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The Effects of Stimulus Fading on Receptive Identification

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Many of the skills needed to live happily and independently are not in the repertoires of children diagnosed with autism, and they do not learn these skills through exposure to others (MacDuff, 2001). One of the skills children diagnosed with ASD struggle to develop is receptive identification. There is often a risk of prompt dependence or failure to transfer stimulus control to the desired stimuli when using LTM prompting methods. Children with autism spectrum disorder may require a different approach in developing a receptive language repertoire. The purpose of this study was to teach a child diagnosed with ASD receptive identification after failure to develop the skill using the traditional method. The present study used a picture-prompt fading method with the targets on the index cards starting at 100 percent intensity and then systematically fading them down to 1 percent intensity. The overall study showed to be effective in teaching the subject receptive identification by using a picture prompt fading procedure.

Keywords: Receptive Identification, autism, picture-prompt fading procedure, generalization

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Listener training is often referred to as the skill of being able to nonverbally respond to verbal stimuli (Carp, 2012). This skill is usually developed in children through repeated interactions with parents, teachers, and older siblings (Hart & Risley, 1975). Although this is a skill that many think to be effortless, it creates a problem when trying to teach it to children diagnosed with autism spectrum disorder (ASD). A limited verbal repertoire creates an environment for children diagnosed with ASD that impacts their ability to learn receptive identification the traditional way (Carp, 2012). This is a significant problem for children diagnosed with ASD because the ability to be able to distinguish between objects with only the presence of an auditory stimulus is a key factor in succeeding in future classrooms beyond kindergarten. Without this skill, children diagnosed with ASD have little chance of succeeding in classrooms with typically developing children. That is why the current study used a procedure that can teach receptive identification by using a picture prompt fading procedure. With the development of this skill, children diagnosed with ASD will be able to more readily participate in everyday tasks with their caregivers, teachers, and classmates.

A study conducted by Gregory Macduff and Patricia Krantz (2001) compared different types of prompts for teaching receptive identification. This specific study is relevant to the research because one of the most important factors in this experiment is the use of prompts to gradually obtain the target behavior. Prompts can be described as the use of "auxiliary," "extra," or "artificial" stimuli that are presented immediately before or after the stimuli that will eventually cue the learner to engage in the behavior of interest (MacDuff, 2001). The specific prompting method that will be used in this experiment is a stimulus-fading procedure. Stimulus-fading procedures exaggerate some physical dimension of a relevant stimulus such as color, size, or intensity to help a person make a correct response (MacDuff, 2001). The study also

discovered that too many trials at one prompting level may increase dependence on prompts (MacDuff, 2001). This is significant to the current research because the participant in the study is known to become prompt dependent and extra precautions may have to be made to decrease the chances of prompt dependency.

Research conducted by Charlotte Carp and Sean Peterson (2001) strengthened past research which demonstrated that picture prompts improve acquisition on a receptive identification task (Carp, 2001). This is relevant to the current research because the subject struggled to learn receptive identification the traditional way and an intervention needed to take place. This study shows further proof that using picture prompts in order to gain stimulus control is an effective strategy when trying to teach receptive identification. The study also incorporated two other experimental conditions, a pointing prompt condition and a trial and error condition. Of the three conditions they discovered that a variety of learners may benefit from the incorporation of picture prompts in auditory-visual discrimination training (Carp, 2001). This gives even more justification into the decision of using picture prompts when trying to teach the subject receptive identification.

An additional study went even further to test the effectiveness of picture prompts on children diagnosed with ASD and brought into question the findings made by Carp and Peterson. The findings found that picture prompts used with a prompt delay were efficacious for teaching receptive labeling to two teenagers diagnosed with ASD (Vedora, 2016). Although the current study did not be include a prompt delay, it still shows that picture prompts were effective in teaching receptive labeling to people diagnosed with ASD. The study also concluded that the pictures served as effective prompts because the participants were able to discriminate the relevant features of the selected comparison from the other comparison to engage in a correct

prompted response to the array of stimuli (Vedora, 2016). This issue is the reason the picture prompt fading method was selected in order to effectively teach receptive identification to the subject. The fading of the pictures will avoid possible prompt dependency when conducting the experiment. By fading the pictures, it will transfer the stimulus control from the sample picture stimulus to the auditory stimulus made by the experimenter.

An existing study comparing the literature on prompt-fading experiments discovered that the most reliable effects come from experiments comparing stimulus and response prompting procedures, which demonstrates a robust effect for stimulus-prompting procedures across both effectiveness and efficiency (Cengher, 2017). These findings are important to the research because it allows for the experimenter to confidently implement the procedure knowing that the research favors a better outcome for the client. The study also found that the blocking effect might explain why stimulus-prompting procedures are more efficient than response-prompting procedures; response prompts are stimuli that typically have a conditioning history, and as a result, have discriminative properties. In contrast, stimulus prompts consist of emphasizing a feature of a stimulus with no prior conditioning history, and then the prompt is gradually faded (Cengher, 2017). This is important to the current research because it shows that there will be no interference in presenting the picture-prompt stimulus along with the auditory stimulus because there was no prior conditioning history on any of the targets.

The purpose of this study is to provide the necessary skills to a child diagnosed with ASD to succeed and to have the prerequisites needed to thrive in future classroom settings. On a larger scale the study will offer more insight into the possible solutions to teaching children diagnosed with ASD receptive identification in the most effective way possible. Without this research we risk the possibility of using methods of teaching that are not the most effective for children

diagnosed with ASD. The current research aims to show that the presence of an auditory stimulus with a picture fading procedure is the most effective way to teach receptive identification to children diagnosed with ASD. This research hopes to be the basis for many more interventions to teach receptive identification to children around the world.

Methods

Participant and Settings

The current research is focused on training receptive identification using a picture prompt fading method. The study used a single participant who is three years old. The participant was a student in a Kalamazoo RESA West Campus Early Childhood Special Education classroom, which specializes in teaching children diagnosed with autism. The participant in the study was previously diagnosed with autism spectrum disorder (ASD) and was being taught different skills by behavioral technicians in a one-on-one classroom setting. The child was chosen for the study because he was not successful on receptive identification using the traditional method of teaching. There was no incentive given to the participant.

The sessions were conducted in a one-on-one classroom setting with an individual booth reserved for the interventionist and the participant. The booth had a table for the interventionist and participant. Sessions were also conducted in a hallway where a variety of reinforcers such as a scooter, wagon, and bike were available to the child. Other areas such as the group room, sensory bin table, and ramp were available for running sessions.

Materials

The procedure materials consisted of a cardboard shelf that was used to place the target stimuli in a line making it easier for the participant to point to the targets. Laminated index cards with pictures of varied intensity were used throughout the study. The targets that were tested in the first set were fork, coat, scissors, and broom. The targets that were tested in the second set were spoon, shorts, chair, and pen. The researcher had an identical set of stimuli of varied intensity. All data were recorded using a counter balanced data sheet. The data was then input into Microsoft Excel where the graphs and figures were created.

Research Design

The objective of the intervention was to prove the effectiveness of a picture prompt fading procedure on training receptive identification in children diagnosed with autism spectrum disorder. The current research used a single-subject design. The researcher started the intervention by running a pre-test to identify four pictures to target. Next, the researcher ran a baseline test to get an understanding of where the participant stood prior to the intervention. The intervention took place over multiple sessions going from 100% intensity in the first session down to 1% intensity in the final session. A probe was conducted after mastery criteria was met for 100% intensity. After mastery criteria was met in all of the stimulus fading procedures the researcher ran a generalization probe to test the effectiveness of the intervention across novel stimuli. A second set of four new targets was then introduced and the same method of teaching was used.

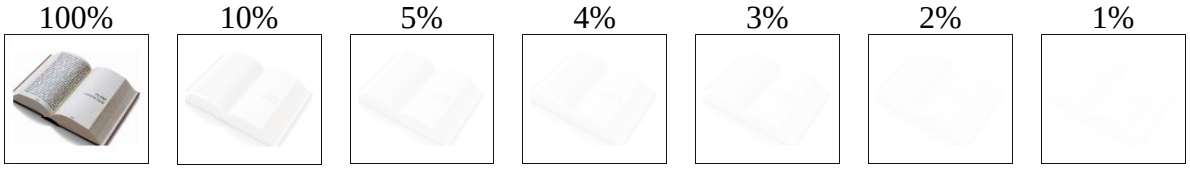

Figure 1. Visual representation of the picture prompt intensities used within stimulus fading sessions.

The participant did not receive any reinforcement during the pretest phase of the experiment regardless of correct or incorrect responses. Positive reinforcement was given in all of the baseline and intervention phases based on correct responses. If the participant responded incorrectly in the intervention phase the experimenter would prompt the participant to respond correctly using the least-to-most prompting method and then followed it by running an ELO and then reinforcing that response. If the participant responded incorrectly during baseline that trial was immediately ended without any error correction. If the participant was not attending to the researcher or the targets the researcher would end the trial and run an ELO or a preference assessment to increase attending.

Data Collection

All data was collected using a counter balanced data sheet. The data sheets were created by using a software that randomized the order of the targets. There was a total of 16 trials per session with each target being tested 4 times. During the baseline and pre-test phases “no response” was recorded if the participant did not respond to any of the target stimuli. During the intervention phases data was only recorded if the participant responded by pointing to one of the targets. Correct responses were recorded with a “+” and incorrect responses were recorded with a “- “. No response was recorded with “NR”. If the participant responded incorrectly the researcher circled the target he picked to identify any bias toward one target. The researcher then recorded the percentage of correct responses over the number of incorrect responses. This same method was used to observe the percentage of correct responses for each specific target in the intervention. If at any time the participant emitted an echoic response the researcher then recorded the response under “notes” by marking an “e” next to the trial.

Appendix A:

Session: 10					**Date:**	**Initials:**
Trial	**Target**				**Data**	**Notes:**
Stimuli:	Chair	Shorts	Pen	Spoon		
1	Chair	Shorts	Pen	Spoon		
2	Shorts	Pen	Spoon	Chair		
3	Pen	Spoon	Chair	Shorts		
4	Spoon	Chair	Shorts	Pen		
5	Chair	Shorts	Pen	Spoon		
6	Shorts	Pen	Spoon	Chair		
7	Pen	Spoon	Chair	Shorts		
8	Spoon	Chair	Shorts	Pen		
9	Chair	Shorts	Pen	Spoon		
10	Shorts	Pen	Spoon	Chair		
11	Pen	Spoon	Chair	Shorts		
12	Spoon	Chair	Shorts	Pen		
13	Chair	Shorts	Pen	Spoon		
14	Shorts	Pen	Spoon	Chair		
15	Pen	Spoon	Chair	Shorts		
16	Spoon	Chair	Shorts	Pen		
%	Chair	Shorts	Pen	Spoon	%	**IOA:**
SS	Chair	Shorts	Pen	Spoon		**TI:**
PS						

Procedures

Dependent Variable

The study focused on the participants ability to correctly identify target stimuli with the presence of a verbal discriminative stimulus (S^D). A correct response consisted of pointing to the corresponding target stimuli 3-5 seconds after the verbal S^D and picture prompt was given. If a correct response was given the participant was rewarded with access to a reinforcer for 30-45

seconds and a "+" was recorded on the data sheet indicating a correct response. If the participant responded incorrectly to the S^D, he was then prompted to make the correct choice. The researcher then gave another instruction and rewarded that behavior with access to a reinforcer. The incorrect response would then be recorded with a "-" next to the trial. The researcher also recorded any echoic behavior exhibited by the participant. The participant had a history of echoic behavior, so the intervention made sure to record any instances where the participant engaged in this behavior. The researcher kept track of this data by marking an "e" in the note's category on the data sheet.

Independent Variable

The independent variable in the study was the varied intensities of sample stimuli. The intensities used were 100%, 10%, 5%, 4%, 3%, 2%, and 1%. IOA was collected by the mentor of the intervention. The IOA collected was 100%. All of the sessions were conducted in the afternoon shortly after the participant arrived at the school. The number of sessions conducted during the day depended on how the participant was feeling and how long the experimenter was on site for the day. On average the experimenter was able to run 1-3 sessions a day over a total of 4 weeks.

Baseline

Baseline was conducted to get an understanding of where the participant stood prior to the intervention phase. The baseline tests were 16 trials each and a total of three baseline sessions were conducted before the intervention.

Intervention

Baseline was used to examine whether or not an intervention was needed. If the participant met whistleblow criteria on baseline, then that was the call for the intervention to take

place. The intervention introduced picture prompts in order to provide that $S^{d.}$ Along with the picture prompts the researcher provided a verbal S^{d} that matched the target on the picture prompt. Mastery criteria for receptive identification was 90% or above for 3 trials in a row and whistleblow criteria was 50% or below for 5 trials in a row. Mastery criteria for the stimulus fading set was 90% or above on 1 session, which would result in a promotion to the next intensity level. Whistleblow criteria was 50% or lower for 1 session, which would result in a demotion to the previous intensity level. If the participant scored 100% on the first 8 trials, he was prompted to the next intensity level for the remainder of that session.

The first intervention was introduced after baseline with the laminated index card at 100% intensity. The intervention consisted of showing the participant the picture prompt along with presenting a verbal S^{D}. The participant was then expected to point to the correct corresponding stimuli in the set. This same method of teaching was used in all of the levels for the stimulus fading procedure. A correct trial was defined as responding to the S^{D} by pointing to the correct target stimulus within 2-5 seconds. If the participant was not responding a preference assessment was conducted or an ELO was conducted to increase responding. An incorrect response was defined as pointing to the wrong target stimuli in the set. Error correction included physically prompting the participant to make the correct response while repeating the verbal S^{D}.

If the participant engaged in any problem behavior throughout the experiment, he was prompted to transition to a different location in an attempt to decrease any problem behavior. If this did not decrease the problem behavior the session was ended, and the researcher waited until the problem behavior ended to resume the experiment.

Results

The overall outcome of the intervention showed that stimulus fading had a positive and lasting effect on the participant's ability to correctly identify target stimuli. On both set 1 and set 2 the participant did not demonstrate the skill during baseline. In the presence of the picture prompts at 100% intensity, the participant was able to correctly identify target stimuli, scoring above mastery criteria in both set 1 and set 2. A probe was then conducted to see if training the participant to correctly identify target stimuli at 100% intensity was all he needed to correctly identify target stimuli with only the presence of a verbal SD. The participant did not meet the mastery criteria on the probes in both set 1 and set 2 indicating that further intervention was needed. During the stimulus fading phases in both set 1 and set 2 the participant quickly promoted to lower intensities without ever having to demote to a higher intensity. During the stimulus fading phases, the participant emitted echoic responses intermittently showing that the participant was listening to the verbal S^D and attending to the target stimuli. After the participant met mastery criteria at 1% intensity, he was then probed again to test whether the intervention had been effective. In both set 1 and set 2 the participant met mastery criteria in the probe phase showing the stimulus fading had a positive effective on teaching receptive identification.

The current research was also interested in testing whether or not stimulus fading would be effective in teaching generalization across different targets. The researcher introduced novel versions of the same targets for both set 1 and 2 to see if the participant was able to identify them. In both set 1 and 2, the participant was able to successfully generalize on all targets meeting mastery criteria in both generalization phases.

The research planned to examine the lasting effect of stimulus fading on receptive identification. The researcher planned to conduct a maintenance probe for the initial targets and

the generalization targets a month after mastery criteria was met on the final phase. Due to the Covid-19 virus the researcher was not able to run a maintenance probe. The researcher expected to see mastery on both phases of this experiment with the ability to positively identify the correct targets even after a month has elapsed.

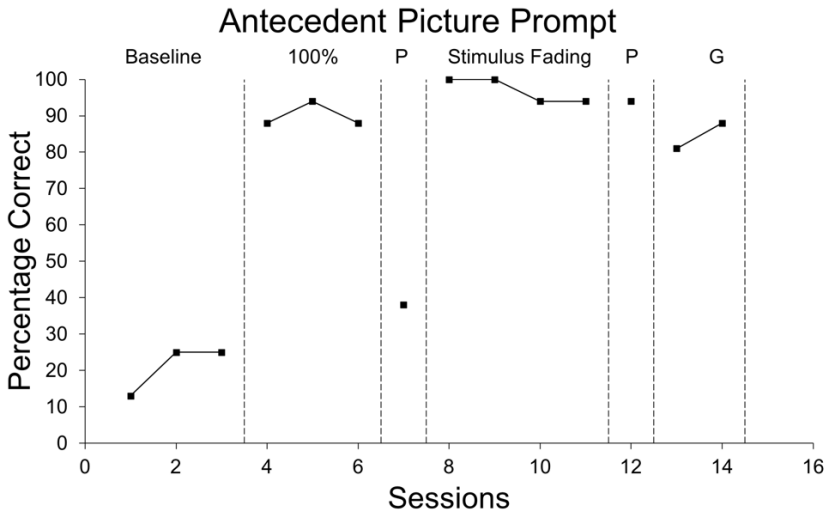

Figure 2: Line graph of set 1 showing an increase in correct responses after stimulus fading was introduced in the final probe and generalization phases.

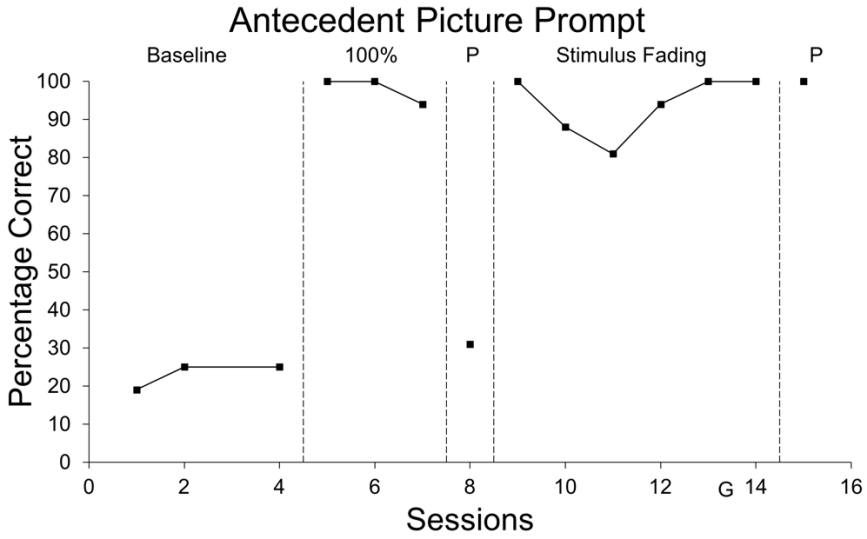

Figure 3: Line graph of set 2 showing an increase in correct responses after stimulus fading was introduced in the final probe phase.

Both graphs depict the effectiveness of a picture prompt on increasing correct responding. In baseline, the participant only picked the correct target 20%-25% of the time, with the target being correctly picked being due to a bias toward one target after it had been previously reinforced. The introduction of the picture prompt at 100% drastically increased correct responding but was not enough to reach mastery criteria in the following probe. The probe showed that training the participant with a picture prompt at 100% intensity was not effective in transferring over that verbal S^D. The introduction of the stimulus fading procedure showed that it drastically increased correct responding in comparison to baseline with a steady trend above mastery criteria, with the participant rarely choosing the incorrect target in some of the lower intensities. After the stimulus fading, a second probe was introduced with the participant meeting mastery criteria in both sets showing that stimulus fading was effective in teaching receptive identification. The graph shows that stimulus fading was also effective in teaching generalization in set 1 which further proves the effectiveness of stimulus fading on receptive identification. Due to the Covid-19 virus, a generalization probe could not be conducted in set 2.

Discussion

After analyzing past literature, the researcher hypothesized that stimulus fading was an effective strategy for teaching receptive identification. The data supports this hypothesis with the participant being able to identify the correct targets after the introduction of stimulus fading. Prior to the introduction of stimulus fading the participant had failed on all 8 targets.

The results showed an increase in correct responding across all 8 of the targets with the participant being able to generalize to novel pictures of the targets. The results were obtained through the fading of the picture prompts, leading to the transfer of the S^D from the visual to the verbal S^D. The experimenter was able to maintain the same experiment throughout the study without ever having to make any alterations to the targets or the procedure.

The current research correlates with previous research with the desired outcome being obtained through the introduction of stimulus fading. In all related research the participant had failed at learning receptive ID using the traditional method. The results show that the participant was able to acquire the skill of receptive identification by having exposure to both a picture prompt and verbal S^D, with the experimenter fading out the picture prompt so that the participant would then only rely on the verbal S^D to pick the correct target. The traditional method relies only on the verbal S^D, making it challenging for some individuals to succeed. The results show that by using both a visual and verbal S^D you can effectively train receptive identification to those struggling with the traditional method. The absence of the picture prompt could be the reason that many students struggle with the traditional method. This study expands on the use of stimulus fading by proving the effectiveness of this method on children diagnosed with ASD. This research can be a guide to future experiments and an aid to teachers and technicians working with children diagnosed with ASD.

The researcher provided the target stimuli prior to showing the sample stimuli. This specific method of training may have left room for error when conducting research. The student would often pick the wrong target before seeing the picture prompt, and then proceed to pick the correct target after being exposed to the picture prompt shortly after. A better approach to this

experiment may be to expose the participant to the picture prompt, and then proceed to show the target stimuli after. This may aid in decreasing incorrect responding.

The participant had been exposed to the Picture Exchange Communication System (PECS) prior to the experiment taking place. With this system the participant is often exposed to different picture icons throughout the classroom, some of which were similar to the targets in the experiment. This exposure may have acted as a confounding variable in the experiment because the researcher was not able to control the exposure to the picture icons throughout the classroom. If done differently, the researcher could attempt to pick targets that do not match any of the classroom picture icons or the ones in the participants PECS book. By doing this you may be able to avoid any possible confounding variables.

A second confounding variable was the participant's health throughout the study. The participant was sick during the beginning of the study which may have had influence on his responding. The participant was more easily agitated, and his motivation was especially low during this period of the study. A participant's health should always be taken into consideration before conducting an intervention and researchers should be cautious of any signs or symptoms to avoid any flawed data in the research.

A third confounding variable was the decrease in motivation throughout the school day. The participant would receive training at different times of the day, some instances were midafternoon and other instances were late afternoon. It came to the researcher's attention that the participant performed significantly better in the midafternoon compared to the late afternoon, but the opportunity to run sessions at the same time each day was not possible. A solution to this problem could be to discuss with teachers and BCBAs a possible schedule that can ensure that all

testing be done during a time that you know your participant responds the best. This can ensure you get accurate data and good responding from your participant.

There were multiple limitations to the study, one of which was the lack of IOA on data collection. The classroom was often busy with students needing attention from various technicians and BCBAs making it difficult to acquire an additional researcher to take IOA. A possible solution to this problem would be to bring in a person from outside of the classroom who you find reliable to assist you in data collection. This can decrease any possible instances where the 2nd researcher may have to leave in the middle of the session to assist another child in the classroom.

The second limitation to the study was the sample size. This experiment consisted of one participant. Although the intervention proved to be effective for this participant, it does not mean it would be effective for others. The small sample size leaves room for error on the effectiveness of the intervention across different children diagnosed with ASD. It should also be acknowledged that past research with larger sample sizes has had similar results.

A third limitation arises from the scope of discussion of the researcher. This was the researcher's first time conducting his own intervention which may have left room for possible error. Due to the lack of experience conducting research and collecting data, and interpreter should be made aware of the researcher's experience in this field.

The fourth limitation was the absence of the maintenance probe. Due to the Covid-19 virus, the researcher was unable to conduct the maintenance probe in both set 1 and set 2. Due to this unforeseen circumstance, the research was unable to prove the effectiveness of stimulus fading on receptive identification across a duration of time. Future research should focus on this aspect of the experiment to provide evidence on the effectiveness of stimulus fading across time.

Without the proper training, children diagnosed with ASD have little chance of succeeding in typical classroom settings. The findings from the current research show that there are measures teachers can take to prepare children diagnosed with ASD for these typical classroom settings. These methods of teaching are a steppingstone towards preparing children to learn using traditional methods.

For future research, one should test the effectiveness of stimulus fading on participants who cannot receive training 5 days a week. The effectiveness of stimulus fading should be known for potential participants who are only able to receive training 1-3 times a week. It could be possible that this method for teaching receptive identification may not be effective for participants who are not in the classroom 5 days a week. This can then show participants that it is indeed an effective strategy or that a different strategy may be more efficient in regard to their availability.

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APPENDIX A: COUNTER-BALANCED DATA SHEET

Figure 1. Visual representation of the picture prompt intensities used within stimulus fading sessions.

Figure 2: Line graph of set 1 showing an increase in correct responses after stimulus fading was introduced in the final probe and generalization phases.

Figure 3: Line graph of set 2 showing an increase in correct responses after stimulus fading was introduced in the final probe phase.