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Using Arbitrary Stimuli to Teach Say-Do Correspondence to Children with Autism

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Abstract

Studies of say-do correspondence, which is typically defined as an individual doing what he/she said they would do and accurately reporting what they did, have focused on training methods for efficient acquisition. Prior research has suggested that using arbitrary stimuli during say-do training may help to facilitate the acquisition process. The current study extended upon previous research by using match-to-sample (MTS) training to create stimulus classes using arbitrarily assigned shapes. These stimuli were then used in correspondence training, along with corrective feedback, modeling, and multiple exemplars to teach correspondence and non-correspondence to children diagnosed with autism. The data from five participants was mixed and suggests that more research on training verbal correspondence and more intensive training for children with autism may be needed.
Key words: say-do correspondence, verbal correspondence, stimulus equivalence training.

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Novelty and Significance

What is already known about the topic?

- Say-Do correspondence can be increased by providing reinforcement for doing what a child said they would do.
- Multiple exemplars, graduated prompting, and errorless learning procedures have been shown to be most effective for teaching say-do correspondence and promoting generalization.
- Generalization to new settings and behaviors is the result of rule-governed.

What this paper adds?

- Using arbitrary stimuli to teach verbal correspondence to children with autism may be beneficial.
- Some children with autism may require a more comprehensive training program before showing correspondences.
- Vocalizations may play a role in non-correspondence.
- This study sheds more light on how best to train verbal correspondence to children with autism.

Since the 1960's, psychologists have explored the correspondence between verbal and non-verbal behaviors (Risley & Hart, 1968; Israel, 1978). One of the first studies on training correspondence (Risley & Hart, 1968), consisted of three separate experiments to develop correspondence training procedures that would lead to generalization. In the baseline condition, children were provided social reinforcement for vocalizations about what toys they played with earlier in the day. During the first phase of treatment, social and edible reinforcement was made contingent upon the participant saying he/she played with the targeted toy. In the second phase, the reinforcement contingency was changed so the child had to play with the targeted toy and make a verbal report.

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Results suggested that verbal correspondence only increased when reinforcement was made contingent upon correspondence of doing, and not just the verbalization of doing (saying). When reinforcement was only contingent upon vocalizing the targeted response, the vocalizations or saying would increase, even if the behaviors, or doing, did not increase. In this way, the verbal behavior of an individual can be brought under the control of non-verbal behaviors (i.e., doing may lead to saying with the proper training).

More recent work has focused on the most effective methods for teaching say-do correspondence and for promoting generalization to different environments and activities. Multiple exemplars, graduated prompting strategies, and errorless learning procedures have been used (Luciano, Barnes-Holmes, & Barnes-Holmes, 2002; Luciano, Herruzo, & Barnes-Holmes, 2001). In most cases, multiple exemplars and errorless learning have been shown to be the most effective at teaching say-do correspondence and promoting generalization to novel situations and behaviors (Hernández López, Rodríguez Valverde, & Luciano, 2011; Luciano *et alii*, 2002).

Some studies have also provided reinforcement to participants for completing a do-say sequence (Lloyd, 2002). Participants were required to perform an action and provide an accurate report of what they did in order to receive reinforcement. Other studies have focused more on using a say-do sequence where participants promise to perform a behavior and receive reinforcement for doing so (Lloyd, 2002; Hernández López *et alii*, 2011; Luciano *et alii*, 2001; Luciano *et alii*, 2002). For example, a child would have to say "I will play with the blocks," and then play with the blocks, not a different toy, in order to gain reinforcement or praise from a teacher.

It is generally agreed that say-do correspondence can be maintained with reinforcement of appropriate verbal behaviors, but that maintaining generalization depends on other factors, such as the function of the behavior (Luciano *et alii*, 2001). Luciano *et alii* (2002) used an errorless learning procedure and multiple exemplars to train say-do correspondence in developmentally delayed children. The use of multiple exemplars, along with referent prompts, helped to promote generalization of say-do correspondence. By using a variety of training examples, Luciano *et alii* (2001) were also able to promote generalization of verbal correspondence while avoiding location or consequence biases. The researchers chose behaviors that had similar functions, which helped to promote generalization of say-do correspondence and suggested that this type of correspondence is a type of rule governed behavior (Luciano *et alii*, 2001).

Hernández López *et alii* (2011) studied generalization using behaviors that were not specifically trained, including a small percentage of say-do relationships that were the opposite of the ones taught in the training phase. By including simple stimulus classes as discriminative stimuli during correspondence training children were able to show both correspondence and non-correspondence for a wide variety of behaviors that were never directly trained (Hernández López *et alii*, 2011).

These results supported the view that say-do correspondence is a type of rule governed behavior. Since the participants were able to successfully apply the contextual clues provided by the stimuli into a variety of settings, it is likely that participants formed an abstraction of a generalized rule. Formation of such a rule would explain the success generalizing the training to completely new behaviors (Hernández López *et alii*, 2011; Luciano *et alii*, 2001; Luciano *et alii*, 2002).

The use of multiple exemplar training in say-do correspondence also supports the idea that verbal correspondence is a type of rule governed behavior. By using multiple exemplars, contextual cues used to relate objects are applied to new, arbitrary stimuli.

This allowed for new stimuli that had never been trained to function as stimuli in verbal correspondence (Törneke, Luciano, & Valdivia Salas, 2008). While researchers have not looked into arbitrary stimuli and their use in say-do correspondence, some research has made that recommendation (Hernández López *et alii*, 2011).

The current study attempted to extend work done by Hernández López *et alii* (2011) by using unfamiliar arbitrary stimuli to teach correspondence and non-correspondence to children with autism. Previous research has suggested that such stimuli will result in faster verbal correspondence training, and may help transfer the skills to a wider variety of untrained settings (Hernández López *et alii* 2011). The stimuli should also facilitate the formation of a generalized response class, which may promote generalization and maintenance.

Method

Participants

Five children, ranging in age from 4 years, 6 months to 7 years, 3 months (one girl and four boys) participated after being recruited from an on-campus center for children with autism. All participants had a diagnosis of autism and were verbal. They showed comprehension of the relationship between what was said and what was then done, but did not show evidence of say-do correspondence relationships. Informed consent was obtained from parents prior to beginning the study.

Setting and Materials

The study was conducted in a small work room at the facility. Part of the room contained a small desk and two chairs and was designated as the "say" area. The remainder of the room contained a long table (with a variety of toys) and chair and was designated as the "do" area. The stimulus training and first part of correspondence training took place in the "say" area. The experimenter kept one set of index cards (7.5 by 5.5 centimeters), data sheets, and reinforcers (e.g., toys, food) at the table.

Cards. Sixteen note cards were used throughout the study. Each card had a simple shape (square, triangle, circle, etc) printed on it in 4.5-point black ink. The first set (eight cards) was used during stimulus training in the "say" area of the correspondence training sequence. A second identical set was used in the "do" area of the correspondence training sequence. The cards were divided into two groups consisting of four shapes each, which were used as stimuli during MTS and correspondence training (see Figure 1).

Play items. The children had an opportunity to interact with various toys typically available in the classroom. The activities included art (dry erase board and markers), fine motor activities (blocks, building toys), imaginative play (toy cars, animals), and some musical toys (singing drum, alphabet speak). Before each trial began, the children were verbally instructed on the different options available to them. At the beginning of the experiment, or when new toys were made available, each participant was allowed a few minutes to become familiar with the available toys.

Measures

The experimenter used a checklist to record participant responses during stimulus training, baseline, and correspondence training. Stimulus training involved MTS training

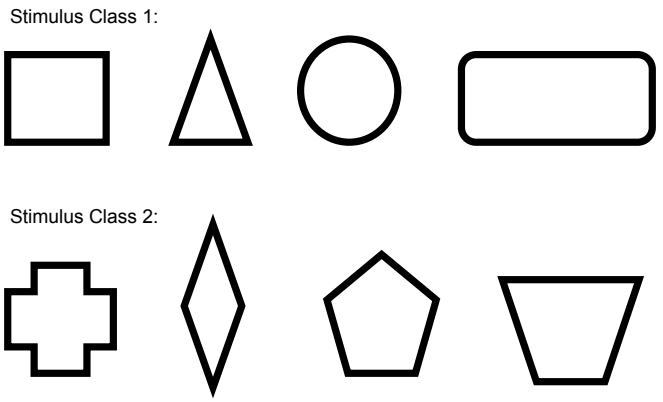

Figure 1. The four stimuli presented in Class One and Class Two.

of six relations (A_1-B_1, A_1-C_1, A_1-D_1, A_2-B_2, A_2-C_2, A_2-D_2) during which the experimenter recorded correct or incorrect on each trial. Testing for the derived relations of symmetry (B_1-A_1, C_1-A_1, D_1-A_1, B_2-A_2, C_2-A_2, D_2-A_2) and equivalence (B_1-C_1, C_1-B_1, B_1-D_1, D_1-B_1, C_1-D_1, D_1-C_1, B_2-C_2, C_2-B_2, B_2-D_2, D_2-B_2, C_2-D_2, D_2-C_2) were scored in the same manner.

During baseline, the experimenter recorded whether the trial was a correspondence or non-correspondence trial, the toy the participant named, the toy they played with, and whether the response was correct or incorrect.

Correspondence was defined as the student playing with an item that was previously named in the "say" area. Non-correspondence was defined as the student playing with an item that was different than the one previously named in the "say" area, or not playing at all. During correspondence training, the experimenter recorded accuracy of stimulus recall in the "say" area, correspondence or non-correspondence in the "do" area, the verbal report of what they said they would do in the "say" area, and whether the trial was performed correctly or not.

Reliability

A second experimenter was present for 33% of the baseline trials and 33% of correspondence training trials to collect inter-observer agreement (IOA). The second experimenter also recorded whether the student engaged in correspondence and/or non-correspondence, the stimulus class shown in the "say" area, and recall of the stimuli (Hernández López *et alii*, 2011). IOA was calculated by dividing the number trials in agreement by the total number of trials, and multiplying by 100. During baseline, IOA for the correspondence trial was 100%, and 90% for the non-correspondence trials (range 75-100%). During correspondence training, IOA was 100% for both correspondence and non-correspondence trials. In addition, IOA for the participant's recall of stimuli was 100%, and 98% (range 83-100%) for the verbal report of the toy played with.

Design

A multiple baseline across participant's design was used to introduce the intervention to participants. For the first participant, the intervention began when a steady state of

responding (no more than three data points' difference) was seen after two baseline sessions. Once the participant reached a stability criterion of two sessions with no more than 5% difference in performance, the intervention began with the next participant. In order to advance to the next phase of the experiment, each participant was required to achieve a mastery criterion of 80% success across two sessions.

Procedure

The experiment was broken into multiple testing sessions across school days to prevent frustration or boredom in students. During testing, participants completed at least five separate trials each day. The experiment was also broken into three phases: stimulus training, correspondence training, and generalization.

Phase 1: Stimulus Training. This phase (stimulus training) involved teaching two separate stimulus classes (A1-B1-C1-D1; A2-B2-C2-D2) and included two parts; *training* of stimulus relations and *testing* of derived relations. A one-to-many, match-to-sample (MTS) paradigm was utilized to train and test the stimulus relations.

Training. During training, two comparison cards (B_1-B_2; C_1-C_2; D_1-D_2) were shown to the participant. The experimenter then gave the participant the sample which was an 'A' card from one of the classes (A_1-A_2), and instructed the participant to match. If the participant matched correctly (A_1-B1; A_1-C_1; A_1-D_1; A_2-B_2; A_2-C_2; A_2-D_2), a small edible reinforcer and verbal praise was given ("very good!"). If the participant did not match correctly (e.g., A_1-B_2), prompts and corrective feedback were given (i.e. visual prompts, "not quite, try again."), and the trial was begun again. Each training session consisted of six separate trials (A_1-B_1; A_1-C_1; A_1-D_1; A_2-B_2; A_2-C_2; A_2-D_2). Once the participant achieved 80% success across two sessions, they proceeded to testing. If the participant completed 25 sessions of training without meeting the mastery criterion, the training ended and the participant did not complete the rest of the experiment.

Testing. During testing, the goal was for the participant to show the derived relations of both symmetry and equivalence. To test for symmetry, two comparison cards were presented (A_1-A_2) and participants were then shown a sample card (e.g., B_1) and instructed to match. There were six symmetrical relations tested (B_1-A_1; C_1-A_1; D_1-A_1; B_2-A_2; C_2-A_2; D_2-A_2). During symmetry testing, there was no feedback given to participants on accuracy of responding. To test for equivalence, two comparison cards were presented (e.g., B_1-B_2) and particpants were then shown a sample card (e.g., C_1) and instructed to match. There were 12 equivalence relations tested (B_1-C_1; C_1-B_1; B_1-D_1; D_1-B_1; C_1-D_1; D_1-C_1; B_2-C_2; C_2-B_2; B_2-D_2; D_2-B_2; C_2-D_2; D_2-C_2) tested. During equivalence testing, as in symmetry, there was no feedback given to participants on accuracy of responding. If a participant did not reach the mastery criterion of 80% success across two sessions within six sessions, then the participant returned to training. Once the mastery criterion was reached in training, the participant returned again to testing. Upon reaching the mastery criterion for this phase (80%), correspondence training began. Figures 2 depicts the trained and untrained relations that were tested in this phase of the experiment.

Phase 2: Say-Do training. The next phase included both correspondence training and generalization testing. Each participant was required to meet the mastery criterion in correspondence training before moving on to generalization testing.

Baseline. Prior to correspondence training, baseline data were collected for all participants. During this phase, the experimenter reminded the participant of the toys available in the play area, and then asked which toy the participant

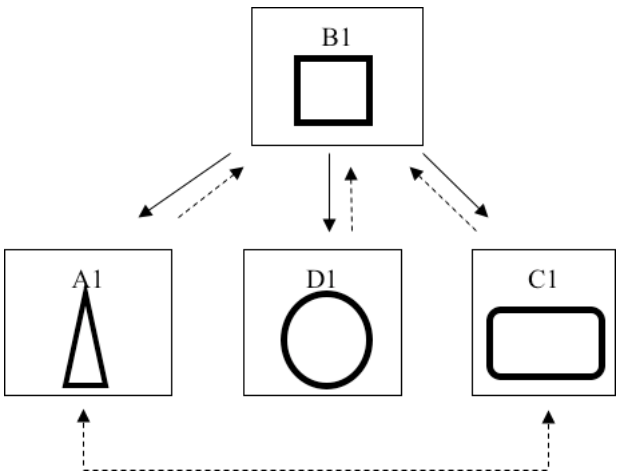

Figure 2. Diagram of trained/tested relations. Solid lines represent relations that were directly trained during the MTS phase. Dotted lines represent the untrained derived relations of symmetry and equivalence.

wanted to play with. After obtaining an answer, the experimenter brought the student to the "do" area, and allowed them to play with that toy for a few minutes. The experimenter recorded what the participant said they would play with, what they actually played with, and whether or not the participant showed correspondence. Baseline data was collected for a minimum of three sessions for each participant, and continued for varying periods of time so that the introduction of the intervention was staggered across participants.

Correspondence Training. At the beginning of each trial, participants were brought to the "say" area and shown a card from one of the two stimulus classes (A1, A2, B1, B2). Only stimuli 'A' and 'B' were used during this phase of the experiment. During correspondence trials, a card from Class One (Figure 1) was used. The experimenter then asked the student which toy they wanted to play with after reminding them of the different toy choices available in the "do" area. After determining which toy the participant chose, they were then escorted to the "do" area. The participant then had to correctly recall which card was shown in the "say" area. If the participant was unable to choose the correct card, corrective feedback was provided. Once the participant was able to choose the correct card, instructions were provided. A card from Class One (Figure 1) was presented if the trial was a correspondence trial. The participant was instructed to play with the toy they previously chose. After this interaction was completed, the experimenter then gave the instruction to "go play." While the participant was playing, the experimenter recorded which card was shown to the student, which card the student selected, and whether the child engaged in correspondence or non-correspondence. After a two to three-minute period had elapsed, the experimenter prompted the student to return and reinforced correspondence or non-correspondence, as designated by the targeted stimulus class (Figure 1). Each student was then brought back to the "say" area and asked, "What did say you would play with when you saw this card," and, "what did you play with?" If the participant was shown a card from Class One and showed say-do correspondence, they were provided with praise and a small edible item for "doing what you said." If the card was from Class Two (Figure 1) and the participant did not show correspondence, praise and a small edible item was provided for "not doing what you said you would." If the participant showed non-correspondence after being shown a card from Class One or correspondence

after seeing a card from Class Two, edibles and praise were not provided. Instead, the experimenter provided corrective feedback (i.e. "You need to play with what you said you would when you see this card. You did not play with what you said you would, so I cannot give you Skittles. You can try again next time"). The experimenter used an error correction procedure and demonstrated which toys could be played with as reinforcement for completion of the trial. Once feedback was given, the trial was presented again in a similar manner to the study by Lima and Abreu Rodríguez (2010). The instructor repeated the directions given in the "say" area, and allowed the participant another opportunity to correctly complete the trial. The trials were presented until the correct type of correspondence was achieved. After the correction procedure, the participant was given a brief break before starting a new trial. Each participant completed at least five trials each testing day. If, after 15 sessions, the participant did not meet the mastery criterion, the participation ended for that participant.

Generalization Testing. In this phase of the experiment, correspondence and non-correspondence was tested with the untrained stimuli from both classes (C_1-D_1; C_2-D_2) and directions, feedback, and reinforcement were not provided (unlike during the correspondence training phase). The experimenter began by asking the participant which toy they would like to play with. A previously untrained card (C_1-D_1; C_2-D_2) was then presented, and the participant was escorted to the "do" area. The participant then had to correctly recall which card they were shown in the "say" area by selecting the matching card in the "do" area. After selecting the matching card, the participant was allowed to play with a toy of their choosing. While the child played with their toy, the experimenter recorded the stimulus shown to the participant, whether or not the participant correctly recalled the stimulus, and whether the participant showed correspondence or non-correspondence. When a two to three-minute period had elapsed, the experimenter prompted the participant to return to the "say" area and began a new trial. During Generalization testing, a minimum of three trials were presented per session and the experiment ended after six generalization trials.

Results

Three of the five participants successfully completed the stimulus training phase of the experiment. The other two participants (3 & 4) continued the stimulus training phase until 25 individual sessions were completed without reaching the mastery criterion and were excluded from proceeding further (Table 1). Participants One, Two, and Five successfully completed the stimulus training phase and passed the test for derived relations. The number of trials each participant took to reach the mastery criterion during the stimulus training phase and during tests for derived relations is depicted in Table 1.

The remaining participants showed a large amount of variability in the number of sessions it took to pass the stimulus training phase. Participant Two needed four sessions

Table 1. Number of trials to criterion on trained and derived relations tests.

Participants	Trials to Criterion	
	Training	Derived Relations
One	10	3
Two	4	2
Three	25	-
Four	25	-
Five	9	10

to pass stimulus training, and passed the test for derived relations after two sessions (which was the minimum). Participant One needed 10 sessions to pass the stimulus training, and required three sessions to pass the derived relations test. Participant Five needed six sessions to pass the stimulus training, but did not meet the mastery criteria for the derived relations tests after six sessions, so stimulus training was repeated. After three more sessions of stimulus training, the participant was again tested on derived relations and passed within four sessions.

After completing stimulus training, Participants One, Two, and Five began the baseline phase of correspondence training. Participant One performed at a steady rate after three sessions, and was introduced to the correspondence training on the fourth session. Participant Two's performance was more variable, so the intervention was introduced after eight baseline sessions. Participant Five required only five baseline

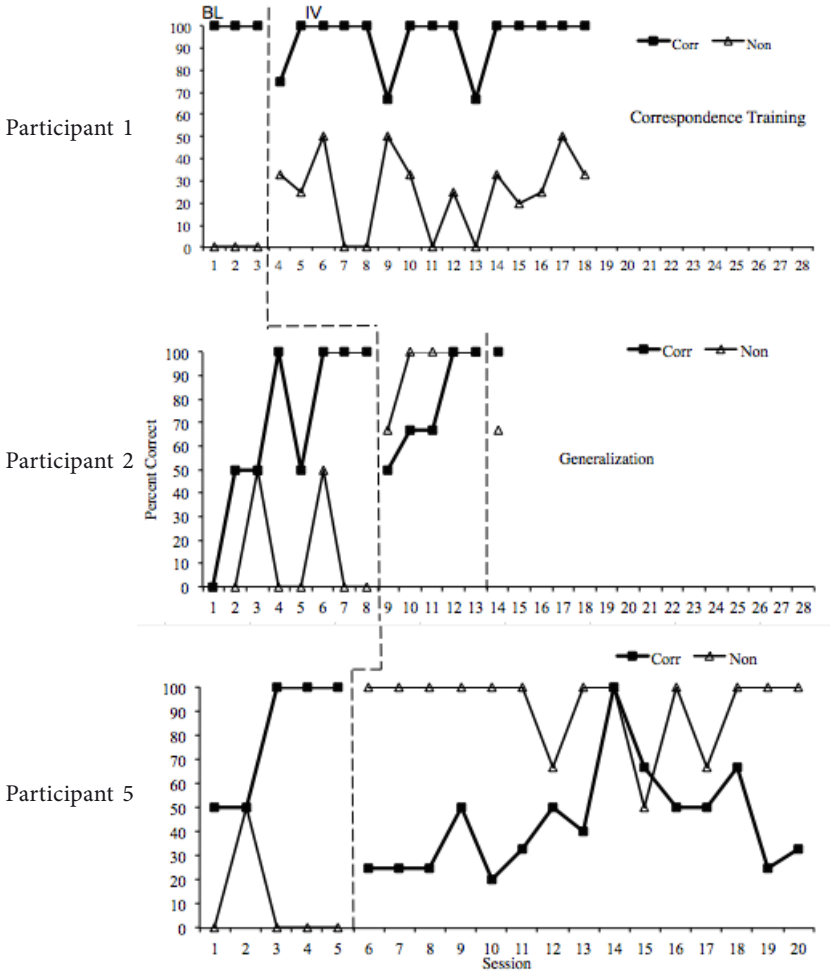

Figure 3. Percent-correct scores on individual sessions for correspondence training. Correspondence trials are depicted by solid squares and non-correspondence trials are depicted by open triangles.

sessions before a steady rate of responding was obtained. Results for all three participants during baseline and correspondence training are shown in Figure 3.

As shown in Figure 3, Participants Two and Five had increasing rates of correspondence before the intervention was introduced. All three participants showed a decreasing rate of correspondence and an increase in non-correspondence immediately after the introduction of the intervention. Participant One showed a highly variable rate of responding on the non-correspondence trials, and Participant Five showed a variable rate of responding on the correspondence trials. Participant Two showed a rapid and steady increase in correct responding on both types of trials until reaching 100% correct performance.

Participant One maintained 100% accuracy for a majority of the sessions on the correspondence trials, but did not meet the 80% mastery criterion for the non-correspondence trials (Figure 3). After 15 sessions with no progress, the experiment was terminated for this participant. For Participant Two, correct performance on the non-correspondence trials occurred more quickly than for the correspondence trials. After five sessions of the training procedure, Participant Two completed both correspondence and non-correspondence trials with 100% accuracy. Participant Five maintained high rates of non-correspondence throughout the trials, and showed slowly increasing rates of correspondence as the trials progressed. Like Participant One, Participant Five did not meet the 80% mastery criteria on the correspondence trials, so the experiment ended after 15 training sessions.

The averages for correct stimuli recall and correct verbal report were also calculated for the three participants. Participant Five had the highest average on the recall of the stimuli, and Participant Two also had a high average. On the verbal recall, Participant Two had the highest average. Average scores for each participant are depicted in Figure 4.

In order to progress the generalization testing, participants were required to reach mastery criterion during the correspondence training phase. Participant Two was the only one to do so and their data is shown in Figure 3. Participant Two showed perfect (100%) generalization with correspondence ("doing what they said they would do") and performed less well (67%) during non-correspondence ("not doing what they said they would do").

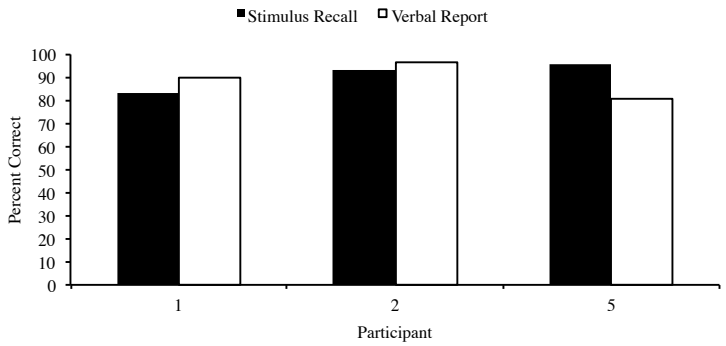

Figure 4. Percent-correct scores for each participant during stimulus recall and correct verbal reports.

Discussion

While one participant showed success with correspondence training, two other participants did not. There were also two participants who were unable to form the stimulus classes and therefore did not complete the experiment. Using arbitrary stimuli to teach verbal correspondence to children diagnosed with autism may be beneficial, but in some cases a more comprehensive training paradigm might be needed. While the participants who completed the correspondence training phase were similar in their levels of functioning, Participant Two appeared to have the most advanced verbal repertoire. It is possible that more intrusive prompts, longer sessions, and modeling would have been more efficient for children with more severe disabilities.

Participant Two showed great success with the correspondence training. This participant also completed the stimulus training with the least amount of sessions, and had high rates of correct responding on both stimuli recall and verbal report. Also, the participant vocalized the rules before each trial began. For correspondence trials, the participant was observed saying phrases such as "play only with the markers." On non-correspondence trials, the participant was observed saying phrases such as "play with not markers," or even naming a different toy. During the generalization trials, the participant vocalized the rules as soon as they were shown the cards, even though the cards used were untrained. The experimenters also noted that Participant Two would say another toy when shown a card from Class Two (the non-correspondence class) and then proceed to play with the markers, which appeared to be a preferred toy. Vocalizations such as these may be viewed as self-rules, which support the idea that verbal correspondence is a form of pliance (Törneke *et alii*, 2008).

This pattern of responding is similar to responses seen in previous studies. As mentioned earlier, Lima and Abreu Rodríguez (2010) stated that repeated vocalizations might serve as a Sd for correspondence or non-correspondence. During the training phase, Participant Two began to repeat the instructions or prompts given on incorrect trials. When instructions were not presented in the generalization phase, the participant provided their own, echoing what the instructor said during the training phase. Participant Two was also the only participant of the three who vocalized the rules stated by the instructor and showed high rates of both correspondence and non-correspondence. One key difference between the vocalizations observed in the current study and the one required in the study by Lima and Abreu Rodríguez (2010) relates to the non-correspondence trials. Unlike the previous study, Participant Two vocalized the rules that would lead to reinforcement, instead of just repeating the toy he selected to play with. This difference is likely the reason that verbalizations led to increased non-correspondence as well as increased correspondence (Lima & Abreu Rodríguez, 2010).

Neither Participants One or Five reliably vocalized the rules provided by the experimenter, which could be one reason they did not meet the mastery criterion for one of the trial types. Both participants were observed repeating parts of the instructions that were provided ("play with same," "play with different,") or repeating which card was shown to them. While these vocalizations were related to the trials being presented, they did not contain as much functional information as the verbalizations emitted by Participant Two, who stated explicitly what they had to play with in order to receive reinforcement. The verbalizations emitted by Participants One and Five might be similar to the random number sequences emitted by some participants in the Lima and Abreu Rodríguez (2010) study, which led to a decreased rate of correspondence.

It is also interesting to note that both Participants Two and Five showed increasing rates of correspondence before the intervention was introduced. Participant One showed 100% correspondence and 0% non-correspondence throughout all baseline trials. Although there was an increasing trend, it is unlikely that this was a result of any extraneous variables, especially since rates of correspondence decreased immediately upon introduction of the intervention. One likely explanation is that the participants became familiar with the different toys during the experimental session as the baseline session continued. Each participant was given a few minutes to explore the room and available toys before beginning the session, but it is possible that the participants didn't have enough time to determine which toy or toys were most preferred until a few baseline sessions had passed.

The results from this study suggest that a more intensive training paradigm may be needed for some children with developmental disabilities. Although the prompting procedure used throughout training was similar to errorless learning procedures, which have been shown to be highly effective with typical children, it may not be enough to promote correct performance for some children (Luciano *et alii*, 2001; Luciano *et alii*, 2002). Future research could provide modeling of correspondence and non-correspondence, or even prompt the child for a few correspondence/non-correspondence sessions before presenting trials. Once this has been completed a few times, the models and prompts could be faded from the training trials. It may also be fruitful to incorporate other methods of prompting or error correction, possibly including modeling or visual cues for the children.

Another possible area of research would be to look more closely at the role vocalizations play in non-correspondence. As mentioned previously, merely repeating what toy was originally selected does not lead to increased rates of non-correspondence (Lima & Abreu Rodríguez, 2010). Incorporating verbalizations in the training that include exactly what needs to be done to earn reinforcement may prove to be beneficial when teaching verbal correspondence. By repeating phrases that describe the contingencies, the process of stating and then completing an action may come under control of the words "saying" or "doing." If children are trained to follow through with what was stated on multiple occasions it is likely that the words "saying" and "doing" will come to control a large number of behaviors, which would suggest that verbal correspondence is a type of generalized operant class (Luciano *et alii*, 2002). This is further supported by the fact that although Participant Two showed a preference for one toy, he showed both correspondence and non-correspondence when playing with multiple toys. Ward and Stare (1990) also suggested that verbalization on the subject's part may be necessary to generalize verbal correspondence. The verbalizations appeared to help Participant Two on the generalization trials, but since they were the only participant to complete correspondence training, no definitive conclusions can be drawn.

Further research could also focus on the stimuli used to signal correspondence and non-correspondence. Two participants did not complete the stimulus training phase of the experiment, which suggests that using arbitrary stimuli to train verbal correspondence may be too difficult for some children with autism. Of the three participants who did complete the stimulus training phase, the two participants who required the most sessions during that phase did not complete the correspondence training. This also supports the idea that arbitrary stimuli may not be the best stimuli to use in training. Researchers could instead look into using simpler stimuli, such as colored cards, to signal when correspondence or non-correspondence will result in reinforcement. Previous research

has suggested that a physical stimulus, such as a card with the selected item on it or placing a sticker in a spot correlated to a location of an object, can act as an Sd instead of vocalizations (Luciano *et alii*, 2001).

Simple, physical stimuli may be effective in correspondence training for multiple reasons. Having physical stimuli may actually be a more salient Sd than vocalizations, since the child is able to carry the Sd with them and use it as a reminder (Luciano *et alii*, 2001). In order for a verbal stimulus to have the same effects, the child must essentially repeat the vocalization until the behavior is completed. Vocalizations are also more arbitrary than physical stimuli, since the child may incorrectly verbalize the action required to achieve correspondence (Luciano *et alii*, 2001). In the current study, the participants were required to show or tell the instructor which card was shown in the "say" area before playing with the toys located in the "do" area. Even though this may have provided a prompt for the participants, simply recalling the stimuli may not have as powerful effect as actually holding the stimulus, which could account for the differences seen between this experiment and previous studies (Luciano *et alii*, 2001, Luciano *et alii*, 2002). Research has also suggested that the relevance of the stimuli to the behavior may also be a contributing factor (Lima & Abreu Rodríguez, 2010; Luciano *et alii*, 2001). If this is true, using stimuli that are representative of the action that needs to be performed may be more effective than using arbitrary stimuli.

Despite somewhat ambiguous results, this study sheds some light verbal correspondence and how best to train it. Previous research has led to useful training protocols, and the current study suggests that these protocols may need to be altered at an individual level when being used to teach children with developmental delays. The current study also shows that is it possible to teach verbal correspondence to children diagnosed with developmental disabilities, such as autism. This could prove useful in designing treatment programs for children in the future.

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