Using Arbitrary Stimuli to Teach Say-Do Correspondence

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ARBIRTRARY STIMULI AND SAY-DO CORRESPONDENCE
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ARBIRTRARY STIMULI AND SAY-DO CORRESPONDENCE

Abstract

Research has looked into various methods of training say-do correspondence, which is typically defined as an individual doing what was said, or doing something and then accurately reporting it. Previous studies have suggested that using arbitrary stimuli and say-do training may help to facilitate the process. The current study extended upon the previous research, by using match-to-sample (MTS) training to create stimuli 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. Two participants were unable to form stimuli classes with the MTS training. Of the three that did form classes, only one successfully learned to show correspondence and non-correspondence in the presence of the correct stimuli. Results of this study suggest that more research on verbal correspondence and more intensive training for children with autism may be needed.

Keywords: say-do correspondence, verbal correspondence, match to sample training

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Using Arbitrary Stimuli to Teach Say-Do Correspondence

Since the 1960's, psychologists have been attempting to learn about correspondence between verbal and non-verbal behaviors (Risley & Hart, 1968). Israel (1978) has indicated that correspondence between verbal and nonverbal behaviors may be a key factor in developmental processes. In addition, some psychologists believe it can play an important role in understanding abnormal behaviors and in developing clinical treatments (Israel, 1978). Populations for the earlier studies varied, ranging from preschool children to adolescents and adults with various developmental disorders. The target behaviors in these studies were defined as having correspondence between what was promised and what was done, or even what was not promised and not done (Lloyd, 2002). One of the first studies on training correspondence, conducted by Risley and Hart (1968) consisted of three separate experiments to develop correspondence training procedures, specifically procedures that would lead to generalization. This study, described below, helped to bring an interest to the area of verbal correspondence, and led to more research in the field.

Early Research

Risley and Hart (1968) believed that maintaining the correspondence between verbal and non-verbal behaviors was a concern for society, especially since many interactions rely on the assumption that correspondence does exist (Risley & Hart, 1968). Say-do correspondence, which is defined as an individual doing what he said he would do, can be associated with adjectives like truthful or reliable, and non-correspondence,

which is not doing what an individual said he would do or reporting inaccurately, can often prove to be aversive for the listener (Lloyd, 2002). This can be seen when individuals avoid others who are not truthful, or even in the manner teachers or parents reprimand children who have lied. In order to find methods of increasing correspondence, Risley and Hart (1968) conducted a study with typically developing preschool children, aged four and five years old. In order to train correspondence in the preschool children, the researchers increased the non-verbal behavior until it matched the verbal report, as opposed to teaching the children to report less until the frequency of reports matched that of the actual behavior (Risley & Hart, 1968). As stated in other studies, acquiring verbal control of non-verbal behaviors was often the desired outcome for correspondence training. These studies also suggested that increasing the non-verbal report to match the frequency of the behavior would be the most efficient, and was used most often in early research (Israel, 1978).

In the Risley and Hart study (1968) children were divided into two groups, differing only on the targeted behavior (playing with blocks or painting). Three separate experiments were then conducted with the children. 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. During a second experiment, group A participated in similar conditions with different target activities to test generalization of

the say-do correspondence training. In a third experiment, a reversal design was utilized with group B to look at the effects of reinforcement when contingent on "saying" only versus reinforcement being contingent upon correspondence occurring (Risley & Hart, 1968).

The results of Risley and Hart's study 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. The verbal behavior of an individual can be brought under the control of non-verbal behaviors. Stated another way, "doing" may lead to "saying" with the proper training (Risley & Hart, 1968). As mentioned in the meta-analysis conducted by Lloyd (2002), the results of Risley and Hart's study led to other experiments that looked into the relation between saying and doing.

General Training

There have been some more recent studies that looked into the most effective methods of teaching say-do correspondence, defined as an individual doing what he or she said he or she would do. Studies have also looked into promoting generalization to different environments and activities. Different strategies used in the research include multiple exemplars, graduated prompting strategies, and errorless learning procedures (Luciano, Herruzo, & Barnes-Holmes, 2001; Luciano et al., 2002). In a vast majority of the studies, 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 (Lopez et al., 2011; Luciano et al., 2002).

Other studies commonly taught verbal correspondence by providing corrective feedback for incorrect responses (Risley & Hart, 1968). Typical children learn verbal correspondence relatively quickly, but it is possible that children with developmental or intellectual disabilities may require another teaching method (Luciano et al., 2002). Luciano et al. (2002) compared corrective feedback to errorless learning when teaching children with developmental delays to engage in say-do correspondence. The results of this study suggested that feedback was not a valid method for instructing children with developmental delays. It also suggested that errorless learning would be a productive way to teach say-do correspondence, and possibly to promote generalization as well (Luciano et al., 2002).

Luciano et al. (2002) also utilized multiple exemplars training, or teaching numerous examples at once, to teach say-do correspondence in order to determine if it was an important component to teaching generalization (Luciano et al., 2002). In an earlier study, Luciano and colleagues were able to use multiple exemplars to teach say-do correspondence (Luciano et al., 2001). In contrast to previous research, the behaviors trained in this study were chosen to be functionally equivalent. The researchers believed this would eliminate any biases that might arise from the relative difficulties of the targeted behaviors. As with other studies, the results indicated that training using multiple exemplars was beneficial in teaching say-do correspondence to young children (Luciano et al., 2001).

Looking at earlier studies in comparison to more recent ones, it is possible to see a difference in the way say-do correspondence was reinforced. Lloyd (2002) performed a meta-analysis on the current research that looked into say-do correspondence. He found that a majority of the initial researchers reinforced a do-say sequence. In other words, participants were required to perform an action and provide an accurate report to receive reinforcement. More recent research, however, tends to employ a say-do sequence. This would involve a participant promising to perform an action, and only receiving reinforcement when that action was completed (Lloyd, 2002; Lopez et al., 2011; Luciano et al., 2001; Luciano et al., 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. Comparing the different studies suggests that using a say-do sequence might prove to be faster, although it is difficult to remove any confounds that might arise from repeated sessions (Lloyd, 2002). The use of multiple exemplar training may be a first step to solving this problem.

Mediating Variables

In addition to studying the relation between saying and doing, Ward and Stare (1990) looked at mediating contingencies that could affect correspondence. Typically, mediating variables can be defined as any behavior or variable that occurs in addition to the initial vocalization and subsequent "doing," (Lima %Abreu-Rodriguez, 2010). In the reinforcement condition, children were provided tokens if they played with (doing) the targeted toy during the free play period (Ward & Stare, 1990). During the verbalization phase, tokens were awarded for stating the intent (saying) to play with a specified toy. In

the correspondence training phase, the participants could only receive tokens if they engaged in say-do correspondence. The researchers found that say-do correspondence was only found in the correspondence training group. The participants' reliance on verbalizing the behavior contradicts previous research that found subject verbalizations were not necessary to correspondence. The authors cited differences in settings, target behaviors, and targeted outcomes as possible reasons for the differences (Ward & Stare, 1990).

More recent studies have also looked at the mediating responses when it comes to say-do correspondence. Lima and Abreu-Rodriguez (2010) split children into multiple groups to look at various mediating variables and how they might affect the development and maintenance of verbal correspondence. One group received tokens for showing correspondence between what was said and what was done, another group received tokens for repeating what was said, and the final group received tokens for repeating a random set of numbers. All subjects participated in the baseline, correspondence training, and generalization phases of the experiment. The results of the study showed that the most correspondence and generalization occurred for the group who repeated what the instructor said. In addition, the group that was instructed to repeat random numbers showed the most non-correspondence in the two training phases of the experiment. The researchers believe that the subject's own vocalizations may serve as a discriminative stimulus (S^D) for the nonverbal behavior (Lima & Abreu-Rodriguez, 2010). The result of this study is similar to Ward and Stares' (1990) study, which suggested that

verbalizations from the subjects are beneficial to developing and maintaining say-do correspondence.

Luciano et al. (2001) used a multiple baseline across behaviors design to train correspondence with four different behaviors. Correspondence was trained with play items, the location where an item would be placed, what item would be put away, and what door a child would select. In order to test for generalization, similar behaviors were tested, but the child had to select a card signaling the item or location, instead of using the selected item. Most children gave a verbal response in the say setting, but a few participants who were unable to verbalize the behavior used a symbolic response (placing a sticker on paper to denote the selected item or location) instead. These children performed better on the maintenance probes, responding correctly on the first trial. The researchers believed that the symbolic response had stronger stimulus control over the behaviors than the verbal responses, which in turn led to better responding, especially in the generalization probes (Luciano et al., 2001).

When looking at the results of this study, Lima and Abreu-Rodriguez (2010) suggested it was the stickers' relevance to the behavior (i.e., the same location) that promoted generalization, much like relevant verbalizations in their study increased generalization. The researchers also believe that stickers with no relevance to behavior would be unlikely to promote generalization (Lima & Abreu-Rodriguez, 2010). It seems possible, based on previous studies (Lima & Abreu-Rodriguez, 2010; Luciano et al., 2001; Ward & Stare, 1990) that a variable's relevance to the behavior being performed,

and not the variable itself, is the key mediating factor to developing say-do correspondence.

Generalization

While it is thought that say-do correspondence can be maintained by reinforcement of the verbalizations, researchers believe maintaining generalization involves more variables, such as the function of the behaviors (Luciano et al., 2001). Some research has suggested that say-do correspondence can function as a generalized operant class. Luciano et al. (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 the referent prompts used, helped to promote generalization of say-do correspondence. The researchers believe this was due to an increased flexibility of the trained actions (Luciano et al., 2002).

By using a variety of training examples, Luciano et al. (2001) were also able to promote generalization of verbal correspondence while avoiding a location or consequence biases. The researchers chose behaviors that had similar functions, which has not been seen in most prior research. The similar functions helped to promote generalization of say-do correspondence, and led the researchers to believe that this type of correspondence is a type of rule governed behavior (Luciano et al., 2001).

Lopez et al. (2011) also attempted to study generalization, and made sure to test behaviors that were never specifically trained. In fact, a small percentage of trials tested say-do relationships that were opposite of the ones taught in the training phase. In this study, the researchers used simple stimuli classes to train correspondence and non-

correspondence. These stimuli classes served as discriminative stimuli for correspondence and non-correspondence, and as a result the children in the study were able to show both correspondence and non-correspondence for a wide variety of behaviors that were never directly trained (Lopez et al., 2011).

The results from Lopez et al. (2011) also support 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 the participants formed an abstraction of a generalized rule. A formation of such a rule would explain the success generalizing the training to completely new behaviors (Lopez et al., 2011). The findings of this study support previous experiments which also suggested the formation of rules (Luciano et al., 2001; Luciano et al., 2002).

Pliance

The use of multiple exemplars 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 or aspects are able to be applied to new, arbitrary stimuli. This allows for new stimuli that have never been trained to function as stimuli in the verbal correspondence (Törneke, Luciano, & Salas, 2008). While researchers have not looked into arbitrary stimuli and its uses in say-do correspondence, some previous research has suggested it as a next step (Lopez et al., 2011). There are, however, many types of rule governed behavior. Previous research in the field has suggested that pliance may be the rule governed behavior most related to say-do correspondence (Luciano et al., 2001).

Pliance is a specific type of rule governed behavior, mediated by speaker consequences. Generally, some type of reinforcement is provided by the speaker contingent upon an individual performing a behavior stated by the speaker (Törneke et al., 2008). Looking at this definition, it is easy to see why researchers believe say-do correspondence is a type of pliance. Pliance can refer to both rules stated by others and self-rules. In the case of say-do correspondence, self-rules are likely to be the controlling factor. A history of reinforcement for doing what one said is likely to cause an individual to act in a similar manner in the future (Törneke et al., 2008). As stated earlier, aversive contingencies for not engaging in correspondence can also serve as a means of maintaining pliance, and a large part of common interactions depend on having at least some say-do correspondence (Lloyd, 2008).

Current Study

The current study attempted to replicate and extend the work done by Lopez et al. (2011). Remedying one shortcoming of the earlier work, the current study used arbitrary stimuli that have no prior meaning to teach correspondence and non-correspondence. 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 (Lopez et al. 2011). The stimuli should also facilitate the formation of a generalized response class, which has been thought to promote generalization and maintenance. Results of this study may help determine if using arbitrary stimuli is a viable method for teaching say-do correspondence to developmentally delayed children.

Method

Participants

Prior to the beginning of the study, approval was sought by the university's internal review board. After obtaining permission, informed consent letters were sent home to be signed by parents whose children attended a university based center for children diagnosed with autism (see Appendix A). Six kindergarten children, ages four to seven years old, were recruited to participate in the study. One girl and five boys were recruited. All participants had a diagnosis of autism prior to starting at the center. Only three participants completed the study, due to a variety of reasons. One participant left the center shortly after the start of the study, and two participants did not pass the mastery criterion for the stimulus training. The three remaining participants were five year old males.

Setting and Materials

The study was conducted in a small work room at the center, with part of the room designated as a "say area" and another part designated as a "do area." The stimulus training and first part of correspondence training took place in the "say area." The "say area," was off to the side of the room, and included a small work desk and two chairs. The experimenter kept one set of index cards (seven and one half by five and one half centimeters), data sheets, and reinforcement at the table. . The "do area" was located on the opposite side of the room, and consisted of a long table with a chair. A variety of toys were located on 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 black ink, 4.5 pt outline. The first set (eight cards) was used in stimulus training and the "say area" of the correspondence training. A second identical set was used in the "do area" of the correspondence training. The cards were divided into two groups consisting of four shapes each, which were used as the stimuli in the MTS and correspondence training. See appendix B for a depiction of the stimuli used.

Play items. The children had an opportunity to participate in 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 starts, the children were verbally instructed on the different options available to them. At the very beginning of the experiment, or when new toys were made available, each participant was allowed a few minutes to become acclimated with the available toys.

Measures

The experimenters used a checklist to record whether the participants showed correspondence and/or non-correspondence. 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 is different than the one previously named in the "say area," or not playing at all. The experimenter also recorded which stimulus was shown to the participant in the "say area," and if the child was able to select the same stimuli upon entering the play setting.

Reliability Measures and Treatment Integrity

A second experimenter was present for 31% of the baseline trials and 31% 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 stimuli class shown in the "say area," and the recall of the stimuli, as done in the procedure used by Lopez et al., (2011). IOA was calculated by dividing the number trials in agreement by the total number of trials, and multiplying by 100 (trial by trial method; (Cooper, Heron, & Heward, 2007). During baseline, IOA for the correspondence trial was 100%, and 90% for the non-correspondence trials (range 75-100%). During the correspondence training phase, 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.

Experimental Design

A multiple baseline across participants design was used for the current study (Kazdin, 2010). This design controlled for testing, instrumentation, history, and maturation effects. By staggering the start of the intervention across participants, the experimenter was able to control for extraneous variables that could affect the results, ruling out both history and maturation threats. 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 be broken into three phases: stimulus training, correspondence training, and generalization.

Phase 1: Stimulus Training. The first part of stimulus training involved teaching two separate stimulus classes to the participants. The first part of the training used a match-to-sample (MTS) paradigm. MTS training is a form of operant learning, where an individual is presented with a sample stimulus and given an opportunity to choose a related (comparison) stimulus. For this study, a one-to-many (OTM) procedure was used, due to its relative effectiveness (Artzen, 2012; Kinloch, McEwan, & Foster, 2013). During OTM training, the 'A' stimuli for each group was be paired with the 'B,' 'C,' and 'D' stimuli of the corresponding group. A field of two comparison cards (letters B through D of both groups), one from each class, was shown to the participant. The experimenter then gave the participant an 'A' card from one of the classes (the sample), and instructed the participant to match. If the participant matched correctly, a small edible reinforcer and verbal praise was given ("very good!"). If the participant did not match correctly, prompts and corrective feedback were given (i.e. visual prompts, "not quite, try again."), and the trial was represented. Each MTS session consisted of six separate trials. Once the participant achieved 80% success across two sessions, he or she

moved on to the next phase of testing. If the participant completed 25 sessions of the MTS training and did not meet the mastery criterion, the training ended and the participant did not complete the rest of the experiment.

The final phase of stimulus training tested for emergent relationships. To test for symmetry, a field of two cards was again presented, with the cards being the 'A' card from both groups. The participants were then given a card (B1-D1 or B2-D2) and told to match. To test for equivalence, the participant was again shown an array of two cards from each stimulus class, B1-D1 or B2-D2. They were then given another card (B1-D1, B2-D2), and told to match. Feedback was not given during this phase. If a participant did not reach the mastery criterion of 80% success across two sessions within six sessions, then the participant returned to MTS training. Once the mastery criterion was reached, the participant was then given the test for emergent relations. Upon reaching the mastery criterion for this phase, correspondence training began. Figures 1 and 2 depict the trained and untrained relations that were tested in this phase of the experiment. A data collection sheet is included in appendix C.

Phase 2: Say-do training. The next phase includes both correspondence training and generalization testing. Each participant was required to meet the mastery criterion in correspondence training before moving on to generalization testing. Data collection sheets are in appendix D.

Baseline. Before correspondence training started, baseline data was 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 wants to play with.

After obtaining an answer, the experimenter brought the student to the "do area," and allowed him or her to play for a few minutes. The experimenter recorded what the participant said he or she would play with, what he or she 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 the introduction of the intervention was staggered across participants.

Correspondence Training. At the beginning of each trial, the students were brought to the "say area," and shown a card from one of the two stimulus classes. Only stimuli 'A' and 'B' were used during this phase of the experiment. During correspondence trials, a card from class one was be used. The experimenter then asked the student which toy he or she wanted to play with after reminding him or her of the different toy choices available in the "do area." After determining which toy the participant chose, he or she was 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 was presented if the trial was a correspondence trial. The participant was instructed to play with the toy he or she previously chose. An example of the interaction, taken from Lopez et al. (2011) is shown below:

> Experimenter: "Remember, you said you would play with the cars. When you see this card, you have to play with the cars. What are you going to play with?"
>
> Participant: "Cars."

Experimenter: “Very good.”

If the trial is one for non-correspondence, a card from class two was shown, and the participant was instructed to play with a different toy than the one he or she previously mentioned. An example of this interaction is shown below (Lopez e al., 2011):

Experimenter: “Remember, you said you would play with cars. When you see this card, you have to play with something different. What did you say you are going to play with?”

Participant: “Cars.”

Experimenter: “That’s right.”

After this interaction is completed, the experimenter 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 has elapsed, the experimenter called the student over and reinforced correspondence or non-correspondence, as designated by the targeted stimulus class. Each student was 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,” (Lopez et al., 2011). If the participant was shown a card from class one and showed say-do correspondence, he or she was provided with praise and a small edible item for “doing what you said.” If the card was from class two and the participant did not show correspondence, praise and a small edible item was provided for “not doing what you said you would,” (Lopez et al., 2011).

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 (Lopez et al., 2011). 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 also demonstrated what toys could be played with to earn reinforcement for the trial, as an error correction procedure. Once the feedback was given, the trial was presented again, in a similar manner to the study by Lima and Abreu-Rodriguez (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 (stimuli C and D). As in the correspondence training phase, the experimenter asked each participant what he or she planned to play with. Unlike the training phase, however, directions, feedback, and reinforcement were not provided in this phase (Lopez et al., 2011). The experimenter first asked the student which toy he or she would like to play with. A previously untrained card (the C and D cards) was then presented, and the participant was led to the "do area" where he/she must again select the matching card. After selecting the matching card, the

participant was allowed to play with a toy of his or her choosing. The experimenter recorded the stimulus shown to the participant, whether or not the participant correctly recalled the stimuli, and if the participant showed correspondence or non-correspondence. After a brief break, the experimenter called the participant into the "say area," and presented a new trial. During Generalization testing, a minimum of three trials were presented per session. The experiment ended after six generalization trials.

Results

Stimulus Training

Three of the six participants successfully completed the stimulus training phase of the experiment. Participant One left the center shortly after beginning the experiment. Participants Four and Five continued the stimulus training phase until 25 individual sessions were completed. Since the participants did not reach the mastery criterion after 25 sessions, they were excluded from the experiment. Participants Two, Three, and Six successfully completed the stimulus training phase and passed the tests for emergent relations. The number of trials each participant took to reach the mastery criterion for the stimulus training phase is depicted in Figure 3, and also in Table 1.

The participants showed a large amount of variability in the number of sessions it took to pass the stimulus training phase. Participant Three needed the least amount of trials on the MTS training, and passed the emergent relations test after two sessions (which was the minimum). Participant Two needed more sessions to pass the MTS training, and required three sessions to pass the emergent relations test. Participant Six needed fewer sessions to pass the MTS training, but did not meet the mastery criteria for

the emergent relations tests after six sessions, so MTS training was repeated. After three more sessions of MTS training, the participant was again tested on emergent relations and passed within four sessions.

Correspondence Training

After completing the MTS training, participants Two, Three, and Six were then started on the baseline phase of the correspondence training. Participant Two was performing at a steady rate after three sessions, so he was introduced to the correspondence training on the fourth session. Participant Three's performance was more variable, so the intervention was introduced after eight baseline sessions. Participant Six required only five baseline sessions before a steady rate of responding was obtained. Results of the training and generalization are shown in Figure 4.

As shown on the graphs, Participants Three and Six 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 Two showed a highly variable rate of responding on the non-correspondence trials, and Participant Six showed a variable rate of responding on the correspondence trials. Participant Three showed a rapid and steady increase in correct responding on both types of trials until 100% correct performance was emitted.

As seen on the graph, Participant Two 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. After 15 sessions with no progress, the experiment was

terminated for this participant. For Participant Three, correct performance on the non-correspondence trials occurred more quickly than for the correspondence trials. After five sessions of the training procedure, Participant Three was completing both correspondence and non-correspondence trials with 100% accuracy. Participant Six maintained high rates of non-correspondence throughout the trials, and showed slowly increasing rates of correspondence as the trials progressed. Like Participant Two, Participant Six 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 Six had the highest average on the recall of the stimuli, and Participant Three also had a high average. On the verbal recall, Participant Three had the highest average. Average scores for each participant are depicted in Figures 5 and 6, and also in Tables 2 and 3.

Discussion

The results of this study were ambiguous. While one participant showed success with correspondence training, two other participants did not. There were also two participants who were unable to form the stimuli 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 intense training paradigm might be needed. While the participants who completed the correspondence training phase were similar in their levels of functioning, Participant Three appeared to have the most advanced verbal repertoire. It is possible that more intrusive prompts,

longer sessions, and modeling may prove to be more efficient for children who have more severe disabilities.

Participant Three showed great success with the correspondence training. This participant also completed the MTS training with the least amount of sessions, and had high rates of correct responding on both stimuli recall and verbal report. It is also of interest that 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, he 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 he was shown the cards, even though the cards used were untrained. The experimenters also noted that Participant Three 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 al., 2008).

This pattern of responding is similar to responses seen in previous studies. As mentioned earlier, Lima and Abreu-Rodriguez (2010) stated that repeated vocalizations might serve as a S^D for correspondence or non-correspondence. During the training phase, Participant Three began to repeat the instructions or the prompts given on incorrect trials. When instructions were not presented in the generalization phase, he provided his own, echoing what the instructor said during the training phase. Participant Three was also the only participant of the three who vocalized the rules stated by the

instructor, and he 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-Rodriguez (2010), lies in the non-correspondence trials. Unlike the previous study, Participant Three 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-Rodriguez, 2010).

Neither Participants Two nor Six reliably vocalized the rules provided by the experimenter, which could be one reason that they did not meet the mastery criteria 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 Three, who stated explicitly what he had to play with in order to receive reinforcement. The verbalizations emitted by Participants Two and Six might be similar to the random number sequences emitted by some participants in the Lima and Abreu-Rodriguez (2010) study, which led to a decreased rate of correspondence.

It is also interesting to note that both Participants Three and Six showed increasing rates of correspondence before the intervention was introduced. Participant Two 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 and 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 sessions, 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.

There are a few directions future research could take in training verbal correspondence. 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 the training was similar to errorless learning procedures, which has been shown to be highly effective with typical children, it may not be enough to promote correct performance for some children (Luciano et al., 2001; Luciano et al., 2002). Future studies could look into providing modeling of correspondence and non-correspondence, or even a prompting the child threw a few interactions that include correspondence or non-correspondence, before presenting trials. Once this has been completed a few times, the models and prompts may be faded from the training trials. It may also be beneficial to look into 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-Rodriguez, 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 behaviors it is likely that the words "saying" and "doing" will come to control a large number of behaviors, which suggests that verbal correspondence is a type of generalized operant class (Luciano et al., 2002). This is further supported by the fact that although Participant Three 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 Three on the generalization trials, but since he was the only participant who completed the correspondence training, no definite conclusions can be drawn from this experiment.

Further research could also look into the stimuli used to signal correspondence and non-correspondence. Two participants did not complete the MTS 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 MTS 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 training method. 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 S^D instead of vocalizations (Luciano et al., 2001).

Simple, physical stimuli may be effective in correspondence training for multiple reasons. Having physical stimuli may actually be a more salient S^D than vocalizations, since the child is able to carry the S^D with him or her and use it as a reminder (Luciano et al., 2001). In order for a verbal stimulus to have the same effects, the child must essentially repeat himself until the action is completed. Vocalizations are also more arbitrary than physical stimuli, since the child may incorrectly verbalize the action required to achieve correspondence (Luciano et al., 2001). In the current study, the participants were required to show or tell the instructor which card was shown to him in the "say area" before engaging 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 stimuli, which could account for the differences seen between this experiment and previous studies (Luciano et al., 2001, Luciano et al., 2002). Research has also suggested that the relevance of the stimuli to the behavior may also be a contributing factor (Lima & Abreu-Rodriguez, 2010; Luciano et al., 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.

As mentioned previously, two participants showed increasing rates of correspondence before the intervention was implemented. It is unlikely that extraneous

variables caused this increase, since the rate of correspondence immediately dropped upon introducing the intervention. It is not, however, possible to completely rule out extraneous variables. Replicating the current study would be useful in determining if the intervention itself was successful for Participant Three's success. Another potential limitation is the setting. Due to logistics, the study was conducted in a room separate from the participant's typical classroom. While the experimenter attempted to arrange for an array of preferred toys, it is possible that the limited selection may have created a biased pattern of responding that affected performance. Replicating the study in a more natural setting, with a large variety of toys, may yield different results.

Despite the ambiguity of the results, this study helped to shed light verbal correspondence and how to best train it. The previous research completed in the field 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.

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Diagrams of Stimulus Training Relations

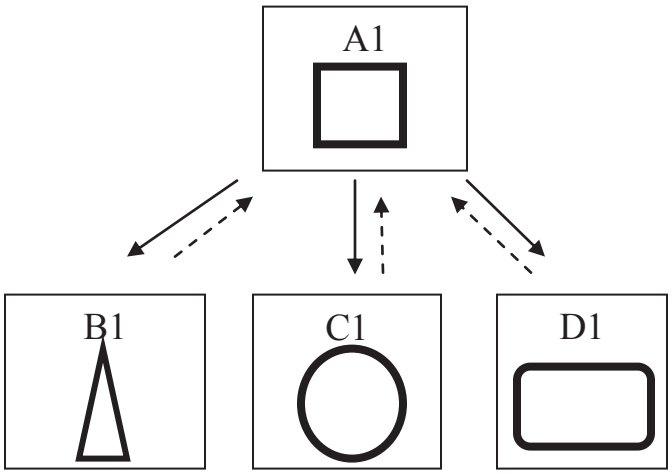


Figure 1. The figure depicts the five stimuli presented in class one. Solid arrows represent relations that are directly trained in the MTS phase. Dotted arrows represent the first of the untrained relations (symmetry).

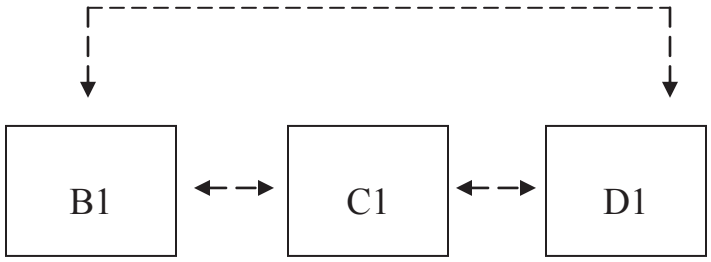


Figure 2. The figure depicts the second set of untrained relations (equivalence) tested for in the stimulus equivalence training

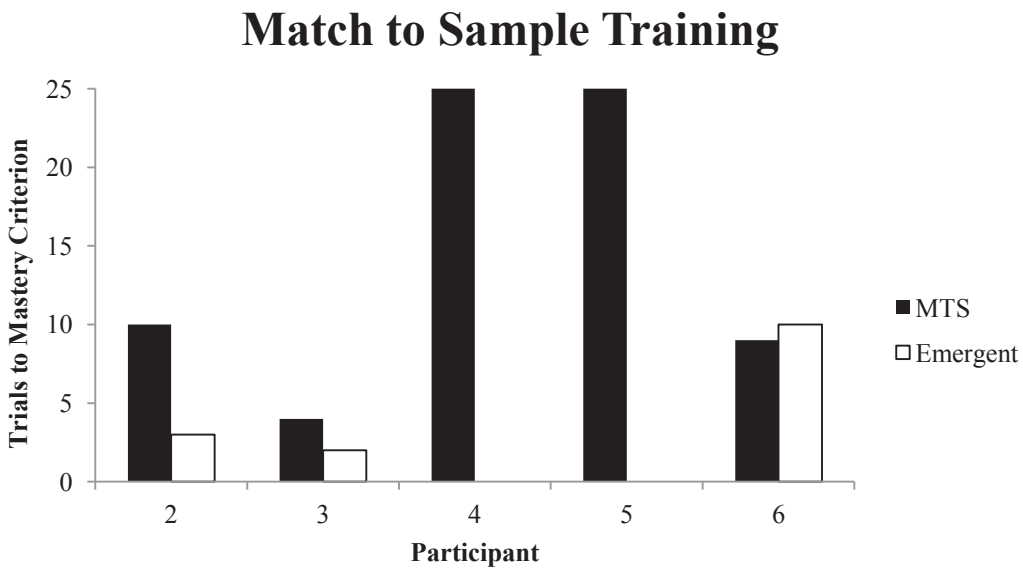


Figure 3. Total number of trials completed to reach the mastery criterion for each participant is depicted above. Participants 4 and 5 did not meet the mastery criterion after 25 sessions, so they were excluded from the experiment. Participant 6 repeated the MTS phase once before reaching the mastery criterion on the emergent relations phase.

Table 1

Number of trials to criterion on MTS and Emergent Relations tests

Participant	Trials to Criterion	
	MTS	Emergent
Two	10	3
Three	4	2
Four	25	-
Five	25	-
Six	9	10

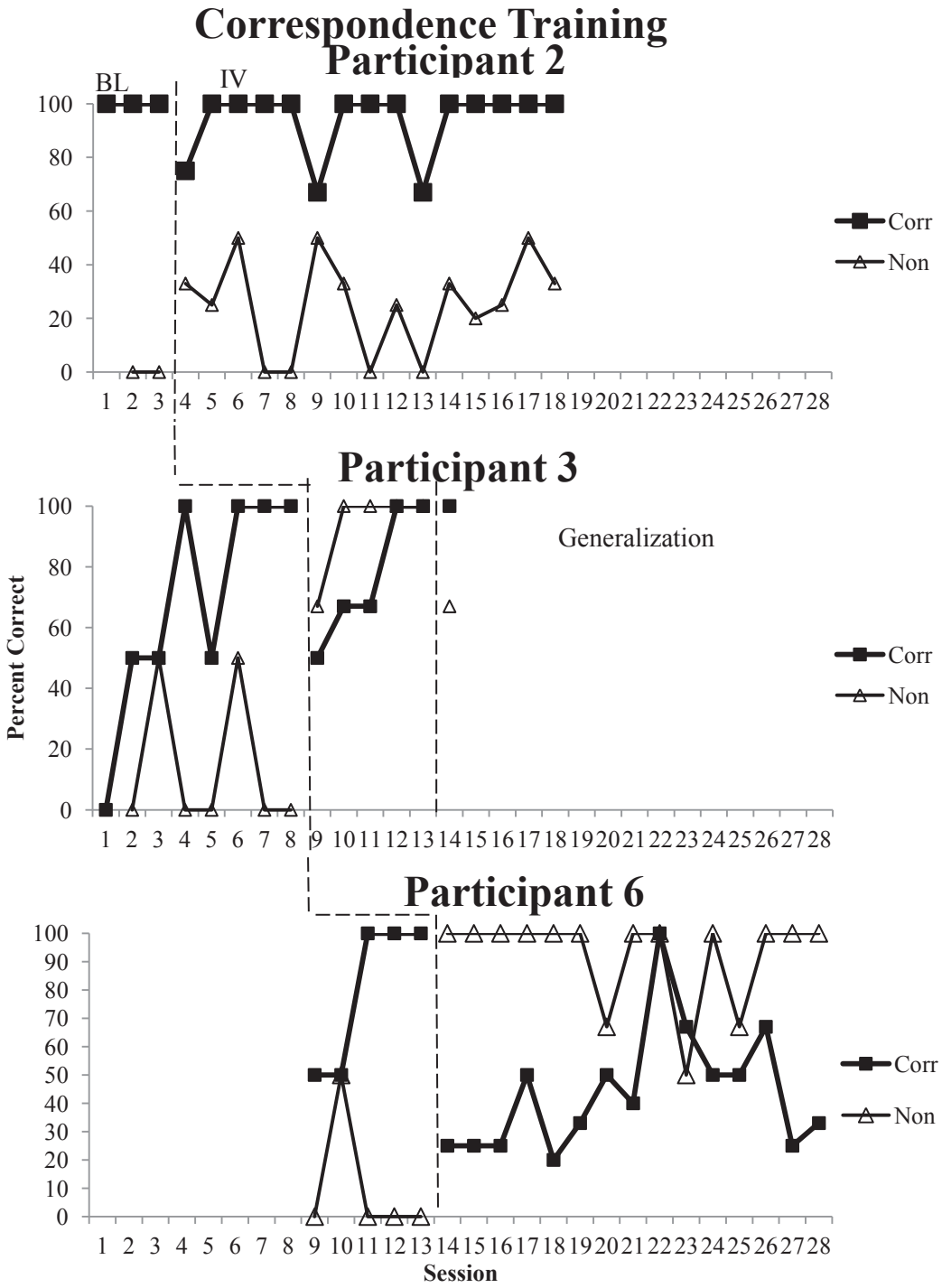


Figure 4. Scores on individual sessions for correspondence training are shown above. Correspondence trials are depicted by the filled in squares, and non-correspondence trials are depicted by open triangles. Baseline, intervention and generalization trials are separated by a dotted line.

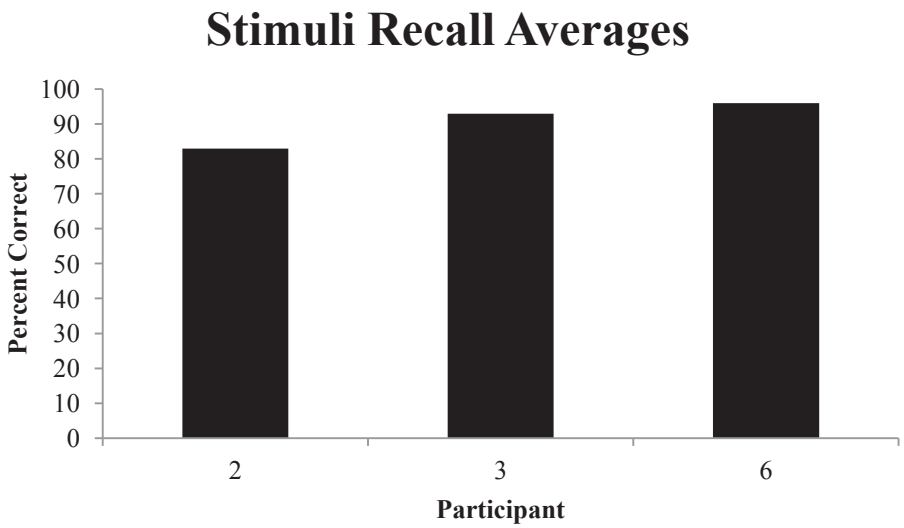


Figure 5. The averages on stimuli recall for each participant is depicted above. Averages were taken from the percent of trials where the participant correctly recalled the stimuli per session.

Table 2

Stimuli Recall Percentage for Each Participant

Participant	Mean	Range
Two	83	83-100%
Three	93	80-100%
Six	96	83-10%

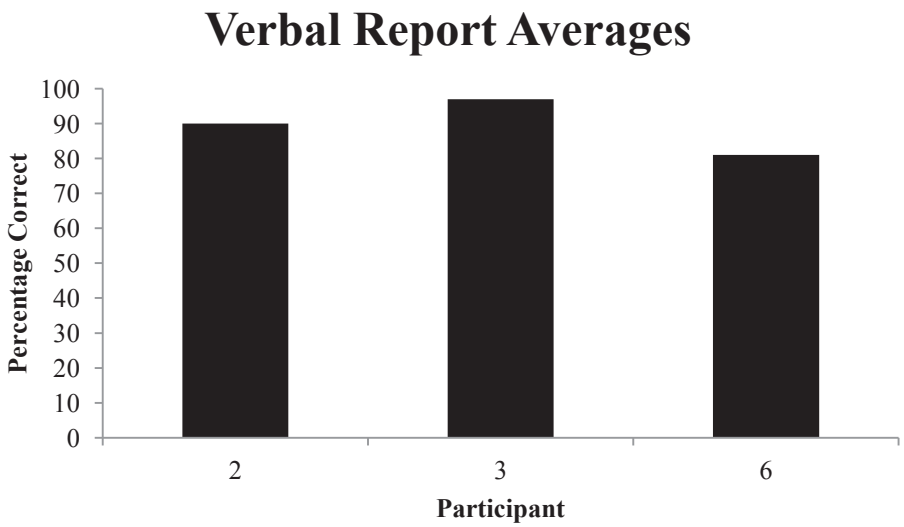


Figure 6. The averages of correct verbal reports for each participant are depicted above. Averages were taken from the percent of trials where the participant made a correct report per session.

Table 3

Verbal Report Percentages for each Participant

Participant	Mean	Range
Two	90	40-100%
Three	97	80-100%
Six	81	33-10%

Appendix A

Informed Consent

Hello Parents,

My name is Katie DiCola, and I am a second year student in the Applied Behavior Analysis program at Youngstown State University. Part of my program requirements includes completing a graduate thesis. I will be looking at methods of teaching say-do correspondence to children with developmental disabilities. Say-do correspondence is a type of rule governed behavior, where an individual is able to perform an action that was earlier stated, or able to accurately report an action that was previously performed.

During the course of the study, participants will complete three testing phases. A stimulus training phase will involve matching colored letters. In the correspondence training phase, students will be taught to "do as you said" or "don't do as you said" in the presence of a specific stimulus. A final phase will be conducted to see if the children generalized the training procedures to new behaviors and environments. Throughout the training, I will be providing small amounts of edible reinforcers to the participants (skittles, M&Ms, or chips) for correct responses. This procedure is identical to the one typically used by teachers at the center during one-on-one trials. If your child has a food allergy, please notify my so I can make separate arrangements.

There are no known aversive consequences associated with this study. All training sessions will take place at the Rich Center during the child's school day, either in his/her typical classroom or a separate trial room. I will work with the teachers to ensure that the children are not being removed from the classroom during their individual work times. You may also withdraw your child from this study at any time, without any consequences. In addition, I will consult with the classroom teachers to determine which behaviors could indicate willingness or unwillingness to participate.

If you have any questions or concerns, please do not hesitate to contact me or my advisor, Dr. Michael Clayton.

Thank you for your participation,

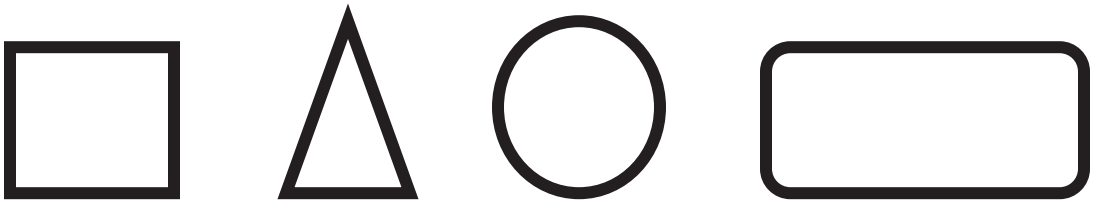
Katie DiCola kldicola@ysu.edu
Dr. Michael Clayton mcclayton@ysu.edu
Dr. Edward Orona, director of grants and sponsored programs eorona@ysu.edu

Child's Name: _____ Age: _____

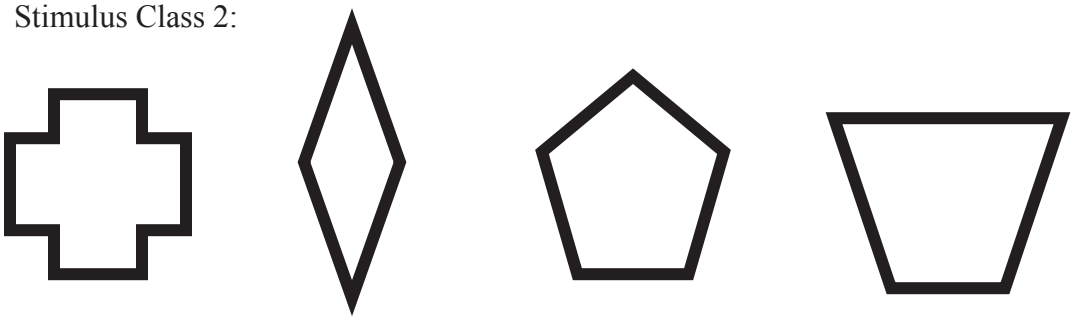
Parent Signature: _____ Date: _____

Appendix B

Stimulus Class 1:



Stimulus Class 2:



Appendix C

Stimulus Training Data Collection

Match to Sample
Participant: _____
Trial: _____
Date: _____

A1-B1	+ -
A1-C1	+ -
A1-D1	+ -
A2-B2	+ -
A2-C2	+ -
A2-D2	+ -

Symmetry
Participant: _____
Date: _____
Trial: _____

B1-A1	+ -
C1-A1	+ -
D1-A1	+ -
B2-A2	+ -
C2-A2	+ -
D2-A2	+ -

Equivalence:
Participant: _____
Date: _____
Trial: _____

B1-C1	+ -
C1-B1	+ -
B1-D1	+ -
D1-B1	+ -
C1-D1	+ -
D1-C1	+ -
B2-C2	+ -
C2-B2	+ -
B2-D2	+ -
D2-B2	+ -
C2-D2	+ -
D2-C2	+ -

Appendix D

Baseline Data Collection

Participant Number: _____ Session: _____ Experimenter Initials: _____

Date	Trial Type	Toy Named	Toy Played With	Correct
	C N			Y N
	C N			Y N
	C N			Y N
	C N			Y N
	C N			Y N

Correspondence Training Data Collection

Participant Number: _____ Experimenter Initials: _____
Session: _____

Date	Trial Number	Stimuli Class	Recall Of stimuli	Correspondence Of Doing	Verbal Report	Trial Correct
		1 2	+ -	+ -	+ -	+ -
		1 2	+ -	+ -	+ -	+ -
		1 2	+ -	+ -	+ -	+ -
		1 2	+ -	+ -	+ -	+ -
		1 2	+ -	+ -	+ -	+ -
		1 2	+ -	+ -	+ -	+ -
		1 2	+ -	+ -	+ -	+ -

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Fax 330.941.2705

November 10, 2013

Dr. Michael Clayton, Principal Investigator
Ms. Katie DiCola, Co-investigator
Department of Psychology
UNIVERSITY

RE: HSRC PROTOCOL NUMBER: 054-2014
TITLE: Using Arbitrary Stimuli to Teach Say-Do Correspondence

Dear Dr. Clayton and Ms. DiCola:

The Human Subjects Research Committee of Youngstown State University has reviewed your response to their concerns regarding the above mentioned protocol and determined that your protocol now meets YSU Human Subjects Research guidelines. I am pleased to inform you that your project is fully approved

Please note that your project is approved for one year. If your project extends beyond one year, you must submit a project Update form at that time.

Any changes in your research activity should be promptly reported to the Human Subjects Research Committee and may not be initiated without HSRC approval except where necessary to eliminate hazard to human subjects. Any unanticipated problems involving risks to subjects should also be promptly reported to the Human Subjects Research Committee.

We wish you well in your study.

Sincerely,

Dr. Scott C. Martin
Interim Associate Dean for Research
Authorized Institutional Official

SCM:cc
Dr. Karen Giorgetti, Chair
Department of Psychology

Youngstown STATE UNIVERSITY 100 years 1908-2008 A PROUD PAST A PROMISING FUTURE