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## Examining the effects of increasing schedule requirements on preference in an applied setting

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**Examining the Effects of Increasing Schedule Requirements on Preference in an  
Applied Setting**

**A Thesis Presented**

**by**

**Ashley A. Ahlers**

The Department of Counseling and Applied Educational Psychology

In partial fulfillment of the requirements

for the degree of

**Master of Science**

**in the field of**

**Applied Behavior Analysis**

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NORTHEASTERN UNIVERSITY

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in an Applied Setting

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**Examining the Effects of Increasing Schedule Requirements on Preference in an  
Applied Setting**

by

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Submitted in partial fulfillment of the requirements for the degree of  
Master of Science in Applied Behavior Analysis  
in the Bouvé College of Health Sciences Graduate School  
of Northeastern University, May 2010

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### **Abstract**

This study describes a two-phase experiment which was conducted to assess the relative reinforcer effectiveness of high, low and moderately-preferred stimuli as the effort required was increased. Two individuals with traumatic brain injury, in an applied setting, were presented with a 3-choice concurrent operants paradigm involving three identical tasks. In each phase, two reinforcers were present along with a no reinforcement option. In Phase 1, the reinforcers available were high and low-preferred stimuli. In Phase 2, the reinforcers available were two moderately-preferred stimuli. When comparing high-preferred, low-preferred, and no reinforcement concurrently, a clear preference for the high-preferred stimuli was demonstrated by both participants as the effort required by the participant increased. In addition, when two moderately-preferred stimuli were concurrently available along with a no reinforcement option, a clear preference for one of the two similarly preferred stimuli was demonstrated for one participant. For the second participant, preference for either of the moderately-preferred stimuli over the no reinforcement option was not demonstrated until the response effort was increased. The results suggest that traditional preference and reinforcer assessments may not accurately account for the relative preference of stimuli when examined in an applied setting.

## Examining the Effects of Increasing Schedule Requirements on Preference in an Applied Setting

Identifying stimuli that may serve as reinforcers has been explored extensively in behavior analytic literature. Researchers have focused on a variety of procedures to both assess an individual's preference and test whether identified stimuli will effectively function as potent reinforcers (e.g., Piazza, Fisher, Hagopian, Bowman, & Toole 1996).

Traditionally, caregivers have been asked to identify stimuli they felt were preferred by individuals for the purposes of reinforcement. In order to test for preference in a more controlled and measurable way, Pace, Ivancic, Edwards, Iwata, & Page (1985) developed the first systematic assessment of preference. Stimuli were presented singularly while an approach response was measured. Green, Reid, White, Halford, Brittain, & Gardner (1988) then conducted a study in which a staff reported ranking of preferred stimuli was compared with this systematic assessment procedure. The authors found no correlation between staff rankings and client initiated approach responses.

With these findings, several different types of systematic preference assessments were developed, including pairing two stimuli and requiring a choice between them (Fisher, Piazza, Bowman, Hagopian, Owens, & Slevin 1992), displaying a multiple stimulus array and replacing any chosen stimuli (Windsor, Piche, & Locke 1994), displaying a multiple stimulus array without replacing any chosen stimuli (DeLeon & Iwata 1996), and observing the duration that individuals

interacted with stimuli in a free choice environment (Roane, Vollmer, Ringdahl, & Marcus 1998).

While these assessments are designed to identify a set of preferred stimuli, a second systematic assessment is needed to measure the stimuli's reinforcing value, if any. These reinforcer assessments are designed to test and/or validate a preference assessment's outcomes. Reinforcer assessment results can identify false positives (Paclawskyj & Vollmer 1995), demonstrate a correlation between relative preference and relative reinforcer effectiveness (Piazza, Fisher, Hagopian, Bowman, & Toole 1996), and illustrate relative preference under a concurrent operants design and absolute preference under a single operant design (Roscoe, Iwata, & Kahng 1999).

Furthermore, reinforcer assessments can utilize a variety of designs. Frequently, the previously identified stimulus is delivered as a consequence for a simple gross motor response on a fixed ratio 1 schedule. Depending on a variety of factors, including design, target response, and schedule of reinforcement, the outcome of a reinforcer assessment can be affected in many ways. Perry & Fisher (2001) explored how behavioral economics can influence response effort, Gottschalk, Libby, & Graff (2000) demonstrated the effects of motivating operations on assessment outcomes, and Tiger, Hanley & Hernandez (2006) evaluated the effect of instituting choice as part of their assessment.

Additionally, the schedule of reinforcement employed in a reinforcer assessment can also have dramatic effects. The same stimulus can be evaluated with varying results depending on the type of reinforcement schedule used. Two studies using progressive ratio schedules showed dramatically different results. Francisco,

Borrero, & Sy (2008) demonstrated that low preferred stimuli can be effective reinforcers even when schedule requirements are increased, while Roane, Lerman, & Vondran (2001) illustrated that this same schedule can differentiate stimuli and their effectiveness according to high and low effort. Similarly, a study comparing fixed ratio to progressive schedule requirements has also shown stimuli to be similarly effective as a function of schedule requirements (Glover, Roane, Kadey, & Grow 2008).

Two studies utilizing an increasing fixed ratio schedule of reinforcement have yielded some important results with interesting practical applications. Tustin (1994) demonstrated a reverse in preference as schedule requirements were increased, and DeLeon, Iwata, Goh, & Worsdell (1997) demonstrated an emergence of preference as schedule requirements were increased, but only for categorically similar stimuli (in this study, only edibles).

Tustin (1994) compared two stimuli, a constant color visual stimulus and a complex sensory stimulus (consisting of visual and auditory components), while systematically increasing the schedule of reinforcement from fixed ratio 1 to fixed ratio 20. Under the FR1 schedule, the participant preferred the constant color visual. When the schedule increased to FR2, preference for both stimuli became virtually equal. As the schedule continued to increase to FR5, FR10 and finally, FR20, the participant's preference for the second stimuli, complex sensory, became even greater over the constant color visual.

DeLeon, Iwata, Goh, & Worsdell (1997) compared functionally similar stimuli (edibles) and functionally dissimilar stimuli (edibles and activities) with two

participants while also increasing the schedule of reinforcement systematically from FR1 to FR20. When functionally dissimilar stimuli were compared, no consistent preference emerged for either participant, even while the requirement increased from FR1 to F2, FR5, FR10 and FR20. In contrast, when functionally similar stimuli were compared, a preference was illustrated to emerge during the FR5 schedule and continued to expand during the subsequent FR10 and FR20 schedules. A reversal to the FR1 condition was conducted for one participant and the previous lack of preference returned.

These results have important practical implications. Preference and reinforcer assessments are used to identify potential reinforcers for use in applied settings. Reinforcer assessments that utilize a FR1 schedule of reinforcement are often not testing stimuli in a way that is comparable to their use in schools, community settings, etc. These environments are generally unable to reinforce behavior on a continuous schedule. Increasing the schedule of reinforcement to levels as high as FR40 means we are better able to assess the effectiveness of the reinforcing stimuli outside of the research environment.

The current research in this area is incomplete. The target behaviors completed in reinforcer assessments are often simple gross motor tasks. Again, other environments will require more complicated responses and assessments should account for this. Additionally, access to the reinforcing stimuli during these assessments is often short, 30 seconds, and not comparable to procedures utilized in applied settings. Therefore, the purpose of this study is to assess reinforcer effectiveness with more applied tasks and realistic reinforcement procedures for use

in educational settings. A MSWO preference assessment will be conducted to identify each participant's high, low and moderately-preferred stimuli. Then, reinforcer assessments will be conducted to determine if manipulating the work required to gain access to reinforcement affects preference.

## Method

### *Participants and Setting*

Two school-age individuals participated in this study. They both attended a school and residential treatment center serving children and adolescents with brain injury. Jamie was 13 years old and had been diagnosed with Costello syndrome. She was able to discriminate objects, pictures and words, could follow multiple step directions and complete 2-digit addition math problems. Derek was 14 years old and had been diagnosed with Neurofibrosis Type II and TBI. He was able to discriminate objects, pictures and words, could follow multiple step directions and multiply the numbers 1 through 9.

Sessions were conducted in therapy rooms located in the participants' school. These rooms were free of distractions and had a table and chairs for the participant and experimenter to sit.

### *Materials*

The stimuli utilized in both the preference assessment and the reinforcer assessments were indicated on 2.5 inches by 6 inches laminated cards (see Appendix A). Each card was labeled with the written name of the stimulus on the left side and an accompanying picture on the right side. The stimuli chosen for each participant were the result of teacher interviews and direct observation. Activities commonly engaged in by the participant were discussed. The stimuli chosen for Jamie were playing with blocks, chatting with the experimenters, using the computer, drawing on a whiteboard, drawing on paper, using a Game Boy Advance SP, going for a walk,

using the gym, completing handwriting worksheets and making copies. The stimuli chosen for Derek were playing on the computer, drawing on a whiteboard, drawing on paper, using a Game Boy Advance SP, going for a walk, using the gym, making copies, listening to music, chatting with the experimenters and playing Uno®. The participants were given 3 minutes to access each stimulus when they exhibited an approach response. The approach response was touching the card indicating the stimuli. Additionally, a timer was used to signal the end of the 3 minute period.

The academic tasks utilized in the reinforcer assessments were based on goals identified by each participant's Individualized Education Plan (see Appendices B and C). Jamie's goal was single and double-digit addition. Derek's goal was single-digit multiplication. Worksheets were created based on these criteria for both participants. The worksheets either contained 2, 4, 10, 20 or 40 problems each.

### *Procedure*

*Preference assessment.* A MSWO preference assessment (DeLeon & Iwata, 1996) was conducted to identify the relative preference of the ten stimuli selected for each participant (see Appendix D). The ten stimuli indicator cards were placed in a semi-circle 6 inches in front of the participant. The experimenter first reviewed all of the choices by pointing to the card and verbally naming the activity. Next, the experimenter had the participant review the choices by pointing to the card and asking the participant to name the activity. Then, the participant was instructed to pick an activity. After a choice was indicated, all of the other cards were removed, the participant was given access to the chosen activity and a timer was started. After

3 minutes, the activity was removed and the cards were once again displayed in front of the participant. The order of the cards were rotated so that the card that was far left previously was then moved to the far right, and all other cards were shifted one position. The participant continued choosing activities until all options were exhausted. This procedure was conducted 5 times with each participant in separate sessions. The results were then calculated by dividing the number of times a stimulus was chosen by the total number of trials the stimulus was available.

*Reinforcer assessments.* Two reinforcer assessments were conducted for each participant (see Appendix E). Phase one consisted of a reinforcer assessment comparing the highest-preferred stimulus and the lowest-preferred stimulus, as identified by the preference assessment, and a no reinforcement option. Choosing the no reinforcement option simply resulted in the presentation of the next trial without a break. Phase two consisted of a second reinforcer assessment comparing moderately-preferred stimuli, which were either approached the same percentage of time during the preference assessment, or close in ranking (within 1 spot).

During phase one, three identical worksheets were placed approximately 6 inches in front of the participant. A card was placed directly above each worksheet, indicating the type of reinforcer to be earned if that worksheet were chosen or indicating that reinforcement was not available. Each worksheet had a corresponding card and the position of the cards were rotated randomly between each trial. During phase one, the cards indicated the highest-preferred stimuli, the lowest-preferred stimuli. The worksheet without a corresponding card was the nothing, or no reinforcement option.

The options for reinforcement were reviewed with the participant before each trial. First, the options were identified and explained by the experimenter. Next, the instructor pointed to each worksheet and asked the participant to identify the reinforcer available. Finally, the participant was requested to pick a worksheet to complete. Once the choice was made, all other worksheets and reinforcement identification cards were removed. When the participant completed the worksheet, the accompanying reinforcer was immediately delivered for three minutes.

Initially, the schedule of reinforcement was FR2, and progressed to FR4, FR10, FR20, and finally, FR40. The requirement of an FR2 schedule was the completion of 2 math problems. Therefore, the requirement of the FR4 schedule was the completion of 4 math problems, FR10 was 10 math problems, FR20 was 20 math problems, and FR40 was 40 math problems. The schedule of reinforcement was increased based upon visual examination of the data. When three consecutive sessions demonstrated consistent results, the schedule was increased. When consistent results were demonstrated during the FR40 schedule, a reversal to the FR2 schedule was conducted.

Phase two followed the same guidelines and procedures as phase one, with only the reinforcement options being manipulated. During this phase, two cards identified the two moderately-preferred stimuli and the no reinforcement option. The schedule of reinforcement was increased in the same way as phase one, FR2, FR4, FR10, FR20, FR40 and a reversal to FR2.

*Inter-observer Agreement and Procedural Integrity*

Inter-observer agreement was collected by an independent observer during 40% of preference assessment trials and 31% of reinforcer assessment trials. IOA was calculated by dividing the total number of trials by the number of agreements and multiplying that number by 100. IOA was measured at 100% for both the preference assessment trials and the reinforcer assessment trials.

Additionally, a procedural integrity data sheet was developed which outlined all steps of the assessments (see Appendices F and G). Procedural integrity was measured during 40% of preference assessment trials and 31% of reinforcer assessment trials. All steps of the assessments were implemented correctly.

## Results

### *Reinforcer Assessments*

Figure 1 illustrates the reinforcers chosen by the participants when comparing high and low-preferred stimuli with the no reinforcement option. This was demonstrated by calculating the percentage of trials during which each option was chosen. When high and low-preferred stimuli were available concurrently with the no reinforcement option, a clear preference was demonstrated for the high-preferred stimuli by both participants.

For Jamie, using the gym, chatting with the experimenters, and the no reinforcement option were concurrently available. During the first reinforcement schedule, Jamie allocated her responses to all of the options, sampling the three different contingencies. Beginning with the FR4 schedule, she began exclusively choosing the gym during every trial. This pattern of allocating her responses to the worksheet which resulted in access to the high-preferred stimuli continued at 100% throughout all reinforcement schedule changes, FR4, FR10, FR20, FR40, and the reversal condition to FR2.

Playing Uno®, going for a walk, and the no reinforcement option were concurrently available for Derek. Beginning with the FR2 schedule, Derek consistently chose the worksheets which resulted in playing Uno over the worksheets which resulted in going for a walk or no reinforcement. This near exclusivity was maintained throughout all reinforcement schedule changes. Derek's preference for playing Uno® ranged from 77.78% during the FR2 condition to 100% during the

FR40 condition. Derek's responding indicated that he preferred the high-preferred stimulus when compared with the low-preferred stimulus and the no reinforcement option.

Figure 2 illustrates the reinforcers chosen by the participants when comparing two moderately-preferred stimuli with the no reinforcement option. Again, this was demonstrated by calculating the percentage of trials during which each option was chosen. The moderately-preferred stimuli compared for Jamie were drawing and playing with blocks, and drawing and making copies for Derek. When moderately-preferred stimuli were available concurrently with the no reinforcement option, a clear preference was demonstrated immediately by Derek. Conversely, Jamie's responding indicated that preference may only emerge after sustained exposure to the stimuli.

Jamie's responding was variable during the first two reinforcement schedules, FR2 and FR4. The two moderately-preferred stimuli, blocks and drawing, and the no reinforcement option were all sampled. Beginning with the FR10 schedule, consistent responding toward the worksheet which resulted in access to drawing began to emerge (48.72%). This pattern of responding continued during the FR20 (66.67%), FR40 (59.72%) and FR2 reversal (100%) schedules.

A different pattern of responding was demonstrated by Derek. When making copies, drawing and the no reinforcement option were concurrently available for Derek, 100% of his responding was toward one stimulus, making copies, regardless of any schedule requirement change. He consistently chose the worksheets which

resulted in making copies over the worksheets which resulted in drawing or no reinforcement.

### *Rate and Accuracy*

Rate and accuracy data were taken on the worksheets completed by Derek and Jamie during both phases (see Figures 3 and 4).

*Rate.* For both participants, the rate of completion was highest during phase two, when moderately-preferred stimuli were compared. For Jamie, her average rate during phase one was 10.16 responses per minute, while her average rate during phase two was 12.76 responses per minute. For Derek, during phase one his average rate was 15.24 responses per minute and during phase two his average rate was 29.06 responses per minute. When the reinforcement options consisted of moderately-preferred stimuli, both participants demonstrated a higher rate of math worksheet completion.

Additionally, as the schedule of reinforcement increased, the participants' rate of completion also increased, although this effect was not consistently demonstrated during the reversal FR2 schedule. In order of the reinforcement schedule changes, Jamie's rates of completion during phase one were: 7.86, 7.34, 8.44, 10.64, 12.35 and 14.3 responses per minute; and during phase two: 10.25, 10.96, 12.56, 12.86, 14.17 and 15.78 responses per minute. While her rate of completion gradually increased as the schedule of reinforcement also increased, it did not return to previous levels when the reversal FR2 condition was conducted.

Derek's rates of completion in order of reinforcement schedule changes during phase one were: 8.28, 12.86, 17.45, 13.34, 18.01 and 21.49 responses per minute; and during phase two: 16.36, 20.67, 75.52, 21.66, 23.76, and 16.36 responses per minute. Note the differences in Derek's phase two data; his rates gradually increase with the exception of a marked increase during the FR10 condition. Also, the reversal FR2 condition in this phase is the only example of similar completion rates between the FR2 and FR2 reversal conditions.

*Accuracy.* Jamie demonstrated the highest accuracy during the FR10 schedule of reinforcement, 79.44% in phase one and 74.49% in phase two (Figure 4). Also, Jamie's accuracy across phases was almost equal, 71.80% in phase one and 69.67% in phase two. The difference in available reinforcers did not affect her accuracy.

Derek demonstrated the highest accuracy during the reversal FR2 schedule in phase one with 41.67% and during the FR4 condition in phase two with 62.50%. Also, Derek had consistently higher rates of accuracy during phase two as compared with phase one. His average accuracy during phase one was 32.11% and during phase two was 41.39%. This discrepancy was most notable during the less effortful schedules, FR2 and FR4.

## Discussion

Examination of the data suggests some interesting findings about the utility and accuracy of preference and reinforcer assessments. For both participants, the preference assessment results indicating high and low-preferred stimuli were validated by the reinforcer assessment results. This is consistent with previous findings when comparing high and low-preferred stimuli (e.g. Piazza, Fisher, Hagopian, Bowman, & Toole 1996, Roscoe, Iwata, & Kahng 1999). Alternately, the preference assessment results indicating moderately-preferred stimuli did not accurately identify relative preference for either participant. When comparing moderately-preferred stimuli, one participant required a longer exposure time to the stimuli before preference became clearly delineated. The second participant demonstrated an immediate and clear preference for one stimulus even though the preference assessment identified both stimuli as having the same preference ranking. These results differ somewhat from previous research in which changes in preference were attributed to the manipulation of the schedule of reinforcement (DeLeon, Iwata, Goh, & Worsdell 1997).

In this study, a change in preference was either demonstrated immediately or after increased exposure time to the stimuli. There is no evidence that the changes in reinforcement schedules had any measurable effect on preference. This difference may be attributed to procedural changes, such as the inclusion of a no-reinforcement option and more complicated tasks.

Interestingly, both participants demonstrated higher rates of responding and either similar accuracy (Jamie) or higher accuracy (Derek) during phase two. One

explanation for these results could be a practice effect. While the tasks utilized in this study were part of the participants' regular school programs, the more effortful work schedules (FR20, FR40) required a large increase in production over baseline levels. During these work schedules, the participants were required to complete up to 40 math problems for each trial, which could amount to 240 math problems for one session. Even without an error correction procedure, this amount of practice could have increased the participants' rate and accuracy during the second phase.

Overall, these results indicate that reinforcer assessments are often needed to determine the validity of preference assessments. Stimuli that are similarly preferred during a preference assessment can be affected by the length of exposure, the schedule of reinforcement by which they are delivered, or even the type of preference assessment used. In order to directly test the validity of preference assessment results for use in an applied environment, several aspects of the traditional reinforcer assessment procedure were manipulated to more accurately mirror an applied environment.

First, stimuli were delivered on a variety of fixed ratio schedules of reinforcement. While many reinforcer assessments test stimuli using a FR1 schedule, this study utilized increasing fixed ratio schedules to better simulate reinforcement delivery in the classroom. Reinforcing behavior on a FR1 schedule is often difficult to maintain for long periods of time in applied settings. Sustained use of a FR1 schedule would essentially require a 1:1 staff to student ratio and perfect reinforcement delivery by staff. Gradually increasing a reinforcement schedule from FR1 is an important tool in any applied environment.

Second, academic tasks were used as target responses instead of simple, gross motor responses. The participants in this study would have found completing a gross motor task, such as sorting blocks, to be low in effort. Therefore, if they had to complete this sorting task 2 times or 20 times we could not be sure that there would be any substantial difference in their response effort. One of the goals of this study was to develop effective reinforcers for difficult tasks, responses which are often required in a classroom. This change to more varied tasks can produce more salient effects during the reinforcement assessment.

Finally, the duration of access to reinforcement was increased to 3 minutes. While some reinforcer assessments allow access to tangible stimuli for 30 seconds, this study tried to minimize any possible punishing effects of a short access time. For example, simply starting one of the stimuli used in this experiment, a Game Boy Advance SP, could easily take up a large amount of the allotted 30 seconds for reinforcement. In this case, some individuals might knowingly forgo choosing this item and select an item in which they could access for the full reinforcement time allotted.

One limitation of this study is the length of time from the initial preference assessment to the final reinforcer assessment phase. Due to experimenter and participant availability, data collection occurred during a period of 6 months. The participants' preference may have changed as a function of time. Only one preference assessment was conducted at the beginning of the study and was not repeated at any time. Additionally, access to the stimuli used was not controlled for

outside of the therapy room. The participants had access to most of these items and activities throughout the day.

A second limitation is the lack of control for one participant during the reversal FR2 condition. Each reinforcer assessment contained a reversal condition to the FR2 schedule of reinforcement in order to replicate the results of the first FR2 schedule. If the results were replicated then experimental control would be demonstrated and any difference in preference could be concluded as a function of the reinforcement schedule. Jamie's results during the FR2 schedule in phase two did not replicate during the reversal FR2 condition. Her results are attributed to the fact that she required sustained exposure to the stimuli in order for clear preference to emerge.

Lastly, the participants were given no feedback on their accuracy or required to complete any error correction. The participants' accuracy had no effect on their access to reinforcement and was never discussed. This lack of feedback and error correction may have affected both the participants' rate and accuracy.

This study has many important implications for the use of preference and reinforcer assessments in applied settings. While this experiment explored the ideas of manipulating the schedule of reinforcement, length of reinforcer access and difficulty of target response, there are still more areas to investigate. Further research should explore using other modes of reinforcing stimuli, including edible reinforcement. Additionally, different schedules of reinforcement could be further manipulated with a variety of academic and vocational tasks. In conclusion, further

ways to make preference and reinforcer assessments more easily applicable to school and community settings should be examined.

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Appendix A

Reinforcer cards

**Computer**



**Chat**



**Uno**



**Go For A  
Walk**



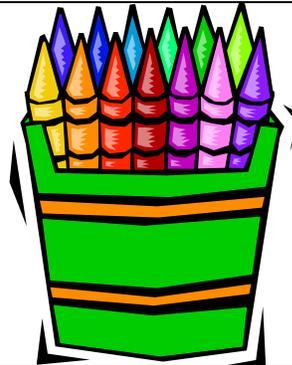
**Make  
Copies**



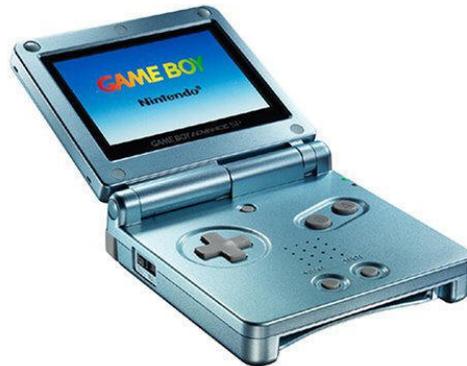
**Draw on  
Whiteboard**



**Drawing**



**Game-Boy**



<h1>Gym</h1>	
<h1>Music</h1>	
<h1>Blocks</h1>	
<h1>Handwriting</h1>	<p>1 2 3 4 5 6 7 8 9 0 ÷ x</p> <p>The quick brown fox jumps over a lazy dog., / -</p> <p><small>ZNuscript Heavy Guided</small></p>

**Appendix B**

Jamie's task

Student:

Date: \_\_\_\_\_

$$\begin{array}{r} 20 \\ +77 \\ \hline \end{array}$$

$$\begin{array}{r} 26 \\ +71 \\ \hline \end{array}$$

---

$$\begin{array}{r} 21 \\ +66 \\ \hline \end{array}$$

$$\begin{array}{r} 20 \\ +11 \\ \hline \end{array}$$

### Appendix C

Derek's task

Student:

Date: \_\_\_\_\_

$$\begin{array}{r} 2 \\ \times 2 \\ \hline \end{array}$$

$$\begin{array}{r} 4 \\ \times 5 \\ \hline \end{array}$$

---

$$\begin{array}{r} 8 \\ \times 5 \\ \hline \end{array}$$

$$\begin{array}{r} 7 \\ \times 5 \\ \hline \end{array}$$

## Appendix D

### *Multiple Stimulus Without Replacement Preference Assessment*

1. Line up stimulus choice cards 1 inch apart in a straight line array
2. Before beginning the assessment, review the stimulus choice cards with the student
 

**“I’m going to review your choices. You can do each activity for 3 minutes. Follow along with your finger.”**

Point to each card and read the verbal description
3. Instruct the student to choose a card
 

**“Which activity would you like to do first? Point to the card with the activity you would like to do.”**
4. Once a card is chosen, remove it from the array and begin the activity.
 

**“You have 3 minutes for \_\_\_\_\_. Once I start the timer you can begin.**

If the activity is a discrete action, no timer is set.
5. If applicable, set a timer for 3 minutes.
6. When the timer goes off, remove the activity or turn it off.
 

**“Your time is up. Have a seat at the table.”**

When the activity is over (ex: copies have been made), have the student return to the table.

**“\_\_\_\_\_ is all done. Have a seat at the table.”**
7. Prior to allowing the student to choose the next activity, remove the card farthest to the left and place it farthest to the right on the line.
8. Instruct the student to pick another card.
 

**“Which activity would you like to do next? Point to the card with the activity you would like to do.”**
9. Repeat procedure for engaging with the stimulus.
10. Repeat procedure until all stimulus cards have been chosen, or until no selection is made after 1 minute.

## Appendix E

### *Reinforcer Assessment*

1. Place three identical tasks in front of student, 6 inches apart – place icon cards behind 2 tasks, leaving the third task without a card.
2. Before beginning the assessment, review the contingencies.  
**“You can choose whichever worksheet you want to do. Each worksheet is the same. If you chose this worksheet, you can earn \_\_\_\_\_. If you chose this worksheet, you can earn \_\_\_\_\_. If you chose this worksheet, you will not earn an activity.”**
3. Ask the student to repeat the contingencies.  
**“If you chose this worksheet, what do you earn?”**
4. Instruct the student to choose a worksheet.  
**“Which worksheet would you like to do?”**  
Once a worksheet is chosen, remove the other two worksheets and icon cards.
5. Start the timer when the student begins working.
6. When the worksheet(s) is completed, stop the timer and record the time.  
**“Nice job finishing your work. You earned \_\_\_\_\_.”**
7. Give access to S<sup>R+</sup> for 3 minutes.
8. Repeat procedure until 6 trials have been conducted.

**Appendix F***Multiple Stimulus Without Replacement Integrity Check*

*Student:*

*Date:*

*Session #:*

- Line up stimulus choice cards 1 inch apart in a semicircle array
- Review the stimulus choice cards with the student  
Point to each card and read the verbal description
- Instruct the student to choose a card
- Once a card is chosen, remove it from the array and begin the activity.
- Set a timer for 3 minutes.
- When the timer goes off, remove the activity or turn it off.
- Remove the card farthest to the left and place it farthest to the right on the semicircle.
- Instruct the student to pick another card.
- Repeat procedure until all stimuli cards have been chosen, or until no selection is made after 1 minute.

**Appendix G***Reinforcer Assessment Integrity Check**Student:**Date:**Condition:**Session #:*

- Place three identical tasks in front of student
- Place icon cards behind 2 tasks, randomized across trials
- Before beginning the assessment, review the contingencies.
- Instruct the student to choose a worksheet.
- Once a worksheet is chosen, remove the other two worksheets and icon cards.
- When worksheet is complete - give access to  $S^{R+}$  for 3 minutes.
- Repeat procedure until 6 trials have been conducted.

### Figure Captions

*Figure 1.* The percentage of trials either the high-preferred stimulus, low-preferred stimulus or no reinforcement option was chosen.

*Figure 2.* The percentage of trials either of the moderately-preferred stimuli or no reinforcement option was chosen.

*Figure 3.* The rate of math worksheet completion measured as responses per minute.

*Figure 4.* The accuracy of math worksheet completion measured as percentage correct.

Figures

Figure 1

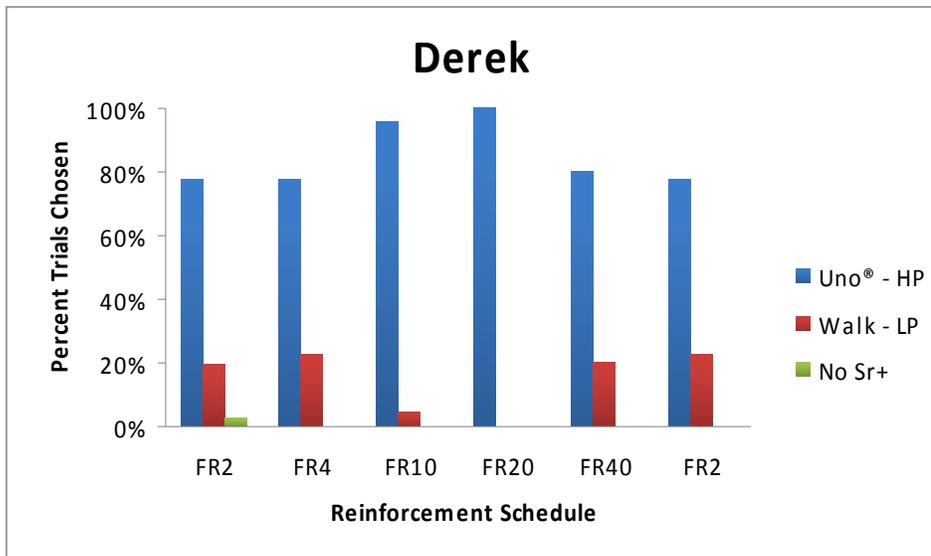
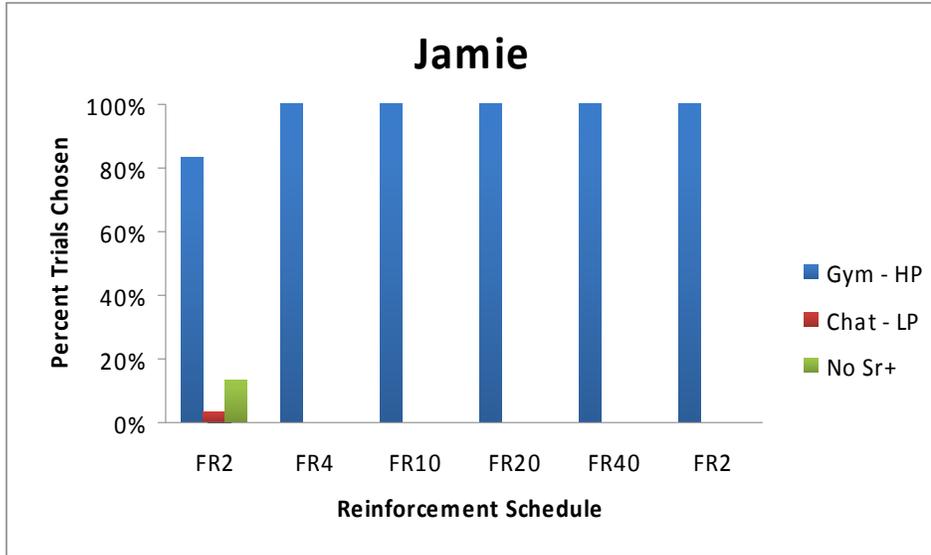


Figure 2

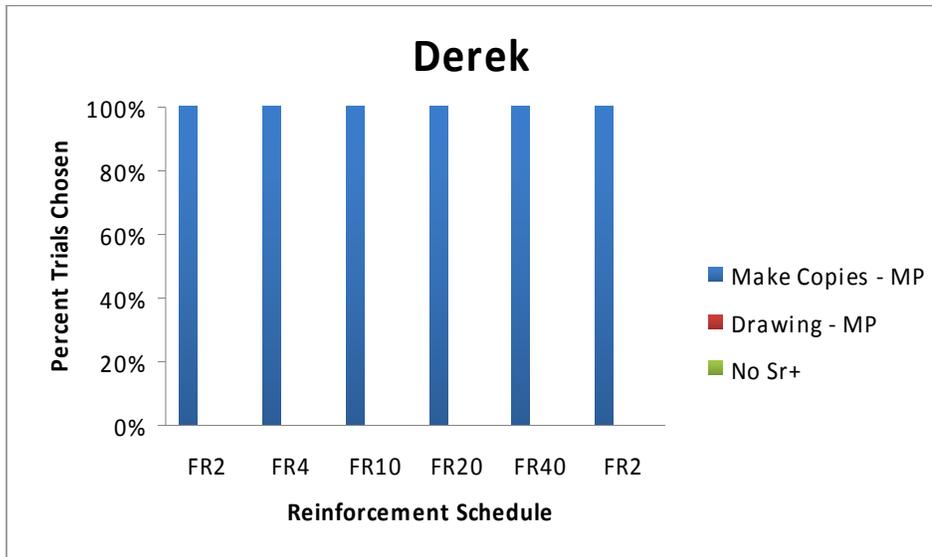
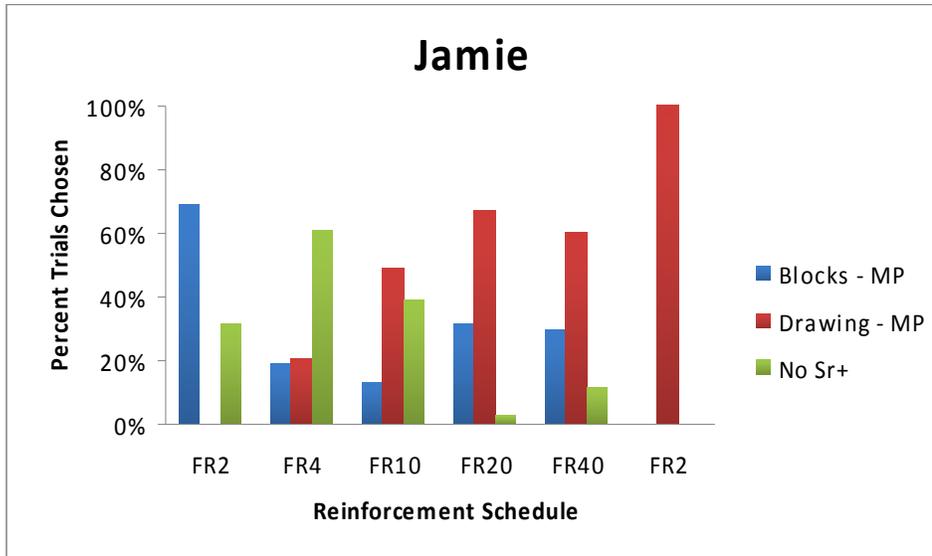


Figure 3

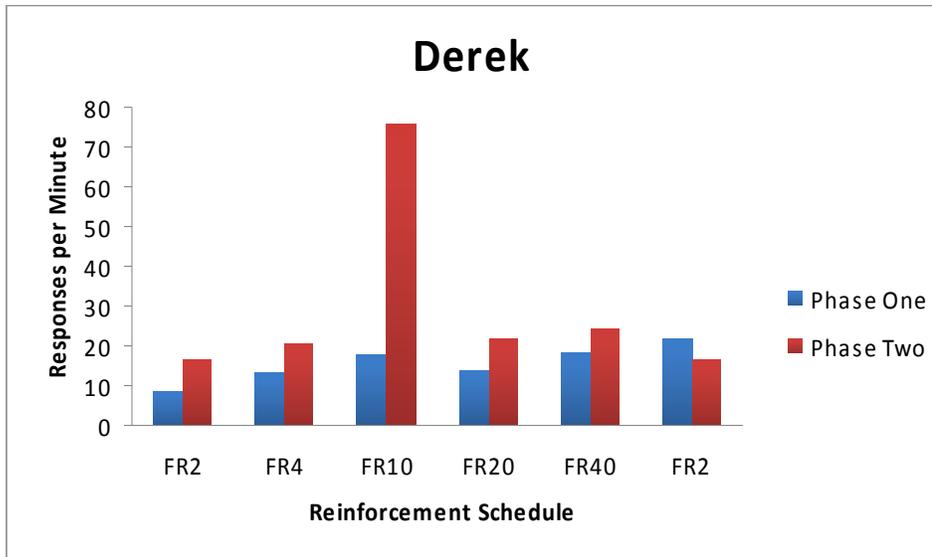
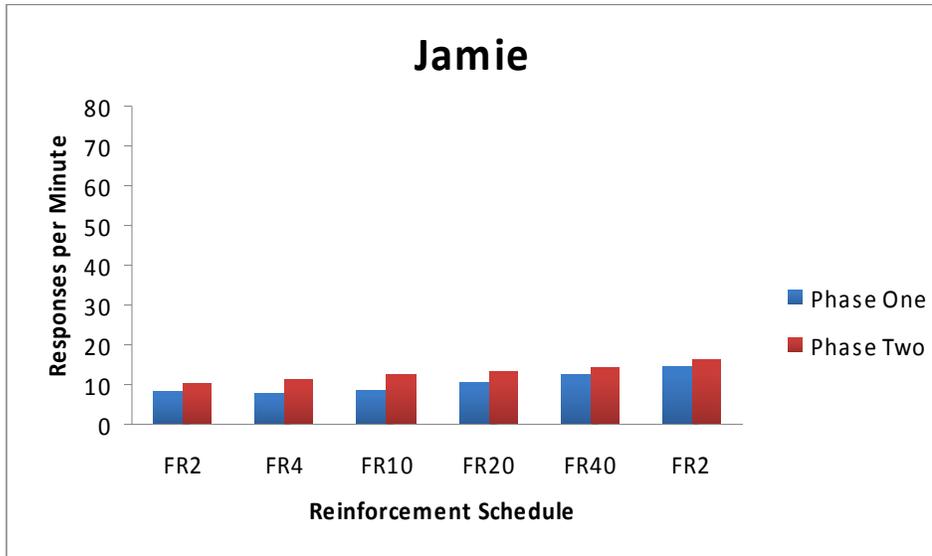


Figure 4

