behavior, and delivering reinforcement immediately, following a response (Carroll, R.A., Kodak, T. & Fisher, W.W., 2013). Even with these instructional aspects held constant, the type of consequence had a differential effect on rates of acquisition. This highlights the importance of ensuring that instructors use high-preferred stimuli in conjunction with high-quality instruction.

Contingent delivery of high-preferred items was also associated with lower rates of problem behavior, albeit to varying degrees, for all participants. Donald engaged in problem behavior in the LP sessions (See Figure 7). Percentage of trials with problem behavior was relatively low during HP conditions except during the initial phase of the contingency reversal.

It should be noted that the change in contingencies also corresponded with a staff change. In both conditions, Donald engaged in higher rates of problem behavior (See figure 7). It is possible that the continuation of problem behavior during the HP2 phase was a carryover effect associated with stimuli a recent association with the LP condition. However, carryover effects would not explain the sudden increase in problem behavior in the HP condition as no change had occurred.

Cody's acquisition is relatively equivalent across conditions although correct responding was initially higher in the HP condition. Unfortunately, Cody's evaluation is still in progress at and we are unable to conclude which condition facilitated acquisition. In general, Cody's overall rate of acquisition is slower than the other two participants. We have recently modified his instructional programming to deliver reinforcement only for correct, unprompted responses (Karsten & Carr, 2009) to promote unprompted, correct responding. Cody's instructional requirement, five targets, may be the reason his rate of acquisition is relatively slower than the other participants. An additional consideration is the manner in which preferred items were delivered. Fienup, Ahlers, and Pace (2011) hypothesized that distributed reinforcement arrangements, schedules in which brief work requirements are alternated with brief access to reinforcement, may have an abolishing effect on reinforcer value. The 30 s period of access to his highly preferred item created frequent interruptions in his play, possibly devaluing the HP consequence. Anecdotally, Cody was resistant to the removal of the Yo Gabba Gabba boombox toy, which was the HP item, at the end of each 30 s period and this frequent interruption of play (to begin the next trial) may have altered the reinforcing value of the item. This possibility may also explain why Cody engaged in low rates of problem behavior in the HP condition. However, Cody engaged in the majority of instances in the LP condition. Future researchers may include

assessing preference for reinforcer delivery in addition to preference for items (Donaldson, DeLeon, Fisher & Kahng, 2014). Finally, it is also possible that items lose their value within an instructional session. Instructors should be aware of any behaviors that indicate that the learner has become disinterested in a preferred item, such as not interacting with the item.

Andrew's rate of acquisition was equivalent in both conditions despite increasing levels of problem behavior in the LP condition (See figure 8). The frequency of Andrew's problem behavior was considerable in the low-preferred condition, suggesting that the instructional setting was aversive (See figure 9). Andrew engaged in stereotypy more frequently during the high preferred condition, but this difference was minor (See figure 10). Given that Andrew's rate of acquisition was equivalent, it is possible that correct responding itself functioned as a reinforcer for Andrew irrespective of preferred (or non-preferred) items delivered by the instructor. Future evaluations may include a feedback only condition to evaluate if contingent delivery of preferred items increases the rate of acquisition above and beyond verbal feedback for correct responding.

Future evaluations may also consider running each condition through to mastery in a reversal design (Karsten & Carr, 2009) rather than the multi-element design employed in the current evaluation. Given the relatively short interval between sessions (10-15 m), it is possible that the consequence for one condition created a contrast effect that altered the value of the consequence in the other condition (Roscoe, Iwata & Kahng, 1999).

Finally, a potential limitation of this study involves the combination of both food and non-food items in one of the preference assessments. The intention was to include food due to its tendency for reinforcer strength, however, two of our participants, Cody and Andrew did not have any food items that were preferred over the other items. Future research may consider the

use of edible items in comparative evaluations, such as this one. Deleon, Iwata, and Roscoe (1997) demonstrated that food items in a preference assessment are often chosen before non-food items, essentially displacing the non-food items as candidates for HP status. It is possible that when food items are delivered in a high-preferred condition relative to any non-food item in a low-preferred condition, the relative difference in reinforcing efficacy is pronounced. The current data suggests this as we saw the most pronounced discrepancy in acquisition rates for Donald, the only participant who received edible items in the high-preferred condition. While reliance on food as reinforcers must be carefully monitored in regard to nutritional intake, it might be a worthwhile concession for a learner who lacks motivation. Future studies might investigate the relationship between food reinforcers and acquisition, specifically.

The necessity of finding reinforcers for children in discrete trial treatment programs remains relevant despite all other advances in teaching techniques and procedures. This study demonstrates that current preference assessment procedures, in most cases, can adequately identify those stimuli that will function as reinforcers sufficient to promote conditions conducive to acquisition of new target responses for children with ASD.

Name	Targets		Trials (per condition)
	High Preferred Set 1	Low-Preferred Set 2	
Donald	coat hanger	nail clippers	12
	shed	globe	
	spatula	colander	
	house plant	oven	
Andrew	ham	pie	15
	pancakes	raisins	
	Jell-O	sausage	
	bagel	lemon	
	Cheez-Its	Fritos	
Cody	ham	corn	15
	pancakes	bucket	
	watch	belt	
	bagel	vacuum	
	chain saw	level	

Table 1. Participants, targets and number of trials per condition

Name	Paired Stimulus Assessment	
	High Preferred	Low Preferred
Andrew	1) number puzzle 2) cars 3) text n' go	cars number puzzle, text n' go Number tiles
Donald	M&Ms	Baby doll
Cody	Yo Gabba Gabba boom box	Elmo toy, text n' go, car racers, Cookie monster

Table 2. High and Low preferred items by participant from the paired stimulus preference assessment

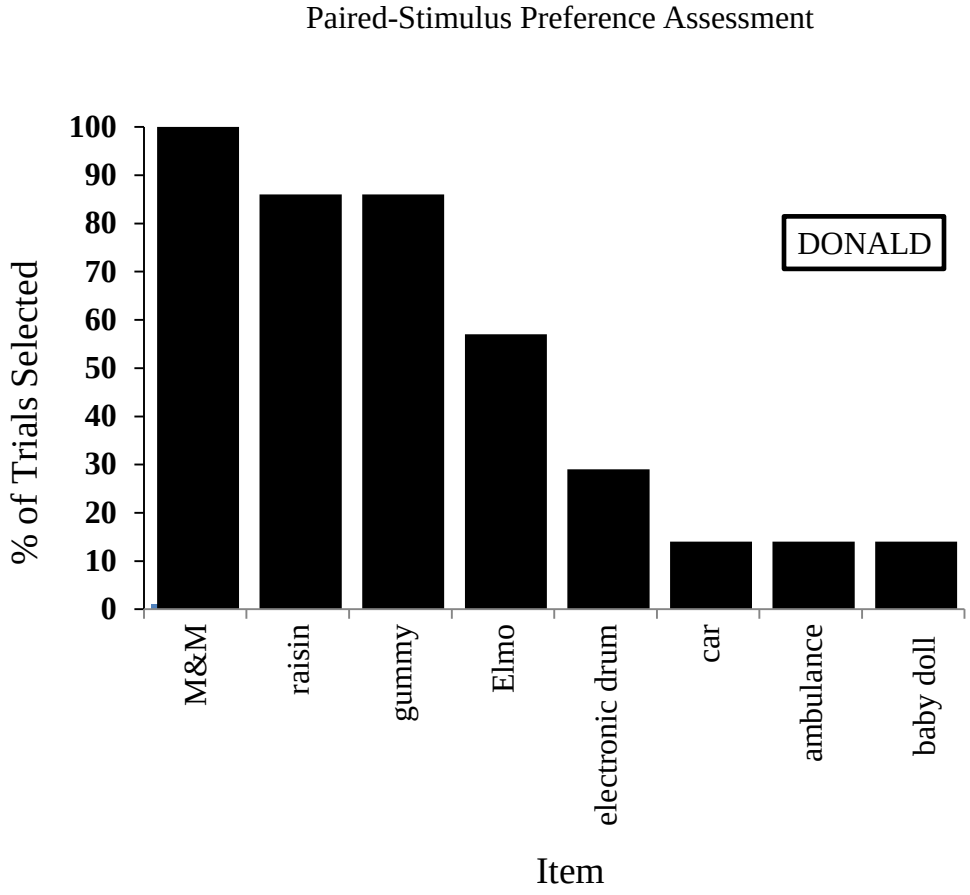

Figure 1. Results of PS preference assessment for Donald

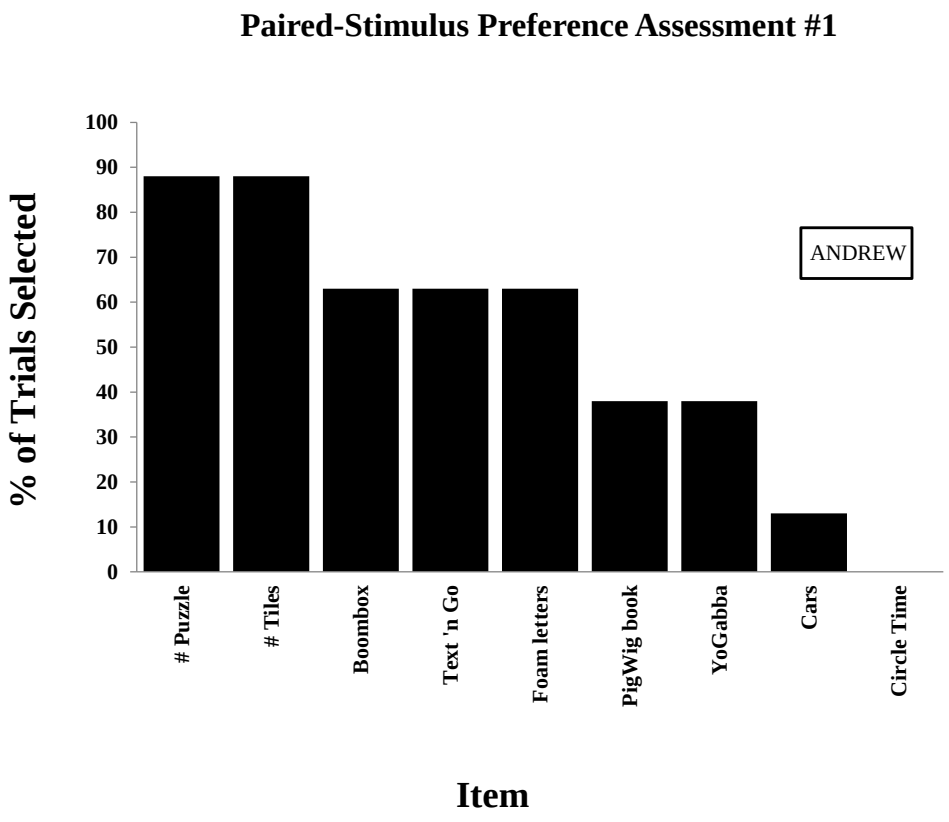

Figure 2. Results of PS preference assessment #1 for Andrew

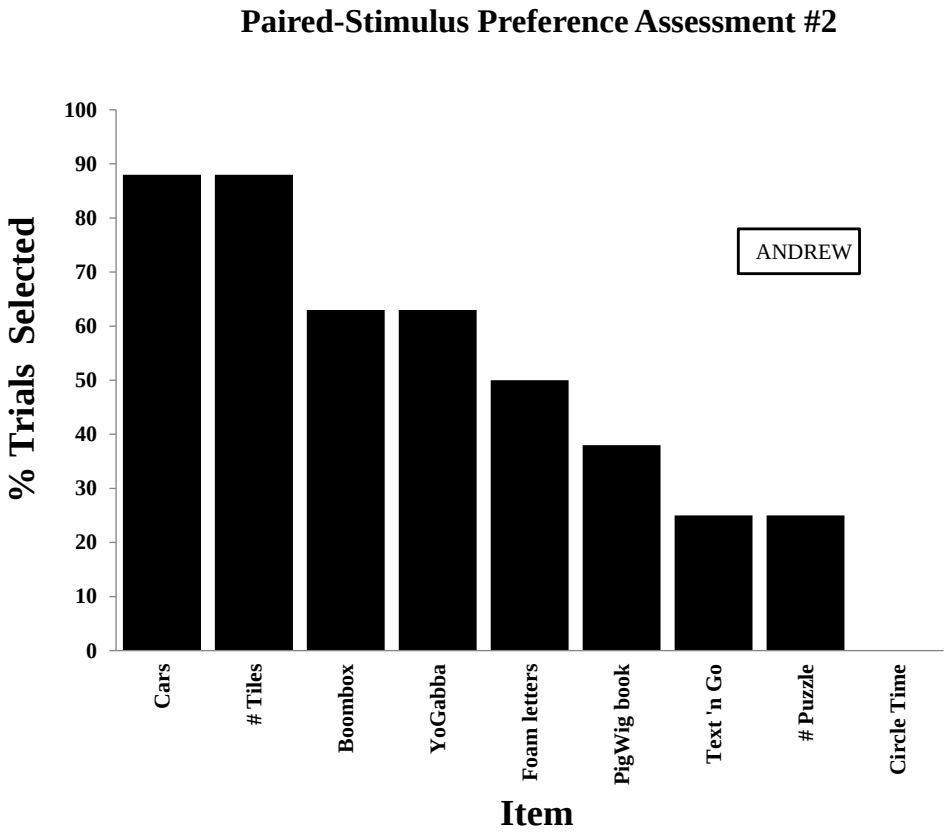

Figure 3. Results of PS preference assessment #2 for Andrew

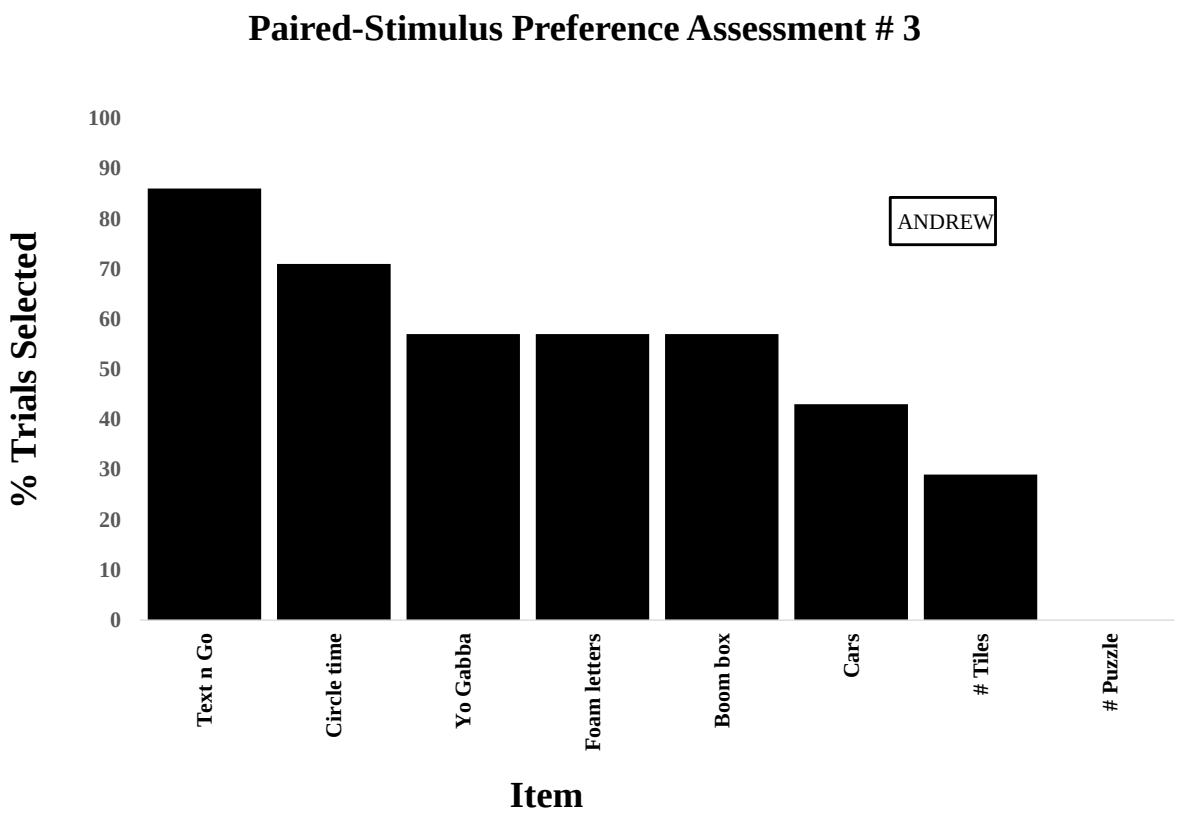

Figure 4. Results of PS preference assessment #3 for Andrew

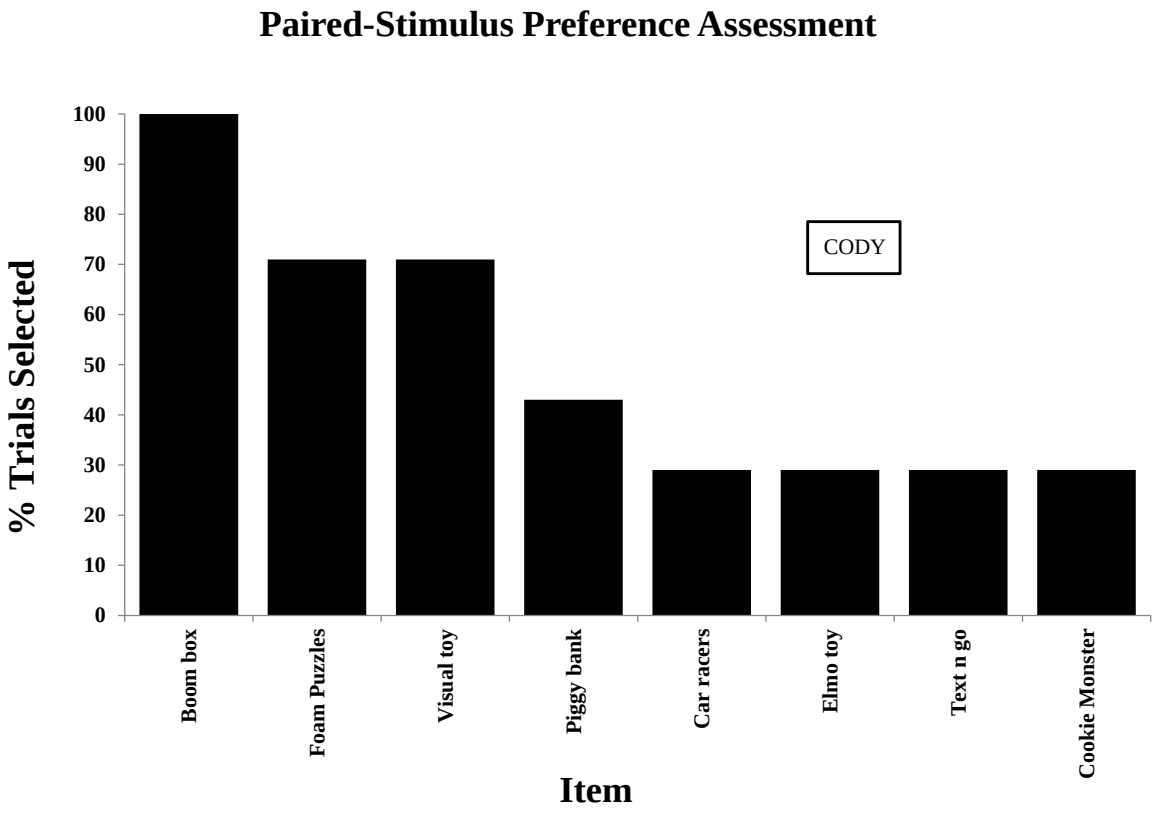

Figure 5. Results of PS preference assessment for Cody

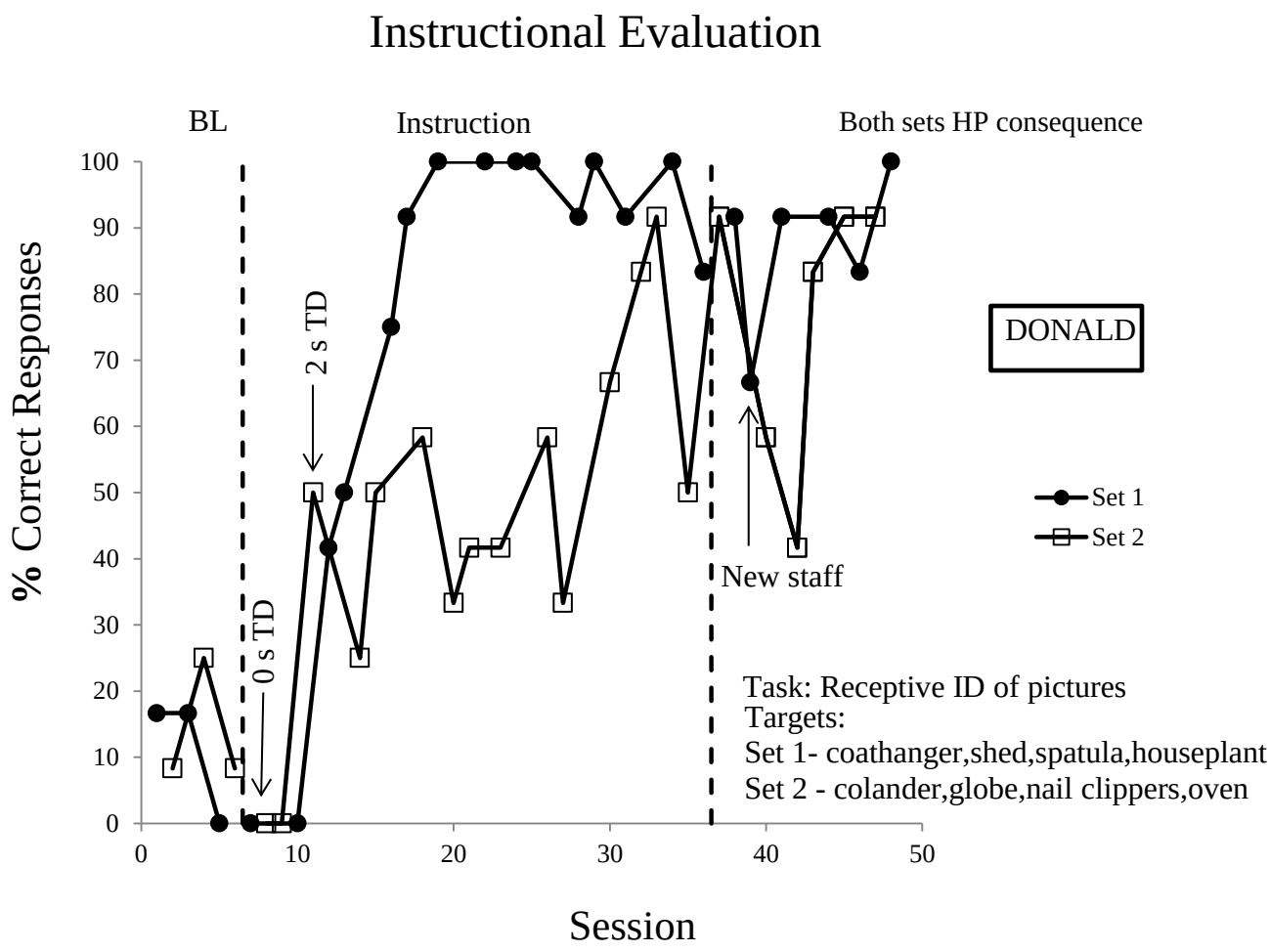

Figure 6. Percentage of correct responding for Donald

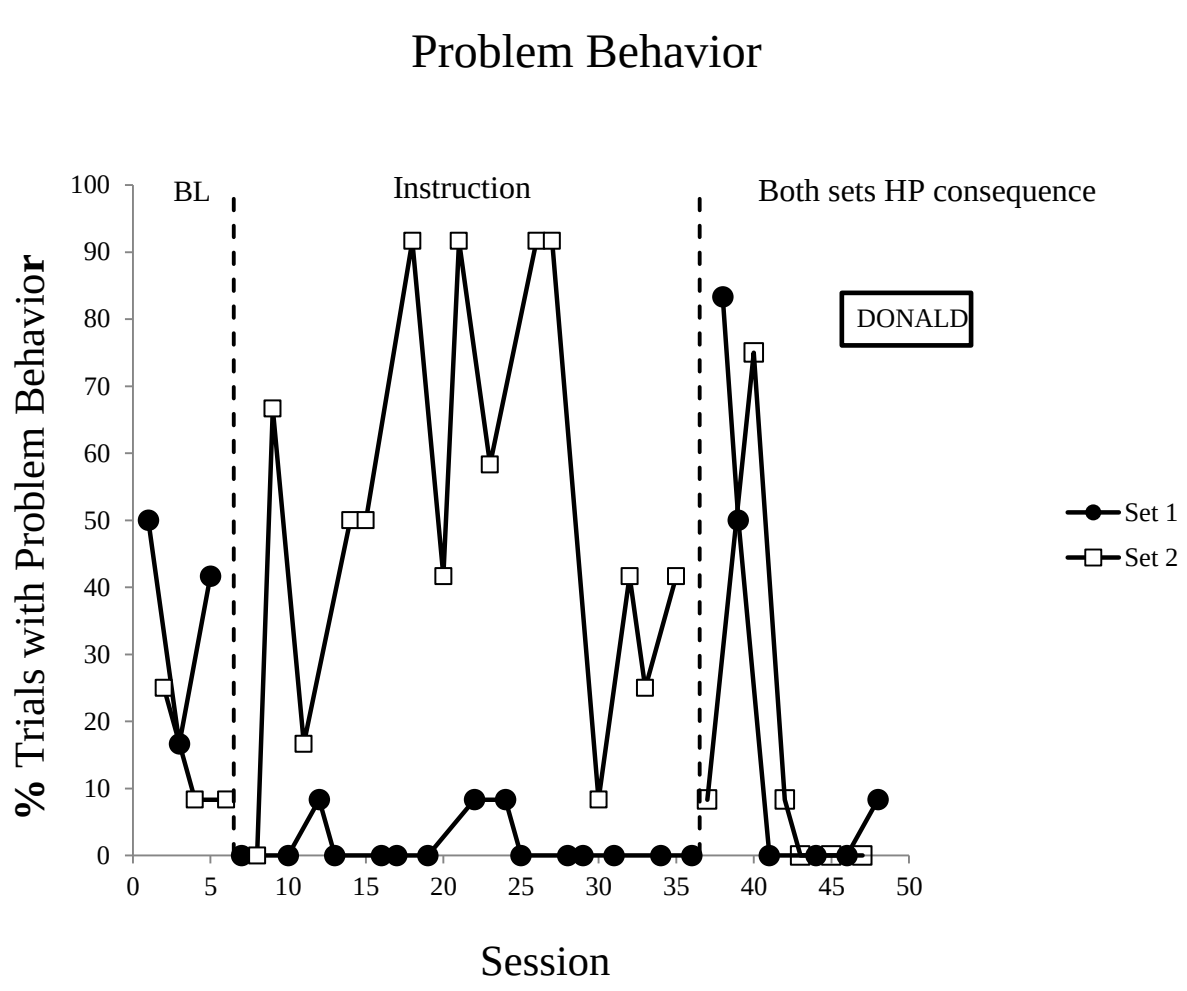

Figure 7. Percentage of trials with problem behavior for Donald

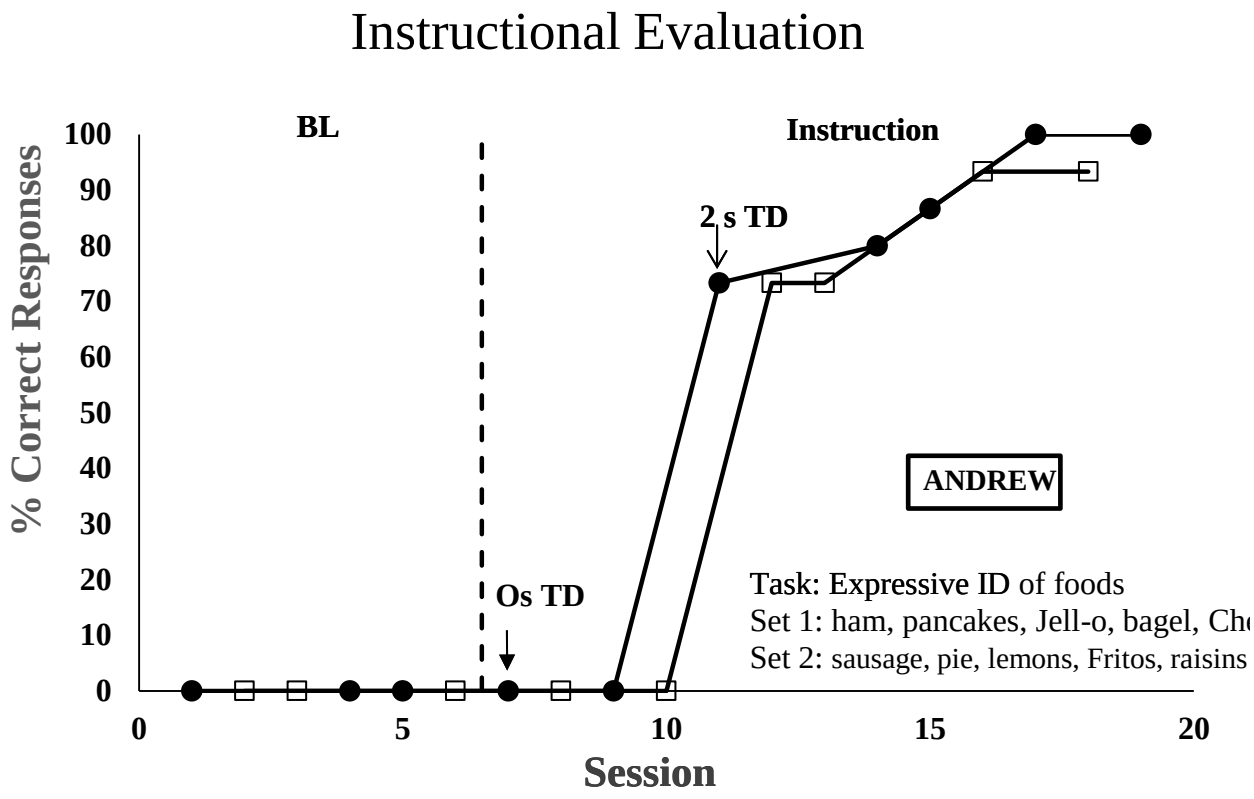

Figure 8. Percentage of correct responding for Andrew

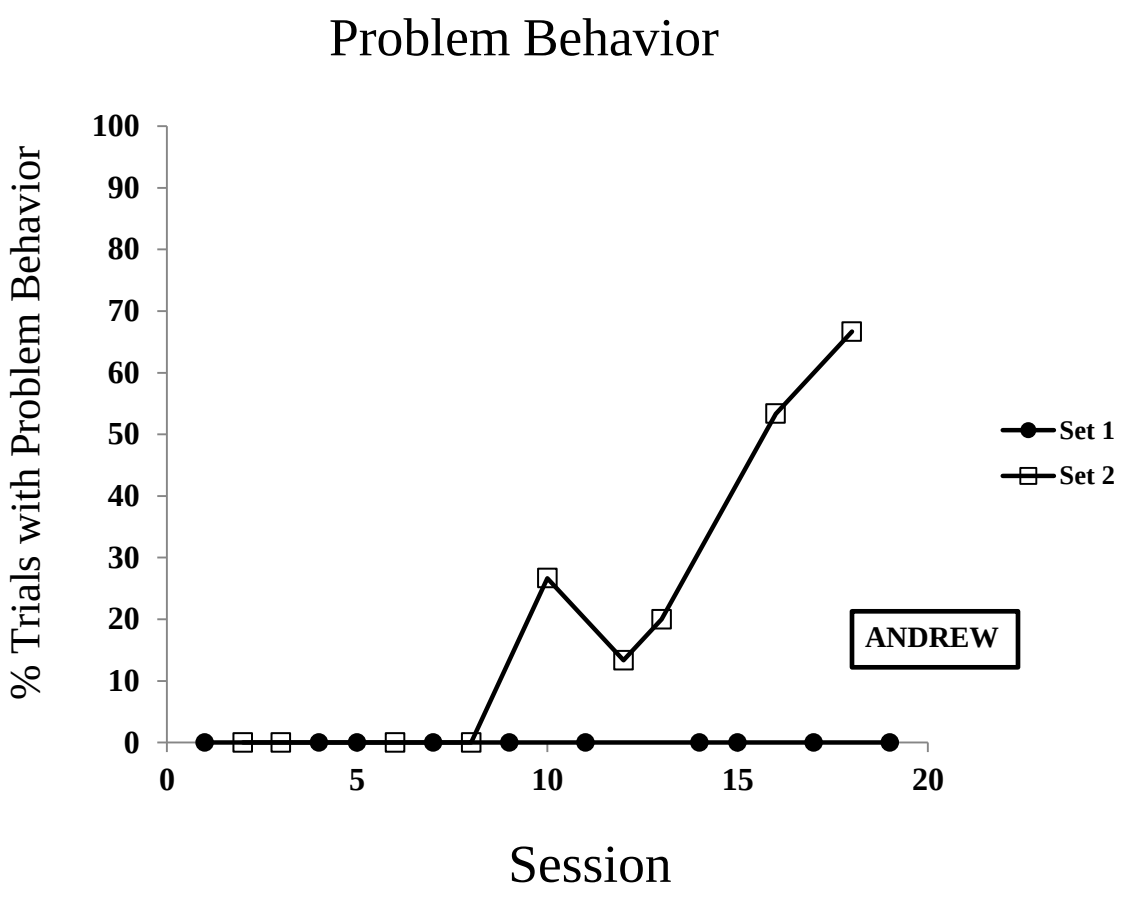

Figure 9. Percentage of trials with problem behavior for Andrew

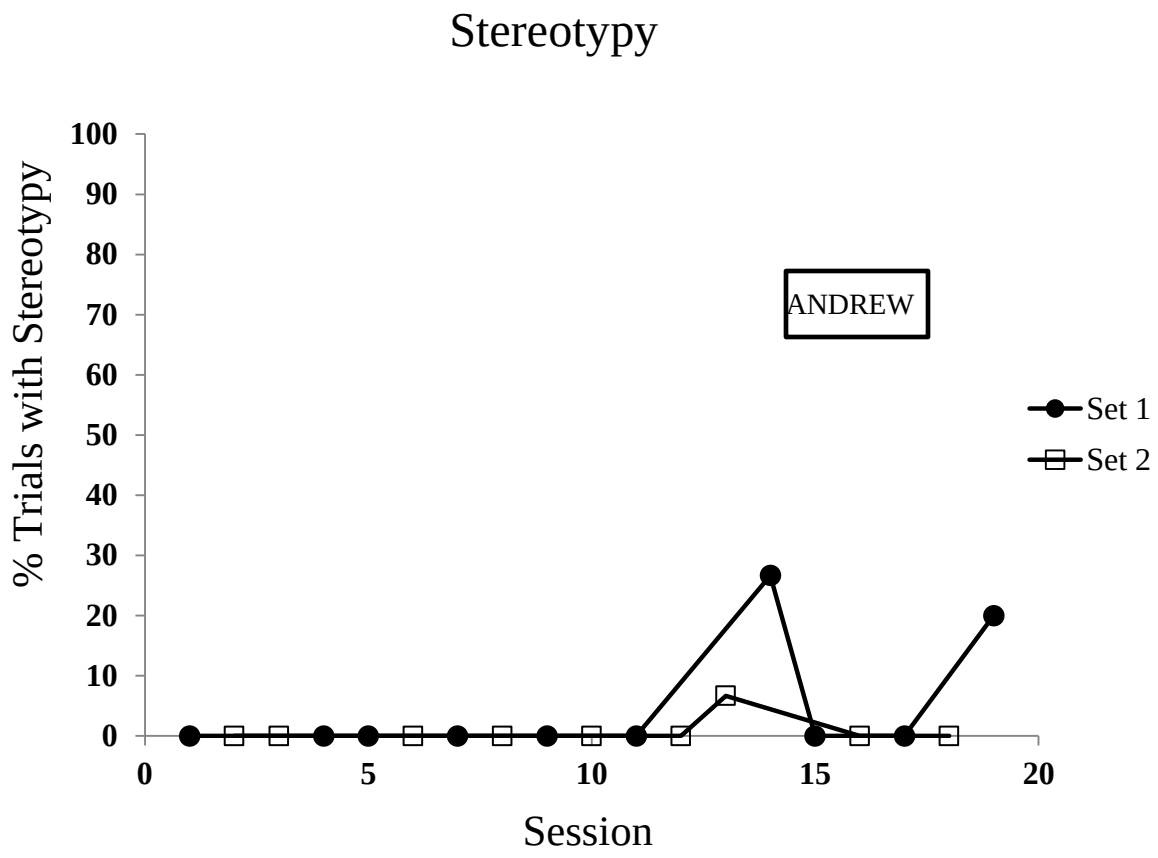

Figure 10. Percentage of trials with stereotypy for Andrew

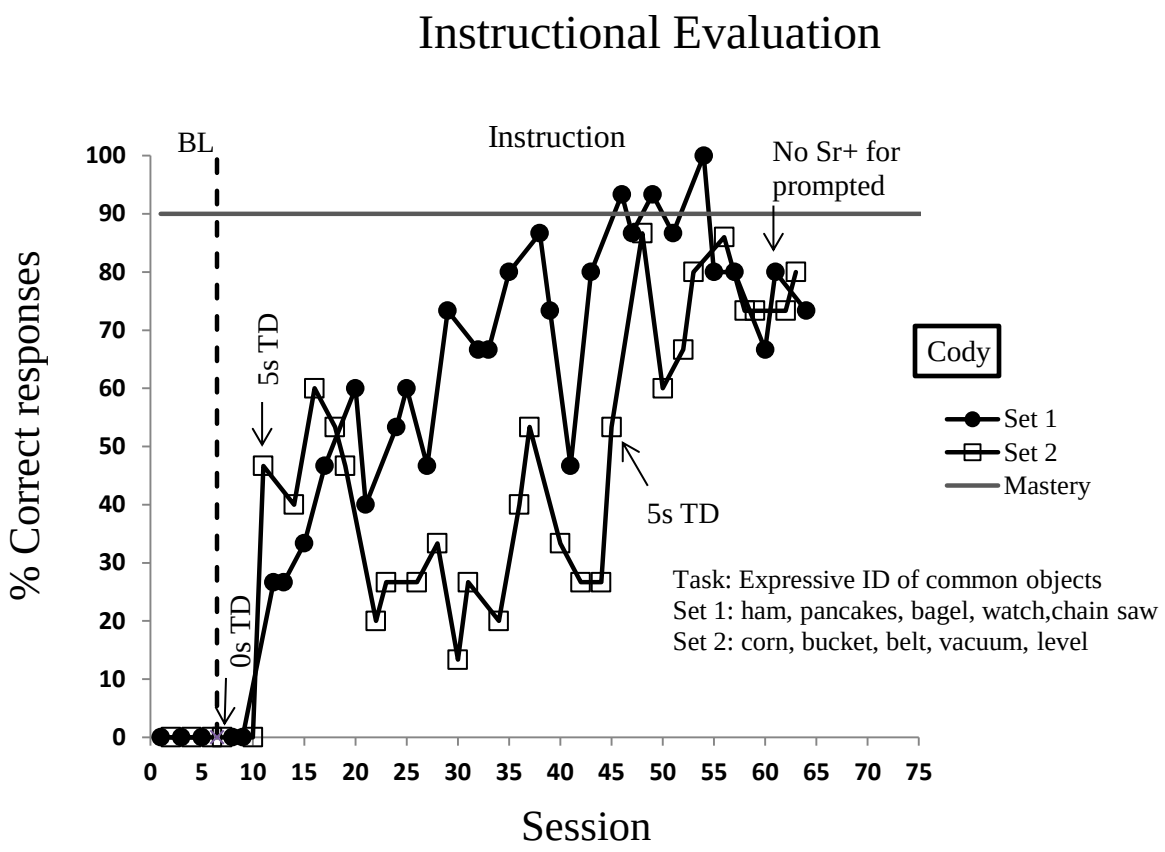

Figure 11. Percentage of correct responses for Cody

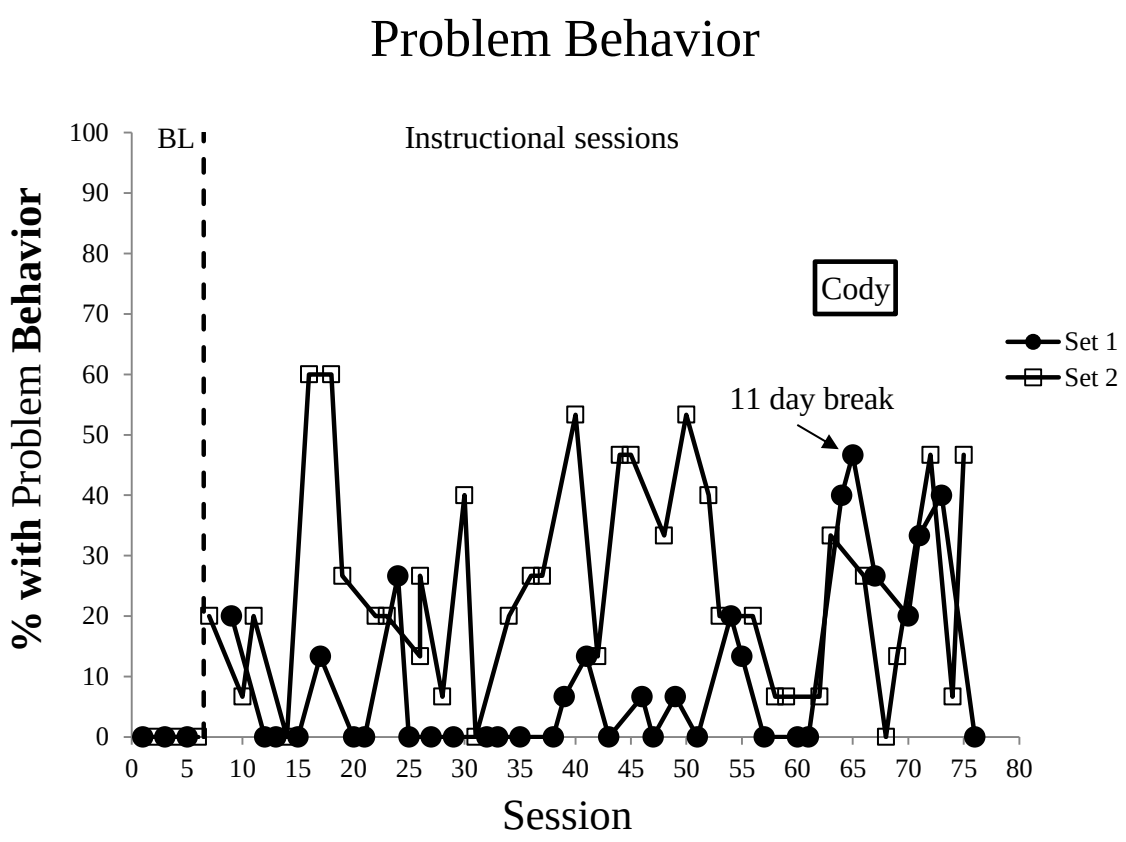

Figure 12. Percentage of problem behavior for Cody

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