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The Use Of Auditory Prompting Procedures And Specific Reinforcer Assignments To Promote Auditory-Visual Conditional Discriminations In Persons With Intellectual Disabilities.

A thesis submitted in partial fulfillment of the requirements

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by

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Abstract

Individuals with autism and developmental disabilities may struggle when presented with auditory-visual relations (Carp, Peterson, Arkel, Peturdottir, & Ingvarsson, 2012). Previous studies have suggested that class specific consequences may serve as an additional stimulus class for acquisition of relational responding to demonstrate stimulus equivalence with the human population. To date, emergence of auditory-visual relations has only been demonstrated with individuals who are ABLA level 6. This study sought to replicate and extend previous findings of Monteiro & Barros (2016), Santos, Nogueira, Queiroz, & Barros (2017), and Varella & De Souza (2014, 2015) by evaluating the effectiveness of class specific consequences in establishing auditory-visual discriminations with intellectually disabled individuals, specifically individuals who are level 4, 5, and/or 6 on the ABLA-R using a table top match to sample procedure. Two of five participants (one ABLA-R level 5 and one ABLA-R level 6) demonstrated emergent auditory-visual relation.

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Introduction

Assessment of Basic Learning Abilities

The Assessment of Basic Learning Abilities (ABLA) was first developed by Kerr, Meyerson, & Flora in 1977. At the time, the ABLA was called the combined auditory visual discrimination (AVC) and was designed to provide psychologists, caregivers, and teachers with predicted measures of an individual's ability to discriminate between stimuli. It was also used to maximize learning components for individuals with discrimination deficits (Kerr, et. al, 1977). The ABLA provides predictable measures of an individual's ability to discriminate by completing a simple motor task to a two-choice discriminative task on various levels. There are six levels that were identified with each level being a prerequisite skill to the next level. Each level increases in difficulty requiring the individual to engage in more complex relational discrimination task. The AVC levels in hierarchical order were: (1) motor response, (2) position response, (3) visual discrimination, (4) visual match to sample, (5) auditory discrimination, and (6) combined auditory-visual conditional discrimination (Casey & Kerr, 1977).

Sakko, Martin, Vause, Martin, and Yu (2004), investigated the potential modification to the ABLA with an examination of a visual-visual non-identity matching task as it relates to the ABLAs hierarchical relation along with its predictability and reliability across multiple participants. They discovered that visual-visual non-identity matching to sample (ABLA-R level 5) may be the prerequisite skill to ABLA level 6. Vause, Martin, Yu, Marion, and Sakko (2005) also supported the modification that lead to the revision of the ABLA in replacing level 5, auditory discrimination, with the prototype of visual-visual nonidentity matching (VVNM). The ABLA has since been modified and is now known as the Assessment of Basic Learning Abilities – Revised (ABLA-R) (DeWiele, Martin, Martin, Yu, & Thomson, 2010). The revision replaced the previous level 5 of auditory discrimination with a visual-visual non-identity matching task. The revised assessment is categorized into six levels, which are assessed by the instructor in an attempt to test the different levels of conditional discrimination tasks that an individual engages in from a simple motor task and five two choice discrimination tasks. The six levels of discrimination are the following:

Level l : Simple Motor Response

Level 2 : Position Discrimination

Level 3 : Visual Discrimination

Level 4 : Visual Quasi-Identity Match-to-Sample Discrimination

Level 5 : Visual Non-Identity Match-to-Sample Discrimination

Level 6 : Auditory-Visual Combined Discrimination

To pass a level, individuals must correctly respond to the sample stimulus *n* for eight consecutive trials, whereas the individual fails the specific level if they incorrectly place the sample stimulus for eight cumulative trials. The ABLA-R suggests that individuals who score below level 4 will not have the ability to make visual conditional discriminations between stimuli. On the other hand, individuals who score at or above level 4 have the ability to make visual identity conditional discriminations. Individuals who pass a certain level typically also pass levels below their passed level, but if the individual has failed a level, they are not likely to pass levels above that failed level (Kerr et. al, 1977). Individuals who fail a certain level on the ABLA have difficulties in learning prerequisite skills to acquire the individual to pass that failed level using standard prompting and reinforcement procedures. Some individuals may achieve the repertoire to pass the failed level, but only after hundreds of teaching trials (Conyers, Martin, Yu & Vause, 2000; Meyerson, 1977; Murphy, Martin, & Yu, 2014; Vause, et. al, 2005; Witt &

Wacker, 1981). One study suggests that individuals who pass and or fail a level will have no performance change when retested months later (Vause, Yu, & Martin, 2007).

Since its development in 1977, and revision in 2010, the ABLA-R has repeatedly shown to predict performance on imitative tasks as well as two, three, and four-choice discrimination tasks (Doan, Martin, Yu, & Martin, 2007; Martin, Thorsteinsson, Yu, Martin, & Vause, 2008; Wacker, Kerr, & Carrol, 1983). For these multiple-choice discriminations, the individuals are presented with tasks similar to those of the ABLA with additional distractors. If the individuals score at a specific level, a multiple-choice task is presented based on their current passed level and a level above, excluding individuals who passed level 6. The study concluded that predictability with the individuals and their ABLA levels stay true to their ability to discriminate regardless of additional distractors in a match to sample task.

Vause et. al (2005), investigated the relationship of language between stimulus equivalence and ABLA with low and high functioning individuals who had minimal verbal repertoires. Individuals were presented with arbitrary non-identical visual stimuli on a match to sample task. The result of the study showed that individuals who achieved level 6 and visual-visual nonidentity matching (VVNM) were able to demonstrate stimulus equivalence whereas individuals who achieved level 4 (visual-visual identity match to sample) did not demonstrate an emergence of stimulus equivalent relations. This study helped lead the revision of the ABLA in replacing level 5 with a VVNM task as a prerequisite to the level 6, combined auditory-visual discrimination. The authors also suggested that level 6, auditory-visual discrimination, may be a prerequisite to learning equivalent relations (Vause et. al, 2005).

Matching to Sample

Matching to Sample procedures are normally arranged as discrete trials. Often times, matching to sample procedures are conducted with technology and the use of a computer apparatus or with table top stimuli. The matching to sample procedure was first introduced with pigeons, that included an apparatus that presented three illuminated keys (Cummings & Berryman, 1961). The sample stimulus illuminated at the center key of the apparatus and a response to the center key produced the presentation of the comparison stimuli with the remaining two keys. A response on the correct comparison stimulus resulted in reinforcement, whereas a response on the incorrect comparison stimulus resulted in a blackout period with no reinforcement. Since then a variety of studies involving matching to sample task have been used as a procedure with other animals and the human population. Sidman (1971), used the match to sample procedure with an individual who had an intellectual disability and taught them to match spoken words to printed words. The apparatus used in the study presented the sample stimulus at the center of the window screen of a matrix following a pressing response. A pressing response from the subject produced visual stimuli onto the outer window. Visual stimuli may be in the form of pictures and or written words, such as a picture of a cat and the written word cat. Although Sidman's study used projections on a translucent window, there are other methods of presenting matching to sample task such as on table top, light chambers, or the commonly used computer/touch screens. Since then, match to sample procedures have been utilized to teach individuals with autism how to match with visual identity and non-identity stimuli (Green, 2001).

Stimulus Equivalence

From the matching to sample procedure discussed previously, stimulus equivalence was first discovered by Sidman in 1971. Sidman's study included a match to sample task across stimuli involving pictures, printed words, and hearing the spoken words. By using the match to sample procedure, Sidman was able to demonstrate an emergence of reading ability with an individual with intellectual disabilities. Prior to Sidman's study, the individual was not able to match printed words to picture or match the spoken word to the printed words. The individual however, was able to match the spoken word to the picture and could say what the picture was upon presentation of the picture. Using a matching to sample procedure, Sidman was able to teach the individual how to read the printed word. The match to sample procedure included the individual matching the presented spoken word to each picture and the printed word. Once the individual was trained on matching the presented spoken word to the corresponding picture and printed word, Sidman demonstrated that the individual was able to match the printed word to the corresponding picture which was not previously trained but rather, emerged as a trained conditional relation.

Similarly, Sidman & Tailby (1982) demonstrated emergent relations with normal individuals using capital and lowercase Greek letters and a matching to sample procedure. They later describe the phenomena of stimulus equivalence as three properties which include reflexivity, symmetry, and transitivity. For two stimuli to hold the same relation to itself it must carry identical characteristics, *aRa*, this is called reflexivity. If an individual matches a stimulus *a* to another stimulus *b* that may not share the same identical properties and reversed, the individual is demonstrating symmetric relation of *aRb* and *bRa*. If an individual demonstrates the ability to make symmetric relations of *aRb, bRa,* and *bRc*, if *aRc* emerges, this is called a transitive relation. In short, reflexive property demonstrates the relation between two stimuli that are identical, symmetry property demonstrates a reverse relation when a non-identical relation has been trained, and transitivity is the demonstration of symmetry with relations that carry prerequisite relations that produces an outcome of emergent conditional relations.

Stimulus equivalence is mainly investigated with the human population, although there are a few studies conducted with non-humans. However, this is not common due to difficulties with the symmetry property (Yamazaki, 1999). Since Sidman's discovery, many researchers have investigated this phenomenon using different approaches and methodology to add to the literature of stimulus equivalence. The literature of stimulus equivalence has expanded from teaching individuals to read, to teaching individuals how to spell (Stromer, Mackay, & Stoddard, 1992), academic skills (Stanley, Belisle, & Dixon, 2018), basic geography (Dixon, Stanley, Belisle, Galliford, Alholail, & Schmick, 2017), auditory-tactile-visual stimuli (Mullen, Dixon, Belisle, & Stanley, 2017), money (Keintz, Miguel, Kao, & Finn, 2011) and many other domains.

Dube, McIlvane, Mackay, & Stoddard (1987) and Dube, McIlvane, Maguire, Mackay, and Stoddard (1989), discussed the 4-term contingency and its relation to reinforcer specific contingencies. In short, the 4-term contingency is the product of the history of reinforcement that results in differential responding in the presence of a discriminative stimulus but is contingent on the presented conditional stimulus (Sidman, 2000). Dube et. al (1987, 1989), demonstrated that specific reinforcers may become part of the stimulus class that specific reinforcers were assigned to through relations associated with those stimuli class members. Individuals respond in such a way to presenting stimuli by conditional relations that resulted in producing specific reinforcers (4-term contingency). In short, a response towards stimulus B1 in the presence of stimulus A1 produces specific reinforcer R1. Dube et. al (1987, 1989), demonstrated this with individuals with intellectual disabilities using a matching to sample procedure with specific edible reinforcers which included spoken name, object and printed symbol (1987) and matching names, objects, and symbols (1989). Participants in the study matched a stimulus to another stimulus and correct responses resulted in a class specific edible reinforcer. If the individual was asked to match A1 → B1 or A2 → B2, following a correct response, reinforcer 1 (R1) was produced. Incorrect responses resulted in the researcher saying “no” while presenting a screen. After some trials, the experimenter faded saying “no” and only presented the screen on incorrect trials.

Sidman’s (2000) theory suggested that equivalent class formation is related to the contingencies of reinforcement and behavioral processes that are exposed to the individual. Prior to the theory, many studies have discovered multiple relations that may emerge within the area of stimulus equivalence but not to the extent for each stimulus class and their specific reinforcing consequences. In response to Sidman’s theory, Barros, Lionello-DeNolf, Dube, and McIlvane (2006), conducted a study investigating class specific consequences and class formation with visual reinforcers with individuals diagnosed with autism. Barros et. al identified the two highest preferred edible reinforcers for each participant which were used as specific reinforcers following correct responses to a match to sample task. One of the two specific edible reinforcers were provided following a correct response during stimulus class 1 trials, whereas the second specific edible reinforcer was provided following a correct response during stimulus class 2 trials. If the task was to match A1 → B1, following correct responding, the researcher provided a specific edible reinforcer (R1) and specific sound (S1) to the participant; matching B1 → C1 resulted in the same reinforcer following correct responses. If the task was to match A2 → B2 and B2 → C2 then following correct responses produced a specific edible reinforcer of R2 and the specific sound, S2. The study demonstrated that class specific consequence functioned as part of the stimulus equivalence class, validating Sidman’s theory on stimulus equivalence being related to the direct outcome of the contingencies of reinforcement.

Following Barros et. al study, Varella and de Souza (2014, 2015) evaluated the emergence of auditory-visual relations with individuals who exhibited visual-visual relations during baseline using specific compound consequences of an auditory stimulus and visual stimulus. For the first study (2014), all participants involved achieved level 6 on the ABLA and for the second study (2015) a single participant achieved level 6 on the ABLA, which indicated that the participants already had the ability to make auditory-visual discriminations. Participants were presented with a match to sample task with two or three distractors following the presentation of a sample stimulus. Following a correct response, the researcher delivered an edible reinforcer as well as an auditory stimulus that was assigned to that stimulus class. Correct responses when matching A1 → B1 and C1 → D1 produced the compound consequence of R1 and S1 and respectively for correct responses when matching A2 → B2 and C2 → D2 produced R2 and S2. In the 2014 study, Varella and de Souza, used novel arbitrary shapes as visual stimuli on a computer program when presenting the match to sample task and instrumental tones for the auditory stimuli. The 2015 study was conducted to replicate and extend the previous study using printed letters (uppercase and lowercase letters) which served as visual stimuli and spoken letter which served as the auditory stimuli. Varella and de Souza (2014, 2015), demonstrated emergence of auditory-visual relations in all participants using specific consequences such as an edible reinforcer with an additional auditory component. Those specific compound consequences may also serve as relational stimuli for the stimulus class that were assigned when evaluating the emergence of auditory-visual discriminations in individuals diagnosed with autism.

Whereas Varella and de Souza used novel arbitrary shapes and specific instrumental sounds with specific edible reinforcers as stimuli (2014) and later used novel printed letter and spoken letters (2015), Monteiro and Barros (2016), extended previous studies by evaluating visual-visual and auditory-visual relations using simpler protocols with countries (Peru and Chile) with four individuals who were high and low functioning when assessed by the ABLA. Two individuals was level 4 while the other two were level 6 on the ABLA. Monteiro and Barros's (2016), procedures were similar to previous studies where individuals who responded correctly to matching A1 → B1 produced a specific sound and edible S1 and R1. However, their study included a simpler procedure by which a prerequisite skill was required of matching A1 → A1/B1 → B1. A correct response produced the consequence of S1 and R1. Similar contingencies were present when matching A2 → A2/B2 → B2 except consequences presented were S2 and R2. The Monteiro and Barros study resulted in only ABLA individuals demonstrating an emergence of auditory-visual relations. Individuals who did not demonstrate emergent auditory-visual relation were level 4 on the ABLA.

Most recently, researchers have investigated the efficacy of complex reinforcers utilizing edibles and videos as specific consequences to establish equivalence class formation in children diagnosed with autism (Santos, Nogueira, de Queioz, & Barros, 2017). Two individuals participated in this study, both performed level 6 on the ABLA. Participants were presented with a match to sample task on a computer with two stimulus classes of arbitrary shapes. Following a correct response, researchers provided the participants with a specific edible and a short 15 second clip of a cartoon video. The study resulted in both participants demonstrating emergent equivalent relations between the two stimuli classes.

Purpose

Individuals with autism and developmental disabilities may struggle when presented with auditory-visual relations (Carp, Peterson, Arkel, Peturdottir, & Ingvarsson, 2012). Previous studies have evaluated the use of class-specific compound consequences in training novel arbitrary relations with children with intellectual disabilities (Monteiro & Barros, 2016; Santos, et. al, 2017, Varella & De Souza, 2014, 2015). The specific compound consequences included an auditory component and a visual component. All four studies included participants that were identified to have performed level 4 or level 6 on the ABLA, which indicated that individuals who were level 4 are able to make visual match to sample conditional discriminations and individuals who were level 6 are able to make auditory-visual conditional discriminations between stimuli (Meyers et. al, 1977). Emergence of auditory-visual relations were demonstrated for all participants who were level 6 and were not demonstrated for participants who were level 4 on the ABLA. The purpose of this study was to replicate and extend previous studies by evaluating the effectiveness of class specific consequences in establishing auditory-visual discriminations with intellectually disabled individuals, specifically individuals who are level 4, 5, and/or 6 using the ABLA-R. To our knowledge, there are no studies that investigate the efficacy of specific compound consequences in establishing auditory-visual discrimination with individuals who are level 5 on the ABLA-R. This study also investigated the efficacy of a table top match to sample procedure using picture cards and electronic tones as stimuli.

Method

Participants

The current study included five participants that were diagnosed with intellectual disabilities. Participants were recruited through a local school. Participant's verbal skills ranged from nonverbal to minimal. Richard was a 17 year old boy who communicated using picture exchange cards and gestures (pointing). He engaged in some vocalization such as sounds, grunts and saying the word "apple". Neal and Brian were both 9 year old males. Neal was able to communicate using words and minimal sentences, such as "go to room", but also was receptive researchers questions, such as “do you want ___”, by which Neal communicated with yes or no head nods. Mario was a 13 year old male. Both Brian and Mario engaged in minimal vocalization such as grunts and sounds but never formulated words. He communicated with through gestures by pointing to leading researchers to desired area. Mel was a 15 year old male. He engaged in vocal echolalia and was able to tact some stimuli. All participants were required to have participated in the ABLA-R and have passed level 4 or above. Individuals who did not pass level 4 on the ABLA-R were excluded from the current study.

Design and Data Collection

A multiple probe design with a set of two stimuli class (cat and dog) were being trained. In addition, two separate visual stimuli class were used as distractors. Individuals were first introduced to an initial probe condition → training conditions, and following mastery → probe for emergence of new relations. All participants were presented with the visual stimuli of a picture and or printed word of a hen, dog, pig, and cat as well as the auditory stimuli text tones – *Chord and Input* (*see table 1*). The match to sample tasks were presented as discrete trials. The trials were counterbalanced using an excel random generator program that randomly positions the placement of the comparison stimuli and which sample stimulus is presented. During the visual-visual matching tasks, a response was considered as the participant picking up the sample stimulus, reaching, and releasing the sample stimulus into one of the four comparison stimuli bins. During auditory-visual matching task, a response was considered as the participant picking up a single comparison stimulus, reaching, and releasing the comparison stimulus onto the researcher’s hand. The percent for correct responses were collected by each correct response during the match to sample task divided by the number of total trials in the trial block.

Initial probe condition consisted of 4 trials for each relation (A→A, B→B, A→B, B→A, C→A and C→B). During emergence probe conditions for A→B B→A relations, a total of 22 trials were presented. These included 16 visual-visual identity (A→A/B→B) matching training trials and a total of 6 visual-visual nonidentity (A→B/B→A) matching probe trials. During probe conditions for C→A/C→B relations, a total of 22 trials were presented. These included 16 visual-visual identity (A→A/B→B) matching training trials and a total of 6 auditory-visual (C→A/C→B) matching probe trials. Training conditions consisted of a total of 24 training trials during visual-visual and auditory-visual matching tasks (*See Table 2)*. During training conditions, mastery criterion was set at 83% (10 out of 12 trials) for 2 consecutive trial blocks. For an individual to show emergence of a new relation during emergence probe conditions, criterion for demonstration is set to 100% for one trial block (does not include training trials).

Inter-observer agreement (IOA) was collected for at least 33% of total sessions for the current study. IOA was collected simultaneously by two researchers present in the room who independently collected data. If a second researcher was not present or if video recording consent had been granted from the participant's parent/legal guardian, video recordings captured the responses made by the participants. Target responses were collected on a trial by trial basis. Percentage of agreement were calculated by dividing the number of responses in agreement by the total number of responses. IOA for all participants except for Richard was above 94% (Neal 97.8%, Brian 99.5%, Mel 94.7%, and Mario 100%). We were unable to collected IOA for Richard.

Materials and Setting

The materials used for the current study included a table, two chairs, edible reinforcers, ABLA-R materials, matching to sample stimuli, data sheets, an IPhone, and a JBL Bluetooth speaker. Sessions were conducted at the participant's school in an office room that measures 5m x 5m or at the University of Nevada, Reno campus with similar room measurements. Sessions were conducted two to five times per week and lasted approximately 40 min each. Each session included, at minimum, 1 trial block. Breaks were provided following each trial block. Edibles and audio stimuli were delivered by the researcher(s). Audio stimuli were presented using an IPhone connected to a JBL Bluetooth speaker. Selected sounds used for the current study can be found from the *text tone* section in the setting of the IPhone.

Assessment of Basic Learning Abilities-Revised

Materials for the ABLA-R included: a box with both red and white diagonal stripes (15cm x 15cm x 16 cm with an opening at the top of 196 sq cm), a yellow can (15 cm diameter and 17cm height with an opening at the top of the can 188 cm), grey foam piece (5cm diameter), small cube with both red and white diagonal stripes (5cm x 5cm x 5cm), a small yellow wood cylinder block (9cm long and 3cm diameter) and wooden cutout of the words "CAN" and "BOX" colored silver and purple, respectively (3cm x 7cm).

Match to Sample

The matching to sample stimuli consisted of 4 - 5cm x 5cm picture cards of a cat, a dog, a pig and a hen in addition to a separate set of four cards with the text CAT, DOG, PIG, and HEN. Four clear plastic containers (7cm x 8cm) were used as containers for the comparison stimuli when presented to the participants.

Assessments

Preference Assessment

The reinforcer assessment for individuals with severe disabilities (RAISD) (Fisher, Piazza, Bowman, & Amari, 1996) was administered to the participant's parents and/or teachers to first identify possible edible reinforcers that may function as specific edible reinforcers for this study. A multiple stimulus without replacement (MSWO) (Deleon & Iwata, 1996) preference assessment was conducted for each participant to confirm the information gathered from the RASID. During the preference assessment, the participants were presented with an array of multiple edibles that were identified from the RAISD. The participants were asked to "pick one" of the presented edibles and following a choice response, the participants were given access to consume the edible until completion of the edible. Once all edibles have been rotated, the top two preferred edibles were used during the study.

Assessment of Basic Learning Abilities – Revised

Following the preference assessment, the ABLA-R was conducted with each of the participants. When conducting the assessment with the participants, the researcher and the participant sat directly across from each other at the session table with the materials for that current level. Before testing, the participants were exposed to a three-step prompting sequence by which the researcher provided a demonstration, a guided trial, and an opportunity for independent response to the individual for each level. For the demonstration step, the researcher stated and modeled to the participants "When I say, where does it go? It goes in here", while placing the sample stimulus in the designated location. Following the demonstration step, a guided trial was presented in which the researcher presented the instruction, "Let's try together" while delivering hand over hand guidance and placing the sample stimulus in the designated location. Following the guided trial, the experimenter provided an opportunity for an independent response by presenting the instruction, "now you try" and handed the sample stimulus to the participants to place in the designated location. Following a correct independent response, the participants may begin the test trials. During the test trials, the participants must place the sample stimulus correctly for eight consecutive trials to move forward from one level to the next level. However, the participants failed the level if they make eight cumulative errors. Errors were defined as the participants placing the sample stimulus anywhere but the designated location. For every error that the participants engaged in, the researcher presented the verbal reprimand, “no, that’s not where it goes”, and followed the three-step prompting sequence. The session was discontinued when the participants failed a level or has passed level 6.

ABLA-R Level 1, either the red box or yellow can was presented to the participants. The participants were required to place the foam stimulus inside whichever receptacle stimulus has been presented. During this level, the researcher provided a model for every trial regardless of whether the participants successfully placed the foam stimulus in the container or not. This level demonstrates the participant’s ability to imitate a simple motor response.

ABLA-R Level 2, the participants were presented with both the red box and the yellow can. During this level, the positions of the containers were fixed in each trial and the participants were asked to place the foam stimulus inside the yellow can container. This level assesses the participant’s ability to discriminate between objects in fixed positions.

ABLA-R Level 3, the participants were presented with both the red box and the yellow can. During this level, the participants were asked to make a visual discrimination of the container’s position. The containers were randomly alternated across trials and the participants were asked to place the foam stimulus in the yellow can. This level assesses the participant’s ability to discriminate position when objects are randomly alternated.

ABLA-R Level 4, the participants were presented with both, the red box and the yellow can. During this level, the participants were asked to match a similar shape to the corresponding container instead of the foam stimulus. The container positions were randomly alternated across trials. This level assesses the participant's ability to discriminate a conditional visual-visual quasi-identity match to sample.

ABLA-R Level 5, the participants were presented with both, the red box and yellow can. During this level, smaller scale matching objects were replaced with a wooden word "CAN" and "BOX" with no physical properties similar to the containers. This level assesses the participant's with the skill to make conditional visual-visual nonidentity discrimination.

ABLA-R Level 6, the individual was presented with both the red box and the yellow can. The participants was asked to place a foam stimulus in the designated container when presented with the instruction, "Y-E-L-L-O-W...C-A-N" in a low-pitched and slow-paced fashion or "RED BOX" in a high-pitched and fast-paced fashion. This level assesses the participant's ability to make conditional auditory-visual nonidentity discrimination.

General Procedures

Matching-to-Sample Task. During the matching to sample tasks, the researcher sat directly across from the participant at the session table. Prior to presenting the sample stimulus, the participants were required to engage in an "ready response" to demonstrate that they were attending to the contingency (Williams, 1977). Ready responses were individualized per participant (*see table 3*) and used to demonstrate the ability to communicate when the participants were ready to be presented with further instruction. Richard's ready response was both hands clasped together and set on the table. Neal's ready response was one hand over the other hand set on the table. Brian's ready response was an up/downward head nod. Mel's ready response was making eye contact. Mario's ready response was palm touching chin. Mario's ready response was previously shaped prior to participating in the study. The comparison stimuli were placed in small clear containers. Comparison stimuli were presented in an array approximately 25 cm away from the participant. Each trial included one correct comparison stimulus (S+) and three distractor stimuli (S-). During visual-visual tasks, the researcher presented the visual sample stimulus 20 cm away from the participant and presented the discriminative stimulus (S^D), "match" to the participant prior to presenting the array of comparison stimuli. The visual stimuli used during visual-visual tasks were describe earlier as the pictures (A stimulus) and printed words (B stimulus) of cat, dog, hen, or pig. The picture of a cat is identified as A1 and printed word cat is identified as B1. Similarly, the picture of a dog is identified as A2 and printed word dog is identified as B2. During auditory-visual tasks, the researcher presented the auditory sample stimulus (C stimulus (S^D)) played from the iPhone. The auditory stimulus *Chord* was identified as C1 and the auditory stimulus *Input* was identified as C2. Following the auditory sample stimulus, the researcher presented the comparison stimuli as well as the researcher's hand, palm face up. If the participants did not respond within 5 s following the presentation of the comparison stimuli, the researcher restarted the trial by removing the stimuli and represented the S^D.

Probe. Prior to training participants relational responses and testing for emergence of visual-visual non-identity and auditory-visual relations, researchers conducted initial probes with each participant on their current relational repertoire towards the presented visual-visual and auditory-visual relational tasks. During the initial probe and emergence probe condition, the researcher provided no additional consequences following a correct or incorrect response from the participant other than removing the stimuli from the table top.

Training Visual-Visual. Training conditions were similar to probe conditions with additional consequences of providing a specific edible reinforcer that was identified during the preference assessment as well as a specific sound that was associated with each stimulus class. The two specific consequences associated with each stimulus class, sound (C1 or C2) and edible reinforcers ($SR^{+}1$ or $SR^{+}2$), were presented immediately following correct responses. That is, if the participants were presented with the task of identity matching the picture of a cat to another picture of a cat (A1→A1), upon correct responses, the researcher immediately presented the specific sound (C1) and edible ($SR^{+}1$). When presented with the different stimulus class of dog (A2→A2), correct responses resulted in presenting the specific sound (C2) and edible ($SR^{+}2$). Similar contingencies were presented during nonidentity match to sample tasks for each stimulus class (A1→B1= C1+$SR^{+}1$). Incorrect responses resulted in the researcher providing a verbal reprimand "no, that's not right" followed by the ABLA-Rs three-step prompting sequence that included a model, a guided, and an opportunity for an independent response before presenting the next trial. If the participant engaged in a correct response during the three-step prompting sequence trial, the researcher provided only verbal praise. Training trials for A→B and B→A relations were alternated by presenting trial blocks of A→B relations first, then trial blocks of B→A relations.

Training Auditory-Visual. During auditory-visual match to sample tasks, the researcher presented the specific sound (C1 or C2) as the S^{D} prior to presenting the comparison stimuli. Participants engaging in a correct response resulted in the researcher providing the specific edible reinforcer ($SR^{+}1$ or $SR^{+}2$) associated with the stimulus class. That is, if the participant was presented with the task of matching the sound (C1) to the picture of a cat (A1), following correct responses, the researcher presented the specific edible ($SR^{+}1$) to the participant. Similar contingencies were presented for the stimulus class dog (C2 → A2 = $SR^{+}2$). Incorrect responses resulted in the researcher providing a verbal reprimand “no, that’s not right” followed by the ABLA-Rs three step prompting sequence that included a model, guided, and opportunity for an independent response before presenting the next trial. If the participant engaged in a correct response during the three-step prompting sequence trial, the researcher provided only verbal praise. For Neal and Mel, during auditory training conditions, an introduction to the delayed paired SR^{+} prompt was presented approximately .5 s to 1.0 s following the S^{D}.

Result

Preference Assessment

A MSWO preference assessment was conducted with edible reinforcers identified through the RAISD. The top two edible reinforcers for each participant were randomly assigned to each stimulus class of *cat* and *dog. Table 3* displays the participant’s specific edible reinforcers. Preferred edibles for Neal and Brian were pudding and apple sauce. Preferred edibles for Mel were Oreos and chocolate covered raisins. Preferred edibles for Richard were initially donuts and Oreos. However, during the study, the participant began to reject the donut and instead, manded for apple juice. The donut was then replaced with apple juice for the remainder of the study. A data label shown on *figure 1,* indicates the change in edible from donut to apple juice. Preferred edibles for Mario were glazed animal crackers and muffins.

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Table 3 displays the participants ABLA-R level. Mel and Mario passed level 4 and failed level 5, receiving the ABLA-R level of 4. Richard and Brian both passed level 5 and failed level 6, receiving the ABLA-R level of 5. Neal passed levels 4, 5, and 6, receiving the ABLA-R level of 6.

Match-to-Sample

Figure 1 depicts the percent of correct responses for each trial block per relation for Richard. During the initial probes, Richard demonstrated the skill to match A→A/B→B relations (identity) at 100% and did not demonstrate the skill to match A→B/B→A (nonidentity), C→A or C→B (auditory-visual) relations. Richard responded at 12% for A→B relations, 37% for B→A relations, 50% for C→A relations, and 12% for C→B relations. During training trials, Richard demonstrated mastery in matching A→A/B→B and A→B/B→A relations. When training A→B/B→A relations, Richard had an edible reinforcer change mid-study. The edible change was due to the participant rejecting donut following correct responses for cat stimulus and instead was manding for apple juice. Following the change in edible, percent of correct responses immediately increased from initial trial blocks to mastery. When training C→A relations, Richard's average correct responses maintained around 50% with a high of 66%. During probe trials, Richard did not demonstrate any emergent relations for A→B/B→A, C→A, and C→B relations but rather responded a high of 66% for A→B/→B→A, 83% for C→A, and 50% for C→B relations.

Figure 2 depicts the percent of correct responses for each trial block per relation for Neal. During the initial probes, Neal demonstrated the skill to match A→A/B→B, A→B/→B→A relations at 100% and did not demonstrate the skill to match C→A or C→B relations. Neal responded at 37% for C→A relation and 12% for C→B relation during initial probes. During training trials, Neal demonstrated mastery to match A→A/B→B, A→B/→B→A, and C→A relations. However, prior to introducing the visual of the specific edibles during C→A relations, two sessions were cancelled due to the participant crying and asking to leave and to return back to their classroom mid-session. Those cancelled sessions are included in the graphs as two blank data points (blocks 7 & 8) before the training block with the visual of the edibles. When introducing the visual of the specific edibles during C→A relations (open triangle marker), Neal responded correctly for 92% of the trials in that trial block. The visual of the specific edibles were then removed following the tone and correct responses for C→A relations and maintained above 83% for two consecutive trial blocks. During probe trials, Neal demonstrated the ability to match A→B/→B→A and C→B relations at 100%. Probe trial blocks were conducted twice during C→A relation because the participant requested to use the bathroom and engaged in a different school activity before returning back to session. During probe trials for C→A relation, Neal responded with a high of 16%.

Figure 3 depicts the percent of correct responses for each trial block per relation for Brian. During the initial probes, Brian did not demonstrate the skill to match A→A/B→B, A→B/→B→A, or C→A, C→B relations. Brian responded at 75% for A→A/B→B relations, 0% for A→B relations, 50% for B→A relations, 37% for C→A relations, and 25% for C→B relations during initial probes. During training trials, Brian demonstrated mastery to match A→A/B→B, A→B/→B→A, and C→A relations. During probe trials, Brian demonstrated the ability to match C→B relation at 100% and responded at 33% for A→B relation, 50% for B→A relation, and 66% for C→A relation.

Figure 4 depicts the percent of correct responses for each trial block per relation for Mel. During initial probes, Mel only demonstrated the skill to match B→A relations at 100% and did not demonstrate the skill to match A→A/B→B, A→B, or C→A, C→B relations. Mel responded 94% for A→A/B→B relations, 87% for A→B relations, 25% for C→A relations, and 12% for C→B relations. During training trials, Mel demonstrated mastery for A→A/B→B and A→B/B→A relations but when training C→A relations, Mel's average correct responses maintained around 50% with a high of 58%. Mel's correct responses following an introduction to the visual of specific edibles were similar to those prior to the visual of specific edibles. During probe trials, Mel demonstrated mastery to match A→B relations and responded at 83% for B→A relation, 33% for C→A relation and 0% for C→B relations.

Figure 5 depicts the percentage of correct responses for each trial block per relation for Mario. During initial probes, Mario did not demonstrate any skill to match A→A/B→B, A→B/B→A, C→A or C→B relations. Mario responded 25% for A→A/B→B relations, 37% for A→B and 25% for B→A relations, 12% for C→A relations, and 25% for C→B relations. During training trials, Mario was only exposed to A→A/B→B relations and not A→B/B→A, C→A or C→B relations. However, Mario experienced 2 separate A→A/B→B relations, one 4-choice and one 2-choice comparison. For A→A/B→B relations, when presented with 4 choice comparison, Mario responded with a high of 42% and when presented with 2 choice comparison, responded a high of 71%. No probes were conducted for Mario.

Discussion

The current study investigated the efficacy of table top stimuli in promoting auditory-visual relations with individuals diagnosed with intellectual disabilities using specific reinforcing edibles and auditory tones. This study extended previous studies by using the ABLA-R (DeWiele, L., et. al, 2010) rather than the ABLA (Casey, L. & Kerr, N., 1977). To date, very few studies have investigated the acquisition of auditory-visual relations with lower-functioning individuals with intellectual disabilities, let alone testing for those emergence relations. Previous research on using class-specific compound consequences (edible reinforcer + auditory stimulus) to test for emergence of auditory-visual relations found that all individuals with intellectual disabilities who were level 6 on the ABLA demonstrated those emergent relations and individuals who were below level 6 on the ABLA (ABLA level 4) did not (Monteiro & Barros, 2016; Santos, et. al, 2017; Varella & De Souza, 2014, 2015). Previous researchers suggested that individuals who fail a certain level on the ABLA are often difficult to teach prerequisite skills in order to pass that failed level using standard prompting and reinforcement procedures. That is, if an individual has passed ABLA-R level 5, but has failed level 6, it is very difficult to teach those skills that may demonstrate auditory-visual discriminations. The results from the current study were similar to previous studies. Participants who were ABLA-R level 4 were unable to demonstrate any emergence or acquisition of auditory-visual relations. The one participant who was ABLA-R level 6 demonstrated an emergence of auditory-visual relations. This suggests that using table top procedures may also result in emergent auditory-visual relations. The interesting findings for the current study that is different from previous studies was that, the current study included two participants who were ABLA-R level 5. Of those two, one participant demonstrated an emergence and acquisition of auditory-visual relations.

Neal was ABLA-R level 6 and demonstrated emergence of auditory-visual relations. It is important to mention that this may not have been possible without the additional paired SR^+ prompt being presented during C→A relations. Two sessions were canceled as a result of the participant crying and asking to end the session. Researchers noticed that the participant began to cry in the presence of the tone serving as an S^D without an edible reinforcer following the tone. It may be that the two canceled session may have served as an extinction condition, being that no reinforcement was presented following the auditory stimulus. Researchers then introduced an approximate .5 – 1.0 second delay of the paired SR^+ prompt following the sample stimulus for one session and faded the paired SR^+ prompt for the following next sessions. During paired SR^+

prompts and the following no-paired SR^+ prompt sessions, Neal did not exhibit any crying behavior.

Mel was ABLA-R level 4 and did not show any acquisition or emergence of auditory-visual relations but demonstrated level 5 skills (non-identity) during the visual matching tasks. The non-identical (picture and written word) class stimuli of dog and cat relations may have been previously established for Mel during his learning history as a result of performing mastery during training conditions for the visual-visual relational tasks. Throughout the visual-visual relational tasks, Mel was not performing consistently in scoring 100% during initial probe and probe conditions. Although all blocks for visual-visual trial blocks were above 83%, some deviation may have occurred throughout those blocks that may have been due to variance in the motivating operations operating on the subject. During regular auditory-visual relations and the delayed paired SR^+ prompt trials, Mel consistently responded to the last corrected response following the three-step prompting procedure. During the delayed paired SR^+ prompt trials, Mel responded towards the comparison stimuli without first making visual contact with the paired SR^+ prompt following the sample stimulus. For Mel, the majority of his responses were chance responses when presented with auditory-visual relations, performing at or below 50%.

The ABLA-R predicts that individuals who are ABLA-R level 4 are able to match a stimulus to another stimulus that hold identical characteristics. However, Mario did not demonstrate the ability to match identical relations during any presentation of A→A/B→B relations. For Mario, it is important to note that initial responses during matching to sample task were all towards the two middle comparison stimuli. Mario never responded to any of the outer comparison stimuli during the 4-choice comparison condition unless it was followed by a three-step prompting procedure when the correct matching stimulus was located on the outer array of the comparison stimuli. Correct responses as shown in *figure 5* during A→A/B→B 4-choice may have been a result of chance. The researchers also noticed that although Mario was engaging in an ready response prior to the presentation of the matching task, Mario did not fully attend to the sample stimulus. An example of this is, Mario engaged in a ready response, indicating that they were ready to engage with the task. However, when presented with the sample stimulus, Mario picked up the sample stimulus without ever looking directly at the stimulus and placed the sample stimulus within the middle comparison stimuli. To increase opportunity in correct responding and reduce opportunity or incorrect responding, the researchers introduced an A→A/B→B 2-choice condition in which Mario was unable to only respond to the two middle comparison stimuli but rather respond to one or the other stimulus. This condition was presented similarly to the ABLA-R level 4 task but continued to use class stimulus 1 and 2 as sample/comparison stimuli. During A→A/B→B 2-choice condition, Mario did respond at a high of 71% for one trial block but researchers continued to note that Mario was not making visual contact with the sample stimulus. Mario's results are similar to previous studies that suggest that multiple distractors as additional comparison stimuli do not differentiate results when presented with 2-4 choice discrimination tasks (Doan, et. al, 2007; Martin, et. al, 2008; Wacker, et. al, 1983).

Table top stimuli and computer technology are both very different approaches when using a match to sample procedure. Studies have argued that a computerized approach establish stronger stimulus control shaping in comparison to regular table top stimuli. A good example of this may be with Mario. During sessions of presenting visual-visual A→A/B→B matching task, Mario did not fully attend to the table top stimuli even when reducing the amount of presented comparison stimuli. One study suggested that using computerized match to sample task may produce a more accurate stimulus control in teaching individuals' conditional discriminations (Carr, Wilkinson, Blackman, & McIlvane, 2000). For Mel and Mario, it may be that individuals who were level 4 on the ABLA-R struggle in shaping stimulus control when teaching conditional discrimination within match to sample procedures. The current study investigated the efficacy of table top stimuli in demonstrating emergent auditory-visual relation and found that two of the five participants demonstrated those emergent relations using table top stimuli. The results of the current study suggest that individuals may demonstrate those emergent relations using table top stimuli.

Previous studies did not introduce any additional visual prompt delay procedure (paired SR^+ prompt) in promoting auditory-visual relations. Although the paired SR^+ prompt delay procedure was only introduced to two of the five participants, only one participant utilized the paired SR^+ prompt delay for acquisition of auditory-visual relation and demonstrated high percentage of correct responding when fading the paired SR^+ prompt. Previous studies demonstrated that, edible reinforcers may serve as an additional stimuli class when assigned as consequences. With an additional prompt delay when presenting the paired SR^+ during training trials for auditory visual relation, the current study's result with Neal might suggest that this procedure may aide in acquisition with individuals who struggle with those relations. Future studies may investigate the efficacy of a prompt delay procedure with the paired SR^+ when investigating emergent auditory-visual relations. As well, future studies should also replicate previous studies procedure on the use of computer technology with an additional paired SR^+ prompt delay for individuals who do not demonstrate any acquisition during auditory-visual training conditions.

Richard was ABLA-R level 5 and engaged in higher percent correct responses during probe condition for C→A and C→B relations than initial probe conditions. Richard did not demonstrate any acquisition or emergence of auditory visual relations. As previously mentioned, we changed one of the two edible reinforcers during A→B/B→A training conditions. Varella and De Souza (2014), suggested that emergent auditory visual relations may be an outcome of stimulus-stimulus pairings with the auditory stimulus being presented with the respective stimulus class. With respect to stimulus-stimulus relations, a possible explanation for the lack of emergent responses during C→A and C→B relations may be due to the change in edible reinforcer during the A→B/B→A training conditions. The change of edible reinforcer may have interrupted the strengthening process of the stimulus-stimulus pairing for that stimulus class. In other words, the history of reinforcement for that stimulus class may have not yet been established as the specific edible reinforcer in association with that stimulus class.

Another potential explanation for the lack of emergent relations for Richard may be due to the definition of mastery criterion for the current study. Mastery criterion for training conditions was set to 83% for two consecutive trial blocks. Richling, Williams, & Carr (In Press), conducted a series of experiments that evaluated a comparison of three mastery criterion and skill maintenance with individuals diagnosed with intellectual disabilities. One of Richling et. al.'s findings suggested that individuals who perform at 80% or 90% across three sessions are likely to respond with lower accuracy whereas individuals who performed at 100% across three sessions demonstrated responding with higher accuracy during maintenance probes. Similarly, other studies found that with individuals who perform at 90% or higher for mastery criterion had higher accuracy in responding during maintenance than those who performed at 50% or 80% (Fienup & Brodsky, 2017, Fuller & Fienup, 2018). Although Richling, et. al (In Press) did have few participants in the 80% criteria group who had high accuracy responses during probes, the majority of the participants responded with low accuracy. The current study held the mastery criterion set at 83% for two consecutive trial blocks, only two participants demonstrated responding with high accuracy during probe conditions for C→B relations and two participants demonstrated responding with high accuracy during probe conditions for A→B/B→A relations. Although the current study included two of five participants who demonstrated emergent relations with the mastery criteria set at 83% for two consecutive trial blocks, studies mentioned previously, also had few participants who demonstrated high accuracy for responding during maintenance probes but had more individuals responding at higher accuracy during maintenance probes when mastery criterion was manipulated at high percentage for 3 consecutive sessions. Future studies should maintain mastery criterion for 3 consecutive trial blocks at 100%. This may demonstrate higher performances during probe conditions when testing for emergent relations.

Brian was ABLA-R level 5 and demonstrated acquisition and emergence of auditory-visual relations. Brian did not demonstrate any emergence of new relations during probe trials except during C→B relations. During initial probes, Brian did not demonstrate high performance with percent correct for any of the presented relations except 75% for A→A/B→B relations. This suggests that the following relations may have been novel for this participant. The results for Brian are similar to previous studies that demonstrate emergent relations during C→B relations. To our knowledge, Brian is the only individual who was level 5 on the ABLA-R and not level 6 which indicated that they did not have the ability to make auditory-visual discrimination prior to the study and demonstrated emergent auditory-visual relations. The current study supports the findings of Vause et. al (2005), which suggested that individuals who can make VVNM and or auditory-visual discriminations may demonstrate stimulus equivalence and individuals who were ABLA level 4 (identity matching) were unable to demonstrate the ability to make equivalent relations.

The ABLA-R is an assessment that presents novel stimuli to an individual by which they may demonstrate the ability to make simple motor responses to auditory-visual conditional discriminations. A limitation for the current study is that we did not focus on presenting novel visual stimuli during identity/non-identity visual relations but rather presented novel auditory stimuli as tones during auditory-visual tasks. For example, Mel was ABLA-R level 4 and Brian was ABLA-R level 6, both demonstrated high percentage of correct responding for A→B/B→A relations during initial probe conditions and mastery during training conditions. This may suggest that both individuals were able to make visual-visual nonidentical conditional discriminations (ABLA-R level 5). This may also suggest that both participants already had a learning history towards the current study's table top stimuli of the animals: cat, dog, pig, and hen.

To date, Monterio et. al (2016) was the only other study that investigated acquisition or emergent auditory-visual relations using specific compound consequences in individuals who were below level 6 on the ABLA. To our knowledge, the current study is the first study that provides some evidence in demonstrating the effects of specific compound consequences in establishing auditory-visual discriminations (ABLA-R level 6) with an individual (Brian; ABLA-R level 5) who did not demonstrate the ability to make those discriminations prior to the study. Future studies should use arbitrary novel visual stimuli during visual-visual training conditions. As well, future studies should also include more individuals who are ABLA-R level 5 and replicate similar procedures of the current and or previous studies to add to the validity of the current studies results. The current study's results are similar to those found by Monterio et. al (2016), that is, individuals who shown to have the ability to respond to visual-visual identical relations (ABLA level 4) did no demonstrate any emergent auditory-visual relations. Jackson, Williams, & Biesbrouch (2006), suggested that individuals who are level 4 on the ABLA may not have the ability to demonstrate stimulus equivalence across visual and auditory modalities but rather may demonstrate stimulus equivalence across only visual modalities. Another avenue of research should investigate training individuals who can only make visual-visual identity relations (ABLA-R level 4) to form arbitrary nonidentical visual-visual relations (ABLA-R level 5) with similar methodologies used in the current study.

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Tables

Table 1.

Stimulus Class	**Picture (A)**	**Written Word (B)**	**Consequence Paired Stimulus (C & SR^+)**
1		**<u>CAT</u>**	**C_1 Chord + SR^+_1**
2		**<u>DOG</u>**	**C_2 Input + SR^+_2**
3		**<u>PIG</u>**	
4		**<u>HEN</u>**	

Table 1. *This table represents the stimuli used for the match to sample task. Shaded rows (1 & 2) are the stimuli targeted to train. Unshaded rows (3 & 4) are stimuli used as distractors.*

***Table* 2.**

Phase	Trial	Relation Sequence	Sample	Comparison S+	S-	S-	S-
1 A-A/B-B Train	6	A1A1	A1	A1	A2	A3	A4
	6	A2A2	A2	A2	A1	A3	A4
	6	B1B1	B1	B1	B2	B3	B4
	6	B2B2	B2	B2	B1	B3	B4
2 A-B 1 & 2 Emergence Probe	4	A1A1	A1	A1	A2	A3	A4
	4	A2A2	A2	A2	A1	A3	A4
	4	B1B1	B1	B1	B2	B3	B4
	4	B2B2	B2	B2	B1	B3	B4
	3	A1B1	A1	B1	B2	B3	B4
	3	A2B2	A2	B2	B1	B3	B4
B-A 1 & 2 Emergence Probe	4	A1A1	A1	A1	A2	A3	A4
	4	A2A2	A2	A2	A1	A3	A4
	4	B1B1	B1	B1	B2	B3	B4
	4	B2B2	B2	B2	B1	B3	B4
	3	B1A1	B1	A1	A2	A3	A4
	3	B2A2	B2	A2	A1	A3	A4
3 A-B/B-A 1 & 2 Train	6	A1B1	A1	B1	B2	B3	B4
	6	A2B2	A2	B2	B1	B3	B4
	6	B1A1	B1	A1	A2	A3	A4
	6	B2A2	B2	A2	A1	A3	A4
4 C-A 1 & 2 Emergence Probe	4	A1A1	A1	A1	A2	A3	A4
	4	A2A2	A2	A2	A1	A3	A4
	4	B1B1	B1	B1	B2	B3	B4
	4	B2B2	B2	B2	B1	B3	B4
	3	C1A1	C1	A1	A2	A3	A4
	3	C2A2	C2	A2	A1	A3	A4
5 C-A 1 & 2 Train	3	A1A1	A1	A1	A2	A3	A4
	3	A2A2	A2	A2	A1	A3	A4
	3	B1B1	B1	B1	B2	B3	B4
	3	B2B2	B2	B2	B1	B3	B4
	6	C1A1	C1	A1	A2	A3	A4
	6	C2A2	C2	A2	A1	A3	A4
6 C-B 1 & 2 Emergence Probe	4	A1A1	A1	A1	A2	A3	A4
	4	A2A2	A2	A2	A1	A3	A4
	4	B1B1	B1	B1	B2	B3	B4
	4	B2B2	B2	B2	B1	B3	B4
	3	C1B1	C1	B1	B2	B3	B4
	3	C2B2	C2	B2	B1	B3	B4

Table 2. *This table represents the phases and number of trials for each relation following initial probes. This table provides the sample stimulus as well as the comparison stimuli and which stimuli is the S+ or S-.*

***Table* 3.**

Name	Age	ABLA-R Level	Ready Response	Edible Reinforcers
Neal	9	6	One hand over other hand on table	Apple Sauce &Pudding
Richard	17	5	Hands clasp together	Apple Juice & Oreo
Brian	9	5	Head nod downwards	Apple Sauce & Pudding
Mel	15	4	Eye contact	Oreo & Chocolate Raisin
Mario	13	4	Palm to chin	Animal Cracker & Muffin

Table 3. *This table represents the participants names, age, ABLA-R level, ready response, and edible reinforcers.*

Figures

Figure 1. *The materials used for the Assessment of Basic Learning Abilities – Revised*

Figure 2.

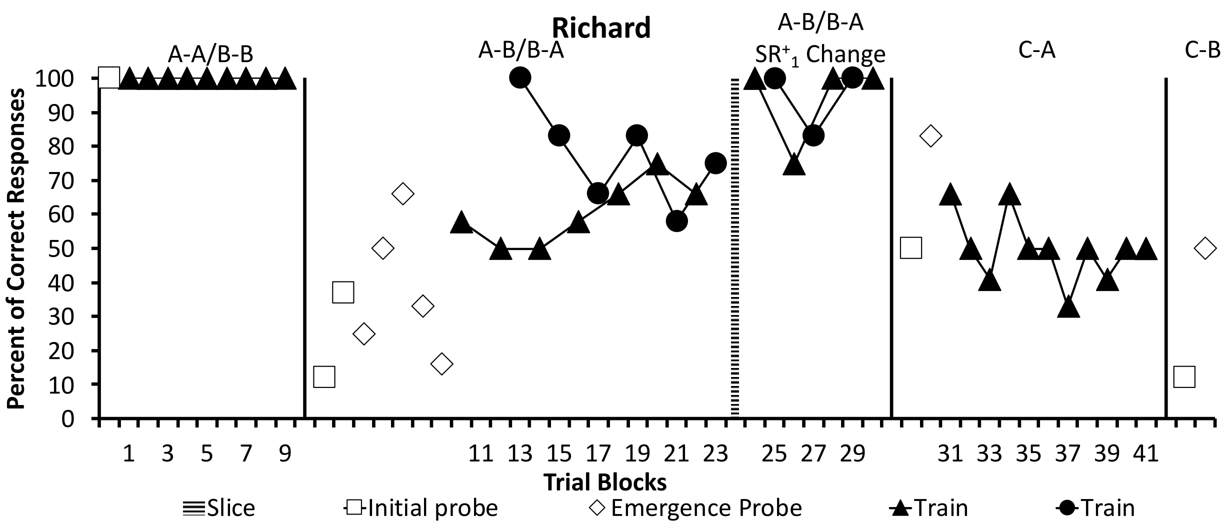

Figure 3.

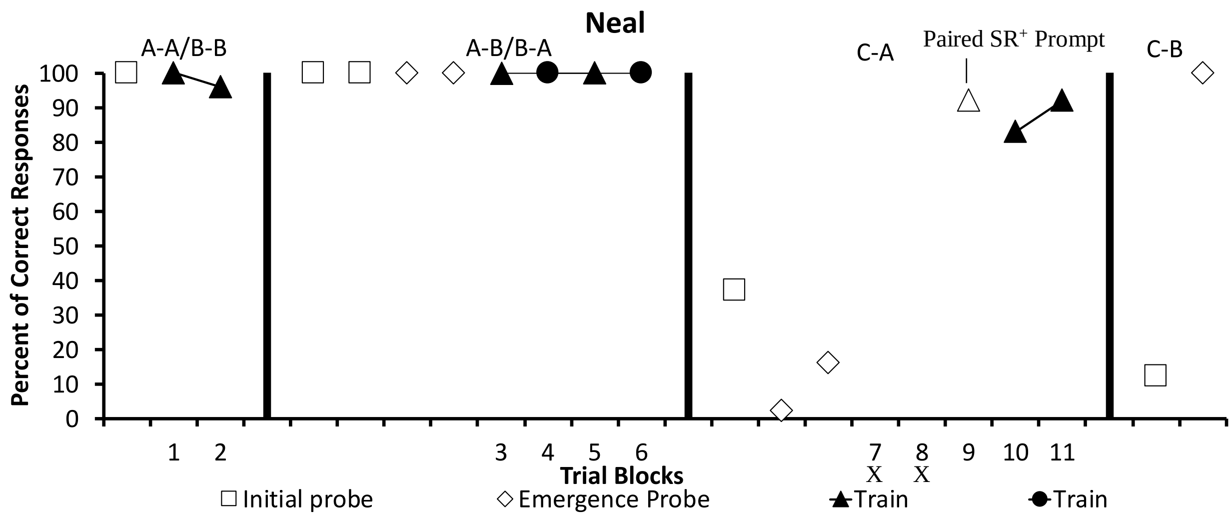

Figure 4.

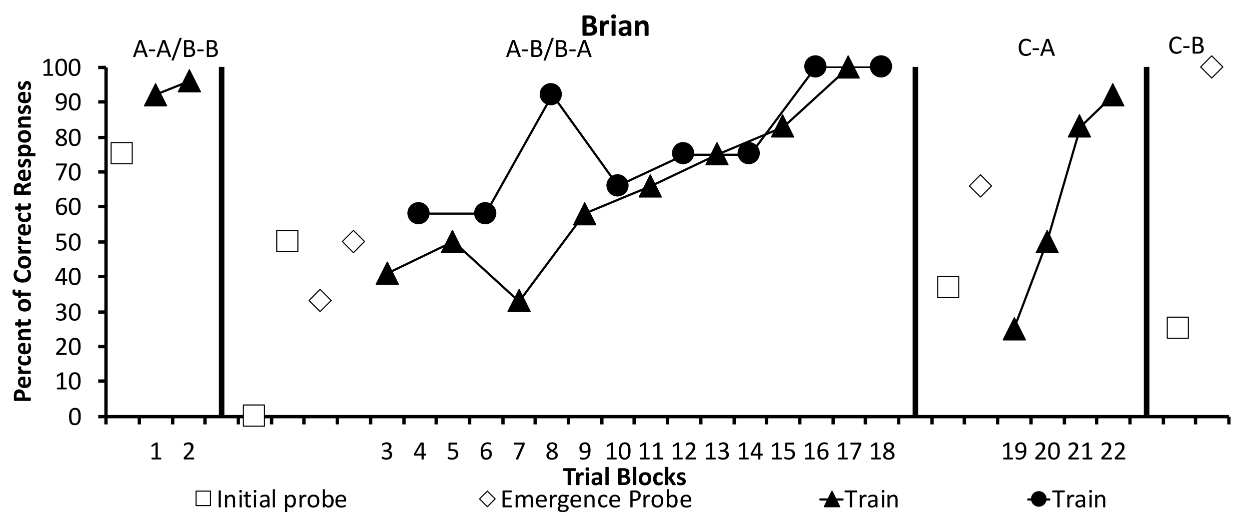

Figure 5.

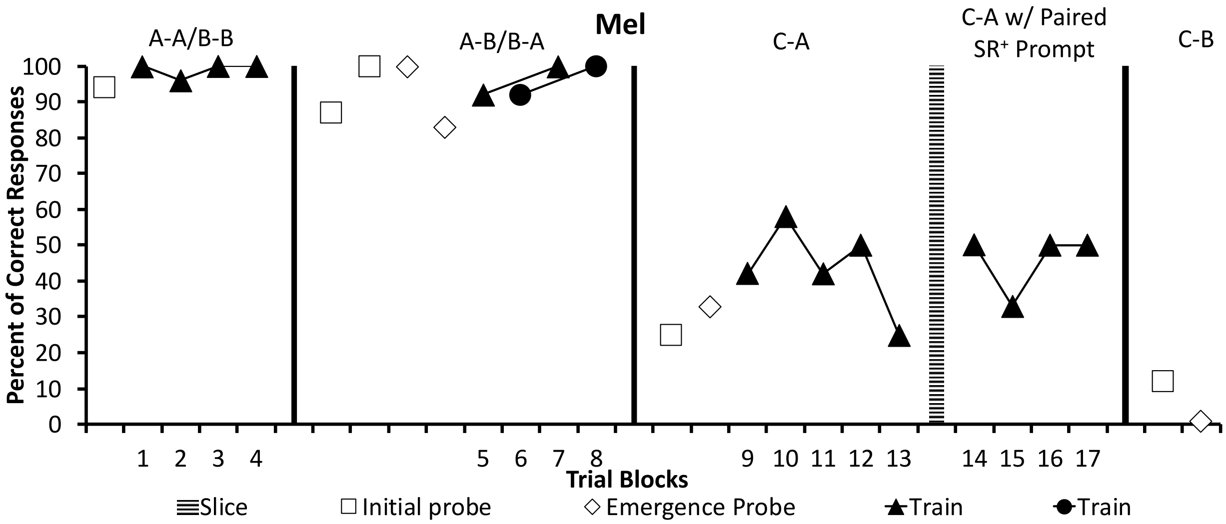

Figure 6.