The Effects of Varying Response Requirements on

Reinforcer Potency

A Thesis Presented

by

Deborah L. Edelman

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

Northeastern University

Boston, MA

May 2013
NORTHEASTERN UNIVERSITY
Bouvé College of Health Sciences Graduate School

Thesis Title: The Effects of Varying Response Requirements on Reinforcer Potency

Author: Deborah Edelman

Department: Counseling and Applied Educational Psychology

Approved for Thesis Requirements of Master of Science Degree

Laura Dudley, MS., BCBA  4/16/13

Hanna Rue Ph.D., BCBA  4/16/13

Karen E. Gould, Ph.D., BCBA  04/16/13
The Effects of Varying Response Requirements on

Reinforcer Potency

By

Deborah Edelman

Bachelor of Art in Psychology

Clark University

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 2013
Acknowledgements

I would like to thank my thesis committee chair Laura Dudley, MS., BCBA, as well as Hanna Rue, Ph.D., BCBA, and Karen Gould, Ph.D., BCBA, for their guidance during the last three years at Northeastern University. I would also like to thank Ann Poppenga, MS., BCBA, for her support at Westwood Public Schools for the past two years. Finally, I would like to thank my friends and family for their unwavering encouragement and confidence throughout my journey.
Table of Contents

Abstract ......................................................................................................................... 2

Introduction .................................................................................................................. 3

Method .......................................................................................................................... 7
  Participants and Setting .............................................................................................. 7
  Response Measurement and Interobserver Agreement ............................................... 8
  Procedure .................................................................................................................. 9

Results .......................................................................................................................... 11

Discussion ..................................................................................................................... 14

References ................................................................................................................... 17

Appendix A .................................................................................................................. 20

Appendix B .................................................................................................................. 21

Appendix C .................................................................................................................. 24

Appendix D .................................................................................................................. 25

Figure Captions .......................................................................................................... 26

Figures ......................................................................................................................... 27
ABSTRACT

The current study evaluated the effects of a progressive fixed ratio (FR) schedule of reinforcement on response rate. This study also attempted to identify the optimal schedule of reinforcement to maintain high rates of responding while avoiding satiation for two children diagnosed with autism and one typically developing child. Following a paired stimulus preference assessment a progressive ratio reinforcer assessment was conducted. Ratio strain was observed for two participants. An unexpected result was observed for the third participant, a decreasing rate of response during the FR20 condition suggests habituation. A dishabituation probe that led to an increase in responding was conducted supporting this conclusion.

Keywords: reinforcer assessment, response requirements, ratio strain, habituation, dishabituation, preference assessment
The ability to determine how, and with which stimuli to reinforce an individual can be crucial to the success of a behavioral intervention procedure. A large number of intervention procedures rely on the principle of positive reinforcement (Cooper, Heron, & Heward, 2007). Positive reinforcement occurs when the future likelihood of a behavior occurring is increased by the immediate presentation of a stimulus following the target behavior (Cooper et al., 2007). In order for a positive reinforcement program to be successful, a reinforcer must be correctly identified and an appropriate schedule of reinforcement must be used.

One challenge when designing a schedule of reinforcement is ratio strain. Ratio strain can occur when moving from a denser reinforcement schedule to a thinner reinforcement schedule (Cooper et al., 2007). Slowly increasing ratio requirements can help in avoiding ratio strain. “Ratio strain will occur also when the ratio becomes so large that the reinforcement cannot maintain the response level…” (Cooper et al., 2007, pp. 314).

Habituation is another challenge that can occur when creating a schedule of reinforcement. Habituation happens when responding to a stimulus, presented repeatedly over a short period of time, decreases or ceases to occur (McSweeney & Murphy, 2009). In 2001, Aoyama and McSweeney used dishabituation, the presentation of a strong, different, or extra stimulus, to restore responding to a habituated stimulus. Aoyama and McSweeney changed the response requirements to produce dishabituation. For example, a fixed ratio 8 (FR8) schedule of reinforcement was briefly inserted into an FR4 schedule of reinforcement. Responding increased, relative to baseline, following this manipulation.
Preference assessments have been used to compare a variety of stimuli and determine which stimuli are preferred over others (e.g. Cote, Thompson, Hanley, & McKerchar, 2007; Fisher, Piazza, Hagopian, Owens, & Slevin, 1992; Gottschalk, Libby, & Graff, 2000; etc.). Descriptive analysis which includes interviews with family, familiar staff, and the individual, as well as observations, produces only tentative results. Cote et al. (2007) asked teachers to assess, through descriptive analysis methods (i.e. interview), which stimuli were preferred by their students. They then conducted a more formal preference assessment using the paired-stimulus preference assessment described by Fisher et al. (1992). They discovered that for five out of nine participants the teachers had identified different stimuli as highly preferred than the results of the formal preference assessment revealed.

Additional research on preference assessment includes the following studies. In 1985, Pace, Ivancic, Edwards, Iwata, & Page conducted a study in which participants were exposed to 16 potentially preferred stimuli in sets of four as part of a preference assessment procedure. Approaching behavior was used to determine if a stimulus was preferred or nonpreferred. In 1992, Fisher, et al, conducted a study in response to Pace, et al, (1985) citing limitations such as participants approaching multiple stimuli at once. Fisher et al, (1992) introduced a procedure in which two stimuli were paired instead of multiple stimuli and one stimulus must be chosen. Their results showed greater differentiation between stimuli within the assessment and higher levels of responding when the participant was presented the preferred stimulus within this contingency.

Identifying a stimulus as preferred for a particular individual, does not show that it has reinforcing potency for that individual. Reinforcer assessments have been used to examine if, in fact, an item has a reinforcing potency (e.g. Francisco, Borrero, & Sy, 2008; Neef, Mace, Shea,
& Shade, 1992; Paclawskyj & Vollmer, 1995; etc.). “Reinforcer assessment refers to a variety of direct data-based methods used to present one or more stimuli contingent on a target response and then measuring the future effects on the rate of responding” (Cooper et al., 2007, pp. 280). In Pace et al’s, 1985 study, Experiment 2 focused on the reinforcing potency of a preferred stimulus, identified in Experiment 1. The preferred stimulus was presented contingent upon the occurrence of a target response.

In 1994, Tustin found that preference for one stimulus over another changed as a result of increased response requirements. DeLeon, Iwata, Goh, and Worsdell (1997) conducted a study in which the purpose was to replicate Tustin’s findings and investigate the conditions under which shifts in preference will and will not occur by making comparisons of categorically similar and dissimilar reinforcers. A multiple stimulus without replacement (MSWO) preference assessment (DeLeon & Iwata, 1996) was conducted. When conducting a MSWO preference assessment an array of stimuli is placed in front of the participant. Once a stimulus has been selected, the participant is allowed to access it for a fixed amount of time. The chosen stimulus is then removed from the array. This continues until all stimuli in the array are selected. Following the preference assessment, reinforcer assessments were conducted. Two similar stimuli (with similar levels of preference) were presented, and two dissimilar stimuli (with similar levels of preference) were presented. Similar stimuli included two edibles; dissimilar stimuli included an edible and a leisure activity. The schedule of reinforcement began at a fixed ratio 1 response (FR1), then progressively increased to FR 2, FR 5, FR 10, and (for dissimilar reinforcers) FR 20. Results were similar for both participants. When the reinforcers were dissimilar responding was allocated roughly equivalently for each reinforcer. A clear preference emerged for each similar reinforcer.
Roane, Lerman, and Vondrain (2001) compared the reinforcing efficacy of preferred stimuli under progressive ratio (PR) schedules. A paired stimulus preference assessment (Fisher et al., 1992) was conducted. Two highly ranked stimuli, which were scored similarly during the preference assessment, were selected for the reinforcer assessment. During the reinforcer assessment reinforcers were delivered on a progressive ratio schedule. For each of the five participants one stimulus was associated with greater response persistence under increasing schedule requirements.

Penrod, Wallace, and Dyer (2008) showed that low preference (LP) stimuli will maintain responding on an FR1 schedule and on a Progressive Ratio schedule in their four participants. They also showed that a high preference (HP) stimulus was more effective in maintaining response persistence under an increasing PR schedule. This means that both HP and LP reinforcers were similarly effective under a low FR schedule, but once the schedule increased HP reinforcers were more effective.

DeLeon, Gregory, Frank-Crawford, Allman, Wilke, Carreau-Webster, and Triggs (2011) manipulated the schedule of reinforcement for four similarly preferred stimuli to investigate how these contingencies affected preference and reinforcer potency. First, a paired-choice preference assessment was conducted to determine which stimuli would be used in the study. A progressive-ratio analysis was conducted in which the participant would complete a task before he was given access to the reinforcer. After the first trial the schedule of reinforcement was thinned, during the second trial the participant was to engage in two responses in order to access the reinforcer, then three responses and so forth. When the participant did not respond for one minute the session was terminated, they termed this the “PR break-point”. The next phase to this study each stimulus was randomly assigned to one of the following four experimental conditions: FR1,
escalating FR, noncontingent reinforcement (NCR), or restricted. During the FR1 a fixed ratio 1 schedule of reinforcement was put in place. In the escalating FR condition the schedule of reinforcement was increased after every fifth session, the reinforcement schedule was FR1, FR2, FR5, and FR10. During the NCR condition the participant delivery of the stimulus was not contingent on responding but was on a fixed time (FT) schedule, which was calculated by finding the average reinforcers earned per minute during the preceding FR1 session. The stimulus which was assigned to the restricted condition was not present during this phase of the study. Finally a preference assessment was conducted with the four stimuli used throughout the study as well as another PR analysis. There were no significant changes in the preference assessment data. The PR break-points increased on average for all conditions, this change was highest for the stimuli in the restricted group and lowest for the stimuli in the NCR group.

These studies suggest that the reinforcing potency of a stimulus varies depending on the schedule of reinforcement used. The current study extends previous research findings by exploring the effects of a progressive FR schedule of reinforcement on response rate. This study also attempts to identify the optimal schedule of reinforcement for two individuals with autism and one typically developing individual.

METHOD

Participants and Setting

Three individuals participated in this study. Alicia was a 16 year-old female diagnosed with autism. She had no verbal speech, communicated mainly using a small communication book (about the size of a wallet) with picture symbols which she pointed to in order to make requests, and had a communication board which worked in a very similar way to the book. Alicia had
access to other forms of communication (i.e., iPad, PECS), but did not make frequent or notable use of these devices. However, she had good receptive language skills and could carry out known directions. Alicia also had no physical limitations. Jesse was an 8 year-old male diagnosed with autism. He communicated verbally and had no physical limitations. Alex was a 4 year-old male. He had no formal diagnosis, but attended speech therapy weekly. He communicated verbally and had no physical limitations.

Sessions for Alicia and Jesse were conducted in their regular school workspace, with the items that were normally found in these spaces (e.g., tables, chairs, etc.). Alex’s sessions were conducted in the dining room of his family home, with items normally found in this room (i.e., dining table and chairs, toys, etc.). Materials that were present for all participants were data collection sheets, pen, and stimuli.

Response Measurement and Interobserver Agreement

During the preference assessment, selection was defined as the participant reaching for and ingesting an edible. A direct frequency recording of selection was used. During the reinforcer assessment responding was measured by direct frequency of responses, direct frequency of edibles delivered, and duration of session. Sessions began following the discriminative stimulus. Sessions were terminated following the delivery of 20 edibles or following the delivery of an edible following 10 minutes from the beginning of the session. For example, if the participant had not yet earned 20 edibles, and the session came to 10 minutes, he or she was allowed to earn the edible he was currently working for before the session came to an end.
Observers were school staff with experience working with children with Autism Spectrum Disorders. All observers were trained in the use of the data collection procedures. During the preference assessment interobserver agreement data were collected during 33% of sessions for all participants. Agreement and procedural integrity for the preference assessment was 100% for all participants. Percent agreement for the preference assessment was calculated by number of agreements divided by number of agreements plus number of disagreements multiplied by 100.

During the reinforcer assessment interobserver agreement data were collected during 36.7% of sessions for Alicia, 53.5% of sessions for Jesse, and 29.4% of sessions for Alex. Agreement for Alicia ranged from 98% to 100%, with a mean agreement of 99.7% for duration and was consistently at 100% for frequency of responses. Agreement for Jesse ranged from 97.8% to 100%, with a mean agreement of 99.4% for duration and was consistently at 100% for frequency of responses. Agreement for Alex ranged from 99.5% to 100%, with a mean agreement of 99.9% for duration and was consistently at 100% for frequency of responses. Percent agreement for duration in the reinforcer assessment was calculated by dividing the smaller duration by the larger duration and multiplying by 100. Percent agreement for frequency of responses for the reinforcer assessment was calculated by dividing the smaller number of responses by the larger number of responses and dividing by 100. Procedural integrity for the preference assessment was collected during 36.7% of sessions for Alicia, 53.5% of sessions for Jesse, and 29.41% of sessions for Alex, procedural integrity for all three participants was 100%.

Procedure
Preference Assessment. A paired choice preference assessment was conducted using edible stimuli. Using a counterbalanced, semi-random data sheet (see Appendix B) in which each stimulus was paired with each other stimulus and the participant was asked to choose one. When the participant made a choice he or she was allowed to consume the edible before the next trial began. If the participant made no choice the next trial began following a 10 second pause.

Seven edibles were chosen for the preference assessment for each participant. These edibles were chosen through teacher and parent interviews and experimenter observations. Alicia was presented with Butterfinger Bites, marshmallows, potato chips, granola bars, chicken nuggets, popcorn, and York Pieces. Jesse was presented with Butterfinger Bites, marshmallows, potato chips, granola bars, chocolate chips, Goldfish crackers, and Cheez-its. Alex was presented with Butterfinger Bites, marshmallows, potato chips, granola bars, Goldfish crackers, Cheez-its, and popcorn.

Reinforcer Assessment. Following the preference assessment, a reinforcer assessment was conducted in which the participants were given a task they could already perform. Following a progressive fixed ratio schedule across sessions, the participants were allowed to access the edibles chosen as most highly preferred during the preference assessments. During each session a piece of colored paper, with the number for the FR schedule of reinforcement written on it, was placed on the work table in direct view of for the participant. The sequence of conditions for Alicia was baseline, FR1, FR2, FR5, FR10, FR20, FR40, and baseline. Alicia’s return to baseline was administered before consistent responding was observed in the FR40 condition due to a clinical necessity to discontinue sessions. The sequence of conditions for Jessie was baseline, FR1, FR2, FR5, FR10, FR20, FR40, and FR1. Finally, the sequence for Alex was baseline, FR1, FR2, FR1, and FR1 during which testing for habituation occurred.
During the reinforcer assessment, Alicia was presented with a sorting task in which blue and red pictures were sorted. Jesse was presented with a spelling task in which he placed a laminated letter J on a board with the other letters of his name on it. Alex was presented with a pen and a blank sheet of paper with the direction to write the letter A.

Delivery of reinforcement was contingent upon the progressive fixed ratio schedule programmed. During baseline, the task was presented to the participants and the discriminative stimulus (S\(_D\)) “Name you can complete the task as much or as little as you want but you won’t earn anything” was presented along with a piece of colored paper with the number 0 on it. Following baseline, participants were exposed to a systematically increasing fixed ratio schedule. The same S\(_D\)s were presented relative to the current FR schedule of reinforcement. Criterion for changing the FR was three consecutive sessions of consistent responding. The schedule followed a general structure for all participants, but was adjusted for each individual participant. During the condition sessions, participants were presented with their respective task and given the direction that they can complete the task as much or as little as they would like and for every FR\(_n\) that they completed, they would earn one edible. During Alex’s FR\(_1\) session in which habituation was tested the same protocol was used as for the FR\(_1\) session, but during trials 4 and 5 Alex earned Butterfinger Bites instead of marshmallows.

RESULTS

Preference Assessments

Figure 1 illustrates the results of the preference assessment conducted with Alicia. Alicia’s most highly preferred stimuli were chicken nuggets, which she chose during 83.3% of opportunities in which chicken nuggets was a choice. She chose popcorn during 66.6% of
opportunities and marshmallow during 50% of opportunities. Her least preferred stimuli were potato chips and York Pieces, each was chosen during 33.3% of opportunities in which they were a choice.

Figure 2 illustrates the results of the preference assessment conducted with Jesse. Jesse’s most highly preferred stimuli were Butterfinger Bites and chocolate chips which he chose during 100% and 58.3% of opportunities, respectively, in which they were a choice. His least preferred stimuli were Goldfish crackers and granola bar, which he chose during 33.3% and 8.3% or opportunities, respectively, in which these stimuli were a choice. An analysis of the data suggests that Jesse showed a left preference, as he chose the stimulus on the left during 78.5% of opportunities during the first and second sessions. During the third session he did not show a preference towards one side or the other, he chose the left stimulus during 42.8% of opportunities. During all three sessions of this assessment he chose Butterfinger Bites during 100% to opportunities regardless of orientation, this suggests a strong preference for this stimulus.

Figure 3 shows the results of the preference assessment conducted with Alex. Alex’s most highly preferred stimuli were marshmallows, which he chose during 100% of opportunities in which marshmallows were a choice. He chose Butterfinger Bites during 41.6% of opportunities. His least preferred stimuli were potato chips, popcorn, and granola bar, each of which was chosen during 0% of opportunities in which they were a choice.

Reinforcer Assessment

Figure 4 shows the results of Alicia’s reinforcer assessment data. During baseline sessions, Alicia exhibited between 0 and 3 responses per minute. In the first experimental
condition, when responding was reinforced on an FR1 schedule, Alicia’s responding stabilized between 6 and 9.1 responses per minute. In the second experimental condition, when responding was reinforced on an FR2 schedule, Alicia’s responding began at variable rates but then stabilized to show an increase from the FR1 condition. A similar increase in responses per minute was observed in both the FR5 and FR10 conditions showed. Alicia’s responding hit a threshold during the FR20 condition where responding then began to decrease. This decrease in responding continued into the first and third sessions in the FR40. The second session during the FR40 shows a spike in responses per minute; unfortunately this condition could not be carried out further to show stable responding due to clinical limitations. Alicia’s parents became concerned about her intake of chicken nuggets during school. Therefore, the final condition was a return to baseline, showing similar low to no rates of responding as does the original baseline condition.

Figure 5 illustrates Jesse’s reinforcer assessment data. During baseline sessions responding was below one response per minute. During the first experimental session, FR1, responding was between 3 and 5.3 responses per minute. Responding then showed small increases following a similar pattern as Alicia. Responses seemed to stabilize during the FR10 and FR20 conditions, but responding during the FR40 condition shows a downward trend. The final experimental condition for Jesse was a return to FR1. During this return to FR1, responses per minute returned to the same levels as during the original FR1 condition.

Figure 6 represents Alex’s reinforcer assessment data. During baseline sessions Alex showed rates of responding that were below 1 response per minute. During the FR1 condition Alex showed similar responding to both Alicia and Jesse. In the second experimental condition, the FR2, responses per minute increased initially but did not show stable rates of responding. A
decreasing trend in responding was seen following the initial increase during the FR2 condition. When a reversal to FR1 was then conducted, responding seemed to be at similar rates to the end of the FR2. Finally a dishabituation probe session was conducted, and responding increased to levels seen during the original FR1 session. During the dishabituation probe session a novel stimulus was presented during the fourth and fifth trials of the session. The original stimulus was presented during all other trials.

**DISCUSSION**

The results of this study showed some expected and unexpected findings. The data set associated with both Alicia’s and Jesse’s progressive ratio reinforcer assessments suggest ratio strain. This finding was anticipated and can help determine an ideal schedule of reinforcement for both of these participants. An unexpected result during Alex’s progressive ratio reinforcer assessment was that his pattern of responding suggested habituation. A dishabituation probe session was run in order to support this finding.

Ratio strain may account for patterns in the data for both Alicia and Jesse. Ratio strain occurs when a schedule of reinforcement becomes so thin that the individual shows a decreased rate of responding (Cooper et al., 2007). In both data sets responding steadily increases, once a threshold is met responding begins to decrease. For Alicia ratio strain was observed in the FR10 condition; for Jesse this threshold was observed in the FR10 and the FR20 conditions. These results lead one to the conclusion that an ideal schedule of reinforcement for Alicia, when using chicken nuggets as a reinforcer, would be an FR10 schedule. Similarly, these results lead one to the conclusion that for Jesse, when using Butterfinger Bites as a reinforcer, an FR20 schedule of reinforcement would be ideal. When using reinforcers of differing potency, ratio strain may
occur at different points within a progressive schedule of reinforcement. For example, an individual may hit strain at a thinner or denser schedule of reinforcement when a reinforcer with higher or lower potency is used, respectively.

Alex’s results were unexpected, but brought this study to an interesting conclusion. During the FR2 condition Alex’s data suggest that he developed habituation to the reinforcer. Habituation occurs when a stimulus is presented frequently over a short period of time and responding decreases or ceases to occur (Aoyama & McSweeney, 2001). This was tested by running a dishabituation probe session. Dishabituation involves the presentation of a strong, different, or extra stimulus that causes responding to be reestablished to a stimulus which originally showed habituation. The data from the dishabituation probe session in which responding was restored to levels from the original FR1 condition supports the theory of dishabituation for Alex.

One limitation of this study is that interobserver agreement was not collected during the baseline condition of the progressive reinforcer assessment. IOA was also conducted during 29.4% of sessions for Alex’s data set, which is below appropriate levels. Another limitation to this study is that during the preference assessment phase of this study Alex did not respond by selecting a stimulus during several trials. This may suggest that the stimuli used during this phase were not preferred. If the stimulus used as a reinforcer for the reinforcer assessment phase was not in actuality a preferred stimulus this may have contributed to the perceived habituation effect.

Future researchers might investigate how ratio strain presents during a fixed ratio schedule of reinforcement compared to a variable ratio schedule. Variable ratio schedules of
reinforcement tend to show higher rates of responding as well as stronger resistance to extinction. Therefore, many schedules of reinforcement are variable as opposed to fixed. Another variation that future researchers may be interested in studying further would be to compare how ratio strain appears when the reinforcer presented is a high preference stimulus versus a low preference stimulus.

Future researchers might also examine how ratio strain and habituation present with non-edible stimuli. Non-edible stimuli may be socially significant for an individual who has dietary restrictions due to allergy or health concerns. This would also be relevant to an individual whose responses are more strongly reinforced by non-edible stimuli.

Finally, there is little applied research examining habituation and ratio strain. Most research on these topics is limited to animal research and medical research. Future researchers may like to examine ratio strain in more detail, in order to broaden the base of literature examining behavioral habituation using human participants.
References


Varying Response Requirements


Appendix A

Preference assessment procedural integrity data sheet

Preference Assessment- Procedural Integrity

<table>
<thead>
<tr>
<th>Data Collector</th>
<th>Student</th>
<th>Date</th>
</tr>
</thead>
</table>

Each item is presented approximately equidistant from the participant

Instructs participant to “pick one”

Waits 10s for student to make a choice

If selection is made, student receives 10 s access or allows student to consume edible

Experimenter repeats instruction after 10 s if no selection is made
Appendix B

Preference assessment data sheet

Preference Assessment- Session 1
Experimenter___________ Date_____

A ___________ B___________ C___________ D___________
E ___________ F___________ G___________

<table>
<thead>
<tr>
<th>Placement</th>
<th>Chosen item</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. A)</td>
<td>B)</td>
</tr>
<tr>
<td>2. B)</td>
<td>C)</td>
</tr>
<tr>
<td>3. C)</td>
<td>D)</td>
</tr>
<tr>
<td>4. D)</td>
<td>E)</td>
</tr>
<tr>
<td>5. E)</td>
<td>F)</td>
</tr>
<tr>
<td>6. F)</td>
<td>G)</td>
</tr>
<tr>
<td>7. G)</td>
<td>A)</td>
</tr>
<tr>
<td>8. A)</td>
<td>C)</td>
</tr>
<tr>
<td>9. B)</td>
<td>D)</td>
</tr>
<tr>
<td>10. C)</td>
<td>E)</td>
</tr>
<tr>
<td>11. D)</td>
<td>F)</td>
</tr>
<tr>
<td>12. E)</td>
<td>G)</td>
</tr>
<tr>
<td>13. F)</td>
<td>A)</td>
</tr>
<tr>
<td>14. G)</td>
<td>B)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Item</th>
<th># of times chosen</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td></td>
</tr>
<tr>
<td>E</td>
<td></td>
</tr>
<tr>
<td>F</td>
<td></td>
</tr>
<tr>
<td>G</td>
<td></td>
</tr>
</tbody>
</table>
Preference Assessment - Session 2
Experimenter___________ Date_____

A ___________ B___________ C___________ D___________
E___________  F___________ G___________

<table>
<thead>
<tr>
<th>Item</th>
<th># of times chosen</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td></td>
</tr>
<tr>
<td>E</td>
<td></td>
</tr>
<tr>
<td>F</td>
<td></td>
</tr>
<tr>
<td>G</td>
<td></td>
</tr>
</tbody>
</table>
**Preference Assessment - Session 3**

**Experimenter___________ Date_____**

A ___________ B ___________ C ___________ D ___________  
E ___________ F ___________ G ___________

<table>
<thead>
<tr>
<th>Item</th>
<th># of times chosen</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td></td>
</tr>
<tr>
<td>E</td>
<td></td>
</tr>
<tr>
<td>F</td>
<td></td>
</tr>
<tr>
<td>G</td>
<td></td>
</tr>
</tbody>
</table>
Appendix C

Reinforcer assessment procedural integrity data sheet

Reinforcer Assessment - PI

<table>
<thead>
<tr>
<th>Data Collector ___________</th>
<th>Student ______________</th>
<th>Date ______</th>
</tr>
</thead>
</table>

**BASELINE** - Prior to session experimenter says “____, you can (do as many or as few math problems/ touch the orange square as many or a few times) as you want, but you won’t earn anything”

**SESSIONS** - Prior to session experimenter says “____, you can (do as many or as few math problems/ touch the orange square as many or a few times) as you want, and for every **FR** times you’ll earn 1 ____”

**SESSIONS** - for every **FR** times that the participant responds he/she earns 1 edible

Each session lasts 10 mins

Record 1 tally mark for each response on data sheet

Record 1 tally mark for each edible earned.
Appendix D

Reinfocer assessment data sheet

<table>
<thead>
<tr>
<th>Reinforcer Assessment</th>
<th>Participant</th>
<th>Session</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Experimenter___________ FR______ Date_____

Total duration of session________

<table>
<thead>
<tr>
<th>1.</th>
<th>Number of responses</th>
<th>Number of edibles earned</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure Captions

*Figure 1:* Percent of times each stimulus was chosen during Alicia’s preference assessment.

*Figure 2:* Percent of times each stimulus was chosen during Jesse’s preference assessment.

*Figure 3:* Percent of times each stimulus was chosen during Alex’s preference assessment.

*Figure 4:* Responses per minute during Alicia’s reinforcer assessment.

*Figure 5:* Responses per minute during Jesse’s reinforcer assessment.

*Figure 6:* Responses per minute during Alex’s reinforcer assessment.
Figure 1. Percent of times each stimulus was chosen during Alicia’s preference assessment.
Figure 2. Percent of times each stimulus was chosen during Jesse’s preference assessment.
Figure 3. Percent of times each stimulus was chosen during Alex’s preference assessment.
Figure 4

Figure 4. Responses per minute during Alicia’s reinforcer assessment.
Figure 5

![Jesse- Reinforcer Assessment](image)

**Figure 5.** Responses per minute during Jesse’s reinforcer assessment.
Figure 6. Responses per minute during Alex’s reinforcer assessment.