12-2014

An Attempt to Establish Approval as a Learned Reinforcer

Kelly T. Kohler
Western Michigan University, KellytKohler@gmail.com

AN ATTEMPT TO ESTABLISH APPROVAL AS A LEARNED REINFORCER

by

Kelly T. Kohler

A dissertation submitted to the Graduate College
in partial fulfillment of the requirements
for the degree of Doctor of Philosophy
Psychology
Western Michigan University
December 2014

Doctoral Committee:

Richard W. Malott, Ph.D., Chair
Stephanie Peterson, Ph.D.
Ron Van Houten, Ph.D.
Steven Ragotzy, Ph.D.

AN ATTEMPT TO ESTABLISH APPROVAL AS A LEARNED REINFORCER

Kelly T. Kohler, Ph.D.

Western Michigan University, 2014

Approval does not function as a powerful reinforcer for many children with autism, making it difficult to reinforce appropriate behavior in a functional and consistent manner. The current study first assessed the effects of establishing approval ("Nice," accompanied by a smile and nod) and nonsense words as discriminative stimuli, with the intent that they might also become learned reinforcers. We conducted several experiments to assess the effectiveness of approval as a reinforcer, including tests on learning new responses (receptive, expressive, free-operant, and simple simultaneous discriminations) and tests on the performance of previously mastered responses (receptive and expressive responses). Despite the effectiveness of the approval statement as a discriminative stimulus, it seemed to act as a very weak reinforcer, at best. We then assessed the effects of response-contingent pairings on the establishment of a learned reinforcer. For the current participant, the response-contingent pairing method seemed to be an effective method for establishing a learned reinforcer. Using this procedure, we were able to maintain the value of the learned reinforcer, as long as it continued to be paired with an unlearned reinforcer contingent on another response.

ACKNOWLEDGEMENTS

I would first like to thank Dr. Richard Malott for the countless hours he spent reviewing and editing my work. Without his extremely effective performance-management system, this dissertation would not have been completed. I have learned so much from him that I will take with me and use for the rest of my life. Because of his support and guidance, I am a better writer, researcher, and most importantly, a better behavior analyst. I cannot overstate how thankful I am to have been given the opportunity to learn from one of the best.

Second, I would like to thank the other members of my dissertation committee, Dr. Stephanie Peterson, Dr. Ron Van Houten, and Dr. Steven Ragotzy. Their time and input on this project was invaluable.

It is also important that I thank Jack for his participation and inspiration in this study. I must also thank his tutors and the rest of the staff at the Kalamazoo Autism Center for helping me collect data and for letting me constantly interrupt their daily routines to run sessions. Their help and patience was always appreciated.

Finally, I would like to thank my parents, Martin and Susan Stone, and my husband, Tyler Kohler, for their unwavering support. They have always been my biggest cheerleaders and pushed me every step of the way. Without their encouragement, I would not be where I am today.

Kelly T. Kohler

TABLE OF CONTENTS

APPENDICES

LIST OF FIGURES

AN ATTEMPT TO ESTABLISH APPROVAL AS A LEARNED REINFORCER

Social stimuli such as praise or approval function as reinforcers for most people. Often, parents and teachers assume that praise is an effective tool for increasing desired behaviors, but for many children with autism, it is not (Ferster, 1961). While it is possible for us to bypass this limitation by using other reinforcers, such as toys and edibles, it is in the child's best interest that we establish praise as a reinforcer. There are many benefits to using praise over these other reinforcers: it is quicker and easier to deliver; it is commonly used in the child's every day, social environment; it is the most commonly used educational reinforcer (Skinner, 1968); it is free of some of the negative side effects of using edibles, such as tooth decay and weight gain; and the reinforcing effects of praise may be less susceptible to something analogous to satiation. Also, if we must rely solely on reinforcers other than praise for teaching new skills, these children are not as likely to benefit from incidental teaching situations that commonly occur in parent-child interactions, where praise is usually given (Greer & Ross, 2008).

It is generally understood in the field of behavior analysis that neutral stimuli can acquire a reinforcing function through pairing with an already established reinforcer (Cooper, Heron, & Heward, 2007; Kelleher & Gollub, 1962; Malott & Shane, 2013). The most commonly cited process by which this occurs is through a simple stimulus-stimulus pairing. However, often this does not seem to effectively establish praise as a reinforcer, at least in some settings (e.g., Dozier et al., 2012; Holth et al., 2009; Lovaas et al., 1966).

Dozier et al. (2012) studied two procedures that might establish praise as a learned reinforcer. In the first study, they used stimulus-stimulus pairing and found that it was not effective in establishing a learned reinforcer for three of four participants, and the results were inconclusive for the fourth. In the second study, they conducted all pairings contingent on a response. This response-contingent pairing was successful in establishing praise as a learned reinforcer for four of eight participants.

Discriminative stimuli are also known to acquire a reinforcing function (Dinsmoor, 1950; Holth et al., 2009; Lovaas et al., 1966; Zimmerman & Hanford, 1966). It may be more effective to establish approval as a discriminative stimulus in order to increase its reinforcing value (e.g., Holth et al., 2009; Lovaas et al., 1966). The benefit of using a discrimination procedure is that it ensures the organism is attending to the neutral stimulus being paired, whereas the stimulus-stimulus pairing procedure does not.

Zimmerman and Hanford (1966) created a learned reinforcer for pigeons by establishing the termination of the Skinner box house and key lights and operation of the food magazine as a discriminative stimulus (S^D) for putting their head into the feeder. They then shaped a key-peck using only those non-food stimuli (termination of lights and operation of the magazine) and maintained it indefinitely, demonstrating the effectiveness of the S^D procedure in establishing a learned reinforcer. Holth et al. (2009) created a learned reinforcer for children of varying ages and diagnoses (autism, developmental disabilities, typically developing) by establishing a neutral stimulus as an S^D for reaching for and consuming a reinforcer. They then demonstrated the stimulus' effectiveness as a reinforcer by delivering it contingent on a free-operant response.

The current study explored the effects of establishing praise as a discriminative stimulus and its subsequent reinforcing effects. We also explored the use of a response-contingent pairing method (Dozier et al., 2012; Theobold & Paul, 1976) and its effectiveness in establishing learned reinforcers.

Method

Participant and Setting

This study was conducted in a case-study format, using only one participant, Jack, who was eight years old at the start of the study. He has been enrolled in intensive behavioral programs since he was two years old, and has gained many skills. At the start of the study, Jack's VB-MAPP (Sundberg, 2008) scores indicated that he had skills typically seen in a 30–48-month-old. He had an expressive vocabulary (tacting and manding repertoire) and a receptive vocabulary (listener repertoire) of approximately 500 words, and he could follow 2-step directions, but his biggest deficits on the VB-MAPP Milestones Assessment were in the social, echoic, and linguistic structure categories.

Since he began receiving behavioral services, edibles have remained Jack's most highly preferred and most frequently used reinforcers. In addition to edibles, he is motivated to "work for" iPad games, physical activities (e.g., running and bouncing on an exercise ball), and a few toys. Although he often asks for tickles or hugs from adults in his environment, it is not clear that social stimuli, especially verbal social stimuli, are powerful enough to sustain responding in a discrete-trial setting.

While participating in the study, Jack was attending the Kalamazoo Autism Center. He attended the center four to eight hours per day, depending on the semester, and all of the sessions were conducted during his time at the center, at his assigned worktable.

Materials

We used several of Jack's most preferred edible reinforcers (e.g., Starburst, Nerds, jelly beans, candy necklaces) throughout the study. We also used pictures of cartoon characters and various objects found in the classroom at the autism center (e.g., toy animals, toy dishes) for our assessments of the value of praise as a reinforcer.

Interobserver Agreement

Tutors who worked with Jack on a regular basis collected interobserver-agreement data on 92% of all sessions, with a mean agreement of 99% and a session range of 80% to 100%.

Independent Variables

We assessed two methods for establishing learned reinforcers: the S^D procedure and the response-contingent pairing procedure. The S^D procedure established both approval and nonsense words as discriminative stimuli in the presence of which Jack could reach for (or hold out his hand) and consume a reinforcer. The response-contingent pairing procedure involved pairing the approval or nonsense word with a reinforcer immediately following a response.

Dependent Variables

We conducted several tests to assess the value of the approval or nonsense words as learned reinforcers. These involved tests on the acquisition of new discriminations, maintenance of previously mastered responses, and rate of responding in free-operant tasks. Each test will be explained in detail below. The sequence of the tests will be described in an expository order, rather than a chronological order. See Appendix A for a timeline illustrating the chronological order in which these tests were conducted.

Experiments

Experiment 1: S^D Procedure with “Nice” and “No”

Baseline. We collected baseline data on two tasks before implementing the S^D procedure. The first test measured Jack’s performance of a mastered task, comparing his rate of responding with edibles vs. approval as consequences. The second test measured his acquisition of a new discrimination using praise to reinforce correct responses. Both tests will be described in detail later.

Intervention. The S^D procedure began with the experimenter placing the reinforcer on the desk and covering it with both hands. She then waited for Jack to sit still and make eye contact, then uncovered the reinforcer and provided either an approval (S^D) or disapproval (S^Δ) statement. In the presence of the approval statement (“Nice,” accompanied by a smile and nod), Jack was allowed to reach for and consume the reinforcer. On the rare occasions when he did not reach, he was physically prompted to do so. In the presence of the disapproval statement ("No," accompanied by a frown and head shake), all reaches were blocked. Reaches were scored as correct in the presence of the approval statement and incorrect in the presence of the disapproval statement. Jack discriminated between "Nice" and "No" from the first session (see Figure 1). Although he was discriminating from the first session, to ensure he was getting a substantial number of pairings, we conducted 10 sessions of the S^D procedure. During the subsequent tests for reinforcer effectiveness, we continued conducting this S^D procedure intermittently before the tests, in order to ensure that "Nice" remained a discriminative stimulus. If an S^D session was conducted immediately prior to a test for reinforcer effectiveness, it is indicated on the graph for that test.

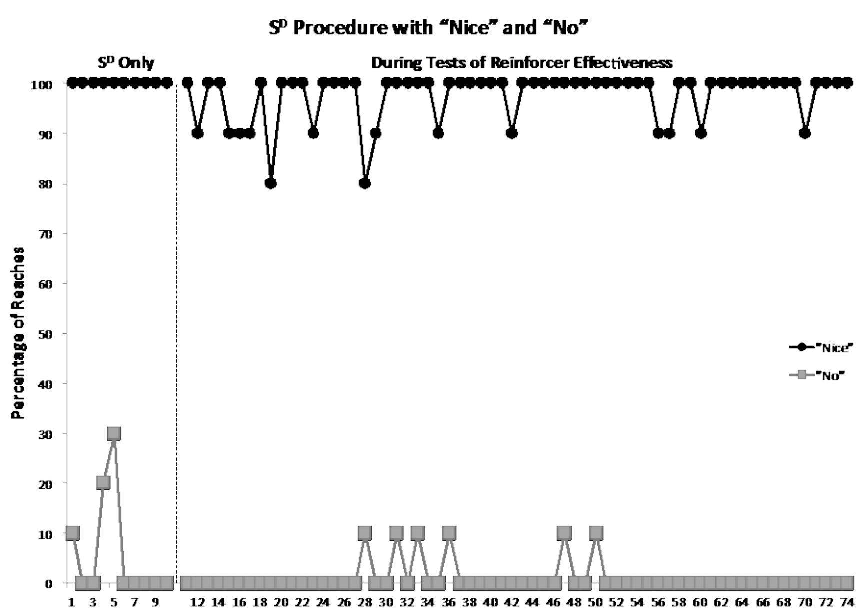

Figure 1. Percentage of reaches on S^D ("Nice") and S^Δ ("No") trials.

Test 1: Instruction following.

Procedure. Our first test of reinforcer effectiveness used the rate of correct and incorrect responding to three instructions that Jack was known to respond to reliably—arms up, clap hands, touch nose (Greer & Singer-Dudek, 2008). We conducted this test with three different consequence conditions—edible, praise, and no consequence. In the edible phases, pieces of candy were dropped into a cup following each correct response; and the cup of candy was given to Jack at the end of each session. No consequences followed incorrect responses in the edible phases. In the praise phases, approval ("Nice," accompanied by a smile and nod) followed all correct responses, and disapproval ("No," accompanied by a frown and head shake) followed all incorrect responses. In the no consequence phases, no consequences were provided for either correct or incorrect responses.

All sessions were 15 trials in length, with each instruction presented five times in random order throughout the session. The session durations were recorded in order to calculate the rate of correct and incorrect responses per min. A response was considered correct if Jack made the correct response within three seconds of the instruction. A response was considered incorrect if he made an incorrect response, or if he did not respond within three seconds. Since these were well-trained responses, most of Jack's incorrect responses were due to longer latencies.

Results. Before we conducted the S^D procedure, we collected baseline data by conducting four phases of this direction following procedure—two edible and two praise phases. During these phases, Jack's mean rate of responding was about 25–26 correct responses per minute during the edible phases and about 14 correct responses per minute during the praise phases, showing clear differentiation between the learned and unlearned reinforcers.

After 10 sessions of the S^D procedure, we conducted six additional phases—two edible, two praise, and two no-consequence phases. Scores improved in the two praise phases, but the high scores in the two no-consequence phases suggest that the consequences for these well-mastered tasks may have been irrelevant (see Figure 2).[1] Therefore, this test failed to demonstrate that we had established a powerful, learned reinforcer.

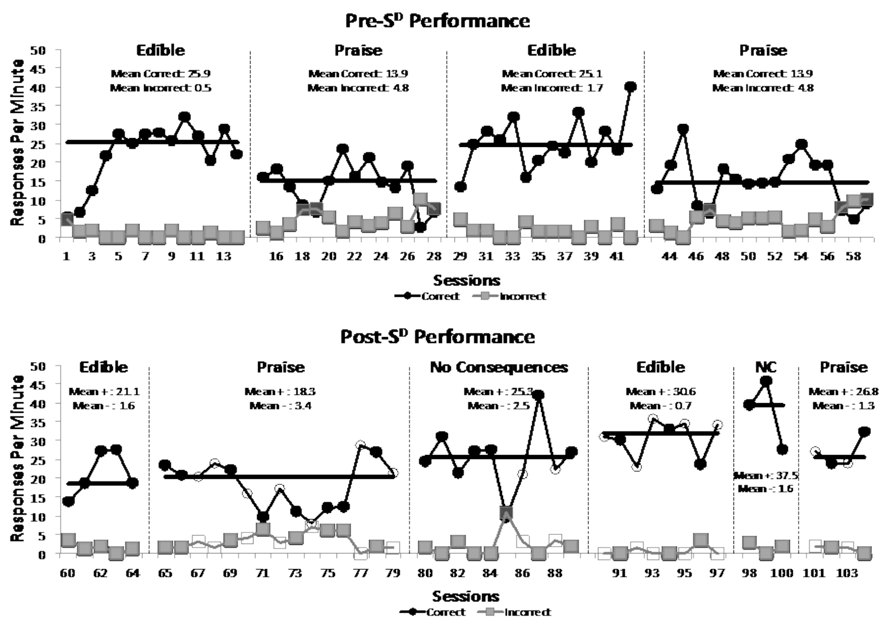

Figure 2. Rate of correct (circles) and incorrect (squares) mastered responses per minute. Horizontal lines indicate the median rate of correct responses for each phase. Open data points indicate that an S^D session was conducted immediately before that test session.

[1] For Jack's accuracy data on this task, see Appendix B.

Test 2: Receptive identification with "nice" and "no"

Procedure. In the second test of reinforcer effectiveness, we conducted a receptive-identification procedure to assess the effects of approval on learning a new discrimination. This procedure involved simultaneously placing three unknown pictures on the desk. The experimenter said the name of one of the pictures (e.g., "Bullwinkle"), and Jack's response was considered correct if he touched the corresponding picture. His response was considered incorrect if he touched one of the other pictures. If he did not respond, the instruction was repeated every 3–5 seconds until he touched one of the pictures (this is in contrast to the previous test, where a slow response was considered incorrect). Sessions consisted of 15 trials, using each stimulus five times per session, in random order. This was the case for all receptive-identification procedures conducted in this study. Correct responses were immediately followed by approval ("Nice," accompanied by a smile and head nod). Incorrect responses were immediately followed by disapproval ("No," accompanied by a frown and head shake). Prompts and error corrections were not used at the start of this procedure, as we were interested in evaluating the effects of only approval and disapproval. However, after 19 sessions with performance at chance levels, we began using an error correction procedure following all incorrect responses. For the error correction, the experimenter said "No" following the incorrect response, repeated the instruction, and pointed to the correct stimulus, until Jack made the correct response. Starting in session 22, we presented S^D trials intermittently (about once every three trials) throughout the session in order to make the S^D and test sessions less discriminable.

Results. First, we conducted 10 baseline sessions of the receptive-identification procedure; and Jack's mean score was 35% correct, chance. After implementing 10 sessions of the S^D procedure, we conducted nine additional sessions of the receptive-identification procedure, and Jack's mean score was 37% correct, still essentially chance.

After those later nine receptive-identification sessions, we added an error correction procedure following incorrect responses. This continued for 45 more sessions, with Jack's mean score rising to only 64% correct. He mastered one of the targets in this final phase but responded at chance levels for the other two targets (see Figure 3).

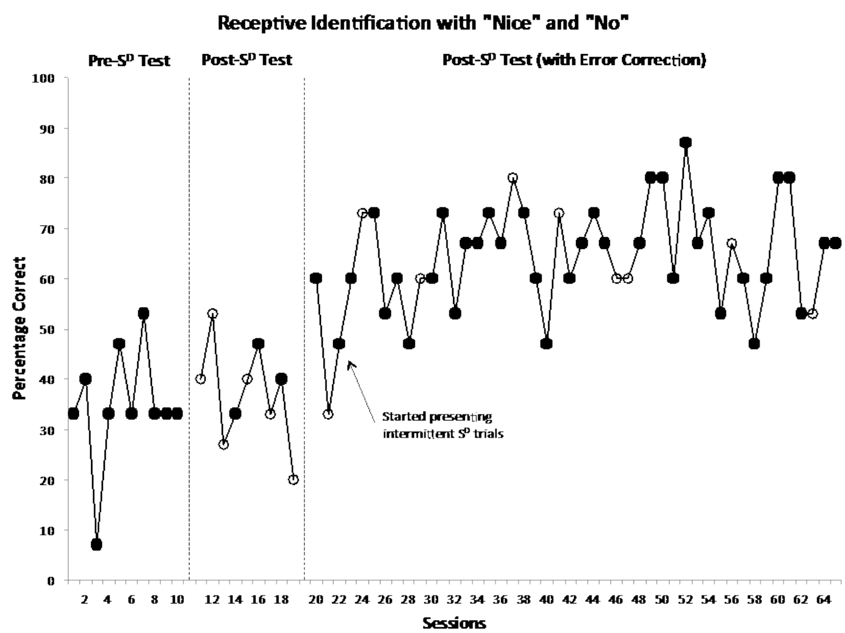

Figure 3. Percentage of correct receptive-identification trials, using approval as a reinforcer. Open data points indicate that an S^D session was conducted immediately before that test session.

Jack’s low accuracy might be due to the low value of our praise as a reinforcer; however, his low accuracy in the next test, Test 3, using his more preferred reinforcers suggests that the receptive-identification training procedure may have been inappropriate.

Test 3: Receptive identification with edibles. We conducted the third test to assess Jack’s rate of learning of a receptive-identification task when edibles were used to reinforce correct responses.

Procedure. This test was similar to Test 2, in that we presented three unknown pictures on the desk and asked Jack to point to one. This time, correct responses were immediately followed by a highly preferred edible reinforcer, and incorrect responses were followed by an error correction, as in Test 2.

Results. We conducted this procedure for 34 sessions, and Jack’s mean score was only 57% correct (see Figure 4). He again mastered one target, but responded at chance levels on the other two. Considering Jack’s extensive receptive repertoire, we felt that 34 sessions (510 trials) was too long to train such a basic discrimination with so little progress. This led us to re-evaluate our procedure for teaching receptive identification.

Teaching through exclusion may be a more effective method for teaching receptive-identification skills. This method involves teaching one acquisition target in an array with several previously mastered targets (Dixon, 1977; McIlvane et al., 1984; McIlvane et al., 1992; McIlvane & Stoddard, 1985). Therefore, tests 4–6 were conducted using this method.

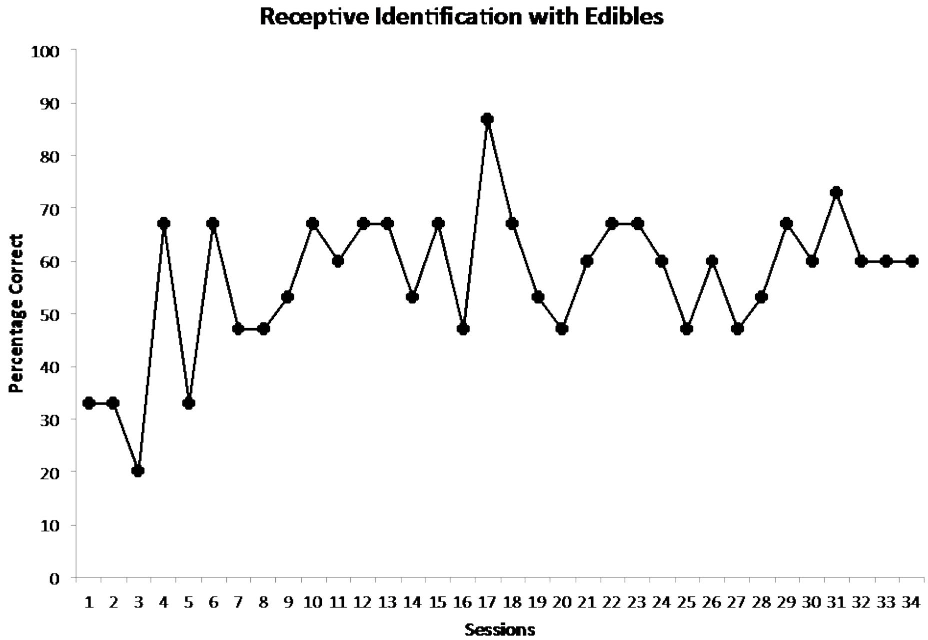

Figure 4. Percentage of correct receptive-identification trials, using edible reinforcers.

Test 4: Receptive identification—Revised (Bell). After analyzing the results from Tests 2 & 3, we revised the receptive-identification task to target one unknown picture and two known pictures at a time (Dixon, 1977; McIlvane, Bass, et al., 1984; McIlvane, Kledaras, et al., 1992; McIlvane & Stoddard, 1985). Our goal was to start over with a neutral stimulus (a bell), so that we could then establish it as a learned reinforcer, using the S^D procedure.

Procedure. The format of this procedure was similar to the format in Test 2. During this test, we presented the presumably neutral auditory stimulus (a bell) contingent on correct responses. Incorrect responses were followed by a brief (1–3 second) time-out, followed by the next trial. We started this experiment with three mastered targets, reinforcing all correct responses with edibles, to demonstrate that these targets were truly mastered. After demonstrating that the targets were mastered, we removed one mastered target from the array and added an unknown target. At this point, we also used the bell rather than edibles. However, Jack mastered that unknown target, suggesting that our presumption that the bell was a neutral stimulus rather than a reinforcer may have been wrong. Therefore, we removed another original, previously mastered target, and added another unknown target. This continued until all three of the original, previously mastered targets had been removed and three previously unknown targets had been taught using only the learned reinforcer.

Results. We started Test 4 with the intent to demonstrate that the bell was not a reinforcer, however, Jack mastered the first two unknown targets quickly and the third in 16 sessions using only the bell as a consequence (see Figure 5). Therefore, it appeared that the bell was already a reinforcer, perhaps an unlearned reinforcer. There was also another, much more complex possibility—namely that Jack selected the untrained target when the other two had already been trained and that simply getting the correct response was a reinforcer (as there was no correction procedure in this test, he wouldn't have been avoiding the correction). In any event, we decided to implement the same procedure using "Nice" and "No."

Test 5: Receptive identification—revised ("nice" & "no")

Procedure. This test was identical to Test 4, except correct responses were followed by approval ("Nice," etc.), and incorrect responses were followed by disapproval ("No," etc.).

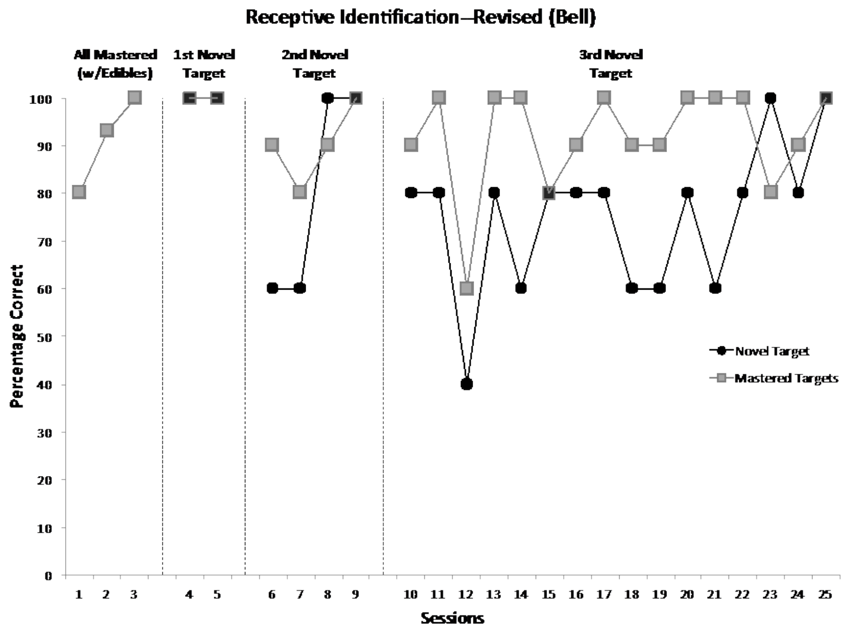

Figure 5. Percentage of correct receptive-identification trials, using a bell as a reinforcer. Circles represent percentage of correct responses to the novel target. Squares represent percentage of correct responses to the mastered targets.

Results. Jack mastered the first unknown target immediately and the second in 10 sessions (in contrast to the four sessions for the second target when using the bell); but after 11 sessions with the third target and no progress, we terminated Test 5 (see Figure 6). These data indicate that the bell was a more effective reinforcer than "Nice," suggesting the S^D procedure was not effective in establishing a sufficiently powerful learned reinforcer.

Test 6: Receptive identification—revised ("Nice" & "Flam"). Another difference between Tests 4 and 5, aside from the consequence for correct responses, is that in Test 5, incorrect responses were followed by "No," rather than nothing, as was the consequence for incorrect responses in Test 4. At this point, we also questioned whether+ "Nice" was really a discriminative stimulus for Jack. In most

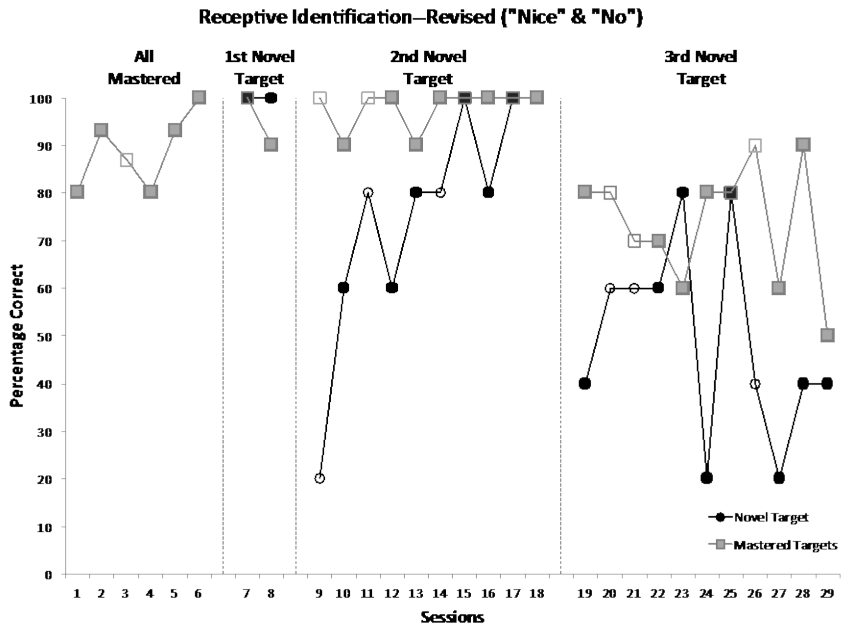

Figure 6. Percentage of correct receptive-identification trials, using approval as a reinforcer. Circles represent the percentage of correct responses to the novel target. Squares represent the percentage of correct responses to the mastered targets. Open data points indicate that an S^D session was conducted immediately before that test session.

contexts, Jack will reach for food if it is present, so we questioned whether "Nice" was actually controlling the reach response in the S^D procedure; perhaps instead, "No" was simply having suppressive effects. Therefore, we replaced "No" with the nonsense word "Flam" to remove the possibility that a previously established suppressive stimulus was responsible for the poor performance in the previous tests.

Procedure. In this test, we conducted an additional receptive identification procedure, this time using the approval statement following correct responses and a nonsense word ("Flam") following incorrect responses. This procedure was identical to the previous procedure, aside from the consequence for the incorrect responses.

Results. Jack mastered the first target after 18 sessions, considerably longer than for the first target in the previous two experiments. We then removed another of the previously mastered targets and added a second unknown target. After 22 sessions of this phase without mastery, we again said "No" following incorrect responses to see if performance would improve. We conducted 10 more sessions of this phase with no improvement before terminating the test (see Figure 7). At this point, we seemed to have lost all stimulus control using these weak consequences.

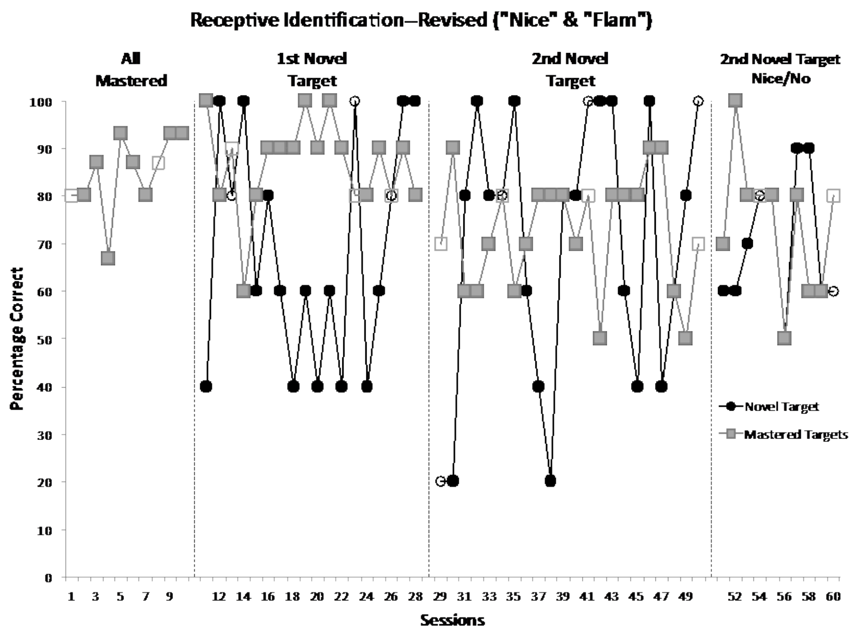

Figure 7. Percentage of correct receptive-identification trials, using "Nice" and "Flam." Circles represent the percentage of correct responses to the novel target. Squares represent the percentage of correct responses to the mastered targets. Open data points indicate that an S^D session was conducted immediately before that test session.

Test 7: Simultaneous discrimination.

Procedure. In the seventh test of reinforcer effectiveness, we conducted a simultaneous-discrimination procedure. In all phases of this test, two items were placed on the desk and no instructions were given. The first phase of this test was a comparison condition. In this phase, a plate and a cup were placed on the desk. If Jack touched the plate, he immediately received a highly preferred edible reinforcer, and if he touched the cup, he received nothing. In the next phase, a toy cow and a toy parrot were placed on the desk. If Jack selected the cow, the experimenter said "Nice." If he selected the parrot, the experimenter said "No." After 16 sessions without a clear discrimination, we started a third phase. In this phase, if Jack selected the parrot, the experimenter said "No" and pointed to the cow until Jack touched the cow, and the experimenter followed with "Nice."

Results. In the first phase, Jack quickly discriminated between the stimulus followed by edibles and the stimulus followed by nothing, selecting the edible stimulus 100% of the time in the third session. However, after 16 sessions of the "Nice" vs. "No" phase, Jack did not reliably select one stimulus more than another. The addition of the error correction in the third phase did not have a significant effect either. This led us to conclude that either "Nice" was not an effective reinforcer, "No" was not an effective punisher, or both (see Figure 8).

Test 8: Expressive identification (tacts). Tests 2–7 attempted to teach a discrimination while requiring Jack to make a selection response. These kinds of tests are ideal because it is possible to teach these discriminations using trial and error, preventing the need for an error correction, which would confound the data. However, tasks requiring a selection response are often less preferred by Jack, or possibly even aversive. This is evidenced by the longer latencies and increased

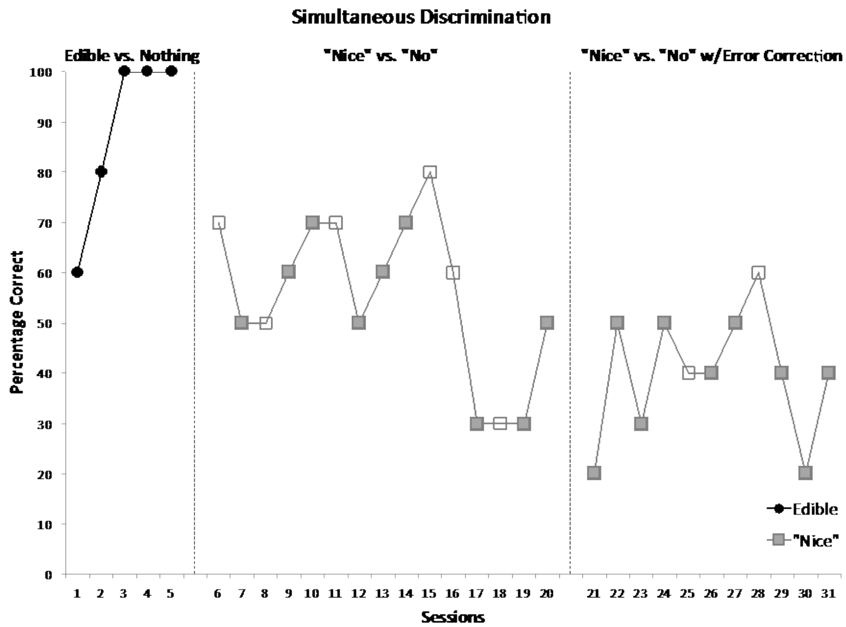

Figure 8. Percentage of simultaneous discrimination selections. Circles represent the percentage of selections of the edible stimulus (plate). Squares represent the percentage of selections of the "Nice" stimulus (cow). Open data points indicate that an S^D session was conducted immediately before that test session.

frequency of off-task behaviors observed by the experimenters and Jack's daily tutors during these tests. For this reason, we also tested the effects of approval on his acquisition of new tacts.

Procedure. This experiment analyzed the teaching of tacts under three conditions: edible, praise, and no consequence. Sets of three pictures were targeted in each condition: one novel, acquisition tact target, and two already mastered tact targets. All three conditions were conducted on the same day, in random order. Other than the consequences and pictures, the procedure was similar in all three conditions, which involved holding up a picture of an item until Jack made a vocal response. Responses were correct if Jack said the name of the item in the picture, and incorrect if he said anything else. Because it is impossible to make a correct response "by chance," an error correction was provided immediately after incorrect responses, across all three conditions. The error correction involved the experimenter modeling the correct response until Jack correctly imitated that response. In the edible condition, correct responses were followed by a highly preferred edible reinforcer, and incorrect responses were followed by the error correction. In the praise condition, correct responses were followed by "Nice," and incorrect responses were followed by "No" and the error correction. In this condition, correct imitation of the experimenter during the error correction was followed by a neutral (no smile or nod, with little inflection) "Nice." In the no consequence condition, the only consequence provided was the error correction following incorrect responses.

Results. In all three conditions, correct responses to the previously mastered targets remained high.[2] In the edible condition, we started by targeting the tact for Bambi. However, Jack was consistently saying "puppy" or "kitty" in the presence of the picture of Bambi. To avoid this conflict, we changed the stimulus to a picture of Chucky, which he mastered in eight sessions. Jack did not meet the mastery criterion for the acquisition targets in the praise or no consequences conditions. However, he scored 80% and 70% respectively in the first session of each condition, showing that some learning had occurred (see Figure 9).

We can draw several conclusions from these data. First, Jack is able to maintain mastered responses for long periods of time regardless of the consequences

[2] It appears there is more variability in the data for mastered targets in the praise condition, but this was due to some interference from Jack's daily programming. A mastered target used in this condition was a ball, and at this time, Jack was learning tacts for snowball and snowflake in his regular program. The errors that he made on the mastered targets during this condition were usually a result of this interference.

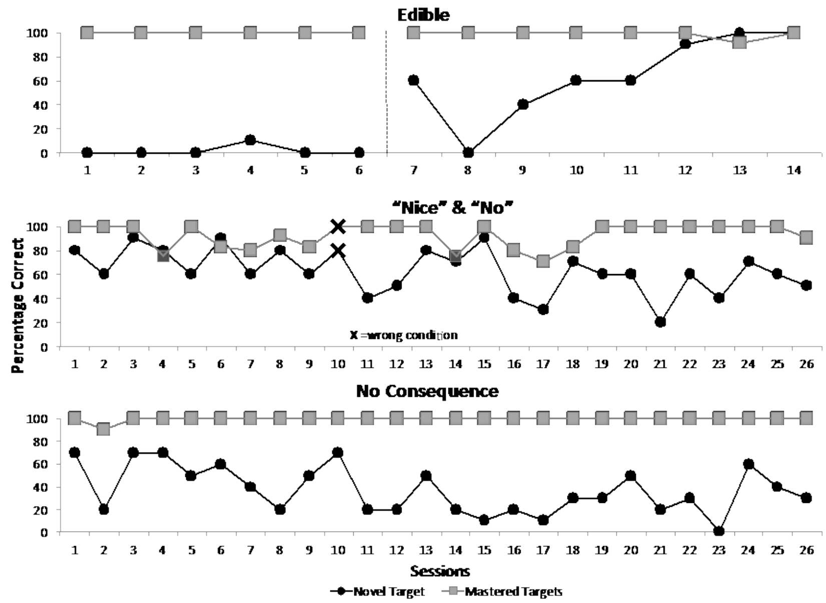

Figure 9. Percentage of correct expressive-identification (tact) trials. Circles represent the percentage of correct responses to the novel target. Squares represent the percentage of correct responses to the mastered targets.

or lack of a consequence. The results from Test 1 also support this conclusion. Second, the high score in the first session of the no consequence condition shows that the error correction must have facilitated some learning. And third, only in the edible condition did he achieve mastery, further showing that edibles are a much more powerful reinforcer for Jack.

Test 9: Free-operant. Much of the previous research in the area of establishing learned reinforcers uses a free-operant task to assess the effectiveness of the newly established learned reinforcer (e.g., Dozier et al., 2012; Holth et al., 2009; Lovaas et al., 1966; Zimmerman & Hanford, 1966). In an attempt to replicate the previous findings, we also implemented a free-operant task.

Procedure. In this experiment, a blue rectangle was placed on the desk in front of Jack. Before the start of each of the first two sessions, he was physically prompted twice to touch the rectangle; and the approval statement was immediately provided after each response. We began the session by starting a timer, set for 3.5 min, as was done by Holth et al. (2009). The approval statement followed all rectangle touches, and all touches were recorded during this time.

Results. Jack touched the rectangle about five times per minute during the first two sessions. After prompts were no longer provided prior to the session, responding dropped below one response per minute. Therefore, we concluded that the approval statement was not powerful enough to maintain much responding, even though Jack had a long history of touching stimuli presented to him (see Figure 10).

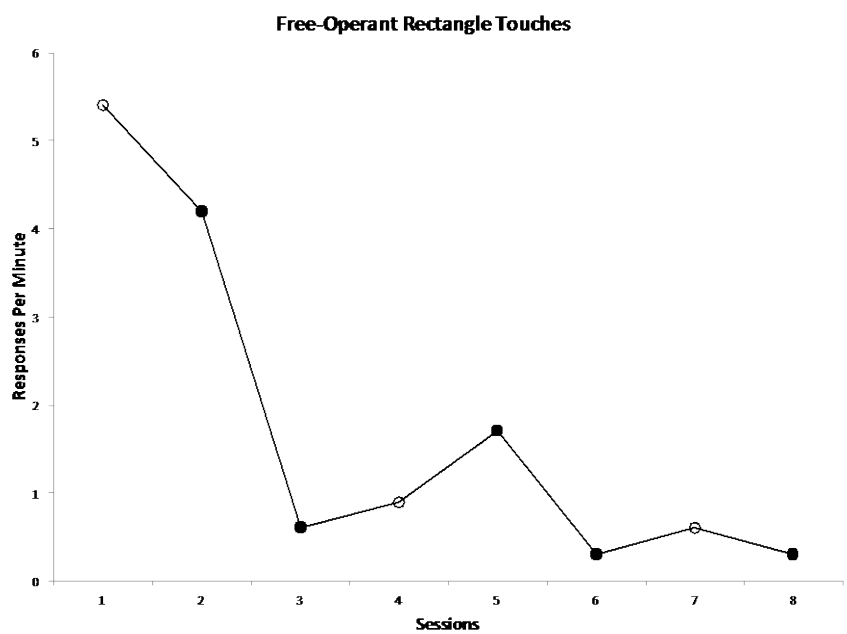

Figure 10. Number of rectangle touches per minute. Open data points indicate that an S^D session was conducted immediately before that test session.

Discussion. The data from the previous nine tests suggest that even though "Nice" had discriminative properties, it did not appear to have become a powerful learned reinforcer for Jack. Because "Nice" is likely a word he has encountered outside of our experimental sessions, it is possible unknown variables that had affected the reinforcing value of "Nice." Therefore, we conducted an S^D procedure using nonsense words in order to exclude the possibility of an unknown behavioral history.

Experiment 2: S^D Procedure with Nonsense Words

After several failed attempts to demonstrate that "Nice" could become a powerful learned reinforcer for Jack, we conducted the S^D procedure using nonsense words that Jack was not familiar with and would not come into contact with outside of our sessions. Once again, edibles were used to reinforce responses in the presence of the discriminative stimulus (the nonsense word).

Baseline. We collected baseline data on a simultaneous discrimination task before implementing the S^D procedure.[3] In this task, we placed two items on the desk, a toy koala and a toy lizard. When Jack touched the koala, the experimenter said "Zig," and when he touched the lizard, the experimenter said "Vex." Jack selected the "Vex" stimulus most frequently during baseline, so "Zig" was selected as the S^D to be used in the S^D procedure.

Intervention. This procedure was similar to the original S^D procedure, but with several modifications, after Jack failed to learn the discrimination. During the

[3] We conducted two tests of reinforcer effectiveness in Experiment 2, but because one of them was not an effective test, it will be described in Appendix C.

first 20 sessions, most of Jack's reach responses on S^D trials were prompted, so we stopped providing prompts when he did not respond to the discriminative stimulus. His responses did increase at this point, but they increased across both the S^D and S^Δ trials, demonstrating that he was still not discriminating between the S^D and S^Δ. Therefore, we first attempted to train the discrimination for a different response (hand out). Jack learned this new response very quickly, but he again was responding on both the S^D and S^Δ trials. Finally, we removed the vocal S^Δ ("Vex") and focused on the discrimination between the vocal S^D ("Zig") and the non-vocal S^Δ (absence of "Zig"). This time, Jack successfully learned the discrimination. We conducted this discrimination procedure using the reach response for six sessions. After that, we conducted three sessions using the hand-out response, and Jack again did very well. We then switched back to the reach response for three final sessions, and again, Jack was successful (see Figure 11).

Results. In the simultaneous-discrimination task following the S^D procedure, Jack reliably selected the "Zig" consequated stimulus (koala) more frequently than the "Vex" consequated stimulus (lizard), for eight sessions (Figure 12, Session 6-13). After that eighth simultaneous-discrimination session, we changed the S^D procedure from a reach response to Jack holding out his hand[4] (Figure 11, Session 75-77), and Jack's responding in the simultaneous-discrimination procedure became much more variable (Figure 12, Session 14-20). We switched back to the reach response in the S^D

[4] We were interested to see if Jack would make the discriminated response during the tests of reinforcer effectiveness following the S^D. Because there were no reinforcers on the table during the tests, he could not make the reach response. Thus, we made a change to the hand-out response.

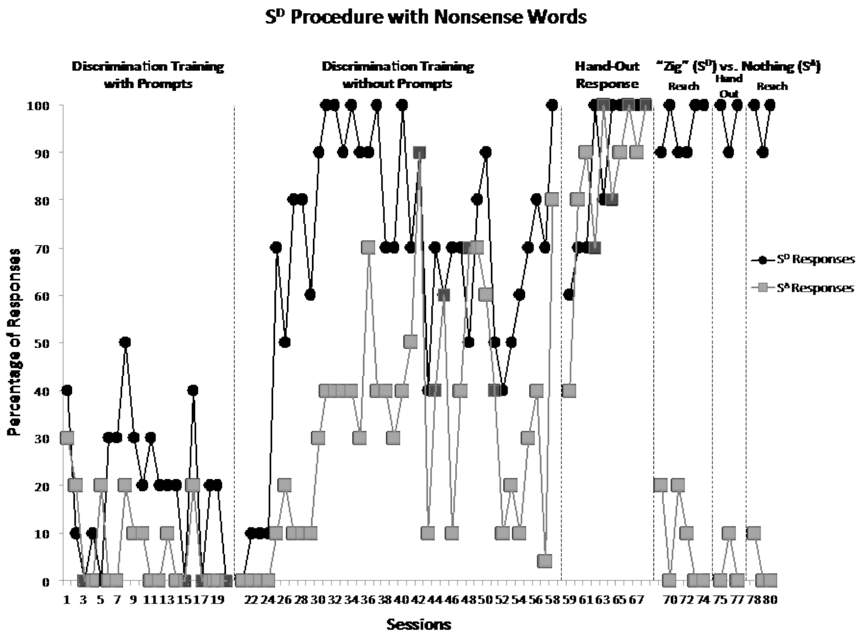

Figure 11. Percentage of reaches or hand-out responses. Circles represent the percentage of responses following the S^D. Squares represent the percentage of responses following the S^Δ.

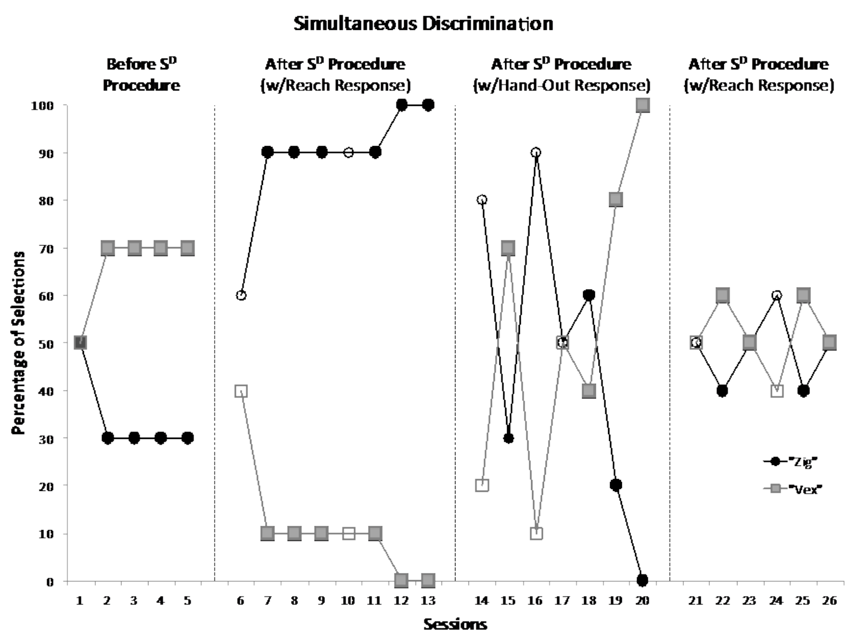

Figure 12. Percentage of "Zig" and "Vex" stimulus selections. Circles represent the percentage of selections of the "Zig" stimulus. Squares represent the percentage of selections of the "Vex" stimulus. Open data points indicate that an S^D session was conducted immediately before that test session.

procedure to see if the change in the S^D procedure was causing the change in performance during the simultaneous discrimination (Figure 11, Session 78-80). We conducted six additional sessions of the simultaneous discrimination after switching back to the reach response but were not able to re-establish the previous discrimination (Figure 12, Session 21-26). Therefore, the S^D procedure was effective in establishing “Zig” as a learned reinforcer, but “Zig” did not maintain its reinforcing value, though we continued to conduct S^D sessions during this test.

Discussion. The results of experiment 2 suggest that the S^D procedure may be an effective method for establishing a learned reinforcer, but those effects may be somewhat transient, at least for Jack. Because there may have been interference in the simultaneous-discrimination task from the changes in the S^D procedure (changing from the reach response to the hand-out response), we conducted a brief replication of this experiment, again using nonsense words.

Experiment 2a: S^D Procedure with Nonsense Words—Replication

Baseline. We collected baseline data on a simultaneous-discrimination task before implementing the S^D procedure. In this task, we placed two toys on the desk, a mouse and a dinosaur. When Jack touched the mouse, the experimenter said “Mog,” and when he touched the dinosaur, the experimenter said “Clar.” Jack selected the “Clar” stimulus (dinosaur) most frequently during baseline, so “Mog” was selected as the S^D to be used in the S^D procedure.

Intervention. In this procedure, “Mog” was the S^D in the presence of which Jack could hold out his hand, which would be reinforced with an edible. The absence of “Mog” was the S^{Δ} in the presence of which hand-out responses were not reinforced. Jack discriminated between the verbal S^D and the nonverbal S^{Δ} from the first session (see Figure 13).

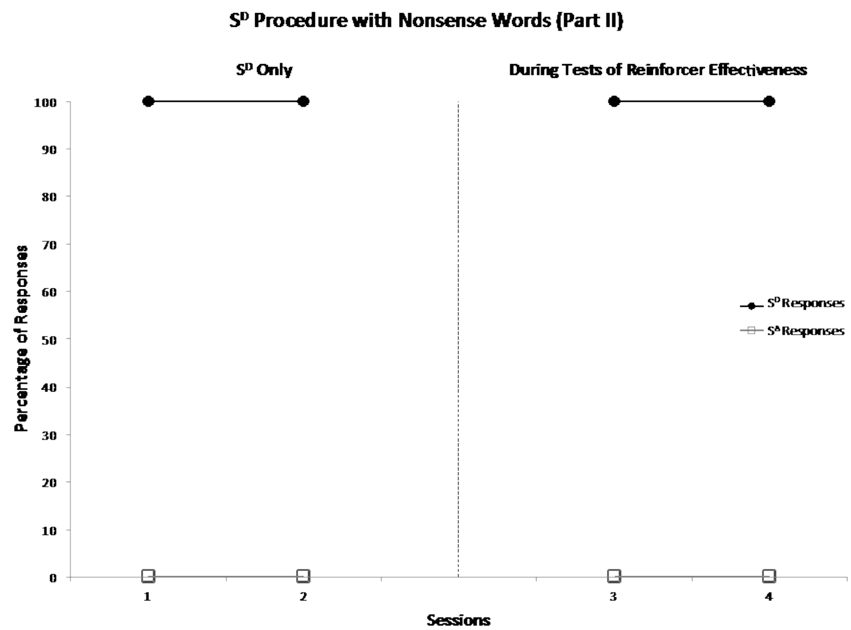

Figure 13. Percentage of hand-out responses. Circles represent the percentage of responses following the S^D (“Mog”). Squares represent the percentage of responses following the S^{Δ} (“Clar”).

Results. Jack selected the “Clar” stimulus more frequently than the “Mog” stimulus both before and after “Mog” was established as an S^D, demonstrating that the S^D procedure had no effect on his selections in this task (see Figure 14).

Discussion. Experiment 2a further demonstrates that the S^D procedure was not effective in establishing a powerful learned reinforcer. Because it was our goal to create a strong, learned reinforcer for Jack, we next explored another method for creating learned reinforcers.

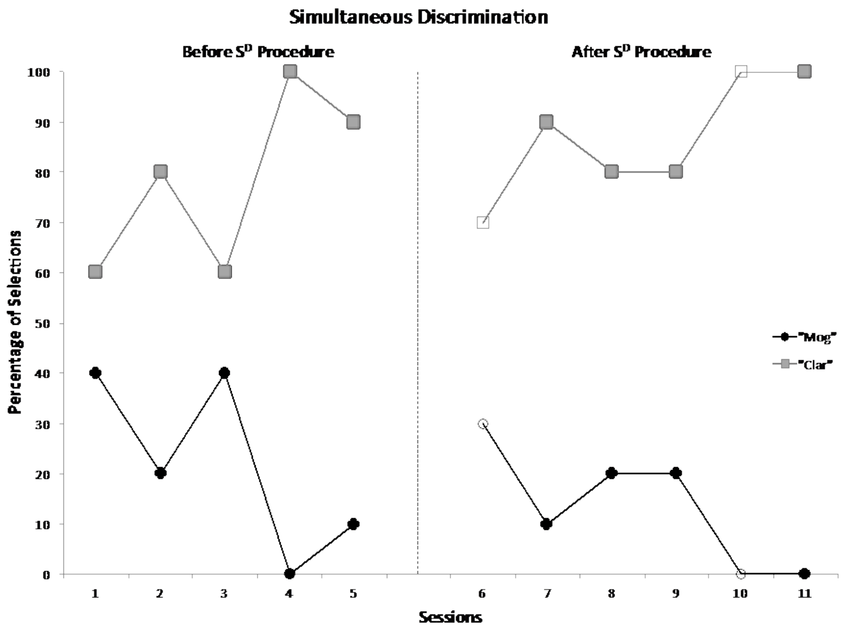

Figure 14. Percentage of "Mog" and "Clar" stimulus selections. Circles represent the percentage of selections of the "Mog" stimulus. Squares represent the percentage of selections of the "Clar" stimulus. Open data points indicate that an S^D session was conducted immediately before that test session.

Experiment 3: Response-Contingent Pairing

After little success establishing a durable learned reinforcer using the S^D procedure, we explored a method described by Dozier et al. (2012). They found that response-contingent pairings (pairing the neutral stimulus with a reinforcer immediately following a response) effectively established praise as a learned reinforcer for four of their eight participants. Unlike Dozier et al. (2012), who conducted all pairings contingent on a free-operant response, we attempted this method in a simultaneous-discrimination format.

Procedure. First, we placed a block and a toy airplane on the desk. When Jack touched the block, the experimenter said "Nice," and immediately gave Jack an edible reinforcer. When he touched the toy airplane, the experimenter only said "No."

Following each trial, the experimenter removed the items from the desk, starting the next trial shortly after. After this discrimination had been learned, we conducted a discrimination reversal. This time, when Jack touched the airplane, the experimenter said “Nice,” and presented the edible. When Jack touched the block, the experimenter said “No.” After this discrimination was learned, we placed two new stimuli, a chair and a pretzel, on the desk. When Jack touched the chair, the experimenter said “Nice,” and when he touched the pretzel, the experimenter said “No.” Edibles did not follow any responses in this phase, as the goal was to establish a new discrimination using approval and disapproval alone.

Results. Jack learned all discriminations very quickly, both during the pairing phase, and again during the discrimination reversal. When we attempted the new discrimination using praise-only, Jack again learned the discrimination quickly. We did a discrimination reversal in the test phase, and he again learned that discrimination quickly, maintaining it for seven sessions (see Figure 15).

Discussion. The response-contingent pairings may be an effective procedure for establishing a learned reinforcer. However, Jack had had a long history with the words “Nice” and “No.” Therefore, we attempted to replicate these findings using unfamiliar words, to evaluate whether this procedure was responsible for the change in the value of “Nice,” or if something else within Jack’s history or current environment was having an effect.[5]

---

[5] Before moving to Experiment 4, we attempted another receptive-identification procedure using “Nice” and “No” but stopped after three sessions with high rates of problem behavior and very low attending. See Appendix D for the data from those three sessions.

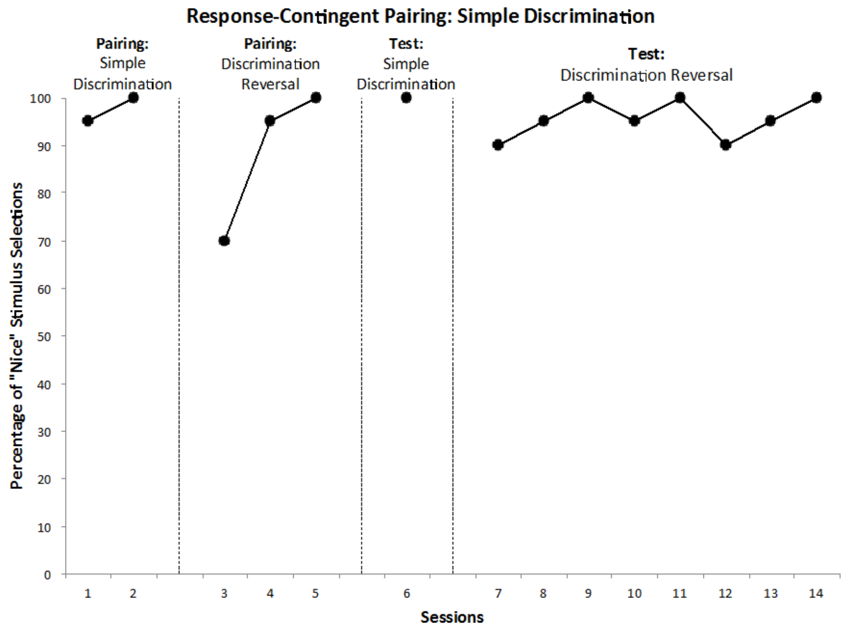

Figure 15. Percentage of "Nice" stimulus selections.

Experiment 4: Response-Contingent Pairing with Nonsense Words

Procedure. This procedure was identical to Experiment 3, using nonsense words and the training of a simultaneous-discrimination with a plastic star and a plastic stick figure. During the first phase, touching the star was followed by the word "Jeb" paired with an edible reinforcer, and touching the stick figure was followed by the word "Wog" paired with nothing. After mastering this discrimination while doing the pairing, we conducted a discrimination reversal while continuing the pairing of "Jeb" with edibles. After these four pairing sessions, we presented two new stimuli, a toy banana and toy grapes and attempted to establish a new discrimination using only the nonsense words, without continuing the pairing with edibles.

Results. Jack learned the new discrimination and the discrimination reversal during the pairing phase almost immediately. However, when we tried to establish a new discrimination using only the nonsense words with no further edible pairing, Jack did not reliably select one stimulus over the other, suggesting that this procedure may not have been as effective as it had appeared in the previous experiment, Experiment 3, with “Nice” and “No.” (see Figure 16).

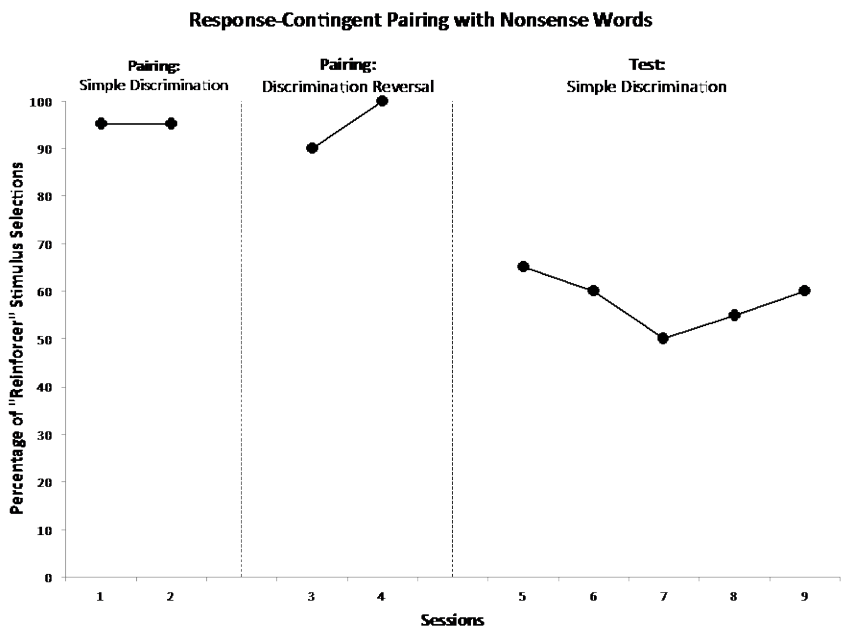

Figure 16. Percentage of “Reinforcer” stimulus selections.

Discussion. It appears that our success in Experiment 3 may not have been a result of the response-contingent pairing procedure. However, this was not an exact replication of the Dozier et al. (2012) procedure, so our next experiment more closely replicated their study.

Experiment 5: Dozier et al. (2012) Replication

The previous two experiments involved response-contingent pairing in a simultaneous discrimination format. However, Dozier et al. (2012) conducted all pairings contingent on a simple, non-discriminated, free-operant response. Therefore, in this experiment, we also conducted pairings contingent only on a free-operant response.

Procedure. Before each session, the experimenter twice prompted Jack to touch a square on the wall, and when he did, the phase-specific consequence was provided. During the first baseline phase, all square touches were followed by no consequences. In the second baseline phase, all square touches were followed by the nonsense word, “Chab.” During the pairing phase, all square touches were followed by “Chab” and a piece of candy. The test phase was identical to the second baseline phase, where all square touches were followed only by “Chab.”

Results. In both of the baseline phases, Jack made an average of less than one response per minute, suggesting that the response was not automatically reinforcing and the word “Chab” was not a reinforcer. During the pairing phase, his responding increased at a steady rate, with a mean of 14.3 responses per minute in the last six sessions. In the test phase, all responses were followed only by the word “Chab.” He averaged about 16.6 responses per minute during the first six sessions. During the seventh session, he made 72.3 responses per min. For most of these responses in the seventh session, he rested his wrist on the wall near the square and tapped it quickly with his fingers while never moving his wrist. He responded so quickly that it became difficult to follow each tap with “Chab.” After the seventh test session, we redefined the response. Now, “Chab” only followed each instance that Jack lifted his hand to touch the square. If he kept his hand at the wall and tapped the square repeatedly without bringing his hand down, the experimenter said “Chab” following only the first tap. We continued testing with this newly defined response for 12 more sessions. Jack averaged 3.4 responses per minute during this final phase, making zero responses in the last two sessions (see Figure 17). These data suggest that the response-contingent pairing of “Chab” and candy caused “Chab” to be an effective but fragile learned reinforcer whose reinforcing value did not maintain. These findings are not surprising, considering that the pairing of “Chab” with edibles was no longer occurring.

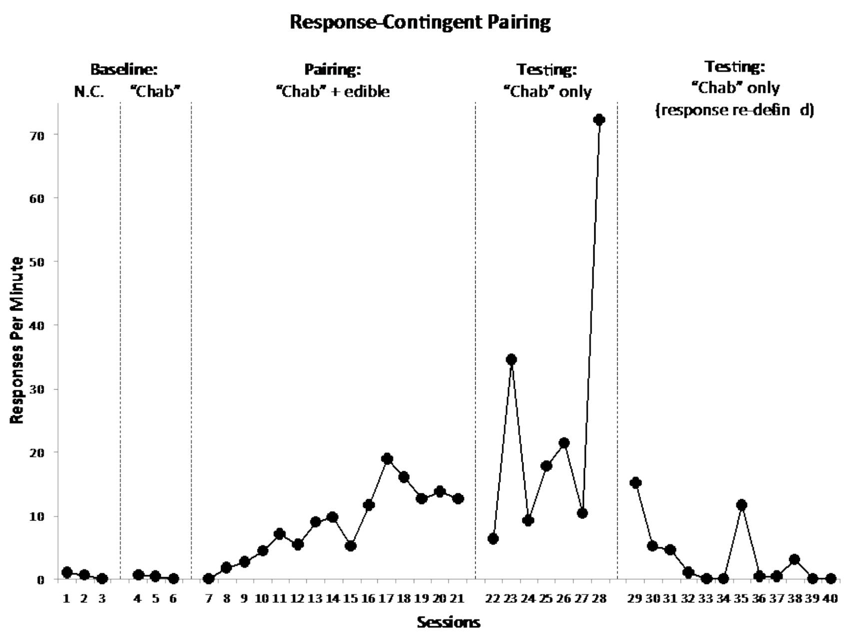

Figure 17. Rate of square touches per minute.

Discussion. Pairings conducted contingent on a free-operant response can establish a learned reinforcer that will then maintain that same free-operant response on its own; however within a few sessions, the learned reinforcer had lost most of its value, perhaps because the pairing was no longer being conducted. The next experiment attempted to rectify this issue.

Experiment 6: Dozier et al. (2012), Revised

In this experiment, we conducted the pairing contingent on one response, while testing the reinforcing effects on another response. This might more closely approximate how learned reinforcers maintain their value in our natural environment.

Procedure. This was similar to Experiment 5, except it involved two free-operant responses. We conducted two baseline phases for each response, as we had done in the previous experiment, one with no consequences following all responses, and one with the novel word "Bon" following all responses. After both baselines, we conducted the pairing contingent on the first response (running his finger along a line on the table), and we conducted the testing on the second response (flipping a card over). This way, we were able to assess the rate of responding on one response while continuing the pairing following the other response.

Results. In the first baseline phase, Jack made an average of 0.5 responses per minute. In the second baseline phase, he made an average of 1.8 responses per minute. These data suggest that the responses themselves were not automatically reinforcing and the word "Bon" was not a reinforcer. The responses in the pairing sessions averaged 10.6 responses per minute, ranging between 8.9 and 14.9 responses per minute. Test sessions averaged 9.1 responses per minute, ranging between 1.7 and 30.6 responses per minute (see Figure 18).

Discussion. These data suggest that this modified version of the Dozier et al. (2012) procedure was effective both in establishing and maintaining an effective learned reinforcer.

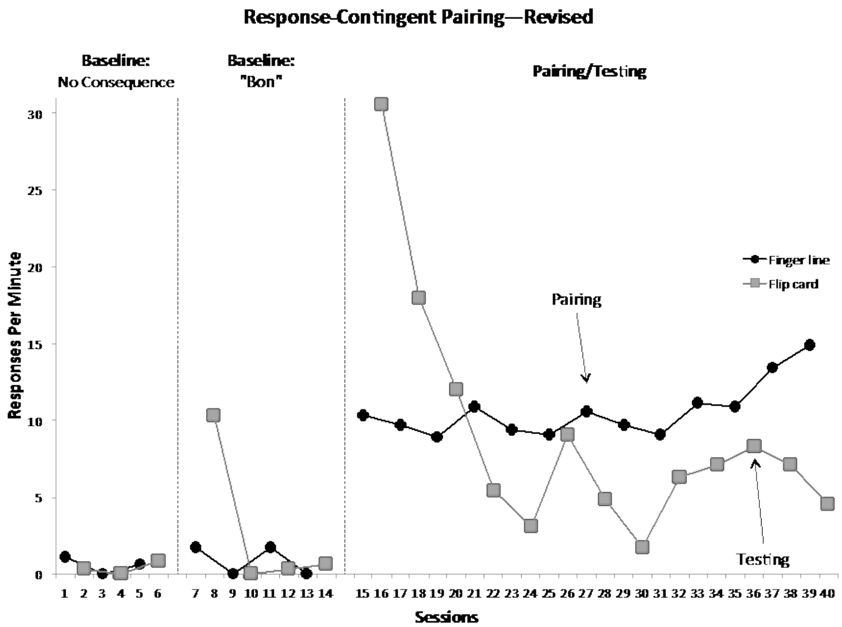

Figure 18. Rate of card flip and finger line responses. Circles represent the rate of finger-line responses per minute. Squares represent the rate of card-flip responses per minute.

General Discussion

This study evaluated two methods for establishing a learned reinforcer for a child with autism, Jack. The first method, the S^D procedure, involved establishing approval as a discriminative stimulus, so that it would also become a learned reinforcer. The second method, the response-contingent pairing procedure, involved pairing approval with an unlearned reinforcer immediately following a response, also so that it would become a learned reinforcer. For Jack, the response-contingent pairing procedure was more effective in establishing a learned reinforcer. In contrast to Dozier, et al. (2012), the response did not maintain for long when the pairing was discontinued. We modified the response-contingent pairing procedure so that one response was still followed by the pairing and another response was followed only by the formerly neutral stimulus. This modified version of the response-contingent pairing procedure was more effective in maintaining these reinforcing effects, and may more closely approximate how learned reinforcers are established and maintained in the natural environment. It is worth noting that even though we were able to establish an effective learned reinforcer, that learned reinforcer sustained responding at a slightly lower and more variable rate than the unlearned reinforcer. It is also worth noting that we did not assess more difficult skills following the response-contingent pairing procedure, as we had done following the S^D procedure. At this point in the study, receptive-identification procedures seemed to have become very aversive for Jack, as indicated by his increased off-task and inappropriate behaviors and increased latencies to respond. For these reasons, we chose not to further assess the value of the learned reinforcers using this format.

Future research may benefit from assessing the value of a learned reinforcer in more than a free-operant context, such as a simultaneous-discrimination or a receptive-identification (conditional discrimination) task. Much of the research on this topic only uses a free-operant task to assess for reinforcer effectiveness, some only conducting one free-operant session (e.g., Holth et al., 2009). While a free-operant task is a good start, it is also a much easier task than often required of a child in a typical discrete-trial program. It is important to know whether the reinforcing value of these learned reinforcers are strong enough so the child can acquire and maintain some of the more difficult skills that are often targeted in discrete-trial programs. It would also be interesting to know how a typically-developing child would perform in a discrete-trial setting using only social reinforcers.

This was a case study using only one child and will need to be replicated with other children, which is currently in progress. Also, we generally followed a practitioner model where our primary goal was for Jack to benefit directly from participating in the study (Malott et al., 2011). Therefore, we originally used the words “Nice” and “No,” though it is very likely that Jack had encountered these words outside the experimental sessions, so it is difficult to determine the extent to which his history with them affected the data. However, one would probably expect that this confound would have resulted in a much more effective learned reinforcer and learned aversive condition than was obtained. Furthermore, we replaced “Nice” and “No” with the nonsense words “Zig” and “Vex,” thus eliminating that confound.

This study demonstrates that the establishment of a learned reinforcer may be more difficult than the literature on the topic suggests. Future research could benefit from further exploring these and other methods for establishing effective learned reinforcers.

REFERENCES

Cooper, J. O., Heron, T. E., & Heward, W. L. (Eds.). (2007). *Applied behavior analysis* (2nd ed.). Upper Saddle River, NJ: Pearson.

Dinsmoor, J. (1950). A quantitative comparison of the discriminative and reinforcing functions of a stimulus. *Journal of Experimental Psychology, 40*(4), 458–472.

Dixon, L. S. (1977). The nature of control by spoken words over visual stimulus selection. *Journal of the Experimental Analysis of Behavior, 27,* 433–442.

Dozier, C. L., Iwata, B. A., Thompson-Sassi, J., Worsdell, A. S., & Wilson, D. M. (2012). A comparison of two pairing procedures to establish praise as a reinforcer. *Journal of Applied Behavior Analysis, 45,* 721–735.

Ferster, C. B. (1961). Positive reinforcement and behavioral deficits of autistic children. *Child Development, 32,* 437–456.

Greer, R. D., & Ross, D. E. (2008). *Verbal behavior analysis: Inducing and expanding complex communication in children with severe language delays*. Boston, MA: Allyn & Bacon.

Greer, R. D., & Singer-Dudek, J. (2008). The emergence of conditioned reinforcement from observation. *Journal of the Experimental Analysis of Behavior, 89,* 15–29.

Holth, P., Vandbakk, M., Finstad, J., Gronnerud, E. M., & Sorensen, J. M. A. (2009). An operant analysis of joint attention and the establishment of conditioned social reinforcers. *European Journal of Behavior Analysis, 10,* 143–158.

Kelleher, R. T., & Gollub, L. R. (1962). A review of positive conditioned reinforcement. *Journal of the Experimental Analysis of Behavior, 5,* 543–597.

Lovaas, O. I., Freitag, G., Kinder, M. I., Rubenstein, B. D., Schaeffer, B., & Simmons, J. Q. (1966). Establishment of social reinforcers in two schizophrenic children on the basis of food. *Journal of Experimental Child Psychology, 4,* 109–125.

Malott, R. W., & Shane, J. T. (2013). *Principles of behavior* (7th ed.). Upper Saddle River, NJ: Pearson.

Malott, R. W., Fronapfel-Sonderegger, B., Perry, K., Shane, J., Stone, K., & Korneder, J. (2011, January). *A practitioner model for undergraduate and graduate training in autism.* Paper presented at the Association for Behavior Analysis Fifth Annual Autism Conference, Washington, DC.

McIlvane, W. J., Bass, R. W., O'Brien, J. M., Gerovac, B. J., & Stoddard, L. T. (1984). Spoken and signed names of foods after receptive exclusion training in severe retardation. *Applied Research in Mental Retardation, 5,* 1–27.

McIlvane, W. J., Kledaras, J. B., Lowry, M. J., Stoddard, L. T. (1992). Studies of exclusion in individuals with severe mental retardation. *Research in Developmental Disabilities, 13,* 509–532.

McIlvane, W. J., & Stoddard, L. T. (1985). Complex stimulus relations and exclusion in severe mental retardation. *Analysis and Intervention in Developmental Disabilities, 5,* 307–321.

Skinner, B. F. (1968). Technology of teaching. New York, NY: Appleton-Century-Crofts.

Sundberg, M. L. (2008). *VB-MAPP: Verbal behavior milestones assessment and placement program.* Concord, CA: AVB Press.

Theobold, D. E., & Paul, G. E. (1976). Reinforcing value of praise for chronic mental patients as a function of historical pairing with tangible reinforcers. *Behavior Therapy, 7,* 192–197.

Zimmerman, J., & Hanford, P. V. (1966). Sustaining behavior with conditioned reinforcement as the only response-produced consequence. *Psychological Reports, 19,* 391–401.

Appendix A

Chronological Timeline of Experiments/Tests

Chronological Timeline of Experiments/Tests

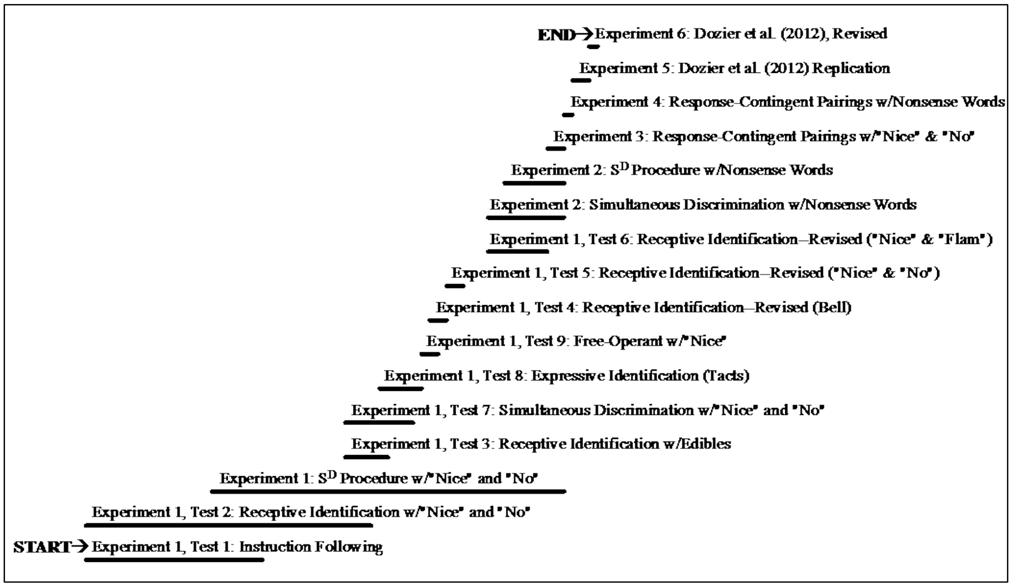

Figure A1. Chronological timeline of experiments and tests.

Appendix B

Experiment 1, Test 1: Accuracy Data

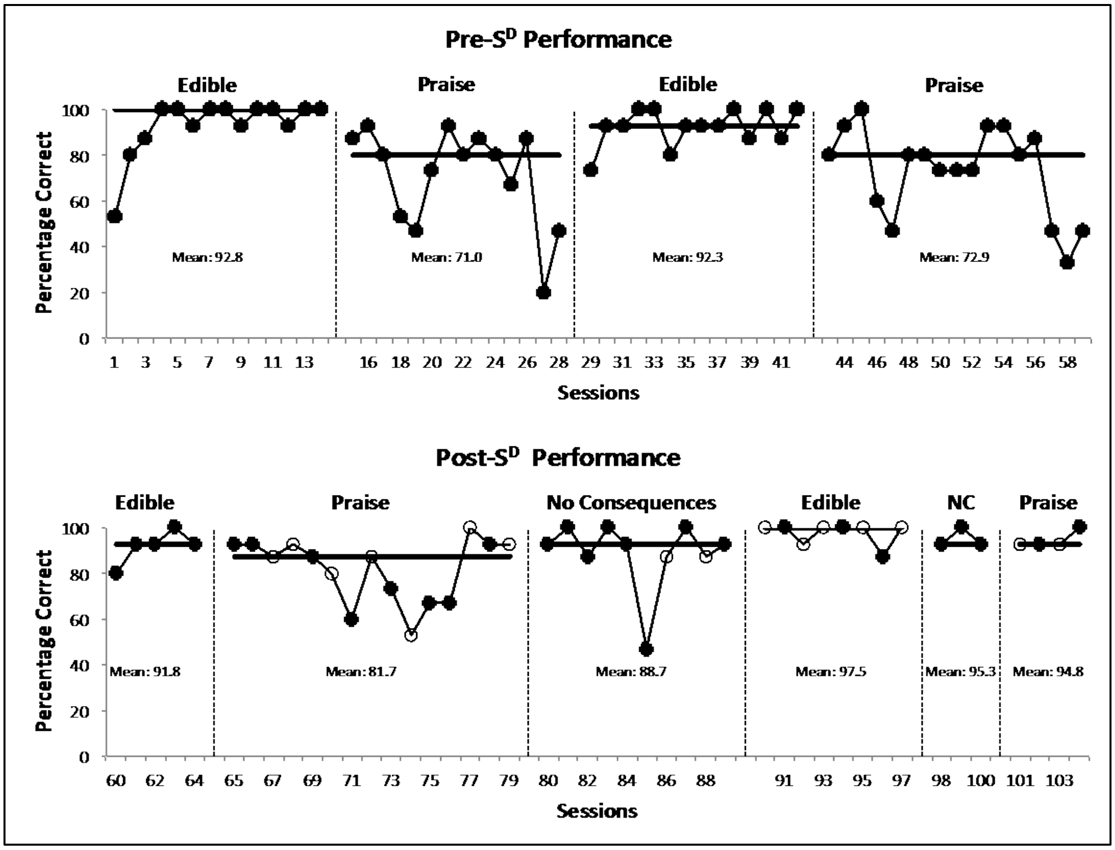

Figure B1. Accuracy of responding. Horizontal lines indicate the median percentage of correct responses for each phase. Open data points indicate that an S^D session was conducted immediately before that test session.

Appendix C

Experiment 2, Free-Operant Test

Experiment 2, Free-Operant Test

In addition to the simultaneous-discrimination task, we tested the S^D from Experiment 2 in a free-operant context. In this test, we used two responses that Jack could easily emit—tapping the wall and tapping his head. Before each session, the experimenter twice prompted Jack to make the response, and when he did, the response-specific consequence was provided.

Baseline. During baseline, we alternated between three "Zig" and three "Vex" sessions. The experimenter said, "Zig" following all wall touches and "Vex" following all head touches. Jack made no responses in baseline.

Results. Following the S^D procedure using "Zig" as the S^D, we conducted two sessions of free-operant wall taps. Jack once again made no responses. To assess the validity of this test, we conducted two additional free-operant wall-tap sessions. This time, an edible reinforcer followed all wall taps. Jack still made no responses, suggesting that this was not an effective test.

Appendix D

Experiment 3, Receptive Identification

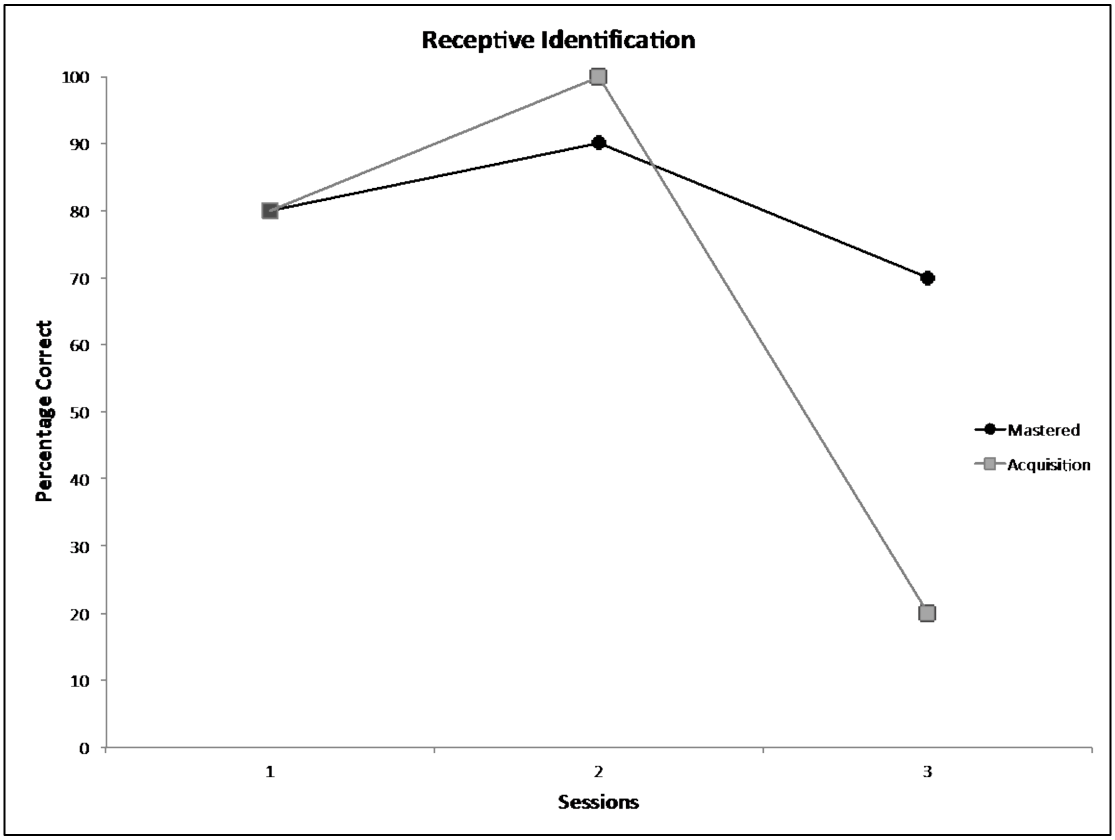

Figure D1. Percentage of correct receptive-identification responses. Circles represent the percentage of correct mastered responses. Squares represent the percentage of responses correct acquisition responses.

Appendix E

HSIRB Approval

WESTERN MICHIGAN UNIVERSITY

Human Subjects Institutional Review Board

Date: October 7, 2013

To: Richard Malott, Principal Investigator
Kelly Kohler, Student Investigator for dissertation
Jennifer Freeman, Student Investigator for thesis

From: Amy Naugle, Ph.D., Chair

Re: HSIRB Project Number 13-10-04

This letter will serve as confirmation that your research project titled "Establishing Approval and Disapproval as Learned Reinforcers and Aversive Conditions" has been **approved** under the **exempt** category of review by the Human Subjects Institutional Review Board. The conditions and duration of this approval are specified in the Policies of Western Michigan University. You may now begin to implement the research as described in the application.

Please note: This research may **only** be conducted exactly in the form it was approved. You must seek specific board approval for any changes in this project (e.g., ***you must request a post approval change to enroll subjects beyond the number stated in your application under "Number of subjects you want to complete the study***)." Failure to obtain approval for changes will result in a protocol deviation. In addition, if there are any unanticipated adverse reactions or unanticipated events associated with the conduct of this research, you should immediately suspend the project and contact the Chair of the HSIRB for consultation.

Reapproval of the project is required if it extends beyond the termination date stated below.

The Board wishes you success in the pursuit of your research goals.

Approval Termination: October 7, 2014

251 W. Walwood Hall, Kalamazoo, MI 49008-5456
PHONE: (269) 387-8293 FAX: (269) 387-8276