

January 01, 2009

Acquisition when reinforcement is delayed

Stefanie Fillers
Northeastern University

Recommended Citation

Fillers, Stefanie, "Acquisition when reinforcement is delayed" (2009). *Counseling Psychology Master's Theses*. Paper 2.
<http://hdl.handle.net/2047/d1001844x>

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Acquisition when reinforcement is delayed

A Thesis Presented

By

Stefanie Fillers

The Department of Counseling and Applied Educational Psychology

In partial requirements

For the degree of

Master of Science

In the field of

Applied Behavior Analysis

Northeastern University

Boston, Massachusetts

April 2009

Acknowledgements

The author would like to thank her thesis committee, Drs. Karen Gould, Hanna Rue, and Jennifer Silber for their assistance with the experimental design and manuscript writing. Additional thanks goes to research chairperson Dr. Gould for her assistance and insight during all stages of this project.

A special thanks to Dr. Hanna Rue, for her constant encouragement, inspiration, and dedication to demonstrating what behavior analysis is all about.

Also, a thank-you to Dr. Jennifer Bass, Shannon Garvey, and Katie Whalley for dedicating their time to this project.

Dedicated to Dr. Myrna Libby.

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Abstract

The purpose of the present study was to compare the effects of two types of markers during delays to reinforcement. The participants were two male adolescents with autism. During a pretest, the participants were asked to label pictures showing specific actions. Twelve action pictures were identified that the participants could not correctly label. Correct labeling was then taught in a delayed reinforcement paradigm in which reinforcement for correct responding was delayed by 5 secs. Within in this paradigm, the participants were exposed to 3 conditions.: clicker, correct, and control. Four different actions were associated with each condition. During the clicker condition, a clicker was sounded immediately upon the participant making a correct selection. Similarly, during the correct condition, the experimenter neutrally stated “correct” immediately following the participant’s correct response. The control condition had no immediate consequence following correct selections. For all three conditions, edible reinforcement was presented after a 5s delay. Results indicated that acquisition occurred fastest in the “correct” condition for both participants. Suggestions for future research are discussed.

Research has long indicated that delays to reinforcement can influence how quickly an individual acquires a skill. Delays can be detrimental to learning because multiple responses can occur before reinforcement is provided, and responses other than the target response could be reinforced. For this reason, Cooper, Heron, and Heward (2007) state that a reinforcer is most effective if it is presented immediately following a response. Even short delays have been shown to affect the potency of a reinforcer. Some studies have even reported that delays of 10 seconds may prevent acquisition all together

For example, Grice (1948) evaluated the acquisition rates during six different delay to reinforcement conditions. The conditions were no delay, and .5s, 1.2s, 2s, 5s, and 10s delays. To compare the delays, Grice trained rats to complete discrimination tasks and recorded the number of trials it took for the subject to meet the criterion of 18/20 trials correct. The results indicated that no delay to reinforcement resulted in the lowest number of trials to criterion, with a median of 20 trials. The .5s delay group's median number of trials was 95; 1.2s delay group's median was 200 trials, 2s delay group's median was 290 trials, and 5s delay group's median was 580 trials. No median was available for the 10s group due to 3 subjects failing to meet the mastery criterion within 1440 trials. For most participants, the .5s delay resulted in almost five times the number of training trials compared to the no delay condition. Additionally, learning the discrimination task was nearly impossible for three of the five subjects in the 10s delay condition.

Both basic and applied research have evaluated methods to reduce the impact of delays to reinforcement. For example, signals during delay intervals are a popular technique used to bridge the gap to the primary reinforcer. Several studies suggest that signals, such as lights and tones, are effective because of their association with the primary reinforcer, which may be the result of

conditioned reinforcement (Williams, 1991b; Grindle & Remington, 2002). A conditioned reinforcer is a previously neutral stimulus that acquires reinforcing properties through pairings with a primary or another conditioned reinforcer (Cooper et. al, 2007). After repeated pairings, conditioned reinforcers can function as reinforcers, even when the other reinforcer is not present.

Some basic research has focused on which types of signals are most effective at maintaining acquisition rates during delay conditions. Williams (1991b), for example, compared acquisition rates of discrimination skills across 4 different types of signals: conditioned reinforcement, brief conditioned reinforcement, marking, and bridging. In the conditioned reinforcement condition, a continuous tone was presented after correct responses until the reinforcer was provided, and no tone was provided for incorrect responses. In the brief conditioned reinforcement condition, a 1s tone occurred immediately after correct responses, and no tone occurred for incorrect responses. In the marking condition, a 1s tone occurred immediately following correct and incorrect responses. In the bridging condition, a continuous tone occurred during the delay interval for both correct and incorrect responses. Additionally, a no signal condition was used as a control. Results indicated that acquisition occurred the fastest in the conditioned reinforcement and brief conditioned reinforcement conditions, relative to the no signal, bridging, and marking conditions.

Applied research has also considered different methods to bridge a delay to reinforcement. Everyday conditions can lead to delays in reinforcement. In the classroom setting, delays can be due to marking data, obtaining the reinforcer, or other distractions in the environment. Using concepts from basic research, educators often use conditioned reinforcers to maintain responding when reinforcement is not immediately available. Conditioned reinforcers in these types of setting are often in the form of stickers, tokens, or verbal praise.

In 2002, Grindle and Remington conducted a study to compare cue value and response marking procedures. In the cue-value condition a cue follows only the to correct and independent responses. In the response marking condition, the same cue follows correct and incorrect responses (which means that any marking effect is independent of cue value). In an alternating treatments design, the effects of training receptive labels to three children with autism using cue value and response marking were compared. In the cue-value condition, the 1s compound stimulus (i.e., red light/tone) was presented twice following each correct response, once immediately and once after a 5s delay with the presentation of an edible reinforcer. In the response marking condition, a 1s compound stimulus (i.e., green light/buzzer) was presented immediately after both correct and incorrect responses but not after the 5s delay with edible reinforcement. Results indicated that all participants learned the first 3 receptive labels in the cue value-condition faster than the response marking condition. This study extends animal research (Williams, 1991b), which indicated that while acquisition occurred in both conditions, cue value was faster teaching the skill.

Grindle and Remington (2005) conducted a similar study comparing marking before a response to marking after a response using social cues. The participants in the study were three children with autism with no history of discrete trial training. In the study, the participants completed a match to sample task across three different conditions (marked before, marked after, and delay) and a 5s delay to reinforcement. In the marked before condition, the experimenter instructed the student to turn over the samples before the participant made a response. In the marked after condition, the experimenter said, "Look!" after correct and incorrect selections. During the delay condition, no immediate consequences followed responses. The results

indicated that marking before or marking after responses led to faster acquisition of receptive label skills than no cue at all.

While research has assessed the effectiveness of different marking procedures, an evaluation of different types of markers is largely undocumented. Event markers are signals used to mark a behavior at the instant it occurs. The term “event marker” has evolved from the term “bridging stimulus” first used by Marion and Keller Breland in the mid-1940s (Bailey & Gillaspy, 2005). The Brelands were well known for using operant psychology principles in the training of animals (Bailey & Gillaspy, 2005). Most commonly, the Brelands used whistles to teach marine animals to perform various tricks. Karen Pryor has recently popularized this technique. Pryor has written books, held trainings and spoken about the effectiveness of using clickers to train dogs and other animals (Pryor, 2002). Event markers come in many forms, such as acoustical markers (clickers), tones, and lights. While event markers are commonly used in both human and animal training, very little research has focused on evaluating their effectiveness.

Social markers, such as praise, are commonly used in applied settings. Lovaas, Freitag, Kinder, Rubenstein, Schaeffer, and Simmons (1966) studied praise associated with primary reinforcers. The participants in the study were two children with schizophrenia with autistic-like symptoms. During the first phase of the study, the experimenter’s paired social praise with edible items in order to establish praise as a discriminative stimulus for food. In the second phase, the reinforcing properties of praise were evaluated through a bar-pressing task. The results indicated that praise functioned as a reinforcer when paired with edibles.

Marking after correct responses has been identified as an effective method in aiding acquisition during delays to reinforcement. An evaluation of the effectiveness of different types

of markers, however, is largely undocumented. The purpose of the current study was to compare acquisition rates of receptive labels using two types of markers during delays to reinforcement.

Method

Participants

Two adolescent males, Jack and Chris, participated in the study. Both were selected based on their receptive language, ability to point to an object, and educational objectives to increase their identification of actions.

Jack was a 17-year-old male diagnosed with autism. For 10 years, he had attended a private school for students with disabilities. Jack used short sentences to request basic needs. He followed two-step directions reliably, and had experience with discrete trial training.

Chris was a 16-year-old male diagnosed with autism. For 12 years, he had attended a private school for students with disabilities. Chris had limited verbal skills; he typically requested items using one-word utterances. He followed two-step directions reliably, and had experience with discrete trial training.

Settings and Materials

All pre-tests, preference assessments, and reinforcer assessments took place in the students' classroom where distractions were limited. A trained staff person or the experimenter conducted these sessions. The experimenter conducted all training sessions in a small assessment room.

Materials present during preference assessments included edible items. Jack's edibles included Cheetos, mini Pringles, raisins, Gushers, fruit snacks, M&Ms, and mini Oreos. Chris's edibles included popcorn, granola bars, and pretzels. Items were selected based on teacher report of observed preferred items and previous preference assessments.

During reinforcer assessments, the two most highly preferred edibles, and the least preferred edible identified during the preference assessment were present in addition to a timer, a tally counter, and a 4 inch by 4 inch piece of blue paper.

Webber Photo Action cards were the stimuli used during pre-testing and training. Each card was the size of a playing card and displayed an image of a person engaged in an action. Appendix A lists all the images used in the experiment.

Materials present during training sessions included a timer, a standard animal clicker from MasterPeace Dog Training, and edibles. An easel display binder containing 18 laminated 8 inch by 11 inch pages was also used. Each page displayed 3 Webber Photo Action cards each of which was mounted on the page using small pieces of Velcro. Cards were centered in the middle of the page and spaced approximately one inch apart.

Dependent Variables, Operational Definitions, and Measurement

During preference assessments, the dependent variable was a selection response. A selection response was defined as the participant picking up an edible and consuming it. Selection was recorded on a trial-by-trial basis using a data sheet that specified the order of items. The percent selection was calculated by dividing the number of times an item was selected by the number of times it was presented across trials, then multiplying by 100.

During reinforcer assessments, the dependent variable was a touch to a blue square. A touch was defined as one of the participant's index fingers contacting the blue square. Between responses, the finger was raised at least an inch above the blue square. The number of responses were measured using a tally counter. The total number of touches was converted to response rate by dividing the total number of touches by the session duration.

Correct selection was the response measured in pretesting and training. Correct selection was defined as the participant pointing to the stimulus that corresponded to the word spoken by the experimenter. During pre-testing, correct selection was recorded by a “+”, and incorrect selection was recorded as a “-.” During training, correct selection was recorded by circling on the datasheet, which specified position of correct and incorrect stimuli. A record was also made of any stimulus chosen in error.

Inter-observer Agreement and Procedural Integrity

Inter-observer agreement (IOA) data were collected by an independent observer during 40% of preference assessment sessions, 33% of reinforcer assessment sessions, and 33% of training sessions. The second observer independently collected data using the same data collection materials as the experimenter.

IOA scores were calculated by dividing the number of agreements by the number of agreements plus disagreements and then multiplying by 100. IOA scores for all preference assessments, reinforcer assessments, and training sessions were 100%.

Procedural integrity data were collected by an independent observer during 40% of preference assessments, 33% of reinforcer assessments, and 33% of training sessions. During preference and reinforcer assessments, a second observer recorded the occurrence or non-occurrence of experimenter behaviors using a 10-item checklist. The occurrence of behavior was recorded by marking a “+” and non-occurrence was recorded by marking a “-.” A procedural integrity score was calculated by the multiplying the total number of behaviors that occurred by the total number of items. Procedural integrity for all preference and reinforcer assessments was 100%.

During training sessions, a second observer collected procedural integrity data on a trial-by-trial basis. Each training session data sheet contained a column for scoring procedural integrity during each trial. Abbreviations for each of the five experimenter behaviors were listed for each trial. The second observer circled a corresponding abbreviation if the experimenter said the correct discriminative stimulus, delivered the correct consequence, waited 5s before delivering a reinforcer, delivered the edible and if there was a 5s inter-trial interval. Procedural integrity score was calculated by dividing the total number of occurrences of behavior by the total number of behavior multiplied by 100. The mean procedural integrity score for all training sessions was 99% (range 99-100).

Procedure

Pretesting

A pretest was conducted to ensure the participants were unfamiliar with the training stimuli. During pretest sessions, the participants were asked to select a card representing a specified action from an array of three cards. The experimenter did not provide prompts or reinforcement for any responses, however, in order to maintain the participants responding, the experimenter delivered praise intermittently between trials. This praise was independent of performance.

The pretest identified the 12 stimuli that would be designated as the correct selection (S+) during training sessions. The criterion for including a stimulus as an S+ was that the participant selected that stimulus no more than once in four trials. The 12 S+ stimuli were randomly assigned to one of three conditions (Clicker, Correct, or Control), so that each condition had four stimuli.

Additionally, the pretest identified stimuli to be used as incorrect choices (S-). The criterion for including a stimulus as an S- was that the participant selected it no more than once in three trials. Pretests identified 23 stimuli to be used as incorrect selections for Jack, and 26 stimuli to be used as incorrect selections for Chris. Each S- was given a number (S-1 through S-23 for Jack and S-26 for Chris), so that incorrect selections could be tracked during training trials.

Preference Assessments

Prior to training the participants' preferences were assessed using a multiple stimulus without replacement procedure (Deleon & Iwata, 1996). Based on prior assessments and teacher observations, seven and three potentially preferred edibles were identified for Jack and Chris, respectively. The experimenter or trained staff then conducted the formal preference assessments. Prior to each assessment, the experimenter provided a small plate with a sample of each edible and instructed the student to eat the snacks. On the first trial, the experimenter placed the edibles in a line in front of the participant in a predetermined random order. The edibles were positioned approximately 3 inches apart from each other, and approximately 5 inches from the participant. The experimenter then delivered the instruction, "Pick one." After the participant selected an item, the experimenter then removed the other items, and allowed the participant approximately 5s to consume the selected edible. The experimenter shifted the remaining items positioning the item that was previously on the left, to the right and delivered the instruction, "Pick one." This process continued until all items had been selected, which resulted in seven trials for Jack and three trials for Chris. The assessment was conducted five times with each participant; the positions of the items were randomized for each session to control for potential positional preferences.

Reinforcer Assessments

During each reinforcer assessment, the participant was seated at a table with a blue square positioned 5 inches in front of him. These assessments included three baseline conditions followed by three edible conditions. Each baseline and edible condition, which were spaced 1 minute apart, and lasted 1 minute.

During the baseline conditions, the experimenter said, “Do this” and modeled touching the blue square. When the participant imitated the response, the experimenter said, “Good job. Now you can do this (and modeled response again) as much or as little as you want but you will not earn anything.” There were no programmed consequences for touching the blue square during baseline. In between conditions, the experimenter removed the blue square and gave no instructions for 1 minute. The participant remained seated at the table.

After the three baseline conditions, the experimenter conducted three reinforcer conditions. A different edible was delivered during each reinforcer condition. These included the first and second highly preferred edibles, and the least preferred edible. Each reinforcer session began in the same way as baseline sessions, except after the participant imitated the touching response, the experimenter said, “Good job. Now you can do this (and modeled response again) as much or as little as you want and you will earn ____” and showed the participant the edible item. During these sessions, the edible was delivered on a FR1 schedule. Reinforcement sessions were conducted once a day for three days. Edibles were counterbalanced across sessions.

Training

Each training session consisted of thirty-six trials. The three condition types (Clicker, Correct, and Control) were counterbalanced within each session, so that each session contained

12 trials of each condition. An easel flipbook was used to display the three stimuli for each trial. One page corresponded to one trial. The three stimuli were arranged in a line in the center of each page. Each page contained one correct selection (S+) and two incorrect selections (S-).

For each condition, there was a different S+. Positions of the S+ were quasi-random, such that no S+ appear in the same position more than two consecutive trials. S+'s appeared the same number of times in each position across each condition. In other words, each S+ occurred four times in the right side position, four times in the center position, and four times in the left side position for each condition.

Teaching procedures were the same across all conditions, with the exception of the consequence that followed independent correct selections. Each trial was initiated by the experimenter instructing, "Touch____." The participant was given 5s to respond.

During clicker condition trials, an acoustical marker was pressed immediately upon the participant making a correct selection. During the correct condition trials, the experimenter immediately stated in a neutral tone, "correct" when the participant made a correct selection. In control condition trials, no marker or "correct" statement was presented immediately following correct selections. In all conditions, edibles were provided 5s after a correct response. Incorrect selections resulted in a 5s delay to a representation of the trial. If the participant selected twice incorrectly, a gestural prompt was provided on the third representation. Incorrect responses received no reinforcers. Verbal praise but no edible reinforcers followed prompted responses.

For all conditions, mastery of discrimination was considered to have occurred when the participant made 10 consecutive correct independent selections. After an S+ was mastered, a new S+ was introduced in the following session. Sessions were conducted once a day, three to five times per week and generally lasted 10-12 minutes.

Results

Results for both participants' preference assessments are displayed in Figure 1. Jack's highest preferred items were chips and Cheetos, with 100% and 50% average percent selection respectively. His lowest preferred item was M&Ms with 14% average percent selection. Chris's highest preferred items were popcorn and granola bars, with 80% and 56.6% average percent selection respectively. His lowest preferred was pretzels with 46.4% average percent selection.

Figure 2 displays the results of both participants' reinforcer assessments. During baseline, Jack's average response rate per minute was .1 and Chris's average response rate per minute was 0. Across 3 sessions of reinforcer assessments, Jack's average response rate was 5.5 responses per minute for chips, 4 responses per minute for Cheetos, and 3.3 responses per minute for M&Ms. Chris's average response rate per minute for popcorn was 11, 9 for granola bars, and 8 for pretzels.

Both participants' responses to all stimuli by condition are displayed in Figure 3. For Jack, acquisition occurred fastest in the correct condition with 40 correct labels out of a total of 43 trials to mastery, followed by the clicker condition with 48 correct labels out of a total of 57 trials to mastery. In the control condition, Jack identified 68 correct labels out of a total of 78 trials to mastery. Similarly, Chris's acquisition occurred fastest in the correct condition with 40 correct labels out of a total of 43 trials to mastery. In the control condition, Chris correctly labeled stimuli during 48 of 56 trials to mastery. During the clicker condition, Chris correctly labeled stimuli during 57 of 70 trials to mastery.

Figure 4 displays the data for each participant's responding during the clicker condition across all stimuli. Jack correctly labeled the first stimulus in 10 out of 12 trials, 18 out of 22 trials for the second stimulus, 10 out of 11 trials for the third stimulus, and 10 out of 12 trials for the

fourth stimulus. Chris correctly labeled the first stimulus during 10 out of 13 trials, 18 out of 23 trials for the second stimulus, 10 out of 10 trials for the third stimulus, and 20 out of 25 trials for the fourth stimulus.

Figure 5 displays the data for each participant's responding during the correct condition across all stimuli. Jack correctly labeled the first stimulus in 10 out of 11 trials, 10 out of 11 trials for the second stimulus, 10 out of 10 trials for the third stimulus, and 10 out of 12 trials for the fourth stimulus. Chris correctly labeled the first stimulus during 10 out of 10 trials, 10 out of 11 trials for the second stimulus, 10 out of 11 trials for the third stimulus, and 10 out of 11 trials for the fourth stimulus.

Figure 6 displays the data for each participant's responding during the control condition. Jack correctly labeled the first stimulus in 18 out of 23 trials, 20 out of 22 trials for the second stimulus, 15 out of 18 trials for the third stimulus, and 10 out of 10 trials for the fourth stimulus. Chris correctly labeled the first stimulus during 10 out of 13 trials, 19 out of 22 trials for the second stimulus, 10 out of 10 trials for the third stimulus, and 10 out of 10 trials for the fourth stimulus.

Discussion

The purpose of the present study was to compare the effects of different markers on acquisition rates during delays to reinforcement. While much research exists supporting using social markers during delays to reinforcement, very little empirical support is available for event markers, such as clickers.

The correct condition resulted in the fastest acquisition for both participants. These results confirm previous research that response-contingent cues can help bridge the delay to reinforcement (William, 1991b, Grindle & Remington, 2002, 2005). During this condition, the

participants made minimal errors and had the lowest number of trials to mastery. The participants' learning history may provide some explanation for this result as both participants had experience with discrete trial training.

For Jack, the clicker condition had very similar results to the correct condition across all stimuli except for stimulus 2, which required additional training. Chris, on the other hand, had difficulty during the training of stimuli 2 and stimuli 4. Staff who were familiar with Chris hypothesized that the sound of the clicker may have been aversive to him, as Chris had previously displayed sensitivity to loud noises.

Research by Grindle and Remington (2005) offers an explanation for the differences between the results of the correct condition and the clicker condition may be explained, by During this study, the experimenters used social markers to bridge the delay to reinforcement, whereas in their previous research (Grindle & Remington, 2002) they had used audio-visual markers. Grindle & Remington (2005) argued that using social consequences may have accounted the stronger results because the participants were more familiar with those procedures.

In the current investigation, these two types of markers were directly compared, and demonstrated similar results. The correct condition, which was similar to verbal consequences provided in Grindle and Remington (2005), demonstrated slightly stronger effects than the clicker condition, which was similar to) use of the audio-visual markers used in Grindle and Remington (2002 For Jack, however, the difference between these conditions was relatively insignificant.

In the control condition, Jack had the slowest acquisition rate. He required almost double the number of trials to mastery compared the correct condition. Chris also had slower acquisition in the control condition compared to the correct condition. For both participants, the effects of

the delay, however, appeared to diminish as familiarity with the task increased. The total number of trials to mastery decreased from the first stimuli to the fourth stimuli, while the number of correct labels increased. When responses to the fourth stimulus were trained, for example, Jack correctly selected the label on its first presentation. After the 5s delay, he contacted the edible contingency and continued to pick the correct stimuli on all remaining trials. While this behavior also occurred in the correct condition, it is interesting that the absence of a cue (i.e., the control condition) had the same result. Chris's results were similar in the control condition. He acquired the final two labels in the control condition with zero errors.

These results are in contrast to previous research that shows that any delay (without a cue) can be detrimental to skill acquisition (Grice, 1948). During the current investigation, the results indicate the participants may have learned the delay procedure. This effect was not noted in previous research regarding delays to reinforcement (Grice, 1948; Grindle & Remington, 2002, 2005).

In general, both participants made very few errors across all stimuli and conditions. One explanation for this result may be their learning history and familiarity with discrete trial procedures. Support for this explanation may come from the Grindle and Remington studies (2002, 2005). In 2002, Grindle and Remington used participants involved in intensive early intervention, and very familiar with discrete trial training. These participants were exposed to a procedure very similar to the cue-value condition, aside from the 5s delay. Whereas, in Grindle & Remington (2005), the participants were unfamiliar with both cue-value and marking procedures, and required significantly more trials than the participants in Grindle & Remington, (2002).

Some of the limitations of the present study include a lack of maintenance data and test of reinforcing effectiveness of the clicker and saying “correct” prior to conducting the study. While the study lacks formal maintenance data, some evidence of maintenance was displayed when some stimuli were carried over from one session to the next and participants’ continued to make correct selections. Additionally, no data is available about the reinforcing value of the clicker or the “correct” before training sessions. As a result, it is unclear whether either cue might have produced these results prior to being paired with an edible.

Tests of the reinforcing value of the markers after the study, however, failed to demonstrate any value for either marker. That is to say, neither saying “correct” nor sounding the clicker had any reinforcing effect on the participants’ behavior during a building task conducted after training sessions. This finding raises questions concerning the role of the marker during the task. Did the markers only function as cues during the task or were the reinforcing properties of the markers limited to the training sessions? It is also possible that the stimuli were weak conditioned reinforcers with very little, if any durability. Future research could investigate this area further.

Results of this investigation highlight the effects of changing traditional discrete trial procedures. Contrary to popular behavior analytic practices, behavior specific praise was not used during the teaching procedure. Instead, a neutral “correct” was used to mark correct responses. An investigation of the effectiveness of using specific verbal markers, like “nice job touching running” compared to comments like “correct” goes largely undocumented and could be an area for future research.

This study compared the effectiveness of two auditory markers during a receptive labeling task with a 5s delay to reinforcement. Future research could investigate the use of

different types of markers, different tasks, or varying the length of the delay to reinforcement.

Additionally, a study conducted with participants with no familiarity with discrete trial training may produce different results.

In summary, the results of this study confirm previous research that response-contingent cues can aid acquisition when reinforcement is delayed. The data extends previous research by contributing an analysis of different types of markers, and adding to a growing body of research dedicated to helping children with autism learn more efficiently.

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Appendix A:

List of all images used.

Chris's S+'s:

Riding	Leaping	Polishing
Selling	Saving	Feeding
Sawing	Talking	Raking
Shampooing	Recycling	Skiing

Jack's S+'s

Shopping	Talking	Drying
Selling	Recycling	Hugging
Rinsing	Writing	Mowing
Pushing	Arranging	Turning

Chris's S-'s

Shopping	Drying	Cleaning	Taking	Reading
Climbing	Painting	Playing	Holding	Ironing
Mowing	Changing	Smelling	Working	Walking
Repairing	Cart-wheeling	Hugging	Shouting	Emptying
Building	Writing	Hanging	Loading	Mopping
Running				

Jack's S-'s

Watering	Working	Cooking	Building	Holding
Skiing	Shouting	Cleaning	Running	Hanging
Pouring	Emptying	Playing	Fishing	Shining
Repairing	Loading	Raking	Feeding	Painting
Taking	Sawing	Flying		

Figure Captions

Figure 1: Percent selection of edibles observed for Jack's 7 item multiple stimulus without replacement preference assessment (top). Percent selection of edibles observed for Chris's 3 item multiple stimulus without replacement preference assessment (bottom).

Figure 2: Response Rate per minute of touching the blue square observed for Jack and Chris across all conditions of baseline, high preference and low preference edibles.

Figure 3: Total number of trials to mastery for Jack and Chris across all conditions.

Figure 4: Total number of trials to mastery for Jack and Chris's clicker condition across all stimuli.

Figure 5: Total number of trials to mastery for Jack and Chris's correct condition across all stimuli.

Figure 6: Total number of trials to mastery for Jack and Chris's control condition across all stimuli.

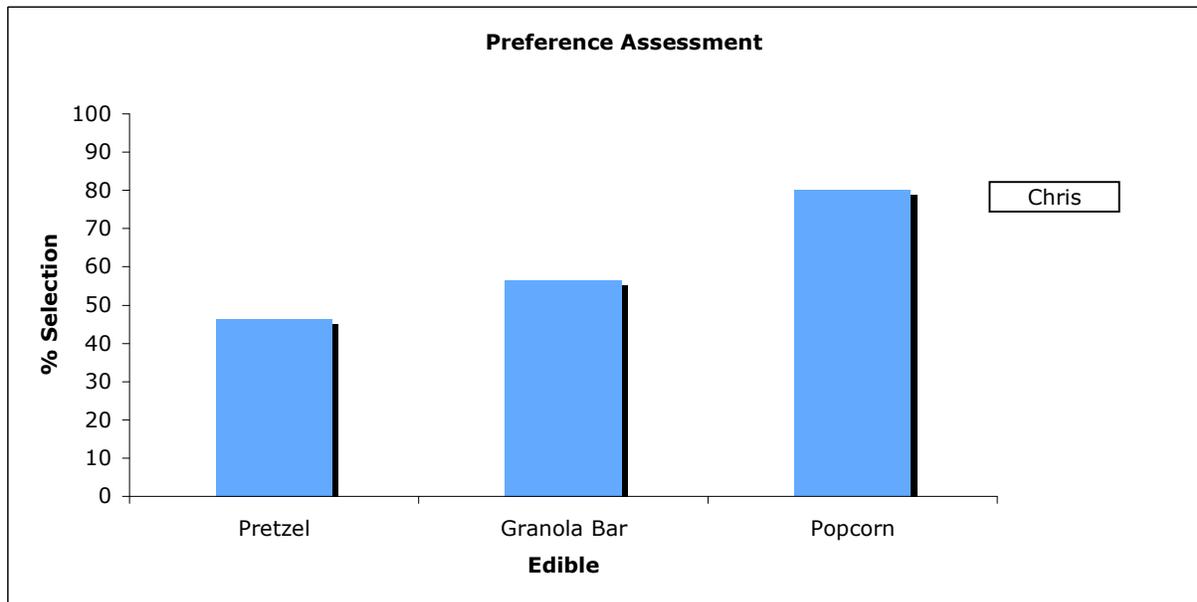
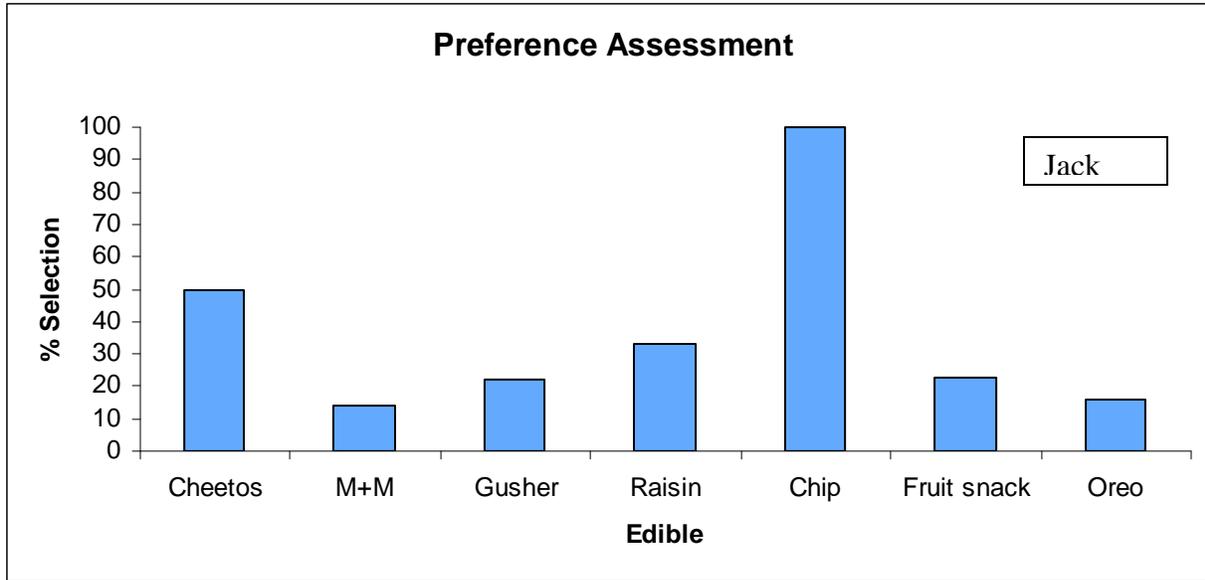


Figure 1

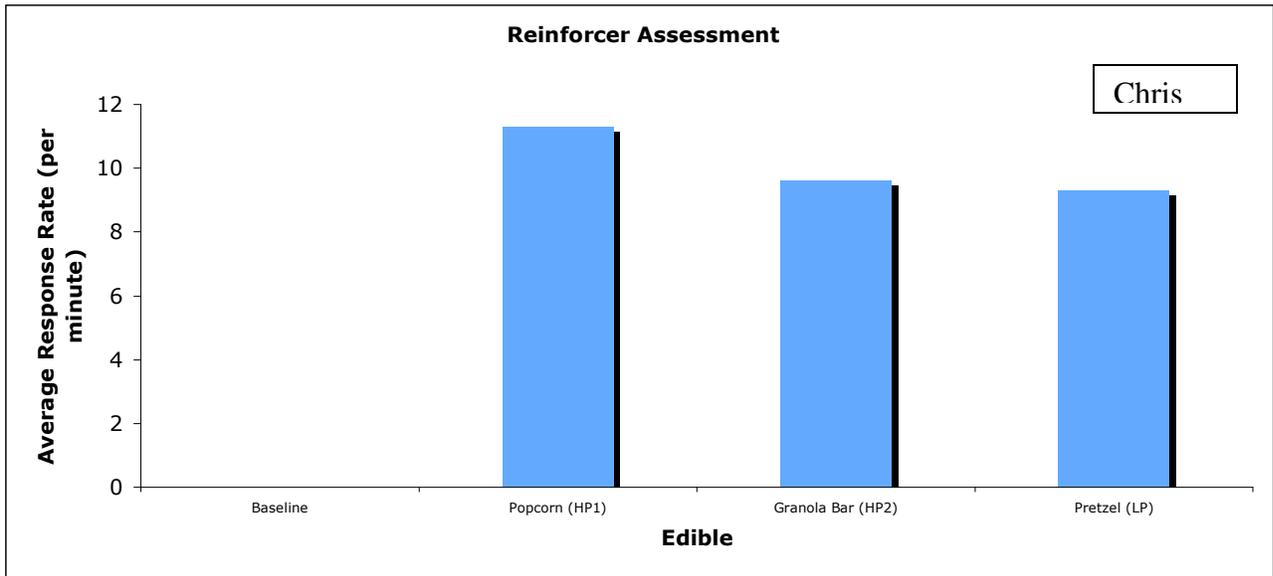
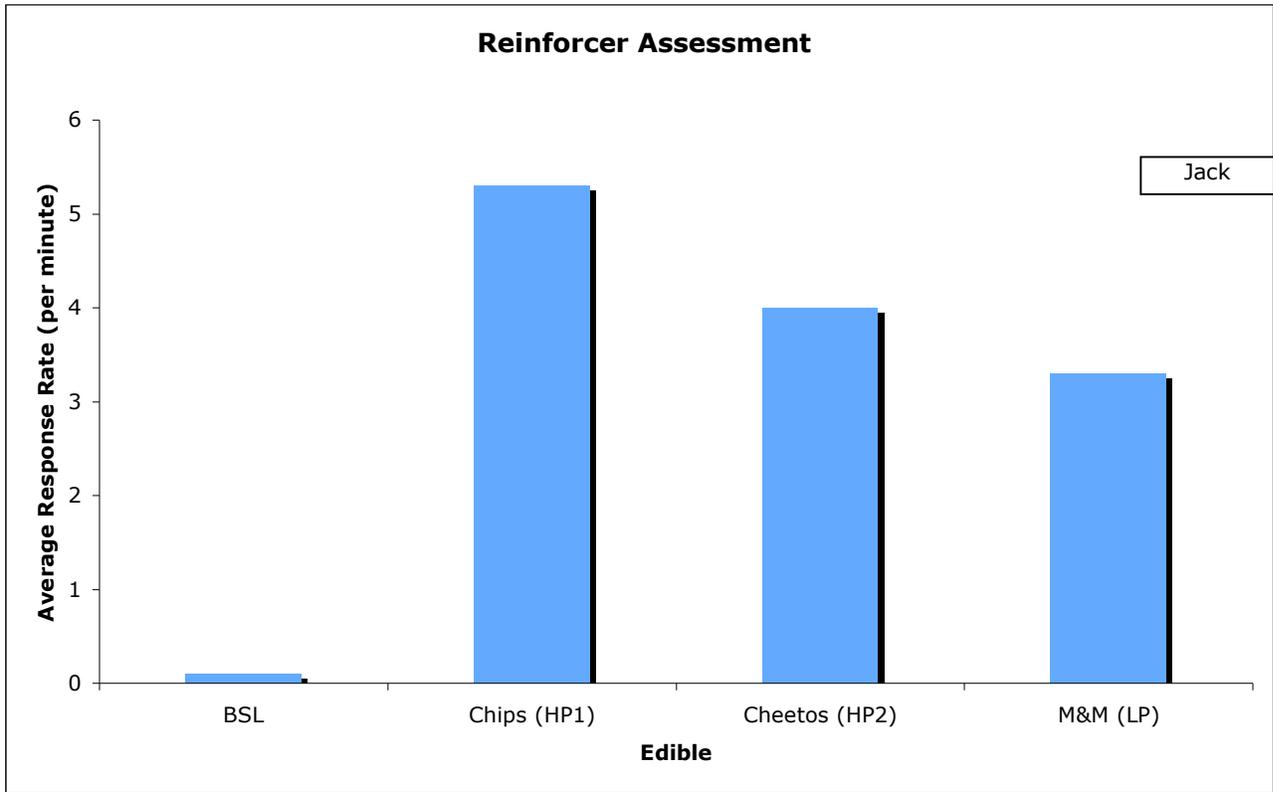


Figure 2

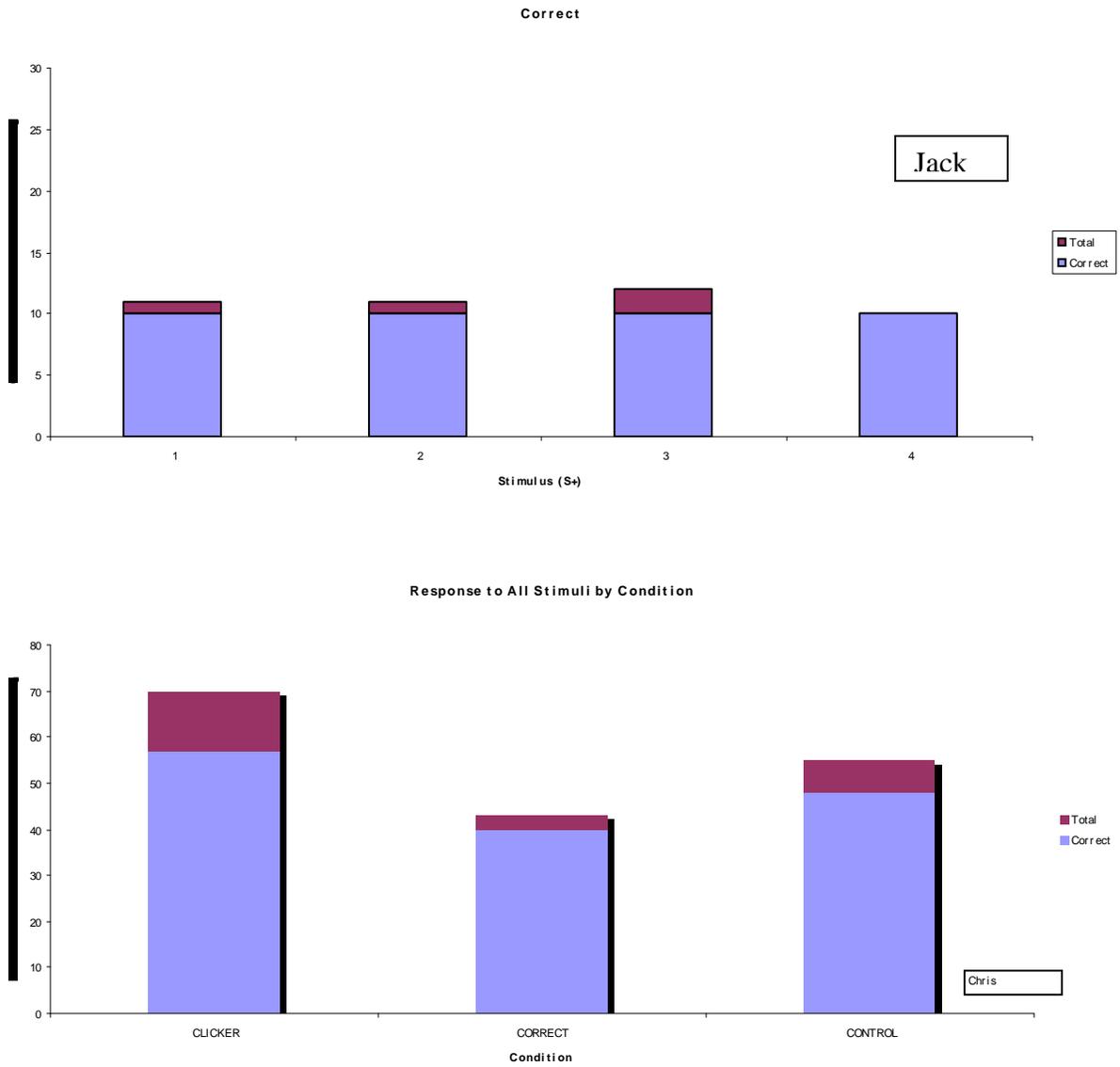


Figure 3

Acquisition when reinforcement is delayed 28

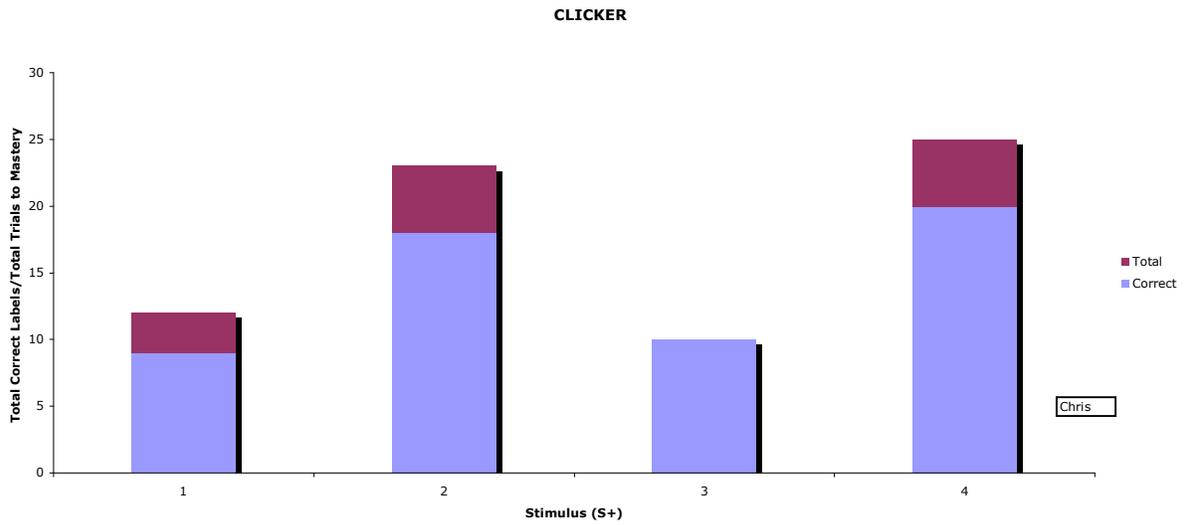
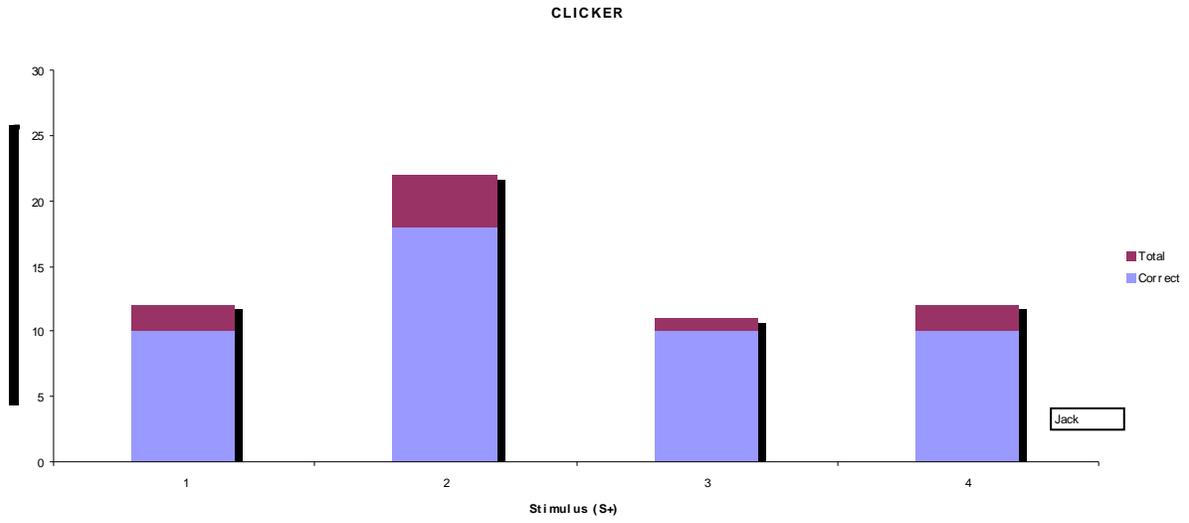


Figure 4

Acquisition when reinforcement is delayed 29

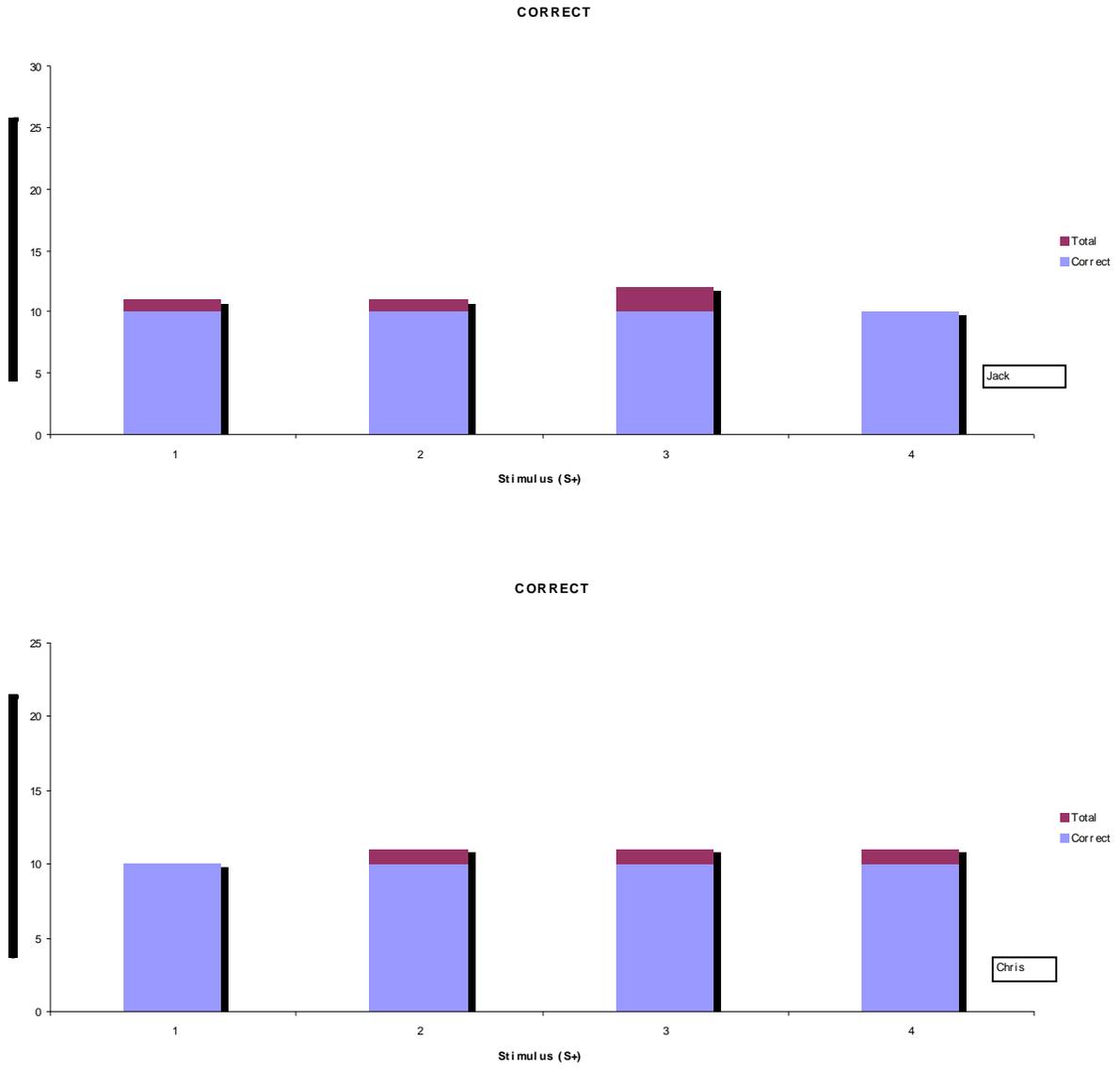


Figure 5

Acquisition when reinforcement is delayed 30

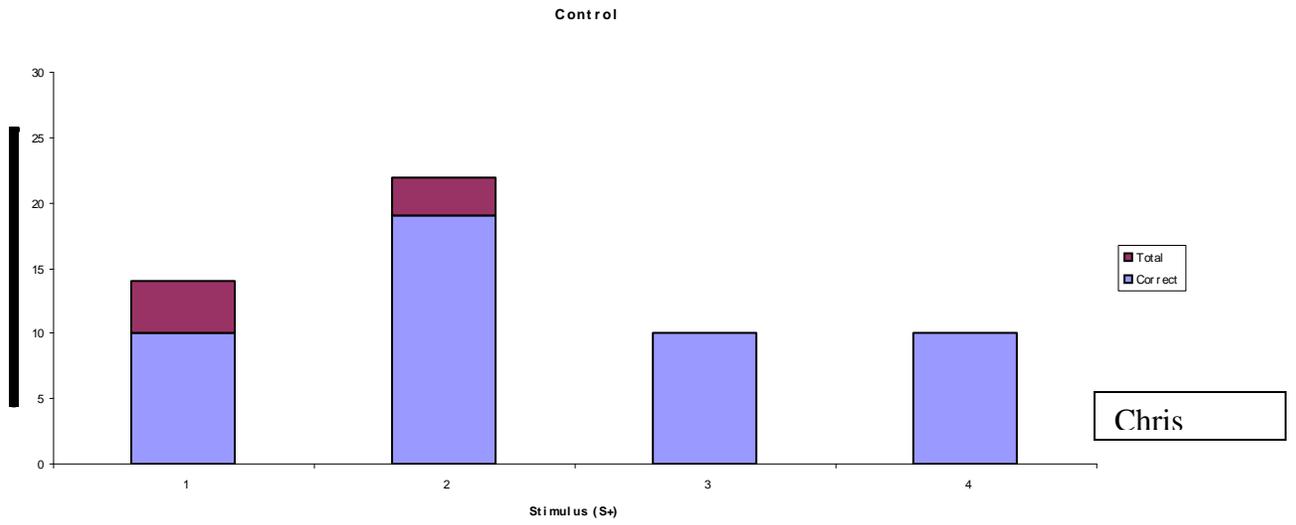
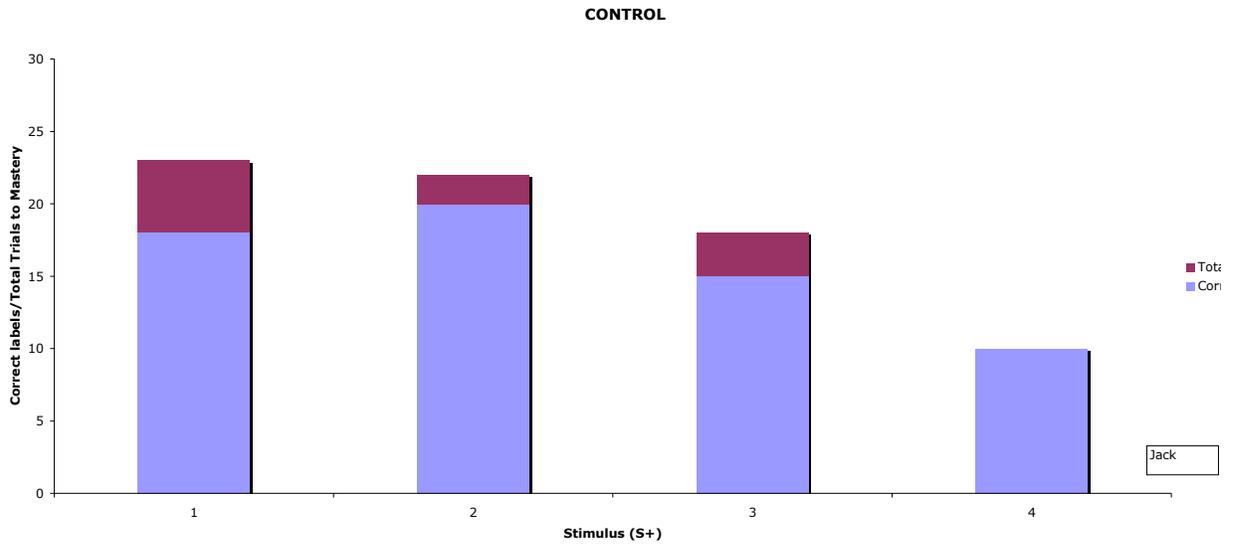


Figure 6