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# Effects of Training Object-Picture Matching on Preference Assessments with Pictures with Individuals with Developmental Disabilities

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in partial fulfillment of the Masters of Arts Degree at the University of Manitoba

THE UNIVERSITY OF MANITOBA

FACULTY OF GRADUATE STUDIES

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**Effects of Training Object-Picture Matching on Preference Assessments with Pictures with Individuals with Developmental Disabilities**

BY

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**A Thesis/Practicum submitted to the Faculty of Graduate Studies of The University of Manitoba in partial fulfillment of the requirement of the degree**

**MASTER OF ARTS**

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Abstract

Preference assessments are often used to identify reinforcers for persons with developmental disabilities who are unable to communicate. Choices are typically presented in tangible, pictorial, or spoken form during preference assessments. Several studies have shown that basic visual and auditory discriminations, as measured by the *Assessment of Basic Learning Abilities* (ABLA) test, predict the stimulus modality that yields the most valid results. Persons who are able to perform a simple 2-choice visual discrimination (Level 3 on the ABLA) are able to choose their preferred stimuli in tangibles. Persons who are able to perform 2-choice visual and quasi-identity matching-to-sample discriminations (Levels 3 and 4, respectively, on the ABLA) are able to choose their preferred stimuli in tangibles and pictures. Lastly, persons who are able to perform 2-choice visual, quasi-identity matching, and auditory-visual discriminations (Levels 3, 4, and 6, respectively) are able to choose their preferred stimuli in all three forms. No research has evaluated whether the acquisition of a new discrimination would increase the effectiveness of a stimulus modality that was previously ineffective during preference assessments. For individuals who rely on tangibles to indicate their preferences, learning to respond to pictures could offer substantial practical and clinical benefits. Therefore, the purpose of this research was to evaluate the effects of teaching partial-identity visual matching on picture preference assessments. Three participants with developmental disabilities or autism were taught object-picture matching in a modified multiple-baseline design across tasks using a multiple-probe technique. Each participant's ability to indicate preference using pictures and objects were assessed during baseline and after training each task. The results showed that a within-stimulus prompt-fading procedure and positive reinforcement for correct responses were effective in teaching 7 of 8 object-picture matching discriminations attempted across participants. However, acquisition of

the discriminations did not influence performance during picture preference assessments following training.

# Effects of Training Object-Picture Matching on Preference Assessments with Pictures with Individuals with Developmental Disabilities

The concept of self-determination is widely recognized as an important dimension of quality of life for persons with developmental disabilities (e.g., Hughes & Hwang, 1996). Assessing preferences and arranging the environment to provide their preferred items is one way of implementing this concept for this population (Baer, 1998). In preference assessments, choices are typically presented in tangible, pictorial, or spoken form. Research has shown that a person's performance on visual and auditory discrimination tasks, as measured by the *Assessment of Basic Learning Abilities* (ABLA) test, predicted which modality would be effective during preference assessments. No research, however, has evaluated whether learning to perform a new discrimination would increase the effectiveness of a stimulus modality that was previously ineffective during preference assessments. Teaching persons who need to rely on tangibles to indicate their preferences using pictures benefits both the individuals and caregivers by making stimulus presentation less cumbersome and increasing the choices that could be offered. Therefore, this research focused on teaching individuals with developmental disabilities or autism to perform object-picture matching and evaluated the effects of this training on preference assessments using pictures.

## *Assessment of Basic Learning Abilities (ABLA Test)*

*Overview.* The ABLA test is a direct assessment procedure that measures the ability of persons with developmental disabilities to learn basic discriminations that underlie many tasks (Kerr, Meyerson, & Flora, 1977). It consists of six tasks, referred to as levels. Level 1 is an *imitation* task where the correct response is to imitate the tester by placing a manipulandum into a container. Level 2 is a two-choice *position* discrimination task. A yellow can and a red box are

presented side by side always in the same positions, and the correct response is to place a piece of white foam always into the container on one side. Level 3 is a two-choice *visual* discrimination task. This task is similar to Level 2, except that the positions of the can and box are switched randomly across trials and the correct response is to place the white foam always into the yellow can, regardless of its position. Level 4 is a two-choice *visual quasi-identity matching-to-sample* discrimination task. The positions of the can and box are randomly alternated across trials, and the person is presented with either a small yellow cylinder or a red cube on each trial. The correct response is to place the cylinder into the yellow can and the cube into the red box. Level 5 is a two-choice *auditory* discrimination task. The box and can remain in stable left-right positions across trials. On each trial, the individual is presented with the white foam and either one of two spoken cues ("put it in the *red box*" or "put it in the *yellow can*"). The correct response is to place the foam into the requested container. Level 6 is an *auditory-visual* discrimination task. This level is similar to Level 5, except that the positions of the containers are randomized across trials.

*Assessment procedures.* Prior to testing each level, the tester models the correct response, physically guides the person to perform the response, and then asks the person to perform the response independently. On each test trial, the task is presented as described above. If the individual responded correctly, the tester would provide praise and an edible, and then continue on to the next trial. If the individual responded incorrectly, the tester would say "No" and correct the error by demonstrating the correct response, guiding the individual to complete the response, and then providing an opportunity for an independent response. A correct independent response during error correction would result in praise from the tester and continuation to the next trial; whereas an incorrect response would result in the error correction being repeated. A *pass* is

assigned to a level if the person has performed eight consecutive correct independent responses, and a *fail* is assigned to a level if the person has accumulated eight errors, whichever comes first. The probability of passing by chance for a two-choice task, if the responses were independent across trials, is 0.0308. That is, a person will pass a level by chance approximately 3 times if the assessment of a level is repeated 100 times.

*Research on the ABLA test.* Considerable research has shown that the six ABLA Levels are ordered from the lowest to the highest level in difficulty for children and adults with developmental disabilities (Kerr et al., 1977; Martin, Yu, Quinn, & Patterson, 1983) and for children with autism spectrum disorders (Morris, 2002; Ward & Yu, 2000). If a person passed a given level, he/she would almost always pass lower levels; if a person failed a given level, he/she would almost always fail higher levels. The assessment has demonstrated high inter-rater and test-retest reliabilities (Martin et al., 1983; Meyerson, 1977; Morris, 2002), and the ABLA auditory discriminations have been shown to correlate with communication skills (Barker-Collo, Jamieson, & Boo, 1995; Kerr et al., 1977; Martin et al., 1983; Vause, Martin, & Yu, 2000). Training studies have shown that performance on the ABLA is quite resistant to change using reinforcement and error correction procedures, similar to the ABLA testing procedures (Conyers, Martin, Yu, & Vause, 2000; Hazen, Szendrei, & Martin, 1989; Yu, & Martin, 1986). The ABLA has also been shown to be predictive of learning academic, prevocational, and everyday tasks (see reviews by Martin & Yu, 2000; Yu, Martin, & Williams, 1989).

*Preference Assessment*

*Single, paired, and multiple-stimulus presentations.* A preference assessment directly assesses the extent to which a person selects one stimulus over others, and the selected stimulus is said to be the preferred stimulus. Stimuli (potential reinforcers) to be assessed can be presented

sequentially or concurrently. The single-stimulus (SS) procedure involves presenting one stimulus on each trial and the order that the stimuli are presented is randomized (Pace, Ivancic, Edwards, Iwata, & Page, 1985). The paired-stimulus (PS) procedure involves presenting two stimuli concurrently on each trial and each stimulus is paired with every other stimulus during the assessment (Fisher et al., 1992). The multiple-stimulus (MS) procedure involves presenting more than two stimuli (usually 6 or 7) simultaneously. In MS *with* replacement, all stimuli are presented on every trial (Windsor, Piche, & Locke, 1994). In MS *without* replacement, after a stimulus has been selected, it is removed from the array and the remaining stimuli are presented on the next trial, and so on, until all stimuli have been selected (DeLeon & Iwata, 1996). In all of the above procedures, the main dependent measure is an approach response to a stimulus and preference is defined as the relative frequency of approaches to each stimulus.

Fisher et al. (1992) compared the SS and PS procedures in persons with severe and profound developmental disabilities, and found that the PS procedure showed a greater differentiation of responding among the stimuli. A limitation to the single-stimulus method is that some individuals tend to approach most or all of the stimuli presented. Windsor et al. (1994) compared the PS procedure to the MS (6 items) *with* replacement procedure to identify food preferences for 8 participants ranging from severe to profound developmental disabilities. In addition, they compared the preference assessment results to staff rankings of the individuals' preferences. The most preferred item was identified when using both the MS and the PS procedure. The MS procedure better differentiated preference than the PS procedure for four of the learners. However, the PS procedure yielded more consistent preferences across administrations than the MS procedure and the latter produced more false negatives. Correlations between staff rankings and the MS and PS procedures were low ($r = .399$ and $r = .370$

respectively). Overall, the MS procedure took less time to administer, but the PS procedure yielded more consistent indications of the individual's preferences across sessions.

DeLeon and Iwata (1996) compared the PS, MS *with* replacement, and MS *without* replacement procedures. Although all three methods identified the same most preferred reinforcer for 4 of the 7 participants, the PS and MS *without* replacement methods produced more consistent rankings of stimuli across administrations and identified the same three top ranked stimuli. Moreover, the authors showed that preferred stimuli that were identified by PS and MS *without* replacement procedures, and which were not selected during MS *with* replacement, functioned as reinforcers to increase responding during reinforcer tests for 3 of the 4 participants.

Higbee, Carr, and Harrison (2000) conducted three MS *without* replacement assessments, followed by a multi-element experimental validation of the top four ranked stimuli. Nine adults with severe or profound mental retardation participated. DeLeon and Iwata's (1996) MS *without* replacement assessment was modified by administering only three MS *without* replacement sessions rather than the five to allow the stimulus preference and reinforcer assessments to be completed in a shorter period of time. The four stimuli ranked as most preferred were then delivered contingent upon the participant emitting the target response on a fixed-ratio (FR) schedule of reinforcement. The FR schedules ranged from an FR 2 to an FR 15. Lower FR schedules were implemented to increase the likelihood that the participants would receive the contingency. All reinforcers were presented in a random order in each session. Results indicated that the most preferred reinforcer produced responding above baseline levels for 6 of the 9 participants, therefore showing a reinforcement effect. One participant showed responding over baseline when given a stimulus ranked second. None of the four stimuli showed a consistent

increase in responding over baseline for 2 participants. Overall, the study supported the results of DeLeon and Iwata.

Relative to the PS procedure, the MS *without* replacement procedure is less time consuming, but it requires the participant to scan multiple stimuli, a repertoire that may not be present in individuals with severe and profound developmental disabilities. Therefore, the PS procedure is more commonly used for this population.

*Preference Assessment and Discrimination Skills*

Ability to perform basic visual and auditory discriminations predicts the effectiveness of tangible, pictorial, and vocal presentations during preference assessments. Using a reversal design, Conyers et al. (2002) examined whether they could predict how consistently persons with mental retardation would choose their preferred reinforcers when the stimuli were presented in tangible, pictorial, and spoken forms. They hypothesized that participants who had passed the ABLA Level 3 discrimination, but failed higher levels, would consistently choose their preferred items when they were presented in tangible form, but not when pictures or spoken cues were used; individuals who had passed both Levels 3 and 4, but failed Level 6, would consistently choose their preferred items when they were presented as objects or pictures, but not when the names of the items were spoken; and individuals who had passed ABLA Levels 3, 4, and 6 could choose their preferred items consistently in all three modalities. Their hypotheses were supported by all 9 participants with developmental disabilities in two experiments, with food and nonfood items, respectively. Schwartzman, Yu, and Martin (2003) replicated the findings of Conyers et al. with 6 participants with developmental disabilities using food stimuli. They also compared the predictions using highly and moderately preferred reinforcers and found that high preference items were chosen more consistently than less preferred items across all modalities. de Vries et

al. (2005) extended the above research to preference assessments of protracted leisure activities. Across 9 participants, the three discriminations measured on the ABLA again predicted the consistency with which the participants chose their preferred activities in each of the three modalities.

Clevenger and Graff (2005) examined whether object-picture matching skills were related to performance on picture preference assessments with 6 participants with developmental disabilities. Half the participants were able to match objects to pictures and pictures to objects while the other half were unable to do so. Results showed that the participants who were able to perform the matching skills showed high correspondence in preference between tangible and picture preference assessments, whereas participants who did not demonstrate the matching skills showed low correspondence between the two assessments. This suggests that object-picture and picture-object matching may be important discrimination skills for preference assessments using pictures.

The above studies emphasize the importance of using a discriminative stimulus in preference assessments. Using a stimulus that an individual is unable to discriminate may result in the person making random or no selections, which could lead to the erroneous conclusion that the person has no preference. It's not difficult to imagine that our responses to choices presented to us in symbols or languages we do not know, will not be a valid indicator of our preferences until we have learned to discriminate those stimuli and the relationships between selecting those stimuli and receiving the respective consequences.

For individuals with developmental disabilities who need to rely on tangibles to indicate their preferences, learning to respond to pictorial or spoken stimuli during preference assessments has several advantages. Pictorial and spoken stimuli are easier to present than

tangibles, they can be used to present options that are impractical or impossible to present with tangibles (e.g., protracted leisure activities), and as a result, more choices and potential reinforcers can be made available.

How can we increase the effectiveness of preference assessments with pictures for individuals who need to rely on tangibles? In a PS preference assessment procedure, if an individual is able to select a preferred stimulus consistently across trials, this suggests that (1) a visual discrimination similar to the ABLA Level 3 two-choice discrimination is present (i.e., being able to track the same stimulus regardless of its position relative to the alternative), and (2) the stimulus is discriminative in that the individual has learned the relation between selecting the tangible stimulus and receiving it as a consequence. For individuals who are able to indicate their preferences with tangibles, but not with pictures, it is possible that the visual discrimination involving the pictorial stimuli and/or the picture-consequence relation has not been established. One way to do so is to provide training on the stimulus-stimulus relation between tangibles and pictures – that tangibles (objects) and their pictorial representations are interchangeable – *and* providing the specific consequence of receiving the selected item. Such object-picture relations are commonly referred to as quasi or partial-identity matching and are similar to the ABLA Level 4 discrimination.

*Strategies for Teaching Failed ABLA Discriminations*

A few studies have taught failed ABLA discriminations to persons with intellectual disabilities using a combination of prompt-fading, error correction, and reinforcement techniques, where each component has been individually demonstrated to be effective. Yu and Martin (1986) compared two procedures to teach 5 individuals with developmental disabilities the ABLA Level 3 visual discrimination. The "control" procedure included components

commonly found in teaching programs: extra-stimulus prompt-fading (a pointing prompt), indirect response-reinforcement (handing an edible to the participant for correct responses), and demonstration of the correct response following an error. The "experimental" procedure included within-stimulus prompt-fading (gradually increasing the size of the incorrect stimulus), direct response-reinforcement (the participant lifted the correct stimulus to retrieve an edible hidden underneath), and error preclusion (preventing the incorrect stimulus from being lifted). Of the 5 participants, 2 met the learning criterion on the training task using the control teaching procedure, but generalized to an untrained generalization task only after additional training had been provided. Three participants learned the training task using the experimental procedure and 2 of the 3 participants rapidly learned a new task without additional training.

A similar training package was used by Hazen et al. (1989) to teach visual partial-identity matching-to-sample tasks (ABLA Level 4). Two of the three participants were individuals with intellectual disabilities. The third participant was diagnosed with autism. All 3 participants passed the visual discrimination level (ABLA Level 3) but failed the visual quasi-identity matching-to-sample discrimination task (ABLA Level 4). A non-concurrent multiple baseline design was used to evaluate the training procedure. The training stimuli consisted of an orange measuring spoon, which was to be matched with an orange measuring cup, and a black pencil which was to be matched to a black cylinder. The experimental training package included within-stimulus prompt fading where the size of the correct stimulus was kept constant while the incorrect stimulus was gradually faded in. All participants rapidly learned the task within 100 trials. However, the participant with autism did not generalize to the ABLA Level 4 task. Conyers et al., (2000) taught 4 ABLA Level 4 participants with developmental disabilities an auditory-visual discrimination. The participants first received the standard training procedure,

similar to the control procedures used by Yu and Martin (1986), but did not meet criterion after 170, 195, and 172 trials. Their experimental procedure included a direct response-reinforcer relationship for correct responses, a response preclusion procedure for errors, and within-stimulus prompting where the verbal request was exaggerated by repeating the request up to a maximum of ten times. Reinforcers used during each session were identified through a brief preference testing at the beginning of each session. After switching to the experimental training procedure, all 3 participants learned the task within 21, 82, and 23 trials. The fourth participant only received the experimental procedure and met the training criterion within 20 trials.

*Purpose of the Study*

Will individuals with developmental disorders who need to rely on tangibles in preference assessments be able to respond to pictures after being taught an object-picture matching discrimination? This research addressed this question. It was hypothesized that individuals who showed a preference during preference assessments with objects but not with pictures would improve their performance during picture preference assessments after being taught object-picture matching discriminations. Specifically, prior to training, it was expected that a high preference would be displayed for items during preference assessment with objects and not when the items were presented in pictures. It was also expected that after training and mastery of one or more object-picture matching-to-sample discriminations, preferences for the preferred items using pictures would increase to levels comparable to that observed for objects.

## Method

*Participants and Settings*

Three individuals participated in this study. Written informed consent for participation was obtained from the participant's parent or substitute decision-maker and assent of the

participant was assessed at each contact. Ethical approval for this study was obtained from the University of Manitoba Psychology/Social Research Ethics Board.

Participant 1 was a 9-year-old boy who was non-verbal and diagnosed with autism. He was receiving applied behavioral intervention services at the time of the study. The training stimuli used in the study were not being taught in the child's curriculum during the study. Participant 2 was a 34-year-old man who resided at River Road Place of St. Amant, a facility for individuals with developmental disabilities. He was non-verbal and diagnosed with profound developmental disabilities. Participant 3 was a 34-year-old man who was also a resident at River Road Place at St. Amant. He was non-verbal and diagnosed with autism.

All participants were screened using the ABLA test. Participant 1 passed up to and including ABLA Level 2 and failed higher levels, Participant 2 passed up to and including ABLA Level 4 and failed higher levels, and Participant 3 passed up to and including ABLA Level 3 and failed higher levels. All participants were also tested on a picture-to-object matching task and none of the participant could perform the discrimination.

Sessions took place in a quiet area at home for Participant 1 and in a testing room at River Road Place for Participants 2 and 3. The participants sat behind a table, in a chair, across from the experimenter. During some sessions, an observer was present to conduct reliability assessments.

*Procedures*

Figure 1 shows a flowchart of the study phases. The detailed procedures for each phase are described below.

*Phase1: Tangible preference assessment to identify four food/activity stimuli.* An initial preference assessment was completed using 10 tangible items to identify two high-preference

and two low-preference food/activity stimuli for each participant. Parents/caregivers were asked to provide a list of food items or activities that the participant liked and how often those items were available to the participant. Food items and activities were selected for assessment with consideration given to ease of presentation, availability, and the participant's preference. Each participant was assessed using a paired-stimulus procedure.

During the assessment, two tangible stimuli were presented concurrently on each trial and each stimulus was paired with every other stimulus. The order of presentation for the stimulus pairings was randomized and the sequence was presented at least twice. On each trial, the two tangibles were presented at approximately equal distance from the participant. The left-right positions of the tangibles were counterbalanced across trials. At the beginning of each trial, the participant was prompted to look at each item and asked to "pick one". The participant was given approximately 8 s to respond. A rejection response was defined as pushing an item away. An approach response was defined as pointing to, reaching for, or touching or taking an item, without rejecting it. An approach response could occur following a rejection of the alternative on the same trial. Immediately following an approach response, the selected item was given to the participant for consumption (food) or engagement (activity) and the participant was praised for attending and cooperating. Attempts to select both items simultaneously were blocked and both items were removed from the table. The experimenter waited 5 s before representing the same trial. There was no consequence for rejecting an item and if the participant rejected both items (one after another) within the trial interval, the trial would end. If no response occurred after 8 s, the trial would end and the next trial would be presented. On each trial, the stimulus that was rejected and/or selected (and whether it was consumed) was recorded. Each session lasted approximately 30 minutes. Assessments with tangibles continued until two preferred and two

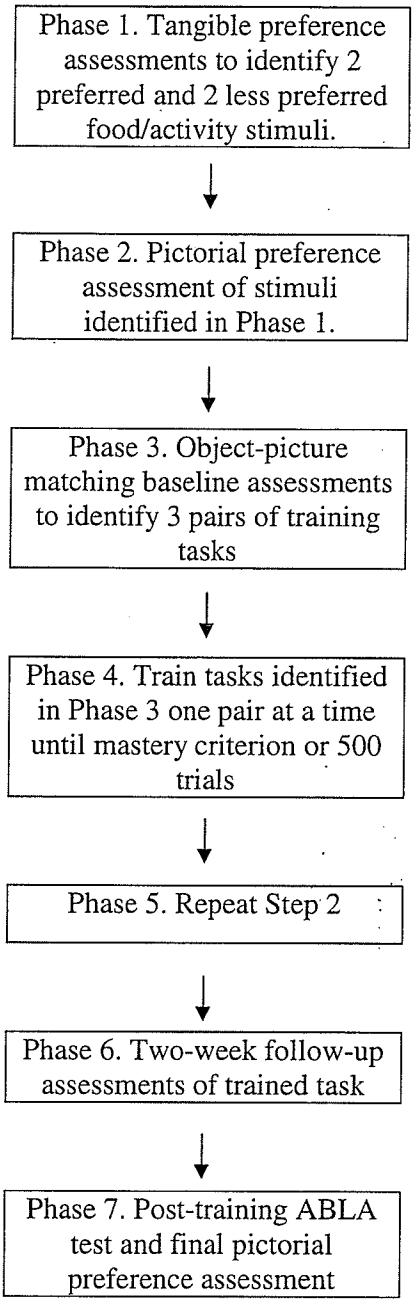


*Figure 1.* Flow chart of study phases.

less preferred food items or activities had been identified. Table 1 shows the items identified for all participants.

*Phase 2: Pictorial preference assessment.* The purpose of this phase was to confirm that the participant was unable to select the preferred items identified above using pictures. The assessment procedure was similar to that used in Phase 1 with the following differences. First, only the four stimuli identified from Phase 1 (i.e., two preferred and two less preferred food items or activities) were presented. Second, during each session, half the trials were presented using tangibles, and the other trials were presented using pictures (20 x 25 cm color photographs). The two types of trials were presented in alternation. Third, assessment sessions were conducted until each unique stimulus pairing had been presented twice using pictures.

*Phase 3: Partial-identity matching-to-sample baselines to identify training tasks.* The purpose of this phase was to identify three pairs of food or activity stimuli for training. These stimuli were comprised of everyday food items, objects, toys, or academic materials. Food or nonfood stimuli were determined based on individual preference and all items identified for each participant fell into the same stimulus class (food or activity) as items used in previous phases. Color photographs (20 x 25 cm) of the objects were prepared and the participants were asked to match objects (samples) to pictures (comparisons) during the assessment. The six stimuli were presented as three two-choice tasks and each pair of tasks was assessed separately using the same procedures.

A guided trial was provided for each stimulus at the beginning of each assessment session. The pictures were placed on the table in front of and at an equal distance to the participant and the participants were prompted to look at each picture in sequence. After the participant looked at each picture, a tangible stimulus depicted in one of the pictures was held up

Table 1

*Preferred and Less Preferred Stimuli Identified during Tangible Preference Assessments.*

| | Preferred Stimuli | Less Preferred Stimuli |
|---|---|---|
| Participant 1 | Cherry Tomatoes<br>Real Fruit Minis ® | Tic Tac ®<br>Pretzel |
| Participant 2 | Animal Puzzle<br>Play-Doh ® | Rubber Snake<br>Coloring Book |
| Participant 3 | Crispers ®<br>Cookies | 7-UP ®<br>Cucumber |

at the participant's eye level, between the two pictures and out of the participant's reach, and the participant was asked to "pick one". The least amount of guidance needed to help the participant to touch the picture that corresponded to the object was provided to ensure correct responding. The participant was then given the edible or object, and praised immediately following the response. The participant either consumed the edible given or played with the object for 15 s and then the object was retrieved. All stimuli were removed from the table and the guided trial was repeated for the second stimulus.

Assessment began following the guided trials. The presentation and consequence procedures on assessment trials were the same as the guided trials, except for the following differences. First, no physical guidance was given. The participant was given 8 s to respond after the instruction "pick one". Second, each trial was recorded as correct (participant pointing to or touching the picture that corresponded to the sample), incorrect (participant pointing to or touching the picture that did not correspond to the tangible), or other response (participant engaging in any other response, including no response). Third, if the participant pointed to the comparison stimulus that did not match the sample or did not respond during the trial interval, all stimuli were removed from the table. Fourth, the positions of the comparison pictures were counterbalanced and each picture was the correct stimulus an equal number of times, but no picture appeared for more than two consecutive trials in the same position or as the correct stimulus. Lastly, each pair of tasks was presented until the participant met the pass (8 consecutive correct responses) or fail (8 cumulative errors) criteria of the ABLA test. The training tasks identified for each participant are shown in Table 2.

*Phase 4: Training partial-identity matching between tangibles and pictures.* During this phase, the participant received training on matching tangible to pictorial stimuli. Individualized

Table 2

*Object-Picture Matching Training Tasks Identified for Each Participant*

| | Object-Picture Matching Training Tasks |
|---|---|
| Participant 1 | 1. Swedish Berries® and Gushers®<br>2. Orange and Fruit-By-The-Foot ®<br>3. Apple Juice and Lays Potato Chips® |
| Participant 2 | 1. Balloons and Miracle Bubbles ®<br>2. Toy Cars and Wooden Blocks<br>3. Toy Stacker and Spin Tops |
| Participant 3 | 1. Popcorn Twists ® and Vegetable Thins®<br>2. Teddy Grahams ® and Butter Pretzels<br>3. Pickles and Carrots |

training was provided to each participant and each training session consisted of 20 to 30 trials. Training was provided for each task in a modified multiple-baseline design across tasks using a multiple-probe technique (Horner & Baer, 1978).

At the start of each session day, the participants and the experimenter engaged in 2 minutes of play and/or social interaction to establish a positive rapport. During this period, the participants were praised for following instructions that had a high probability of success.

A within-stimulus prompt-fading procedure was used during training (Conyers et al., 2000; Hazen et al., 1989; Schreibman, 1975; Yu & Martin, 1986). The procedure involved identifying a stimulus condition (starting point) under which the target behavior was occurring and modifying the stimulus condition gradually, while maintaining the occurrence of the target behavior to the modified condition, until the desired stimulus condition was reached. Moreover, the procedure involved modifying some relevant features of the stimulus (e.g., exaggerating a feature such as shape and/or color of a stimulus) as a prompt and gradually changing those features to resemble the target stimulus. For example, if the participant were able to perform identity matching with objects, then that would be the starting point of the fading program. From there, the goal would be to fade the comparison stimuli from three-dimensional objects to pictures, while the samples remained as objects. Table 3 illustrates the fading steps used for teaching block and car to Participant 2. At any given fading step with the exception of the final step in the training program, after every three consecutive correct responses with at least one response for each comparison stimulus, the next fading step was presented on the next trial. At any given step with the exception of the final step, after two cumulative errors, the preceding fading step was presented on the next trial. At the last fading step, after eight cumulative errors, the preceding fading step was presented. The mastery criterion for the training task was 8

Table 3

*Fading Steps Used for Participant 2's Training Task involving Wooden Blocks and Cars as the Stimuli*

| Fading Steps and Features Modified | Sample | Comparisons | Consequence for Correct Matching |
|---|---|---|---|
| Step 1. (Starting point: Identity matching) | Four Tangible Wooden Blocks or four Cars presented as the sample on each trial. Sample will always be a tangible stimulus. | 4 Tangible Wooden Blocks and 4 Cars presented on every trial | Participant will always be given the sample after pointing to the matching comparison |
| Step 2. Add photo cut out to tangibles | | 4 Wooden Blocks and 4 Cars placed onto photograph of corresponding pictures. | |
| Step 3. Reduce the amount of the tangibles that are on the picture | | 3 Wooden Blocks and 3 Cars placed onto photograph of corresponding pictures. | |
| Step 4. Reduce the amount of the tangibles that are on the picture | | 2 Wooden Blocks and 2 Cars placed onto photograph of corresponding pictures. | |
| Step 5. Reduce the amount of the tangibles that are on the picture | | 1 Wooden Block and 1 Car placed onto photograph of corresponding pictures. | |
| Final Stage | | The photographs of the samples are presented | |

consecutive correct responses (ABLA pass criterion) at the final step within a session. Training for a task was terminated if the mastery criterion was not met after approximately 500 training trials (25 sessions).

On each trial, if the participant pointed to the comparison pictures that matched the object, the object was immediately given to the participant, praised was provided, and the response was recorded as correct. If the participant pointed to the comparison picture that did not match the object or did not respond during the trial interval, all stimuli were removed from the table, the response was recorded as incorrect or no response, and then the experimenter presented the next trial.

*Phase 5: Pictorial preference assessment.* Immediately following the completion of training for each task, the pictorial preference assessment (Phase 2) was repeated.

*Phase 6: Two-week follow-up assessment of training tasks.* Two weeks following the termination of each training task, the object-picture matching baseline for the task was repeated to evaluate retention.

*Phase 7: Post-training of the ABLA test and final pictorial preference assessment.* After training had been completed for all three tasks, the ABLA test was repeated to evaluate whether the training had any impact on the participant's performance on the test. The pictorial preference assessment was repeated two weeks after the termination of the final training task.

*Reliability Checks*

Interobserver reliability checks were conducted for each participant and during each phase of the study. During a reliability check, the observer independently recorded which item was selected on each trial. A trial was considered an agreement if both the observer and the experimenter recorded the same participant response; otherwise, the trial was scored as a

disagreement. An agreement score was calculated for each observed session using the following formula: number of agreements/(number of agreements + disagreements) x 100% (Martin & Pear, 2003). The percentage of sessions observed during each phase of the study ranged from 33% to 100%. The mean percent agreement per session across participants and phases was 99.9%, with a range of 97.2% to 100%.

Procedural integrity checks were conducted for each participant and during each phase of the study to evaluate whether the experimenter carried out the procedures as planned. During a procedural integrity check, the observer recorded for each trial whether the experimenter carried out the steps correctly using a checklist (see Appendices A through D for checklists used during each phase). A trial was considered correct only if the experimenter had carried out all the steps correctly. The percentage of sessions observed during each phase ranged from 33% to 100% across participants. The mean percent of trials carried out correctly by the experimenter across participants and phases was 99.7%, with a range of 96.7% to 100%.

## Results

Figure 2 shows the percentage of correct trials during baseline and training sessions across the three tasks (top three graphs) for Participant 1. During baseline the percentages of correct trials per session were near chance level for all three tasks (range 40% to 60%) and each of the object-picture matching task baseline assessments were terminated after Participant 1 made 8 cumulative errors (fail criterion). Participant 1 met the mastery criterion after 133 training trials for Task 1 and after 579 trials for Task 2, but did not meet the mastery criterion for Task 3 after 511 training trials, at which point training was terminated. During the two-week retention assessments, he passed (8 consecutive correct responses before 8 cumulative errors) Task 1, but not Tasks 2 and 3.

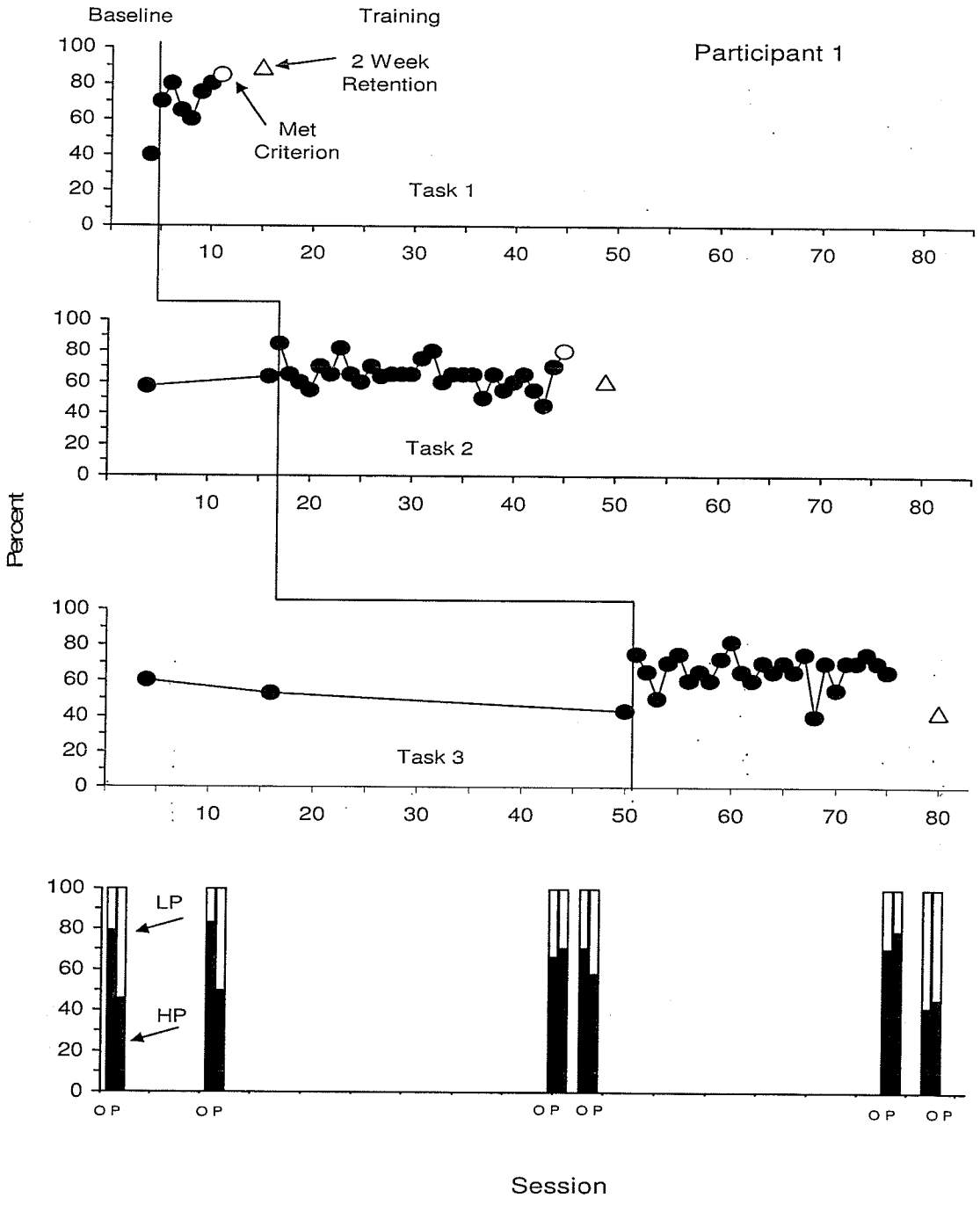


*Figure 2* . The top three graphs show the percentage of correct trials during baseline and training sessions across the three tasks for Participant 1. Unfilled circles indicate training criterion was met. Triangles represent retention assessments. The bottom graph shows the mean percentage of trials that the high and low preference (HP and LP) stimuli were selected during preference assessment before and after training each task. The O and P represents object and picture trials, respectively.

The bottom graph in Figure 2 shows the percentage of trials the high preference (HP, black bar) and low preference (LP, white bar) stimuli were selected during preference assessments using objects (O) and pictures (P), respectively. During the first assessment conducted before training was initiated, HP and LP objects were selected an average of 79% and 21%, respectively, indicating a strong preference for the HP. The HP and LP pictures were selected an average of 46% and 54%, respectively, indicating no strong preference. During the second assessment, conducted after Task 1 was mastered, preferences for HP and LP objects and pictures were almost identical to the first assessment. During the third assessment, conducted after mastering Task 2, preference for the HP objects decreased slightly relative to the previous assessments to a mean of 67%, whereas preference for HP pictures increased to a mean of 71%. Because of these changes, the preference assessment was repeated and it yielded a slight increase for objects (71%) and a decrease for pictures (58%). During the fifth assessment, conducted immediately after mastery of Task 3, the preferences for HP were comparable with objects (71%) and pictures (79%). During the last preference assessment, conducted two weeks after training was terminated for Task 3, preference for the stimuli appeared to have shifted with the participant favoring the LP (58%) over the HP (42%) with objects, and preference with pictures corresponded to the results of the objects assessment (LP 54% and HP 46%).

Figure 3 shows the percentage of correct trials during baseline and training sessions across the three tasks (top three graphs) for Participant 2. During baseline the percentages of correct trials per session were near chance level for all three tasks (range 43% to 60%) and each of the object-picture matching task baseline assessments were terminated after Participant 2 made 8 cumulative errors. Participant 2 met the mastery criteria after 55 trials for Task 1, after

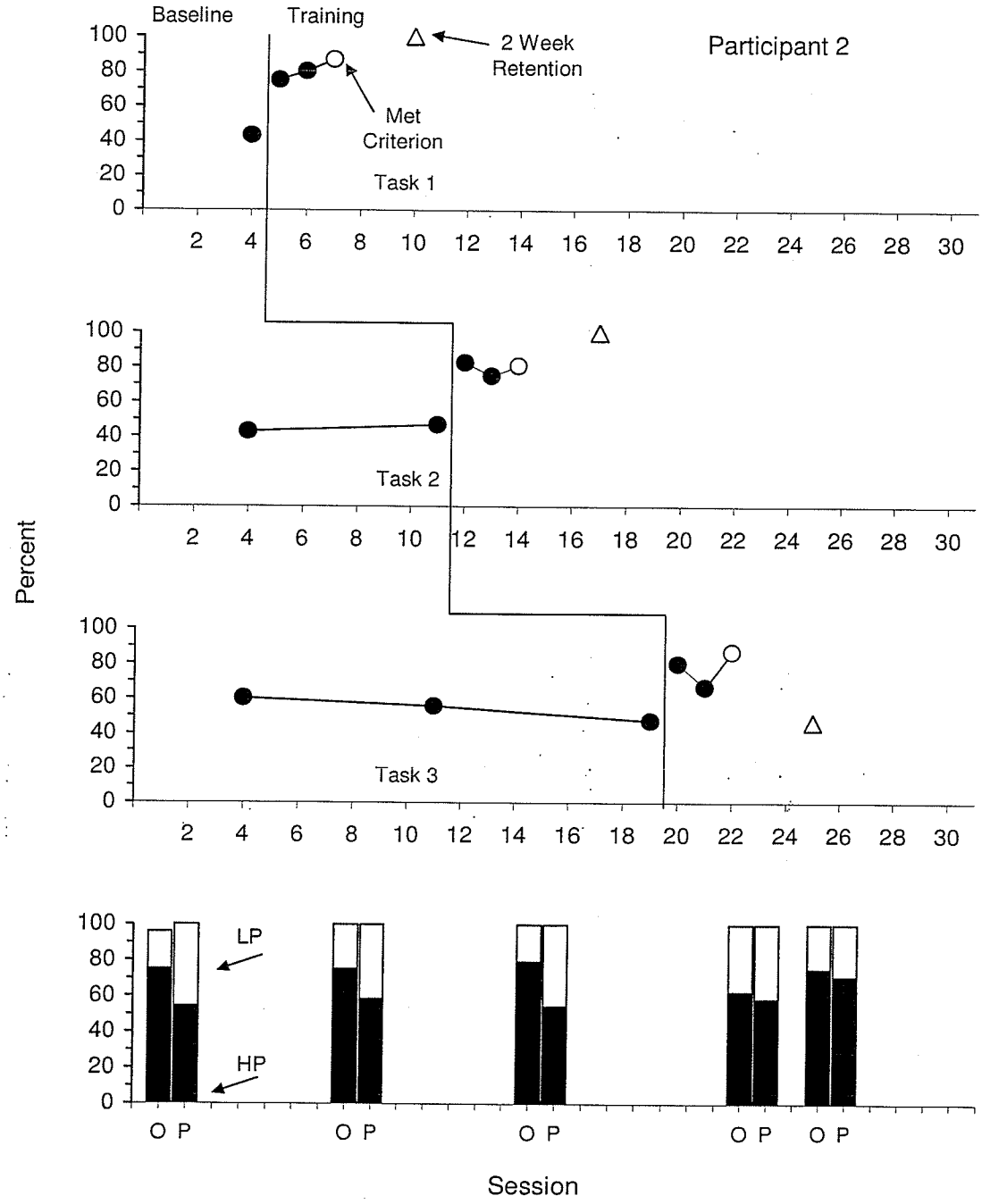


*Figure 3*. The top three graphs show the percentage of correct trials during baseline and training sessions across the three tasks for Participant 2. Unfilled circles indicate training criterion was met. Triangles represent retention assessments. The bottom graph shows the mean percentage of trials that the high and low preference (HP and LP) stimuli were selected during preference assessment before and after training each task. The O and P represents object and picture trials, respectively.

64 trials for Task 2, and after 56 trials for Task 3. During the two-week retention assessments, he passed Tasks 1 and 2, but failed Task 3.

The bottom graph shows the percentage of trials the high preference (HP, black bar) and low preference (LP, white bar) stimuli were selected during preference assessments using objects (O) and pictures (P), respectively. During the first assessment, the HP and LP objects were selected an average of 75% and 21%, respectively, indicating a strong preference for the former (they did not sum to 100% due to no response on one trial). Preference for the HP pictures was near chance level (54%) indicating no strong preference. During the second and third preference assessments following mastery of Tasks 1 and 2, respectively, the results were similar to the first assessment. The fourth preference assessment, conducted immediately after mastering Task 3, preference for HP objects and pictures were comparable. However, this was a result of a decrease in preferences with objects (to 63%) rather than an increase in preference with pictures. The last preference assessment, conducted two weeks after termination of training for Task 3, showed that preference for HP objects returned to baseline level (75%) and preference for HP pictures increased to 71%.

Figure 4 shows the percentage of correct trials during baseline and training sessions across the three tasks (top three graphs) for Participant 3. During baseline, the participant met the fail criterion on all three tasks (percent correct ranged from 33% to 71%). He met the mastery criterion for Task 1 after 48 trials and performed at 100% during the 2-week retention test. He passed Task 2 during the second baseline assessment, so no training was provided. For task 3, Participant 3 met the mastery criterion after 123 training trials, but did not meet the criterion during the retention test.

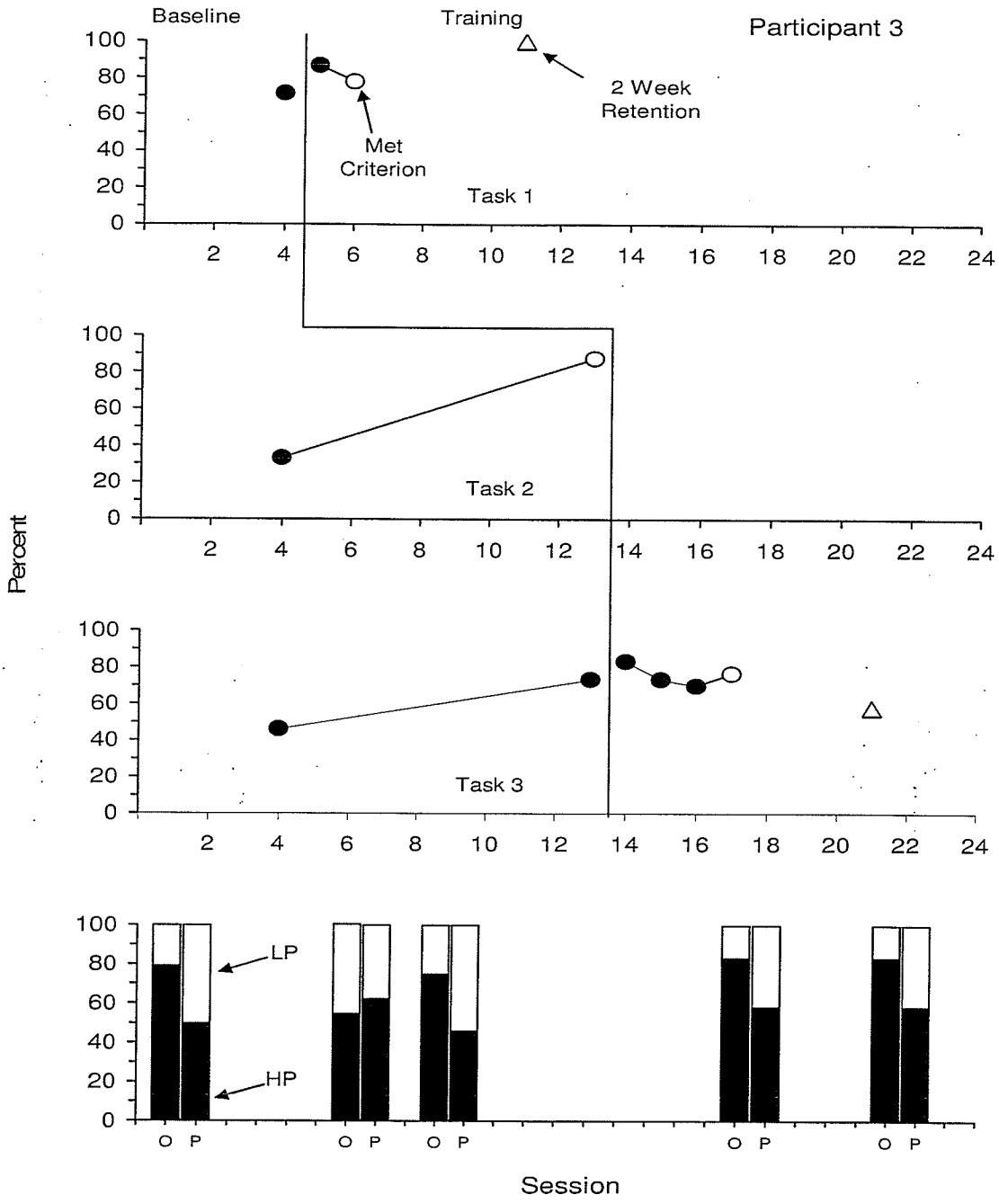


*Figure 4*. The top three graphs show the percentage of correct trials during baseline and training sessions across the three tasks for Participant 3. Unfilled circles indicate training criterion was met. Triangles represent retention assessments. The bottom graph shows the mean percentage of trials that the high and low preference (HP and LP) stimuli were selected during preference assessment before and after training each task. The O and P represents object and picture trials, respectively.

The bottom graph shows the percentage of trials the high preference (HP, black bar) and low preference (LP, white bar) stimuli were selected during preference assessments using objects (O) and pictures (P), respectively. During the first assessment conducted before training was initiated, preference for HP objects averaged 79%, whereas preference for HP pictures averaged 50%. During the second assessment, conducted after Task 1 was mastered, preferences for HP objects were comparable to pictures, but this resulted mainly from a decrease in object preference (from 79% to 54%) and a only slight increase in picture preference (from 50% to 63%). Since there might have been a change in preference, the assessment was repeated to verify the results. Results showed that preference for HP objects and pictures replicated the first assessment. During fourth and fifth preference assessments, conducted immediately and 2-weeks after Task 3 was mastered, respectively, results were similar to baseline, which showed a strong preference for HP objects, but not for pictures.

With respect to performance on the ABLA test, prior to training, Participant 1 passed Level 2 and failed higher levels, Participant 2 passed Level 4 and failed higher levels, and Participant 3 passed Level 3 and failed higher levels. Following the completion of training for all tasks, Participant 1 gained one level passing up to Level 3, Participant 2 decreased two levels passing up to Level 2 position discrimination, and Participant 3 showed no change in levels.

## Discussion

The purpose of this study was to evaluate the effects of training object-picture matching on preference assessments using pictures. It was hypothesized that for individuals who showed preference for items using objects but not pictures during preference assessments, learning object-picture matching would enable them to indicate their preferences using pictures. Although the modified multiple-baseline design across tasks using a multiple-probe technique offered

strong evidence for the effectiveness of the training procedures in teaching object-picture matching, the preference assessment results did not support this hypothesis. If both objects and pictures had shown comparable levels of preference for the HP stimuli following training and if a strong preference for HP over LP, similar to baseline levels, were observed, it would have offered evidence in support of the hypothesis. Across the 13 preference assessments conducted after training had been initiated, only two offered such evidence (second last preference assessment for Participant 1 and last assessment for Participant 2). It could be argued that the last preference assessment for Participant 1 also provided supporting evidence on the assumption that preference for the HP and LP stimuli had reversed.

Three reasons may account for the observed results. First, a problem encountered in the study was that preference fluctuated across assessments with objects. The instability may be due the fact that preferences for the HP items were not very strong at the beginning of the study (means ranged from 75% to 79% across participants). Items with a preference in this range may be more susceptible to satiation effects with repeated exposures throughout the study. Therefore, identifying and using items with a stronger preference (e.g., 90% or higher) may alleviate this problem in future research.

Second, although the three participants met the learning criterion on seven of the eight training tasks attempted, retention was weak to moderate across all participants. Only three of the seven training tasks met the pass criterion during retention. Perhaps a more stringent training criterion could have improved retention.

Third, despite the association between matching-to-sample discriminations and picture preference assessment found in previous research (Clevenger & Graff, 2005; Conyers et al., 2000; de Vries et al., 2005; Schwartzman et al., 2003), it is possible that this discrimination is not

a prerequisite or only one of several skills required for picture preference assessment. For example, an individual's ability to perform generalized object-picture matching (i.e., being able to learn to match novel stimuli quickly) may be required for picture preference assessment. Future research is needed to examine this possibility.

In addition, Clevenger and Graff (2005) found that individuals who could indicate their preferences with pictures showed both object-picture and picture-object matching (i.e., reversing the roles of the stimuli as sample and comparison). Past research in stimulus equivalence (Sidman & Tailby, 1982) has shown that being able to perform one relation does not automatically engender the reverse relation. Future research should consider assessing and training both relations.

Results of the training and ABLA assessments are noteworthy. First, studies have found that teaching a task at a failed ABLA level usually requires extensive training (Martin & Yu, 2000), but Participants 1 and 3 each learned two new discriminations relatively quickly. Moreover, Participant 3 showed generalization to Task 2 after mastering Task 1. Second, both participants learned discriminations greater than one level above their highest passed ABLA discrimination level during baseline (Participant 1 was at Level 2 and Participant 3, Level 3). Nonidentity matching has been shown to be above ABLA Level 4 (Sakko, Martin, Vause, Martin, & Yu, 2004). Lastly, Participant 1 gained one ABLA level during post-training assessment. While this positive outcome might have been a result of training, it must be tempered by the results of Participant 2 whose ABLA levels decreased by two during the post-test. The cause of the performance decrease was unclear.

In summary, the results of this study support the effectiveness of the training procedures in teaching object-picture matching discriminations. However, mastery of the tasks did not

improve performance on picture preference assessment. Further research to examine how to teach individuals to respond to picture preference assessment is warranted.

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# Appendix A

## Procedural Reliability Checklist for Phase 1

**Phase 1 - Data Sheet for Tangible Preference Assessment to Identify Food/Activity Stimuli**

Participant ____
Session 1/3
Edibles used: A _____ E _____ I _____
B _____ F _____ J _____
C _____ G _____
D _____ H _____

* If the experimenter carried out the procedure correctly, put a checkmark. If not, please put an X.

| Date | Tester | Observer | Trial | Choice | | No Choice | Consume/ Engage | | Procedural Reliability | | | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Yes | No | Correct Stimulus Pairing | Correct Verbal Prompt | Correct Consequence | |
| | | | 1 | E | G | | Yes | No | | | | |
| | | | 2 | B | I | | Yes | No | | | | |
| | | | 3 | D | C | | Yes | No | | | | |
| | | | 4 | A | H | | Yes | No | | | | |
| | | | 5 | I | F | | Yes | No | | | | |
| | | | 6 | C | E | | Yes | No | | | | |
| | | | 7 | G | D | | Yes | No | | | | |
| | | | 8 | F | A | | Yes | No | | | | |
| | | | 9 | H | E | | Yes | No | | | | |
| | | | 10 | I | G | | Yes | No | | | | |
| | | | 11 | B | J | | Yes | No | | | | |
| | | | 12 | E | D | | Yes | No | | | | |
| | | | 13 | J | H | | Yes | No | | | | |
| | | | 14 | C | A | | Yes | No | | | | |
| | | | 15 | J | G | | Yes | No | | | | |
| | | | 16 | F | H | | Yes | No | | | | |
| | | | 17 | A | I | | Yes | No | | | | |
| | | | 18 | D | E | | Yes | No | | | | |
| | | | 19 | G | C | | Yes | No | | | | |
| | | | 20 | H | D | | Yes | No | | | | |
| | | | 21 | C | J | | Yes | No | | | | |
| | | | 22 | I | E | | Yes | No | | | | |
| | | | 23 | B | H | | Yes | No | | | | |
| | | | 24 | J | D | | Yes | No | | | | |
| | | | 25 | E | F | | Yes | No | | | | |
| | | | 26 | G | I | | Yes | No | | | | |
| | | | 27 | A | B | | Yes | No | | | | |
| | | | 28 | F | I | | Yes | No | | | | |
| | | | 29 | H | C | | Yes | No | | | | |
| | | | 30 | D | J | | Yes | No | | | | |

# Appendix B

## Procedural Reliability Checklist for Phase 2, 5, and 7 (Final Pictorial Preference Assessment)

**Circle the Apropriate Assessment:** Phase 2 Phase 5 Phase 7

Following Task #___

Participant # _____

High A _____ Low C _____

B _____ D _____

* If the experimenter carried out the procedure correctly, put a checkmark. If not, please put an X.

| Date | Tester | IOR | Trial | Modality | Choice | | No Choice | Consume/ Engage | | Procedural Reliability | | | | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Yes | No | Correct Modality Presented | Correct Stimulus Pairing | Correct Verbal Prompt | Correct Consequence | |
| | | | 1 | picture | A | C | | Yes | No | | | | | |
| | | | 2 | picture | B | D | | Yes | No | | | | | |
| | | | 3 | tangible | D | B | | Yes | No | | | | | |
| | | | 4 | picture | B | C | | Yes | No | | | | | |
| | | | 5 | tangible | B | D | | Yes | No | | | | | |
| | | | 6 | tangible | A | C | | Yes | No | | | | | |
| | | | 7 | picture | D | A | | Yes | No | | | | | |
| | | | 8 | tangible | B | A | | Yes | No | | | | | |
| | | | 9 | tangible | D | C | | Yes | No | | | | | |
| | | | 10 | picture | D | B | | Yes | No | | | | | |
| | | | 11 | tangible | C | A | | Yes | No | | | | | |
| | | | 12 | picture | A | D | | Yes | No | | | | | |
| | | | 13 | picture | B | A | | Yes | No | | | | | |
| | | | 14 | picture | D | C | | Yes | No | | | | | |
| | | | 15 | tangible | B | C | | Yes | No | | | | | |
| | | | 16 | picture | C | A | | Yes | No | | | | | |
| | | | 17 | tangible | C | B | | Yes | No | | | | | |
| | | | 18 | picture | A | B | | Yes | No | | | | | |
| | | | 19 | tangible | A | B | | Yes | No | | | | | |
| | | | 20 | picture | C | D | | Yes | No | | | | | |
| | | | 21 | tangible | C | D | | Yes | No | | | | | |
| | | | 22 | tangible | D | A | | Yes | No | | | | | |
| | | | 23 | tangible | A | D | | Yes | No | | | | | |
| | | | 24 | picture | C | B | | Yes | No | | | | | |

# Appendix C

## Procedural Reliability Checklist for Phase 3 and 6

**Circle the Appropriate Assessment:** Phase 3 Phase 6

**Task #**
**Participant #** _____
**Items used:** A _____
B _____

* If the experimenter carried out the procedure correctly, put a checkmark. If not, please put an X.

| Date | Tester | IOR | Trial | Sample | Present-ation | | No Choice | Engage/Consume | | Procedural Reliability | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Yes | No | Correct Stimulus Pairing | Correct Verbal Prompt | Correct Consequence |
| | | | 1 | B | **B** | A | | Yes | No | | | |
| | | | 2 | A | B | **A** | | Yes | No | | | |
| | | | 3 | B | A | **B** | | Yes | No | | | |
| | | | 4 | A | **A** | B | | Yes | No | | | |
| | | | 5 | B | A | **B** | | Yes | No | | | |
| | | | 6 | A | **A** | B | | Yes | No | | | |
| | | | 7 | B | A | **B** | | Yes | No | | | |
| | | | 8 | A | B | **A** | | Yes | No | | | |
| | | | 9 | B | **B** | A | | Yes | No | | | |
| | | | 10 | A | B | **A** | | Yes | No | | | |
| | | | 11 | B | **B** | A | | Yes | No | | | |
| | | | 12 | A | B | **A** | | Yes | No | | | |
| | | | 13 | B | **B** | A | | Yes | No | | | |
| | | | 14 | A | **A** | B | | Yes | No | | | |
| | | | 15 | B | A | **B** | | Yes | No | | | |
| | | | 16 | A | **A** | B | | Yes | No | | | |
| | | | 17 | B | A | **B** | | Yes | No | | | |
| | | | 18 | A | **A** | B | | Yes | No | | | |
| | | | 19 | B | A | **B** | | Yes | No | | | |
| | | | 20 | A | B | **A** | | Yes | No | | | |
| | | | 21 | B | **B** | A | | Yes | No | | | |
| | | | 22 | A | B | **A** | | Yes | No | | | |
| | | | 23 | B | **B** | A | | Yes | No | | | |
| | | | 24 | A | B | **A** | | Yes | No | | | |
| | | | 25 | B | A | **B** | | Yes | No | | | |
| | | | 26 | A | **A** | B | | Yes | No | | | |
| | | | 27 | B | A | **B** | | Yes | No | | | |
| | | | 28 | A | **A** | B | | Yes | No | | | |
| | | | 29 | B | A | **B** | | Yes | No | | | |
| | | | 30 | A | B | **A** | | Yes | No | | | |

# Appendix D

## Procedural Reliability Checklist for Phase 4 Training Object-Picture Partial-identity Matching Training Task 2 of Participant 2

**Phase 4 - Data Sheet for Training Object-Picture Nonidentity Matching Task**

Participant # _____
Training Task # ____
Session # ____
Previous Fading Step ____
Previous # of Errors _____

A Cars
B Blocks

* If the experimenter carried out the procedure correctly, put a checkmark. If not, please put an X.

| Date | Tester | IOR | Step | Trial | Sample | Present-ation | | No Choice | Procedural Reliability | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | Correct Fading Step | Correct Stimulus Pairing | SD "Look" for each comparison | Correct Sample | Correct Verbal Instruction | Correct Conseq-uence |
| | | | | 1 | B | B | A | | | | | | | |
| | | | | 2 | A | B | A | | | | | | | |
| | | | | 3 | B | A | B | | | | | | | |
| | | | | 4 | A | A | B | | | | | | | |
| | | | | 5 | A | B | A | | | | | | | |
| | | | | 6 | B | B | A | | | | | | | |
| | | | | 7 | A | B | A | | | | | | | |
| | | | | 8 | B | B | A | | | | | | | |
| | | | | 9 | A | A | B | | | | | | | |
| | | | | 10 | A | B | A | | | | | | | |
| | | | | 11 | B | A | B | | | | | | | |
| | | | | 12 | B | B | A | | | | | | | |
| | | | | 13 | A | A | B | | | | | | | |
| | | | | 14 | B | A | B | | | | | | | |
| | | | | 15 | A | A | B | | | | | | | |
| | | | | 16 | A | B | A | | | | | | | |
| | | | | 17 | B | B | A | | | | | | | |
| | | | | 18 | B | A | B | | | | | | | |
| | | | | 19 | A | A | B | | | | | | | |
| | | | | 20 | B | A | B | | | | | | | |

| Fading Steps | Comparison A - Cars |
|---|---|
| 1 | Objects only (4 cars) |
| 2 | 4 cars on picture |
| 3 | 2 cars on picture |
| 4 | 1 car on picture |
| 5 | picture only |

| Fading Steps | Comparison B - Blocks |
|---|---|
| 1 | Objects only (4 blocks) |
| 2 | 4 blocks on picture |
| 3 | 2 blocks on picture |
| 4 | 1 block on picture |
| 5 | picture only |