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Effectiveness of pictorial preference assessments for children with disabilities

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Effectiveness of Pictorial Preference Assessments for Children with Disabilities

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Abstract

Pictorial stimulus preference assessments are a valuable resource for practitioners to determine stimuli that may function as reinforcers to aid in possible behavior change plans or skill acquisition objectives. The purpose of this study was to examine the effectiveness of electronic pictorial stimulus preference assessments (EP-MSWO) compared to a tangible stimulus preference assessment (T-MSWO) for children. This study includes two participants, aged 2 and 9, and involved in in-home behavioral services. Participants reached level two of the *Verbal Behavior Milestones Assessment and Placement Program (*VB-MAPP*)* prior to the study being implemented. Participants were exposed to a pre-matching skills assessment prior to the start of this study. Then, an EP-MSWO and T-MSWO assessment, both with contingent access to selected stimuli. A reinforcer assessment was conducted to confirm the findings of the EP-MSWO and T-MSWO.

Introduction

The effectiveness of pictorial preference assessments for children will be examined in this paper. Pictorial preference assessments are an alternate modality to that of a typical stimulus preference assessment. Pictorial preference assessments can be defined as a procedure used to determine stimuli that an individual finds preferable, using pictures (electronic or printed) to represent those stimuli. Pictorial preference assessments can determine where that stimulus falls in preference value when compared to other identified stimuli, and their supposed value as a reinforcer for the individual (Cooper et al., 2020). Pictorial preference assessments are often conducted with young children or individuals with severe and/or multiple disabilities. They are used to determine stimuli that may be reinforcing to the individual and play a key role in a behavior change plan or skill acquisition objectives.

There are multiple advantages to using pictorial preference assessments. The use of pictorial preference assessments allows a practitioner to include activities (e.g., playground, movies, going on a walk) or other tangible items that are located in a certain place (e.g., basketball, trampoline, chalk drawing outside) outside of the setting in which the preference assessment is being conducted. This is a unique advantage that pictorial assessments have to offer that typical stimulus preference assessments do not.

Background of Stimulus Preference Assessments

Stimulus preference assessments (SPAs) refer to a variety of procedures used to determine (a) the stimuli that the person chooses, (b) where that stimulus falls on a scale of high to low preference, and (c) how the preference of that stimuli changes may change as tasks are demanded, deprivation occurs, or reinforcement schedules are changed.

Commonly used SPAs are single-stimulus, paired-stimulus, multiple-stimulus-without-replacement, and brief free operant. As the field of applied behavior analysis has grown, researchers have conducted studies on if these assessments would be any more or less effective using different modalities, such as pictorial preference assessments.

History of Stimulus Preference Assessment

A critical part of behavior change programs is having an effective reinforcer for the practitioner to use with their clients in order to increase the likelihood of desired behavior. Finding potential reinforcers can be done with little complication for typically developing learners by asking what they like. For learners with severe and/or multiple disabilities, there are more barriers to finding what may be reinforcing. These barriers can include an individual with a limited vocal repertoire, idiosyncratic preferences with varying preference stability, and lack of exposure to a variety of reinforcers in some environments (Heinicke et al., 2019).

Preferences can be found but may change easily due to the person's age, interest level, time of day, social interactions, and the presentation of motivating operations (Cooper et al., 2020). This of course is true for all learners but for individuals with severe and/or multiple disabilities, they may engage in an activity that seems preferred for a limited time before preferences shift due to any of the reasons listed above. Researchers and practitioners have developed two different approaches to solve this problem, stimulus preference assessments and reinforcer assessments.

Characteristics of Stimulus Preference Assessments

Stimulus preference assessments are often conducted in tandem to reinforcer assessments to determine if a preferred stimulus functions as a reinforcer (Cooper et al.,

2020). Stimulus preference assessments can be conducted in a variety of ways. Cooper et al. (2020) breaks these methods into three categories consisting of (1) asking the learner to identify preferred stimuli; (2) observing how the learner approaches, interacts, or engages with pre-chosen stimuli available to them in the environment; or (3) conducting a trial-based assessment with the learner to determine possible preferred stimuli.

Commonly used SPAs include the following: single-stimulus (SS), paired-stimulus (PS), multiple-stimulus-without-replacement (MSWO), multiple-stimulus-with-replacement (MSW) and brief free operant (FO). These fall under the trial-based category of SPAs where practitioners present tangible stimuli to individuals in a variety of ways. Single-stimulus assessments are conducted across a series of trials where one stimulus is presented at a time. Preference is determined by how many times the individual makes approach responses per stimulus. Paired-stimulus is similar to single-stimulus with the exception that two stimuli are placed in front of the individual at the same time, and only one may be selected. Preference is determined by how many times a stimuli has been selected compared to other stimuli in trials. This assessment is typically conducted over several trials much like multiple-stimulus-without-replacement. MSWO involves three or more stimuli in the trial. Only one stimuli may be selected and once it is chosen, it is taken out of the array and is not presented again in future trials. The individual must choose from the options left. and this is repeated until no more stimuli are left. In this assessment, preference is determined by calculating the percentage of which item was selected across trial. Similar to MSWO, a multiple-stimulus-with-replacement assessment follows the same procedure as a MSWO but instead of removing the chosen stimuli after each trial, stimuli are placed back into the array in a rearranged order than previously

placed. Moving to brief free operant, multiple stimuli are placed in front of an individual and they can interact with any of the items for five minutes. The length of time an individual interacts with each stimuli determines preference.

There are several factors to consider when determining which SPA will be the best fit for the individual involved. Chazin and Ledford (2016) outlined these factors. If the practitioner does not understand what the individual likes or dislikes, they should conduct a free operant assessment. This allows the practitioner to observe the individual in an environment with multiple possibly reinforcing stimuli, to see which stimuli the individual engages most frequently. This is an appropriate option for an individual who engages in challenging behavior when preferred items are removed or an individual who cannot choose between two items. SS is another appropriate option for an individual with these qualities. If the practitioner is conducting an assessment with tangible items and the individual demonstrates the prerequisite skills of choosing between three or more items without engaging in problem behavior when the items are removed, an MSWO is an appropriate option. An MSWO would be the fastest and most accurate way to determine a hierarchy for a large number of items (Chazin & Ledford, 2016). If the individual can only choose between two items, a PS preference assessment would be appropriate. If the practitioner is working with an individual who engages in challenging behavior when preferred stimuli are removed from the environment, appropriate options would include an MSW for tangible stimuli or MSWO for edibles. Though an MSW is more time-consuming then an MSWO, the individual always has the option to choose the same stimuli, which may prevent the challenging behavior or damaging the rapport with new practitioners (Chazin & Ledford, 2016).

Purpose of the Study

As described above, stimulus preference assessment can be conducted in several different methods. Over the years, researchers have evaluated stimulus preference assessments in not only different methods but different modalities, with the main modality including the tangible item. This literature review will look at pictorial preference assessments, an alternate modality of commonly used stimulus preference assessments. Most research conducted on pictorial preference assessments look at their effectiveness of having photos of stimuli used in the array of the assessment rather than a tangible item being used. Groskreutz and Graff (2009) outlined the advantages pictorial preference assessments hold for practitioners. The ability to generate a large catalog of pictures that could then be used prior to purchasing reinforcers could be an important money saving tool for schools or organizations as well as using electronic photo representations readily available on a tablet device like an iPad. Educators or practitioners could conduct pictorial preference without access assessments with all individuals to determine which items should be purchased for use in the upcoming days and weeks (Groskreutz & Graff, 2009). They can take advantage of pictorial preference assessments by depicting centers, playgrounds, gym, art, or any other location in the school that could serve as reinforcement to a child within an assessment by taking a photograph and displaying it electronically on a tablet device. This study adds to the current literature that supports the effectiveness of pictorial preference assessments for children or individuals with multiple or severe disabilities.

The following research questions guided this study:

1. Are electronic pictorial preference assessments as accurate as tangible preference assessments in determining stimulus preference?
2. Do the items identified in the electronic pictorial multiple stimulus without replacement preference assessments function as reinforcers in a follow-up reinforcer assessment?

Review of the Literature

A literature review was conducted to look at the effectiveness of pictorial preference assessments for children. This literature review includes seven articles that explore pictorial preference assessments and their effectiveness as opposed to a typical tangible or edible preference assessments. This chapter begins with the procedures involved in the systematic review, followed by the outcomes of included articles. Preference assessments are a valuable resource for practitioners looking to find what is reinforcing to young children or children with disabilities. Preference assessments can be used to determine hierarchies many different stimuli. Hierarchies can be determined for toys, edible items, social interactions, activities, caregivers, locations, and more (Chazin & Ledford, 2016).

Procedure

The literature used in this review came from a search that contained the following criteria: (a) that the article came from a peer reviewed journal; (b) that the article be available online; (c) that the article be in English; (d) and/or that the article involves an intervention on children. Articles were found using keyword searches on the following databases: (a) Wiley Online Library All Journals; (b) EBSCOhost EJS; and (c) ProQuest Research Library. The following keywords were used in the searches for articles used in this review: (a) “pictorial preference assessment”; (b) children; (c) effective.

A total of seven studies involving pictorial preference assessments and children were found (Brodhead et al., 2016; Clevenger & Graff, 2005; Davis et al., 2010; Graff & Gibson, 2003; Groskreutz & Graff, 2009; Heinicke et al., 2016; Northup et al., 1996).

There was a range of children and adolescents involved in the seven studies in this review between the ages of 2 years to 20 years old, all diagnosed with a developmental disability. The intended focus for this literature review was preschool aged children, but due to a dearth of research with younger children, the search was expanded to include children and adolescents up to 21 years old. Each article involved studied the effectiveness of pictorial preference assessments compared to a range of other modalities that will be talked about in a later section of the review. A thorough review of the studies purpose, population, involved stimuli, format and results were all done and supported the content of this review.

An Evaluation of a Brief Multiple-Stimulus Without Replacement Preference Assessment Conducted in an Electronic Pictorial Format

Brodhead et al. (2016) used this study to compare the results of a brief pictorial MSWO preference assessment with contingent access to selected stimuli to the results of a brief tangible MSWO (T-MSWO) in children with autism.

Participants

The participants in this study were five male children between the ages of 4 and 11 with a diagnosis of autism. The authors recruited the individuals in this study due to the report from their teachers that each individual had difficulty communicating preferences for toys. Each individual was involved in 35 hours of early-intensive behavioral intervention for children with autism, weekly. They were not exposed to pictorial preference assessments prior to this study being conducted.

Method

Teachers were interviewed to find five unique toys for each participant and then photos were taken with an Apple iPad. Pre-matching skills were then measured prior to the study beginning, it was nine trials of picture to object matching. Four participants demonstrated 100% accuracy with one participant demonstrating 44% accuracy. Trials were conducted with toys as stimuli to compare electronic pictorial multiple-stimulus-without-replacement to a tangible multiple-stimulus-without replacement assessment in a multielement design. Dependent variables acting as the overall correlation between assessments across participants (Brodhead, et al., 2016).

Results

According to the authors, the overall correlation between assessments across participants was strong and statistically significant. After the assessments concluded, a follow up reinforcer confirmed high preferred toys were identified in the electronic multiple-stimulus-without-replacement. The findings provide preliminary support for the effectiveness of a stimulus preference assessment in electronic format. Such a format may eventually allow for the standardization of the presentation of stimuli in educational settings (Brodhead, et al., 2016).

Due to the limitations in this study, it was not determined if the children preferred the electronic modality of the pictorial multiple-stimulus-without-replacement preference assessment. Limitations included if the assessment was as timely to administer and if the prerequisite skills are similar enough to the prerequisite skills of a typical pictorial multiple-stimulus-without-replacement assessment.

Assessing Object-to-Picture and Picture-to-Object Matching as Prerequisite Skills for Pictorial Preference Assessments

Clevenger & Graff (2005) conducted this study to determine the level of correspondence between tangible and pictorial preference assessments with individuals who could and could not match pictures and objects.

Participants

Participants in this study ranged from ages 12 to 16 with a variety of diagnoses. Of the six participants, four were diagnosed with autism, one with Fragile X syndrome and a development delay, and one participant with pervasive development disorder. All participants had little to no verbal speech and communicated with either limited sign language or pictures.

Method

Similar to Brodhead et al. (2016), a pre-matching assessment was conducted prior to the study as well as when the study concluded. The assessment included picture-to-object and object-to-picture matching tests with the same objects and pictures that were used in the preference assessments. Four sessions of preference assessments were then conducted with both a tangible assessment and a pictorial assessment, followed up by a reinforcer assessment to confirm the highly preferred items indicated in both the tangible and pictorial assessments. The format used was a paired-stimulus preference assessment with edibles used as the tangible stimuli and photographs of edibles used as the pictorial stimuli. It is important to note that this pictorial assessment was a pictorial preference assessment with access, meaning that if a participant chose the photograph, indicated by touch, the experimenter would then present the item to the participant. A multiple baseline design was used with approach responses for edible items or photographs as the dependent variable.

Results

Clevenger & Graff (2005) stated that both assessments yielded similar preference hierarchies for 3 of 6 participants who also displayed matching skills and differed for the other 3 of 6 participants who did not display matching skills. Reinforcer assessments then verified that items identified as high preference on pictorial paired stimulus (PPS) functioned as reinforcers but only for participants with matching skills.

Limitations for this study included limited generality and a small category of chosen stimuli. Generality was limited due to having three participants per condition throughout the study. Edibles and photographs of edibles were used as stimuli rather than community-based or social activities. Clevenger & Graff (2005) stated edible items were used for their ease of delivery and to allow faster evaluation of between matching repertoires and PPS outcomes.

Efficiency of Forced Choice Preference Assessment: Comparing Multiple Presentation Techniques

Davis et al. (2010) stated the purpose of the current study was to assess which presentation methods were most efficient both in terms of time to complete the assessment and the identification of stimuli that functioned as reinforcers (i.e., strengthened responding). Pictorial preference assessments were included in the presentation methods studied.

Participants

This study had 6 participants between the ages of 6 and 12 years old. Diagnosis ranged from autism to other related disorders. Participants were chosen for the study due to their diagnoses, ages, and skill sets (Davis et al., 2010).

Method

This study was conducted in multiple stages. The first stage was used to create a list of the activities/toys and edibles that should be used in the assessment for each participant. A parent or teacher of each participant completed a survey that indicated what they thought the student liked to eat, drink, smell, listen to, play with, hold, read, we well as activities they enjoyed participating in. Stimuli in this study ranged from edibles to tangibles to activities. The study chose four different formats to conduct assessments: actual item with access, actual item with no access, picture with access, picture with no access. Researchers had three participants who took part in activity/toy assessments, one participant took part in both edible and activity/toy assessments, and two participants took part in edible assessments (Davis et al., 2010). A multiple baseline design was used in both stages of the study. The efficiency of different presentation methods acted as the dependent variable for study one and the ability to predict stimuli as reinforcers acted as the dependent variable in study two.

Results

Overall, Davis et al. (2010) found hierarchies of high preference items to be similar for most participants, regardless of preference assessment presentation method. The picture –no access condition was the most efficient method, with the briefest (average) time to complete. All presentation methods identified items that functioned as reinforcers. Limitations included the small sample size and lack of procedural fidelity on the actual preference assessments.

Using Pictures to Assess Reinforcers in Individuals with Developmental Disabilities

This study done by Graff & Gibson (2003) compared hierarchies of preferred stimuli generated by tangible and pictorial preference assessments in individuals with developmental disabilities and to assess if these items functioned as reinforcers.

Participants

All participants in this study were males diagnosed with autism and between the ages of 14 and 20 years old. Each participant used a mixture of sign language and pictures to communication due to limited verbal communication.

Method

Prior to the study, each participant was assessed on their picture-object and object-picture match-to-sample skills, each participant had 100% accuracy. Two types of preference assessments were then conducted, a tangible paired-stimulus assessment and a pictorial paired-stimulus with access, both with food as stimuli. With both assessments, once participant had an approach response (e.g., reaching for item), they were given the stimuli to consume. This was followed by a reinforcer assessment where participants had access to as many reinforcers as they could earn in the five-minute session. A multiple baseline design was used throughout the study in both the preference assessments and the reinforcer assessments. The percentage of trials each stimuli was approached or touched acted as the dependent variable in the preference assessment portion of the study. The dependent variable in the reinforcer assessment was the free operant response rate.

Results

Graff & Gibson (2003) determined that for 3 of 4 participants, tangible and pictorial preference assessments generated similar preference hierarchies. Reinforcer assessments verified that items identified as high preference on both assessments

functioned as reinforcers for a simple free operant response. Thus, pictorial preference assessments successfully identified functional reinforcers for these participants. Limitations for this study included a small sample size and like the Clevenger & Graff (2005) study, that community-based activities were not examined due to their inability to be placed as a tangible on a tabletop like the edibles involved in this study.

Evaluating pictorial preference assessment: The effect of differential outcomes on preference assessment results

Groskreutz & Graff (2009) state the current study examined the use of pictures to assess preferences of consumable stimuli with participants with developmental disabilities.

Participants

Participants in this study included four males between the ages of 15 and 17 years of age, with autism and one male with autism and Dandy Walker syndrome. All participants used some form of picture communication and sign language with two of the participants also having some verbal communication skills while the others only having verbal approximations. The participants were chosen because ongoing preference assessments were needed to identify potential reinforcers for skill acquisition programs and interventions for the reduction of challenging behavior (Groskreutz & Graff, 2009).

Method

Similar to other studies included in this review, Groskreutz & Graff (2009) required all participants to be assessed in a photo-to-object and object-to-photo matching prior to the preference assessment. All participants displayed 100% accuracy in this assessment. Three types of preference assessments were then conducted with each

participant: tangible paired-stimulus, pictorial paired-stimulus with access, and pictorial paired-stimulus without access. Edibles were used as stimuli in each assessment. Tangible paired-stimulus and pictorial paired-stimulus with access both provided opportunities for participants to consume chosen stimuli in each trial. A reinforcer assessment was completed as a follow-up assessment to confirm highly preferred stimuli. This study was done under a multiple baseline approach with the primary dependent variable being the percent of opportunities on which an item or photo of the item was approached (Groskreutz & Graff, 2009).

Results

Groskreutz & Graff (2009) conclude that overall, the tangible paired-stimulus, pictorial paired-stimulus with access, and pictorial paired-stimulus without access yielded similar preference hierarchies for 4 participants. The studied showed that the pictorial paired-stimulus without access assessments took less time to administer, much like the Davis et al. (2010) study determined. The main limitation noted in this study was the small number of participants. The second limitation was that the same participants were exposed to both phases of the study. The researchers note that participants' responses in phase two may have differed if they had not been exposed to phase one.

Assessing the Efficacy of Pictorial Preference Assessments for Children with Developmental Disabilities

This study, according to Heinicke et al. (2016), assessed the feasibility of using pictorial SPAs with children with developmental disabilities.

Participants

Participants in this study range from 2 years to 11 years old with three females and five males. Diagnoses of the participants include autism, attention deficit hyperactivity disorder, Noonan syndrome, and a developmental delay. Researchers also noted that six of the eight participants had a history with stimulus preference assessments.

Method

This study was broken into two experiments. It is important to note that Heinicke et al. (2016) had participants complete object-to-picture and picture-to-object matching much like other studies reported in this review. In experiment one, participants were involved in a pictorial stimulus preference assessment without access followed by a reinforcer assessment. Heinicke et al. (2016) assessed the role of contingent access to the stimulus by comparing the results of a pictorial SPA without contingent access to the results of a reinforcer assessment. In experiment two the participants that had no correspondence were involved in a pictorial stimulus preference assessment with access followed by another reinforcer assessment, schedule thinning, and another brief reinforcer assessment. If contingent access to the stimulus was found to be a necessary component of a pictorial SPA, the effects of schedule thinning were evaluated to determine whether a pictorial SPA could be made more practical for those participants (Heinicke et al., 2016). Heinicke et al. (2016), used an alternating treatment design for this study with the dependent variable being the total responses to the pictorial paired stimulus preference assessment with contingent access.

Results

The results of experiment one demonstrates that certain prerequisite skills, such as pictorial mands and object-picture/picture-object matching, might be correlated with the

success of the pictorial modality when contingent access is not provided (Heinicke et al., 2016).

The authors noted that five of the eight participants did show correlation between their prerequisite skills and the success of the pictorial stimulus preference assessment without access. For experiment two, authors state that results demonstrate that schedule thinning was an effective method to establish conditioned reinforcement properties for pictorial stimuli for participants who did not have correspondence between pictorial SPAs without access and subsequent RAs. Overall, Heinicke et al. (2016) conclude the results of this study have implications for behavior analysts who work with individuals with developmental disabilities. Heinicke found that pictorial SPAs were successful for less than half of the participants who completed the protocol when these assessments were conducted without contingent access (Heinicke et al., 2016). Limitations in this study included the use of edibles as reinforcers. The authors noted that edibles are powerful reinforcers, and they encourage practicing behavior analysts to research the effectiveness of toys and activities as well as edibles when including reinforcing stimuli in behavior change programs.

A Comparison of Reinforcer Assessment Methods: The Utility of Verbal and Pictorial Choice Procedures

Northup et al. (1996) investigated to further evaluate the utility of a verbal stimulus-choice procedure for identifying reinforcers for children with ADHD.

Participants

Participants included two boys and two girls both with diagnoses of attention deficit hyperactivity disorder between the ages of 6 and 9 years old. They were chosen due to their involvement in a summer program for children diagnosed with ADHD.

Method

This study had participants involved in a paired-stimulus assessment where tokens acted as stimuli. Tokens represented and could be traded in for an edible, tangible, activity, attention, or escape. The edible, tangible, and attention option were provided in a one-to-one ratio, whereas activity or escape were time based and participants were given two minutes to engage. The study was broken into three phases. The first phase involved a verbal survey that acted as a verbal preference assessment which was followed a pictorial preference assessment, where the tokens were used. In the second phase, researchers had participants complete a reinforcer assessment which was followed by phase three of completing all three assessments once more in an identical manner. A multiple baseline design was used with the dependent variable acting as the total completion of a non-preferred worksheet activity.

Results

Northup et al. (1996) explains that the findings of this study show that the survey alone is not an accurate description of high and low preferences for these individuals. Including a verbal or pictorial assessment increases the likelihood of differentiation of an individual's high and low preferences which will provide the individual with more effective reinforcers. The overall limitation of this study was the reliance of verbal report for reinforcer identification procedures. Northup et al. (1996) reiterates that the results

suggest that asking children only to name their own preferences may not be sufficient to identify potent reinforcers, even if the questions are based on a structured survey.

Contributions to Current Research

Stimulus preference assessments continue to be a valuable resource in determining preferred stimuli for a variety of individuals in a variety of settings. As the use of stimulus preference assessments grow, the different modalities do as well. This review showed the advantages and growing use of pictorial preference assessments. Groskreutz & Graff (2009) state that these alternative formats are important extensions of the current tangible preference assessment techniques for several reasons. First, they allow assessment of items that may not be presented directly to a participant, such as trips to the store or going to the park. Second, they may save time or money. This review includes studies that highlight the above reasons like the versatility of using more than just tangible or edible stimuli in preference assessments but rather using activities, social interactions, locations, and toys that may not be able to be placed on a tabletop. Many of the above studies also stated that pictorial preference assessments, often without access, proved to be the mostly timely of all preference assessments. Researchers should continue to study pictorial preference assessments as they progressively prove their reliability in determining reinforcers for individuals.

Research Gap

More research needs to be conducted on pictorial preference assessments as they continue to grow in versatility. The focus of research should be accurately depicting community-based options in pictorial preference assessments as well as expanding how pictures can be represented. Future research should study to determine the effectiveness

of the following formats as compared to a typical preference assessment: electronically in color, printed in color, electronically in black and white, printed in black and white. These are all valid outlets for future research on pictorial preference assessments.

Method

Participants, Selection Procedures, and Setting

Two participants were chosen for this study through convenience sampling. Selected participants met the following inclusion criteria: (a) received in-home behavioral services, (b) identified as reaching level two of manding and tacting in the *Verbal Behavior Milestones Assessment and Placement Program* (VB-MAPP; Sundberg, 2008), (c) in need of a stimulus preference assessment to guide intervention, and (d) adequate hearing and vision to understand the researcher's directions and attend to the pictorial modality stimulus preference assessment. For the privacy of all participants, pseudonyms are used throughout this study.

Isaac. Isaac, a two-year-old male of Middle Eastern descent, lived with his mother, father, and younger infant brother. Arabic, Turkish, Kurdish, and English were spoken in the household. Isaac had strong vocal communication skills and fluently spoke Arabic, while understanding Turkish, English, and Kurdish. Isaac was diagnosed with autism spectrum disorder (ASD) in October of 2021 after his parents became concerned with his peer interaction and play skills. It is important to note that the researcher provided in-home behavioral services, 12 hours a week, to Isaac at the time of the study. The researcher completed the VB-MAPP (Sundberg, 2008) with Isaac to aid in the creation of his objectives for in-home behavioral services. The VB-MAPP assessment resulted in Isaac reaching level three of manding and tacting; it was required for him to reach level two to be involved in the study. Prior to receiving in-home behavioral services, Isaac’s parents reported the following maladaptive behaviors: hitting, biting, kicking, pushing, grabbing, screaming, and yelling when trying to gain attention from

others. Isaac's parents reported that Isaac enjoyed trucks, trains, books, watching cartoons, and playing with kinetic sand. Isaac did not have experience with preference assessments prior to this study.

Mark. Mark, a nine-year-old male of Middle Eastern descent, lived with his mother, father, and three siblings. Arabic was spoken in the home. Mark was a second-grade student at a private day school for children who experienced academic and behavioral challenges in the public school system. Mark had limited vocal communication skills and spoke English and Arabic in three-to-four-word phrases. Mark was diagnosed with ASD at the age of three after speech and behavioral concerns by his parents. At age seven, Mark was diagnosed with an accompanying intellectual and language impairment. It is important to note that the researcher provided in-home behavioral services, 9 hours a week, to Mark at the time of the study. Prior to this, Mark was receiving 15 hours of behavioral services from the same in-home behavioral company, the decrease in hours was due to a change in clinicians and plan for discontinuation of services in May 2022. The VB-MAPP (Sundberg, 2008) was completed by treatment team in September 2021. Mark was identified as reaching level two of manding and tacting in the VB-MAPP assessment, making him eligible for this study. Mark's parents reported the following maladaptive behaviors: screaming, crying, hitting himself, biting himself when denied access to preferred items or there was a change in routine. Mark's parents reported that Mark enjoys outside play, playing with play-doh, and listening to songs on his iPad. Mark had completed preference assessments in the past at school to aid in his behavior intervention plan.

All research sessions took place within each participant's home. The researcher conducted all assessments. Each session was video recorded to collect data on procedural fidelity and to calculate interobserver agreement.

Researcher

This study was conducted by a full-time graduate student in their second year of the Master of Education in Special Education with a Behavioral Specialist concentration at James Madison University. This researcher had a Master of Arts in Teaching with a teaching license in Early Childhood Special Education and Early/Primary Education PreK-3 from the Virginia Department of Education. The researcher had four years of experience in early childhood classroom settings and seven months as a behavior support clinician with an in-home behavioral company. During the entirety of this study, the researcher completed coursework to become a Board Certified Behavior Analyst (BCBA).

Materials

Materials used in this study consisted of an Apple iPad with the screen size of 10.2 inches, and the Google Slides application to display photos of selected toys. After toys were identified, pictures of each toy were taken with an Apple iPad. Pictures were 2 x1.5 in. Pictures were displayed with three photos in the top row and two photos in the bottom row on the Google Slide (see Figure 1). Toys used were as follows: book, train, blocks, truck, and car. Family interviews and anecdotal observations were conducted to identify five toys that were often preferred by participants in play.

Research Design and Dependent Variables

This study was conducted using an alternating treatment design. This study alternated between an electronic pictorial multiple stimulus without replacement (EP-MSWO) preference assessment and a tangible multiple stimulus without replacement (T-MSWO) preference assessment using the stimuli selected for each participant based on caregiver report and anecdotal observation from researcher. Each assessment included contingent access to the selected toy. This study first used a pre-matching task prior to implementing the EP-MSWO and T-MSWO conditions. A reinforcer assessment was used following the assessments to confirm the items that were deemed highly preferred by the EP-MSWO assessments. Dependent variables were the overall rank of each stimulus in the EP-MSWO assessment and the T-MSWO assessment.

Data were collected in this study using a pre-matching task data collection sheet, MSWO data collection sheet, and a reinforcer assessment data collection sheet (see Appendix A). Interobserver agreement data and procedural fidelity were collected using their respective data sheets (see Appendix B).

Procedures

Skills Assessment- Pre-Matching Task

Prior to the EP-MSWO and T-MSWO conditions, a pre-matching task was conducted with each participant. The participants were asked to complete six trials of a picture to object matching task. Stimuli used in this task were the same toys used in the EP-MSWO and T-MSWO conditions. The stimuli were identified by toys the researcher had readily available and identified as toys of interest by participant's caregivers. Photos were taken of each stimulus with the iPad. Each stimulus was presented three times over

the six trials. Stimuli were placed in front of the participant, three items equally distanced apart, in one row. The researcher gave the instruction of *"match"* to the participant. The participant had 10-seconds to match the stimuli to the picture that was presented on the iPad. The 7x5.3 in. pictures were displayed on the iPad. Pictures were displayed using Google Slides, with one picture presented at a time. Matching was scored as correct if the participant touched the toy that corresponded with picture on the iPad within the 10-seconds. Matching was scored as incorrect if the participant did not touch the corresponding toy within 10-seconds or if the participant touched multiple toys. If the participant responded incorrectly across three of the six sessions, another opportunity was given by clearing the array and representing the stimuli. If participant failed a second time, participant did not advance to the MSWO comparison trials.

MSWO Comparison

Both preference assessments were conducted each day for five days. A random choice generator used to determine which assessment was done first on a given day. Each preference assessment consisted of five trials. The EP-MSWO and the T-MSWO were conducted five minutes apart. The EP-MSWO used in this study resembled that of Brodhead et al. (2016). The five toys for each participant that were identified through caregiver interview and anecdotal observation were shown on an iPad through the Google Slides application in two rows with three photos on the top row and two photos on the bottom row. As choices were made, the selected photo was deleted and the array became two photos on the top row and two photos on the bottom row followed by three photos in one row and so on. The researcher sat on the opposite side of a table from the participant. The iPad was placed in front of the participant. Once situated, the researcher said to the

participant, *"Touch the picture of the one you want."* Selection was indicated by the participant touching the picture with their finger within 5 seconds of the instruction given by researcher. Once the participant selected a picture, they were given 30 seconds to interact with the toy shown in the picture before being told, *"My turn"* by the researcher. The researcher took the toy from the participant and placed it out of sight. The researcher deleted the previously selected picture, rearranged the photos, and presented the iPad with the instruction of *"Touch the picture of the one you want."* This continued across five trials. If the participant did not respond, did not respond within five seconds, or touched multiple pictures, the researcher allowed the participant another opportunity to respond. Another opportunity was given by removing the iPad, rearranging the pictures, and presenting the iPad again with the instruction of *"Touch the picture of the one you want."*

The T-MSWO resembled the procedures described above with the exception of the stimuli being physically presented to the participants. Stimuli were presented in a single row in front of each participant, equal distance apart and away from the participant. Selection was indicated by the participant making a choice within 5 seconds of the researcher's request of *"Touch the one you want."* Following the EP-MSWO procedure, if the participant did not respond, did not respond within 5 seconds, or touched multiple toys, the researcher allowed the participant another opportunity to respond. Another opportunity to respond was given by rearranging the toys, and presenting the array again with the instruction of *"Touch the one you want."* Once a selection was made, the other toys were removed and the participant was again given 30 seconds to interact with the chosen toy before the researcher said *"My turn,"* where the

researcher took the toy from the participant and placed it out of sight. The array was rearranged and placed back in front of the participant. This continued across five trials. Throughout each preference assessment, the selected toy was recorded for each trial. At the conclusion of each preference assessment, toys were ranked on preference level from a high preference of 1 to a low preference of 5. After five rounds of trials, the toys were ranked based on the sum of the rankings across the three days (Chazin & Ledford, 2016).

Reinforcer Assessment

Following the EP-MSWO and T-MSWO comparison condition, a reinforcer assessment was conducted. The reinforcer assessment was implemented to confirm if toys were correctly identified as highly preferred based on the results of the EP-MSWO assessment and ultimately functioned as reinforcers. The reinforcer assessment chosen for this study resembled that of Brodhead (2016), Heinicke (2014), and Piazza et al. (1996). The reinforcer assessment was five minutes in duration and was conducted one time for each participant after all rounds of both the EP-MSWO and T-MSWO assessments were completed. The arbitrary response of dropping a paperclip was chosen to serve as a response to evaluate during the reinforcer assessment. At the beginning of the trial, three cups were placed in a row, equally distanced apart from each other and the participant, in random order. Each cup was covered in either yellow, blue, or green construction paper. The toy that was determined to be highly preferrable was placed behind the green cup and the toy that was determined to have low preference was placed behind the yellow cup. Both toys were visible through the assessment. The blue cup acted as a control for this assessment and was not related to any toy. A group of paperclips was placed on the table. Before the trial started, the researcher modeled what each response

and corresponding consequence looked like and then provided an opportunity for the participant to practice. The researcher showed the participant the group of paperclips and instructed the participant that they were allowed to move as many paperclips as they would like while moving only one at a time and could stop at any time or until trial ended at five minutes. The participant was told *"Place the paperclip in a cup."* After placing the paperclip in the cup, the participant was given access to the toy that corresponded with the cup the paperclip was placed in, for 15 seconds. This was counted as a response. Responses were not counted if multiple paperclips were dropped into the same or different cups. Data were taken on the total number of responses for each cup. Toys were confirmed as reinforcers when the rates of responding were higher with the high-preference toy compared to the lower-preference toys.

Procedural Fidelity and Interobserver Agreement

A second observer was identified and trained. The second observer was a graduate student completing coursework in applied behavior analysis in the Master of Education program at James Madison University. The second observer recorded data on participant responses and researcher's procedural fidelity for the pre-matching task, the preference assessments, and the reinforcer assessment by watching video recordings of all sessions. Training of the second observer included an explanation of each participant data sheet, explanation of procedural fidelity data sheets for each condition, and prerecorded video of the researcher and confederate modeling procedure and responses of each condition. The second observer took data on prerecorded videos with participant data sheets and procedural fidelity data sheet. Researcher and second observer compared data taken. A predetermined criterion of 90% interobserver agreement (IOA) was set for

second observer and researcher to meet on data taken on prerecorded video for IOA training to be complete. After reviewing prerecorded video and participant data sheets, IOA was calculated to be 100% and IOA training was complete. For second observer training, procedural fidelity was collected and calculated to be 100%.

The researcher compared data sets to calculate IOA for all conditions. For both the pre-matching task and preference assessments, agreement was scored if both observers recorded the same toy as being chosen for that trial. The number of agreements for the toy selected in each trial were divided by the total number of trials and multiplied by 100. Across pre-matching task trials, IOA was recorded as 100% which fell into the acceptable range of above 90% agreement. In the MSWO conditions, IOA was calculated three of the five days (65%). IOA was 100% for MSWO conditions. Similarly for the reinforcer assessment, the number of agreements of total number of responses for each trial was divided by the total number of opportunities for agreement and multiplied by 100. IOA for the reinforcer assessment was 100% across all participants, which fell into the acceptable range of above 90% agreement. In addition, the second observer recorded data on procedural fidelity for the implementation of the pre-matching task, the preference assessments, and the reinforcement assessment by watching the video recordings of each session. Procedural fidelity was recorded as 100% across recorded trials.

Results

Skills Assessment- Pre-Matching Task

As discussed in the methods section, the pre-matching task was completed to ensure that participants had picture to object matching skills. Participants were asked to match pictures to objects over six trials with three presentations of each toy. Five of the toys used in the trial were the toys also used in the MSWO condition of study. The toys used in this assessment were as follows: book, blocks, car, train, playdough, and truck. The playdough was ultimately omitted from the MSWO condition due to anecdotal observations from researcher and caregiver report. Both Isaac and Mark showed 100% accuracy with pre-matching task and moved onto the MSWO comparison trials.

MSWO Comparison

Next, both participants were exposed to one T-MSWO and EP-MSWO daily across five sessions with the same toys: blocks, train, car, truck, and book. It is important to note that items identified as highly preferred would have lower ranking (e.g. 1) and items identified as least preferred would have a higher ranking (e.g. 5). Isaac showed little to no correspondence in preferences yielded from T-MSWO assessment and EP-MSWO but Isaac made similar selections within the EP-MSWO and T-MSWO across all sessions in this condition. The results of Isaac's T-MSWO showed a high preference for the car and a low preference for the blocks. In Isaac's EP-MSWO, results showed a preference for the book and a low preference for the train (see Figure 2). Similar to Isaac, Mark had little correspondence in preferences yield from T-MSWO assessment and EP-MSWO assessment but within the assessment, similar selections were made across sessions. In Mark's T-MSWO, results show a high preference for the book and a low

preference for the blocks. The EP-MSWO yielded two items as highly preferred, the train and the car, and two items as least preferred, the blocks and the truck (see Figure 3).

Reinforcer Assessment

A reinforcer assessment was conducted for both Isaac and Mark to confirm the results of their EP-MSWO assessments. Isaac's results yielded inconclusive for the reinforcer assessment and did not confirm toy deemed as highly preferrable in the EP-MSWO when compared to the toy deemed least preferred in the EP-MSWO (see table 1). For Mark, two items were tied as the highest preferred item in the EP-MSWO. The researcher used the results from the T-MSWO and anecdotal observations to choose one highly preferred item to use in the reinforcer assessment, the car. Similarly, to Isaac, Mark's results yielded inconclusive and did not confirm the car as highly preferrable when compared to the toy deemed least preferred (see Table 1).

Discussion

The purpose of this study was to determine if electronic pictorial preference assessments are as accurate as tangible preference assessments in determining stimulus preference, and if the items identified by the electronic pictorial preference assessment function as reinforcers in a follow-up reinforcer assessment. The researcher began the study by having participants complete a pre-matching task. Participants were asked to complete a pre-matching task to show that picture-object matching was in their skill set. Both Isaac, 2, and Mark, 9, showed this skill which was expected by researcher due to both participants level two of manding and tacting in the *Verbal Behavior Milestones Assessment and Placement Program* (Sundberg, 2008).

Both participants completed all preference assessment trials. Both Isaac and Mark followed researcher directions throughout assessments and waited for contingent access to items upon their choice. The toys deemed highly preferrable for both Isaac and Mark differed across preference assessments. The toys deemed as least preferred also differed for Isaac and Mark across assessments. It is important to note that Isaac appeared to have a side bias in the T-MSWO assessment. Isaac's side bias showed on both the right and the left side. Isaac was consistent in his first stimuli choice across sessions, the car, which was ultimately deemed highly preferred from his T-MSWO assessment. After Isaac's first choice, the remainder of his choices favored a certain side, changing from left to right across sessions. In three sessions, the side bias favored the right and in the remaining two, favored the left. This side bias was not prevalent in Isaac's EP-MSWO assessment. Similar to Isaac, Mark showed a side bias in his T-MSWO across all sessions. Mark had two stimuli that were consistently his first choice, the book and the

truck. If the stimulus was placed on the far-right side, all of Mark's choices would be on the far-right side of the remainder of the session. This continued in sessions when the chosen stimulus was on the left side, Mark's choices would favor the far-left side and similarly if the chosen stimulus was presented in the middle of the array. Mark showed no side bias in the EP-MSWO. Originally thought to be a limitation of the study, the slightly different EP-MSWO layout may have mitigated the participants' side biases demonstrated in the T-MSWO. The presentation of the EP-MSWO differing from the typical array presented in a T-MSWO highlighted that neither participant showed a side bias in their EP-MSWO assessment.

The reinforcer assessment was conducted at the conclusion of both preference assessments. The reinforcer assessment was conducted to confirm the results of the electronic pictorial preference assessment because this study had a goal to contribute to research that supports electronic pictorial preference assessments as suitable alternatives to the evidence-based practice of tangible preference assessments. The reinforcer assessment did not confirm the toys deemed highly preferable for both Isaac and Mark in the EP-MSWO. Isaac had a number of responses during the reinforcer assessment trial but displayed interfering behaviors (e.g., placing paperclip in mouth) during the assessment and did not accept contingent access to items when the paperclip was placed into the corresponding cup. Mark followed assessment directions as they were given. However, his reinforcer assessment results aligned with his least preferred item in the EP-MSWO.

Limitations

The researcher identified six limitations in this study. The first described above would be the participants' side biases during their T-MSWO assessments. The second limitation of the study was the arbitrary choice of dropping a paper clip into a cup as the response for Isaac's reinforcer assessment. The paperclips used in the reinforcer assessment were novel items for Isaac. A less novel choice may have helped Isaac to follow the researcher's directions in the reinforcer assessment. It is also possible that Isaac's age is what caused him to not understand the contingent access that would follow his responses in the reinforcer assessment. A third limitation would be the small participant pool in this study which limits the ability to generalize these findings to a larger population of individuals who would benefit from a stimulus preference assessment. The fourth limitation in this study were the chosen stimuli. Due to the research setting and method procedures, stimuli were limited to toys available in the home rather than activities (e.g., slide, throwing a ball, trampoline) that were researched in existing literature. The next limitation in the study pertains to the second question driving this research, if the items identified in the electronic pictorial multiple stimulus without replacement preference assessments function as reinforcers in a follow-up reinforcer assessment. The reinforcer assessment did not confirm the items that were identified as possible reinforcers by the EP-MSWO which could lead a practitioner to question the effectiveness of an electronic pictorial stimulus preference assessment format. This point leads us to the last limitation in this study. The reinforcer assessment was conducted based on the results of the EP-MSWO assessment for each participant due to suggestions from existing literature. Since a T-MSWO assessment is an established

practice for determining a preference hierarchy, it was not planned to confirm results with a follow-up reinforcer assessment.

Contribution to the Current Research

This research contributes to existing literature on electronic pictorial preference assessments. The current literature has evaluations of preference assessments with tangible or pictorial formats but there are very few studies that look at an electronic format of preference assessments. The findings from this study show that there is much more research to be done in relation to electronic pictorial preference assessments to determine best practice as the accessibility to this modality becomes more feasible for practitioners. Findings from this study also suggest that electronic pictorial preference assessments could be a useful tool for individuals who would otherwise display a side bias in a traditional tangible preference assessment.

Areas for Future Research

More studies are needed to determine best practices for a tool like electronic pictorial preference assessments. An area of future research could focus on the choice of activities rather than items that can be presented with contingent access to participants. This could provide practitioners with the opportunity to present more activities as possible reinforcers for individuals receiving behavior analytic treatments. Another area of future research could be if there is a difference in effectiveness of pictorial stimuli presented in black and white or presented in color. Many practitioners of behavior analysis may reside in a school setting where access to color printing is limited. If it is more effective to present stimuli in color, it would be more cost efficient to present stimuli in an electronic pictorial format rather than a printed format. Lastly, as mentioned

above, the findings in this study suggest that electronic pictorial preference assessments could be used to mitigate a side bias in an individual who would otherwise present with one in a traditional tangible preference assessment.

Recommendations for Practice

This study successfully completed T-MSWO and an EP-MSWO preference assessments for two participants, but preferences were not confirmed by a follow-up reinforcer assessment for the EP-MSWO. In this study, a reinforcer assessment to confirm the results of both the T-MSWO and EP-MSWO would have been beneficial rather than only conducting a reinforcer assessment for the EP-MSWO. In real world application, practitioners should consider conducting reinforcer assessments to determine if identified items can truly function as reinforcers, no matter the preference assessment format. The use of a follow-up reinforcer assessment to confirm preference assessment findings is a tool that is not often taken advantage by practitioners but would be considered best practice to ensure that practitioners are providing potent enough reinforcers for individuals in their treatment plans. If a practitioner plans to conduct a follow-up reinforcer assessment, an arbitrary response item should be chosen carefully. For Isaac, the paperclips chosen were a novel item which resulted in interfering behaviors. The item should be well known to ensure focus on the stimuli presented in front of participant, rather than the item used to make responses.

Before implementing a pictorial preference assessment of any kind, a picture to object matching assessment would be recommended. In this study, picture to object matching was a beneficial pre-assessment to guarantee that participants had the skill set to complete this study. If an individual does not hold the skill to match picture to object

or object to picture, a practitioner should consider a more traditional form of preference assessment. Another context to consider would be the possibly of tangible preference assessment results displaying a side bias for an individual, as they did in this study for both Isaac and Mark. This study showed using an electronic pictorial preference assessment could mitigate this potential skew in preference assessment results by differing from a tangible preference assessment array.

Researchers should continue to investigate electronic pictorial preference assessments since other studies, though limited, have determined the practice to be beneficial and successful in determining stimulus preference when compared to a typical tangible preference assessment. This would be an efficient, effective, and opportunity enhancing tool if best practice was determined and found to be evidence-based.

Table 1

Isaac

Number of Responses for Low Preference Stimuli	Number of Responses for Control (No stimuli associated)	Number of Responses for High Preference Stimuli
5	3	0

Mark

Number of Responses for Low Preference Stimuli	Number of Responses for Control (No stimuli associated)	Number of Responses for High Preference Stimuli
3	0	0

Figure 1

EP-MSWO in Google Slides

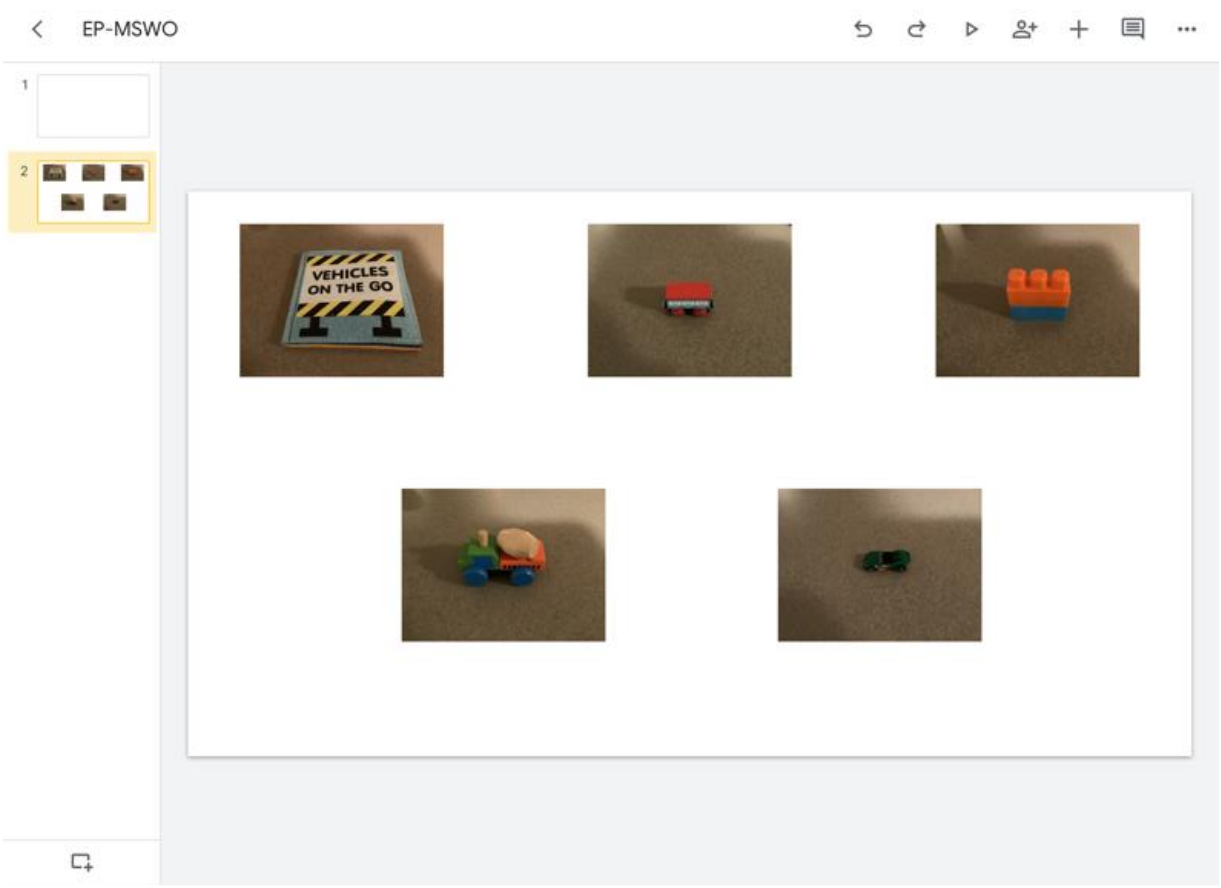


Figure 2

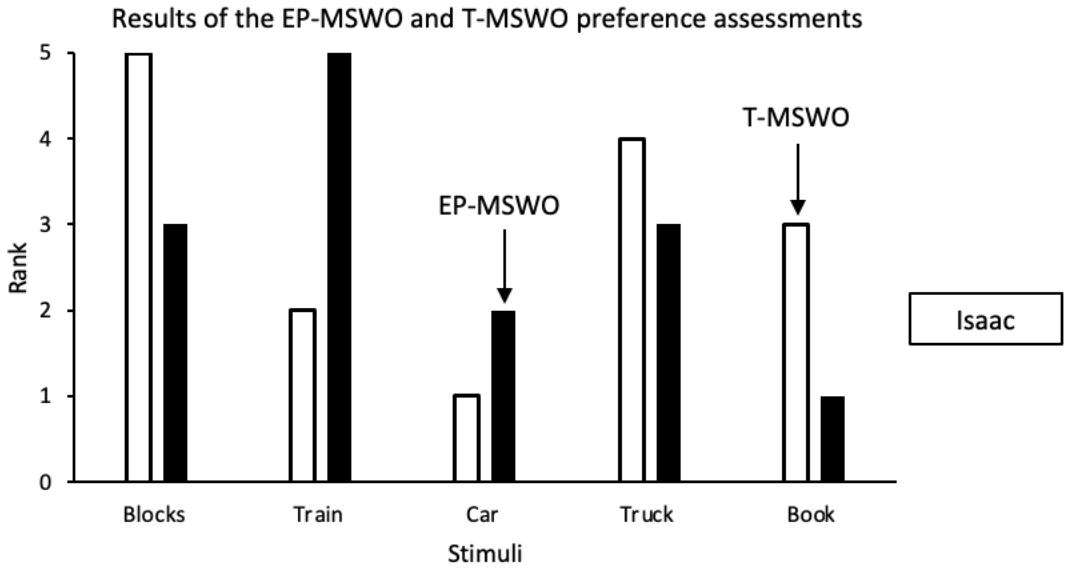
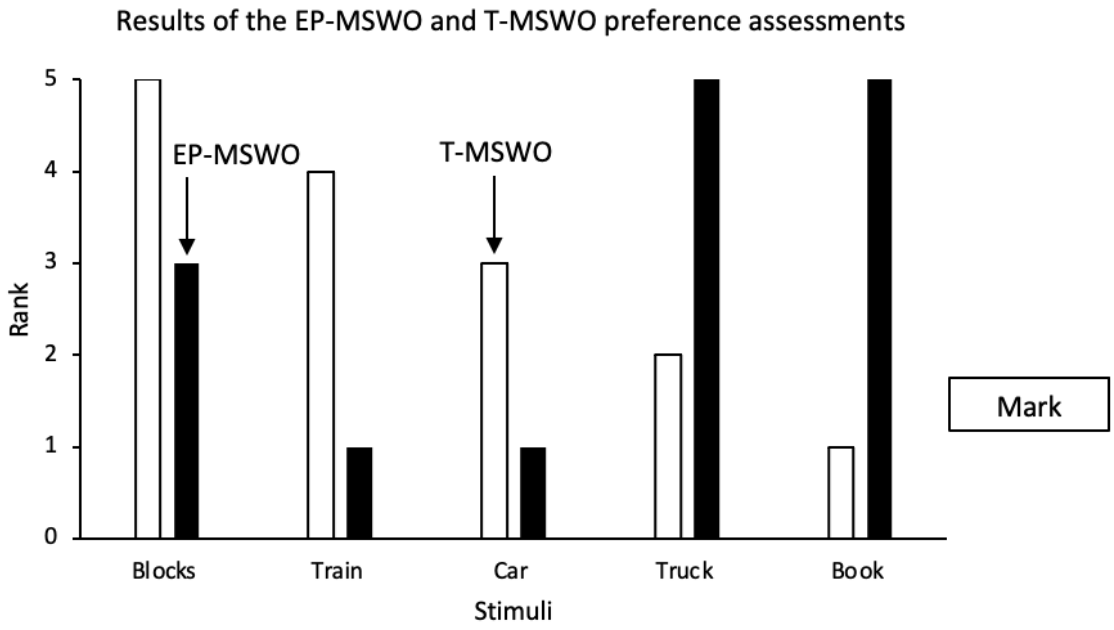

Results of the EP-MSWO and T-MSWO preference assessments
Rank
5
4
3
2
1
0
EP-MSWO
T-MSWO
Blocks
Train
Car
Truck
Book
Stimuli
Isaac

Figure 3


Results of the EP-MSWO and T-MSWO preference assessments
Rank
5
4
3
2
1
0
EP-MSWO
T-MSWO
Blocks
Train
Car
Truck
Book
Stimuli
Mark

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Appendix A

Procedure Data Collection Sheets

Skills Assessment: Pre-matching task
Participant: _____

Item A: _____
Item B: _____
Item C: _____
Item D: _____
Item E: _____
Item F: _____

Trial #	Picture shown	Placement of item selected & item chosen
1	A	C B A
2	B	C A B
3	C	A B C

Trial #	Picture shown	Placement of item selected & item chosen
1	C	E D C
2	D	D C E
3	E	C D E

Trial #	Picture shown	Placement of item selected & item chosen
1	D	D E F
2	E	F D E
3	F	E F D

Trial #	Picture shown	Placement of item selected & item chosen
1	F	A F B
2	A	F A B
3	B	A B F

Trial #	Picture shown	Placement of item selected & item chosen
1	B	C B D
2	C	B D C
3	D	D B D

Trial #	Picture shown	Placement of item selected & item chosen
1	E	E A F
2	F	F E A
3	A	F A E

Sum of correct responses for A: ___out of 3
Sum of correct responses for B: ___out of 3
Sum of correct responses for C: ___out of 3
Sum of correct responses for D: ___out of 3
Sum of correct responses for E: ___out of 3

Pre-Matching Task Data Collection Sheet

MSWO for 5 items
Participant:

Item A: _____
Item B: _____
Item C: _____
Item D: _____
Item E: _____

Sum of row #s for A: _____
Sum of row #s for B: _____
Sum of row #s for C: _____
Sum of row #s for D: _____
Sum of row #s for E: _____

Date:	Trial #1
Item selected	**Placement of item selected**
	x x x x x
	x x x x
	x x x
	x x
	x

Date:	Trial #2
Item selected	**Placement of item selected**
	x x x x x
	x x x x
	x x x
	x x
	x

Date:	Trial #3
Item selected	**Placement of item selected**
	x x x x x
	x x x x
	x x x
	x x
	x

Date:	Trial #4
Item selected	**Placement of item selected**
	x x x x x
	x x x x
	x x x
	x x
	x

Date:	Trial #5
Item selected	**Placement of item selected**
	x x x x x
	x x x x
	x x x
	x x
	x

Highest preferred items (lowest summed row #s)

Moderately preferred items (moderate summed row #s)

Lowest preferred items (highest summed row #s)

EP-MSWO and T-MSWO Data Collection Sheet

Reinforcer Assessment
Participant:

Trial 1

Cup	# of Responses
Yellow Cup	
Blue Cup	
Green Cup	

Reinforcer Assessment Data Collection Sheet

Appendix B

Interobserver Agreement and Procedural Fidelity Data Collection Sheets

Procedural Fidelity Checklist		
Observer Initials:	Date:	Definition of terms
Second observer training ☐ Give the observer the participant data sheet ☐ Explain that each step is a component skill the participant must exhibit. ☐ Read each step aloud. ☐ The researcher and the second observer watch a prerecorded video of each condition while taking data using the participant data sheet. ☐ Compare the data taken by the second observer and the researcher. ☐ If IOA is less than 90% watch the video again clarifying the step(s) that were not agreed upon. If IOA is 90% or higher training is complete.		Participant: The individual who has provided written consent to have their behavior observed and recorded. Researcher: The person in charge of the creation and implementation of the study. Second Observer: The individual that has a background in data collection and has agreed to volunteer their time to ensure the fidelity of the study. Interobserver agreement (IOA): The percentage of agreement between the data collected of the same event by two people.
Percentage Completed		

Procedural Fidelity Checklist	
Observer Initials:	Date:
Pre-matching: ☐ Secure the participant's attention. ☐ Prepare the array ☐ Show picture on iPad of item for trial, say "match" or "which one matches?" ☐ Clear and rearrange array ☐ Repeat for each trial ☐ Observe and record the participant's responses.	
Percentage Completed:	