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An experimental comparison of the effects of positive reinforcement and negative reinforcement during skill acquisition

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**An Experimental Comparison of The Effects of Positive Reinforcement and
Negative Reinforcement During Skill Acquisition**

A Thesis Presented

By

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The Department of Counseling and Applied Psychology

In partial fulfillment of the requirements

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Abstract

Many different teaching strategies have been assessed to help increase the behavioral repertoires of individuals with developmental disabilities and Autism. This study compares the effects of positive reinforcement and negative reinforcement during skill acquisition. The results indicate that although more sight words were acquired during the negative reinforcement condition, when using a multi-response repetition error correction procedure, there was a higher rate of inappropriate session behavior.

An Experimental Comparison of The Effects of Positive Reinforcement and Negative Reinforcement During Skill Acquisition

Learning can be difficult for individuals with developmental disabilities and autism spectrum disorders (ASD); therefore, there is a significant amount of research regarding the improvement of teaching strategies used for skill acquisition (Lerman, Vorndran, Addison & Kuhn 2004; Day, 1987; Smith 2001; Fabrizio & Pahl, 2007). Current research demonstrates how different teaching strategies such as behavior chaining, match-to-sample, errorless teaching, discrete trial training and exclusion-based teaching can facilitate learning. In practice, educators may use several different teaching strategies, either in isolation or as part of a teaching package, to achieve skill acquisition.

Research supports the use of discrete trial training (DTT) as a teaching strategy when working with individuals with developmental disabilities (Smith, 2001). In particular, DTT can help these individuals acquire skills such as communication, social interaction and daily living (Newsom, 1998). Not only does DTT help to enhance the repertoires of these individuals, it may also have long-term benefits such as increasing an individual's IQ score and decreasing the need for professional services (McEachin, Smith and Lovaas, 1993). The five aspects of a discrete-trial program include: (1) the discriminative stimulus, (2) prompt (as necessary), (3) the participants response, (4) the consequence delivered contingent upon the response, and (5) the inter-trial interval (Smith, 2001). Both antecedent and consequence manipulations can increase the rate of acquisition.

Antecedent strategies consist of material alteration to prompt the individual, gestural or physical prompts from the instructor, or insertion of other materials (Lerman, Vorndran, Addison & Kuhn, 2004). Research indicates that antecedent intervention is more effective than reinforcement alone when teaching multiple skills (Lerman et al. 2004). Results also indicate that antecedent prompts in combination with reinforcement for correct responding have a greater effect on participants in order for them to reach mastery criteria.

In addition to reinforcement, other consequence procedures may also be manipulated in order to increase teaching effectiveness. Common consequence procedures include, time-out, extinction, and error correction (Rodgers & Iwata, 1991). Error correction is defined as teacher delivered feedback, which is given contingent on the participant responding incorrectly in the presence of a particular stimulus (Wolery, Bailey, & Sugai, 1988). A multi-component study was conducted in order to analyze the effectiveness of error-correction strategies (Worsdell, Iwata, Dozier, Johnson, Neidert & Thomason 2005). The study consisted of three phases, Phase I determined that a multiple-response repetition for each error would increase the rate of sight-word acquisition over a single-response repetition. The results of Phase II show that the schedule of error correction is also a factor to consider when constructing a teaching protocol; multi-response repetition after each error is more effective than multi-response repetition on a variable schedule of errors. Lastly, Worsdell and colleagues determine that relevant rather than irrelevant stimuli used after an error is more effective in increasing the rate of sight-word acquisition. Over all the study showed that a multi-response error-correction procedure would increase the rate of acquisition. One

hypothesis that comes from these results is that in an attempt to avoid the correction procedure, individuals will respond correctly. Therefore, the purpose of the study was to compare the effects of positive reinforcement and negative reinforcement on skill acquisition.

Method

Participant and Setting

Three adolescent males (Paul age 20, Andrew age 12 and Joey age 11) diagnosed with autism and receiving home-based services participated in this study at their respective homes. These individuals were all verbal communicators and had a history of sight word reading, but were identified as individuals who would benefit from further instruction. All sessions were video taped using a laptop computer present on the table during instruction.

Procedure

In Phase I of the study, a multiple stimulus without replacement preference assessment (MSWO) was conducted using procedures identified by DeLeon and Iwata (1996). Once a hierarchy of preferences was determined, a reinforcer assessment was conducted to identify reinforcers used in Phase II. Procedures for the reinforcer assessment were based on Moher, Gould, Hegg (2008).

Phase II started immediately after reinforcers were identified. During baseline sessions, each participant was asked to read numerous sight words, each hand written on a 3in x 5in white index card. Every word was presented 3 times within baseline sessions. If the word was read correctly each time it was presented, it was not used during

acquisition. Words identified for training were randomly divided into two sets for the positive reinforcement condition and the negative reinforcement condition. Colored index cards and place mats were used in order to increase the likelihood that the participants would discriminate between conditions.

An alternating treatment design was used to compare the effects of positive reinforcement and negative reinforcement on sight-word acquisition. A random numbers table was used to determine the order of each condition.

In the positive reinforcement condition, a reinforcer was provided contingent upon a correct response, and no consequence was delivered for an incorrect response. In the negative reinforcement condition, a correct response was followed by no consequence, and an incorrect response was followed by a correction procedure. The correction procedure was conducted 5 times and consisted of the experimenter reading the word and the participant imitating the response. This error correction procedure was similar to the multi-response repetition error correction procedure used by Worsdell et al. (2005). In the positive and negative reinforcement conditions, 10 target words were presented each session. Each of these words was presented 3 times for a total of 30 trials. A mastery criterion was achieved if the participant responded correctly to the 3 consecutive presentations of the target word. As target words were mastered, novel target words were introduced. This procedure maintained 10 target words in rotation for each condition at all times.

During both positive and negative reinforcement conditions, data was collected on the frequency of inappropriate session behavior. Inappropriate session behavior was

defined as any instance of a participant getting out of his seat, laughing, or yelling (using a voice above conversational tone).

Interobserver Agreement and Response Reliability

In order to calculate Interobserver agreement (IOA) and procedural integrity for this experiment all of the sessions were video recorded on a computer. A second person trained in the procedures watched the videos and recorded data independent from the first experimenter. A checklist consisting of the steps required to complete each phase was used to determine procedural integrity.

During Phase I of the study, IOA and procedural integrity were taken for 100% of the sessions. IOA was 100% and procedural integrity also was 100%. IOA was calculated by dividing the number of sessions in agreement by the total number of sessions multiplied by 100. A procedural integrity was determined using a checklist that included correct placement of possible reinforcers, appropriate consequences delivered during the prescribed sessions, and appropriate rotation of conditions.

In Phase II of the study, IOA was calculated by dividing the number of trials in agreement by the total number of trials multiplied by 100. IOA was taken for a total of 35% of sessions across all three participants and averaged 99%, ranging from 98-100%. Procedural integrity was also taken for 35% of the sessions and averaged 100%. A procedural integrity checklist was used that included the correct color presentation for each condition, the delivery of the appropriate consequence procedure, and the correct number of stimuli used.

Results

During Phase I of the study, a hierarchy of preferences was identified for each participant (see Figure 1). The two highest preferred items, and the lowest preferred item were used during the reinforcer assessment. During Phase I, reinforcers were identified for all three participants (as seen in Figures 2, 3 and 4). Patrick's reinforcers were identified as Sour Patch Kids and fruit snacks, Joey's reinforcer was identified as money, and Andrew's reinforcers were identified as Cracker Jacks and Oreos. Multiple preference assessments were conducted for Joey to identify multiple reinforcers. A hierarchy could not be identified when food items were used, once money was introduced, a preference was identified therefore only one high preferred item was used during Joey's reinforcer assessment.

Results in phase II showed all participants meeting mastery criteria for more target words in the negative reinforcement condition than in the positive reinforcement condition. Patrick met mastery criteria for 23 words in the negative reinforcement condition, and 10 words in the positive reinforcement condition, across a total of 20 sessions. (See Figure 5) He engaged in zero occurrences of inappropriate session behavior in both the positive and negative reinforcement conditions. In the negative reinforcement condition there were more words in training, and more words mastered relative to the positive reinforcement condition. However, it took slightly more trials to master a word in the negative reinforcement condition. On average, it took 6 trials for Patrick to meet mastery criteria in the positive reinforcement condition, and 8 trials in the negative reinforcement condition (see Figure 8).

The results for the second participant, Joey, are similar to Patrick. Joey met mastery criteria for 18 words in the negative reinforcement condition, and 4 words in the positive reinforcement condition. He engaged in 0 occurrences of inappropriate session behavior during the positive reinforcement condition, and an average of 2.5 occurrences of inappropriate session behavior in the negative reinforcement condition, with a range of 1-6 occurrences (see Figure 6). In the negative reinforcement condition he had more words in training, and more words met mastery criteria relative to the positive reinforcement condition. The average number of trials to mastery for both positive and negative reinforcement conditions was 6 trials (see Figure 8).

Lastly, Andrew met mastery criteria for 16 words in the negative reinforcement condition, and 6 words in the positive reinforcement condition. Like Joey, he engaged in zero occurrences of inappropriate session behavior during the positive reinforcement condition. He engaged in an average of 3.5 occurrences of inappropriate session behavior during the negative reinforcement condition, with a range of 1-7 occurrences per session (see Figure 7). Similarly to the other participants, Andrew also had more words in training, and mastered in the negative reinforcement condition. However, on average it took 6 trials to mastery criteria in the positive reinforcement condition, and 7 trials to mastery criteria in the negative reinforcement condition (see Figure 8).

Discussion

The data suggests that for three participants the function of the target behavior, learning sight word acquisition, was avoidance motivated. The multi-response repetition error correction procedure appear to be an aversive, and in order to avoid it, the

participants increased the rate of acquisition. For 2 of the 3 participants, this increase was also accompanied with an increase in inappropriate session behavior. This data suggests that although positive reinforcement may not be necessary for acquisition, it may be useful in maintaining low rates of inappropriate session behavior during training sessions. The combination of procedures may maintain low rates of inappropriate session behavior, increase the rate of acquisition, and may decrease the number of trials to mastery criteria.

There are several limitations to the current study. Firstly, the two comparison conditions provided a different number of exposures to the target words. In the negative reinforcement condition, the correct response was repeated several times during the correction procedures, providing the participants with more opportunities to hear the correct response. However, this was not true during the positive reinforcement condition. To equate the numbers of exposures, descriptive praise could have been used in the positive reinforcement condition in which the correct response was repeated. An additional limitation was that the combination of positive and negative reinforcement procedures may have resulted in different rates of acquisition and inappropriate rates of session behavior. The last limitation was that maintenance data was not collected to determine if a specific condition had an effect on the retention of each sight word. Maintenance data may show if over time words are retained at a higher rate in a specific condition.

Future research should include the investigation of various response topographies. The present study focused on verbal response topography, a match to sample task may yield different results. The present study used a multi-response error correction

procedure where the response was repeated 5 times. Varying the repetition to fewer or greater repetitions may change the potency of the error correction strategy.

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Figure Captions

Figure 1: Results of a multiple stimulus with out replacement preference assessment for the three participants.

Figure 2: Results of the reinforcer assessment for Patrick.

Figure 3: Results of the reinforcer assessment for Joey.

Figure 4: Results of the reinforcer assessment for Andrew.

Figure 5: Rate of acquisition for the positive and negative reinforcement conditions, and the rate frequency of inappropriate session behavior for Patrick.

Figure 6: Rate of acquisition for the positive and negative reinforcement conditions, and the frequency of inappropriate session behavior for Joey.

Figure 7: Rate of acquisition for the positive and negative reinforcement conditions, and the frequency of inappropriate session behavior for Andrew.

Figure 8: Average number of words in acquisition, the average number of words mastered, and the average number of trials to acquisition for each participant, in both the positive and negative reinforcement conditions.

Figure 1

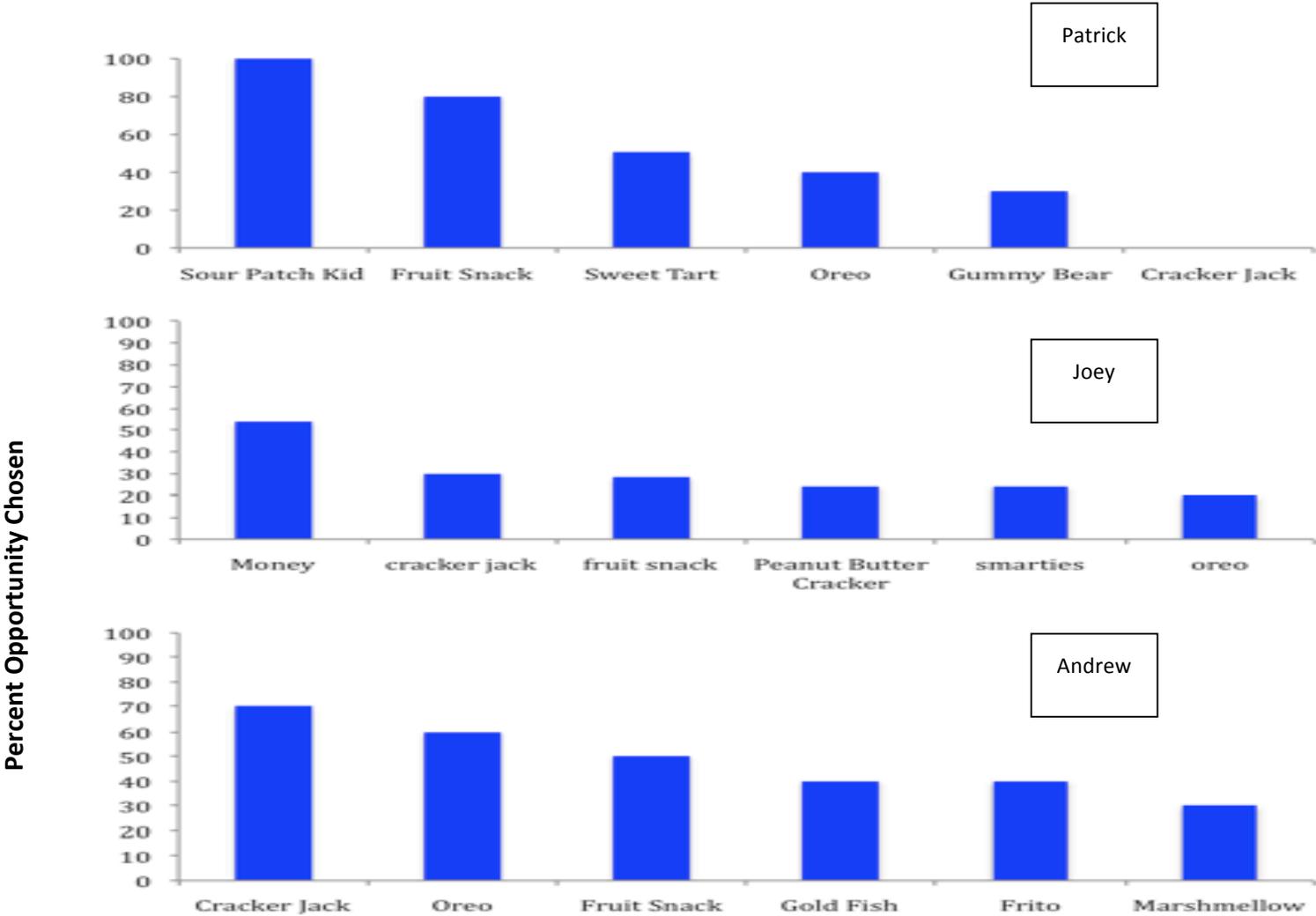


Figure 2

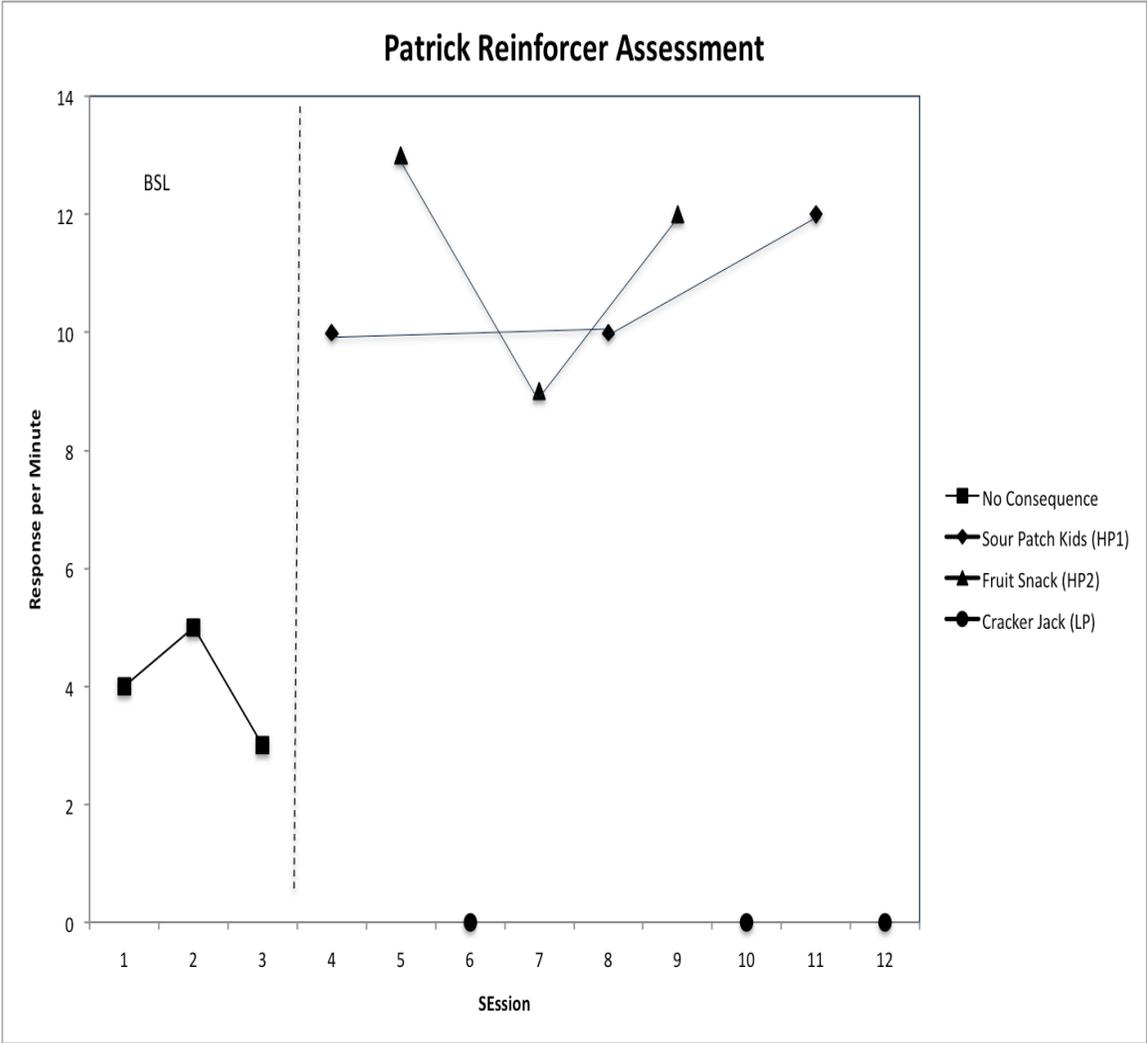


Figure 3

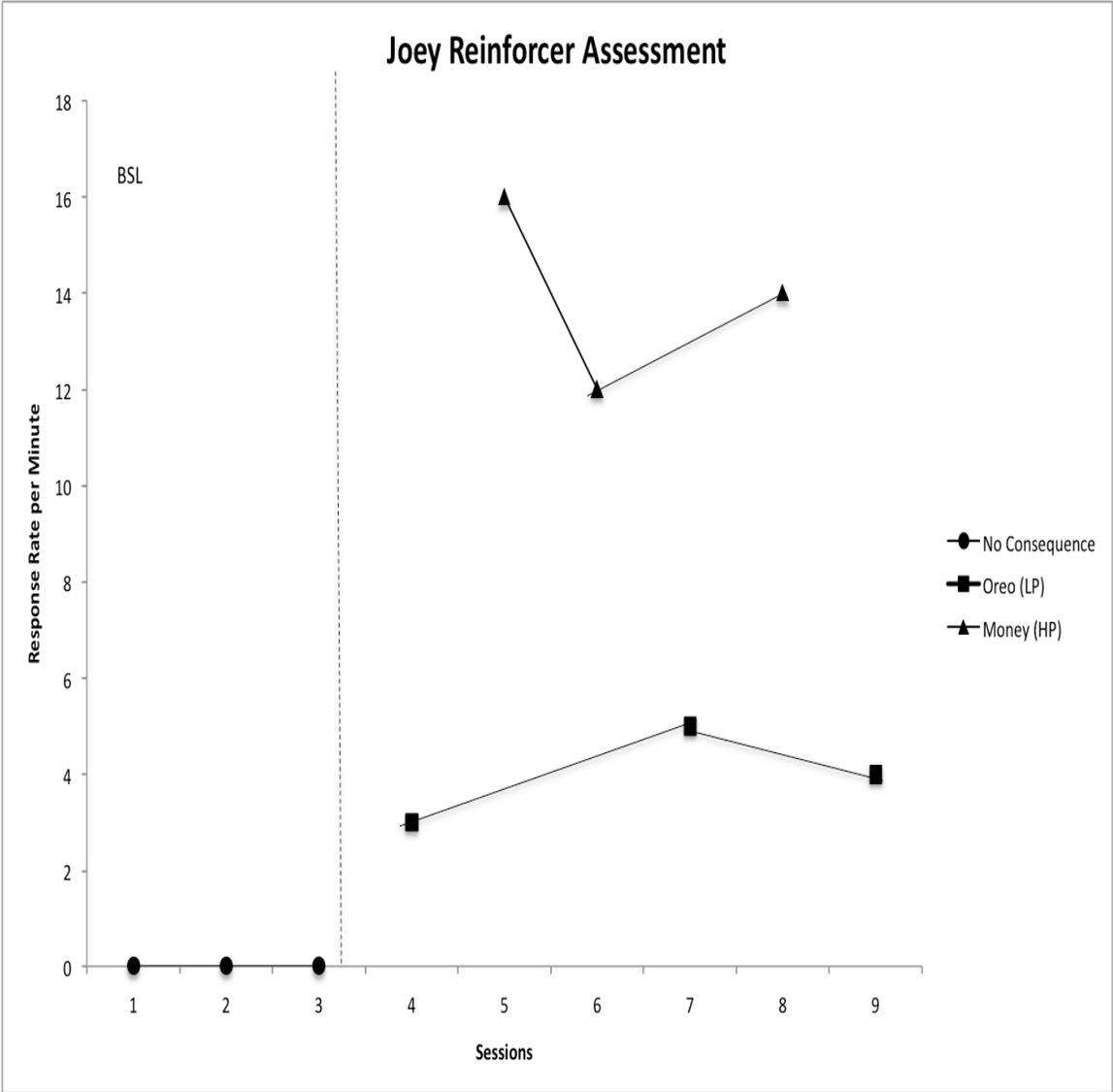


Figure 4

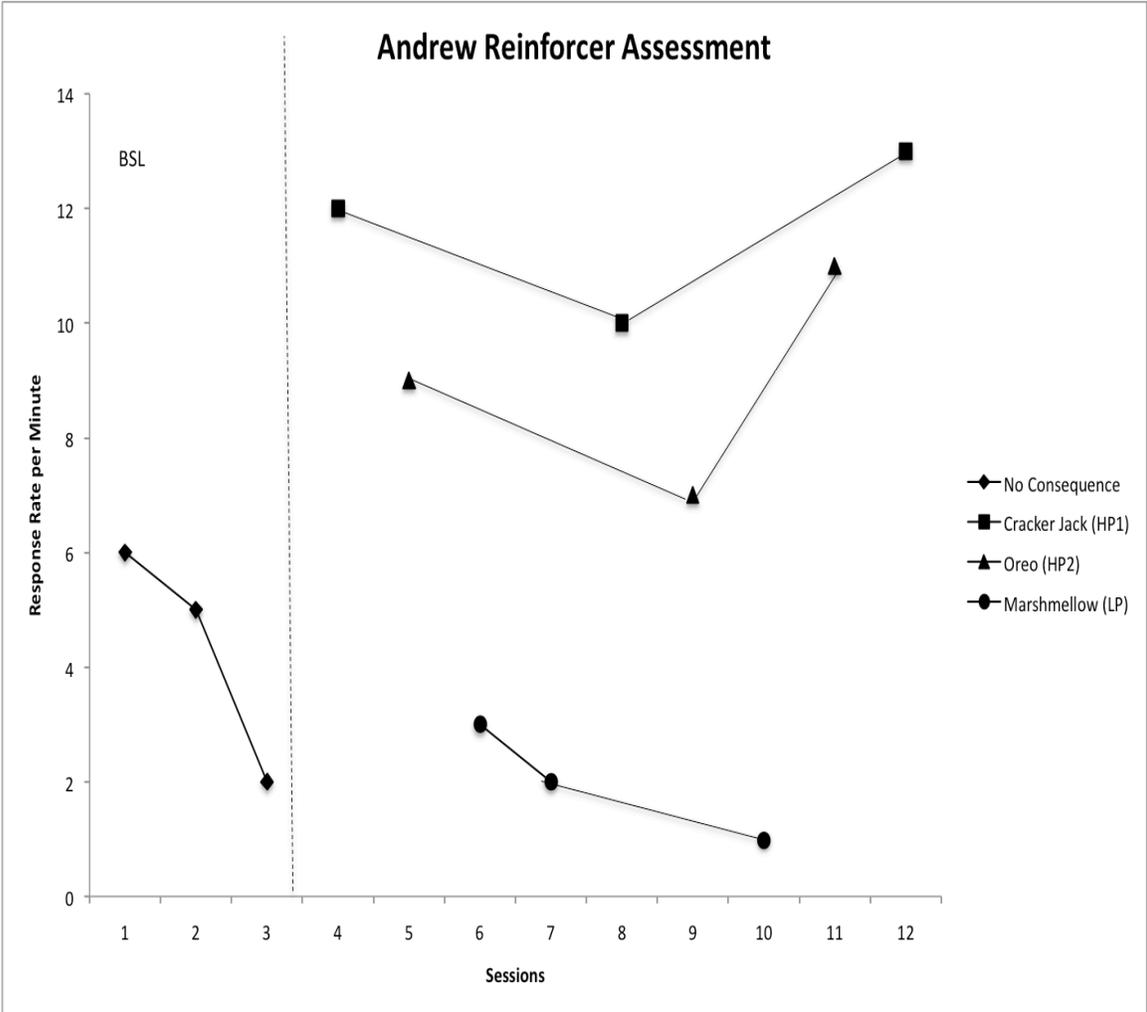


Figure 5

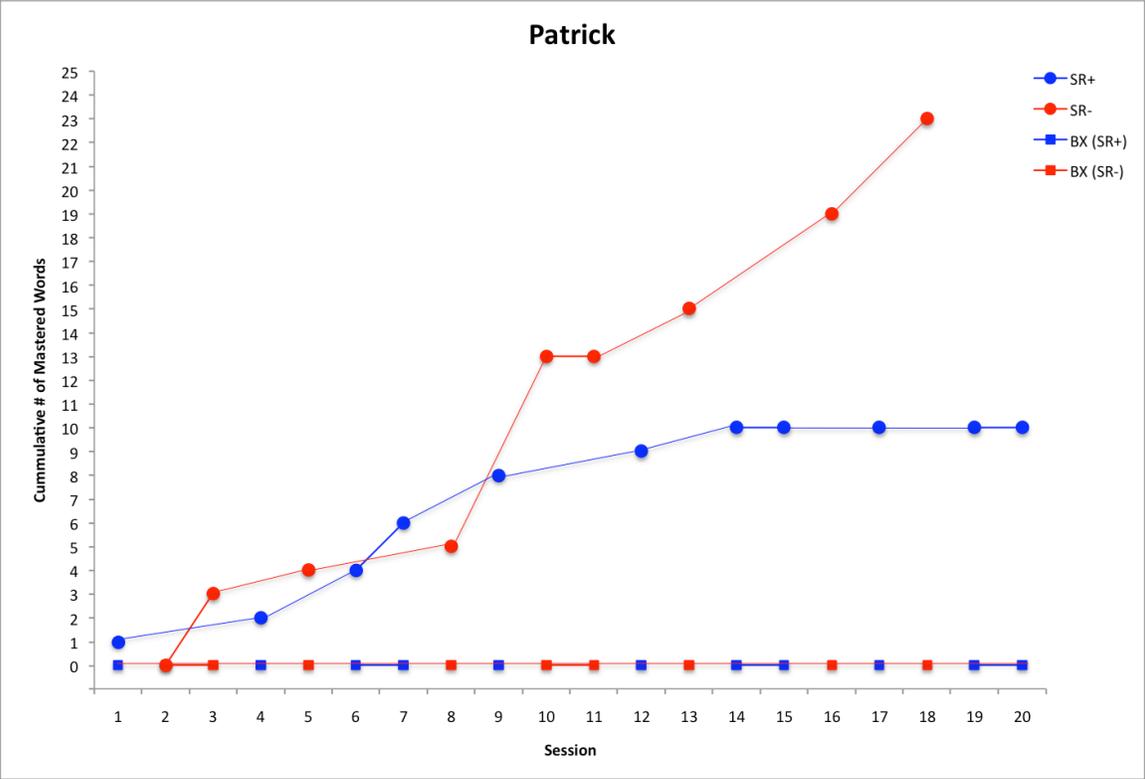


Figure 6

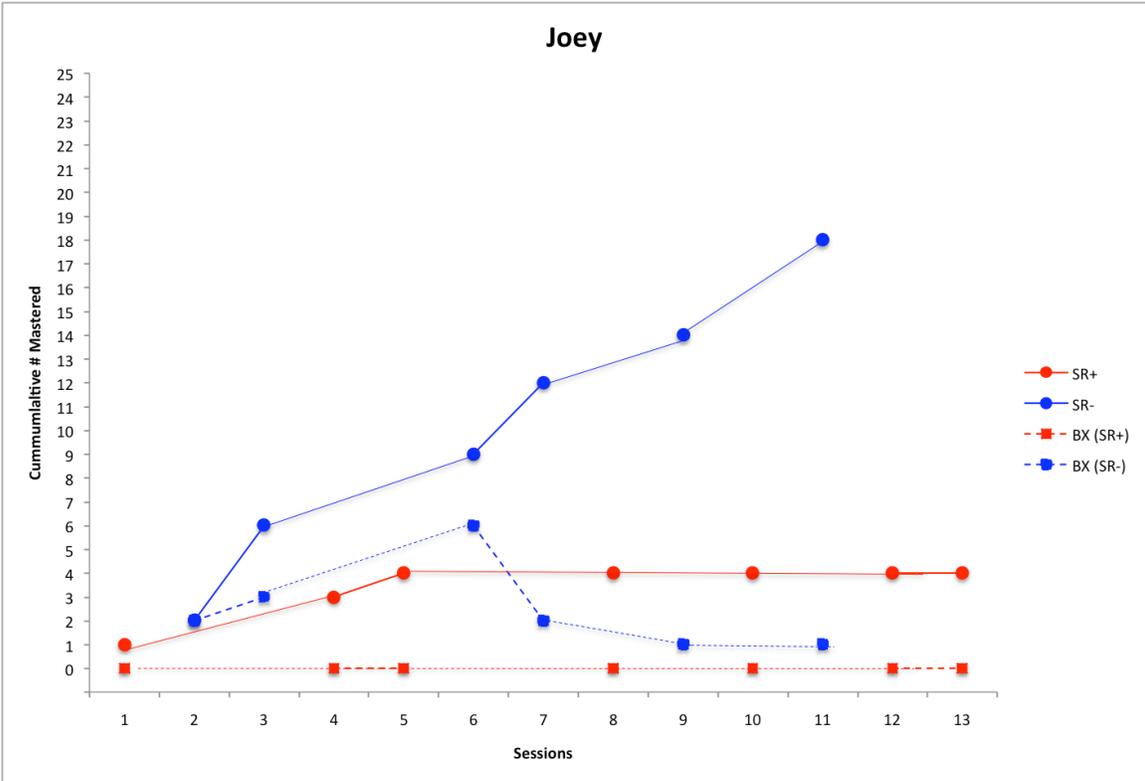


Figure 7

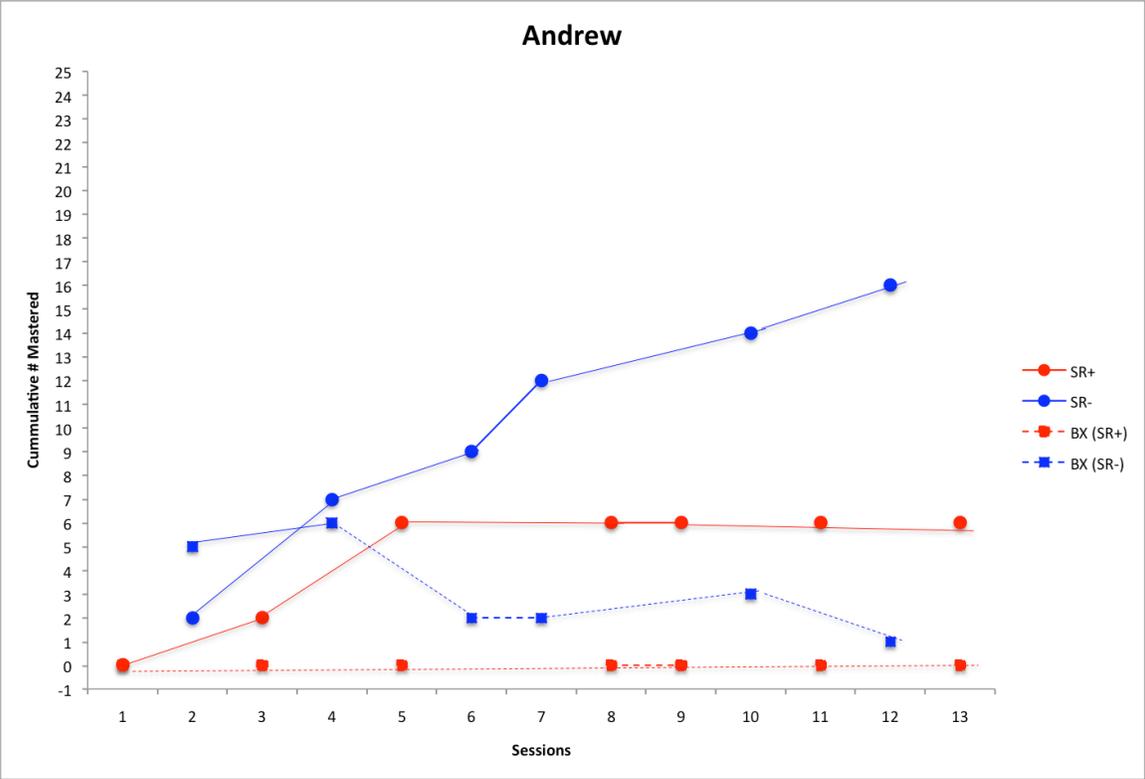


Figure 8

