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Reinforcement/Punishment and Task Performance

The Relative Effects of Positive Reinforcement, Response-Cost, and a Combination Procedure on Task Performance with Variable Task Difficulty

Aubrey Morrison
Huron University College

The present experiment investigated the relative effects of positive reinforcement, response-cost, and a combination procedure on task performance with variable task difficulty in an adult population. As the background research produced conflicting results, no specific hypotheses were made. Participants were randomly assigned to one of six conditions, completed either 10 easy anagrams or 10 difficult anagrams, and were reinforced and/or punished according the experimental condition. Data from 28 participants were used for statistical analyses. Results were largely insignificant. Possible explanations for these results and recommendations for future research are discussed.

Methods of behaviour control are used in a wide variety of situations. For instance, parents and teachers often employ these techniques in an effort to increase or decrease the occurrence of certain behaviours in children. They are also a common component of programs in various institutional settings with patients or inmates. They are even seen in work settings, as employers often use these techniques to improve the job performance of their employees. These are just a few of the many instances in which these procedures can be useful. Clearly their applicability is far-reaching, which makes it all the more important to gain a better understanding of the particulars of these techniques.

Two methods of behaviour control that have received considerable attention both in practice and in research are positive reinforcement and negative punishment, otherwise
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known as response-cost. Positive reinforcement is a means of increasing a particular
behaviour by following that behaviour with a desired stimulus. The effect of this
procedure was first studied by E. L. Thorndike in the late 1800s and early 1900s. He
demonstrated that the nonreflexive, or voluntary behaviours of animals could be
manipulated by reinforcing desired behaviours. For example, in a series of experiments
by Thorndike (1898), an animal was placed in a small box, called a puzzle box, and had
to perform various behaviours, such as pressing a lever, turning a button, and pulling a
loop of wire, in order to obtain the food placed outside the box. The more the animal
was reinforced for these behaviours, the more frequently and quickly they were
performed (Thorndike, 1898). From these experiments came Thorndike’s Law of Effect,
which stated that behaviours that are followed by a pleasant stimulus will be more likely
to occur in the future as the association between that behaviour and the pleasant stimulus
is strengthened. Similarly, he contended that behaviours that are followed by an
unpleasant stimulus will be less likely to occur in the future (as cited by Mazur, 2001). It
is this last statement that would correspond to the other procedure of interest in the
present experiment; that is negative punishment, or response-cost. This procedure
involves decreasing the occurrence of a behaviour by removing a desirable stimulus
following that behaviour.

Research by B. F. Skinner in the mid 1900s further increased the interest in these
procedures. He referred to the process of increasing or decreasing behaviours through
the consequences that follow as operant conditioning. Skinner outlined the various
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methods of reinforcement distribution, which are known as reinforcement schedules. Reinforcements may be administered after a certain number of responses, in a schedule called a fixed-ratio schedule. The number of responses required for each reinforcement may vary around an average—though the actual number may differ on each trial—in a schedule called a variable-ratio schedule. A fixed-interval schedule is when reinforcements are delivered following the first occurrence of a particular behaviour after a set amount of time has elapsed. The amount of time may vary around an average in a schedule called a variable-interval schedule. Finally, perhaps the most basic schedule, and the one that will be the focus of the present experiment, is that of continuous reinforcement, wherein reinforcements are delivered after every occurrence of a particular behaviour.

While the effectiveness of continuous schedules of both positive reinforcement and response-cost has been well documented, it is not clear whether one procedure is more effective than the other. A fair amount of research has been conducted regarding the relative effectiveness of positive reinforcement and response-cost procedures, but the results have been quite mixed. Some studies have found that positive reinforcement produces more desirable effects, some have favored response-cost, some have found that positive reinforcement and response-cost are equally effective, and still others have found that a combination of positive reinforcement and response-cost is even more effective than either of the two alone.

A study by Sattler, Betz, and Zellner (1978) had 80 first and third grade boys and
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girls perform a lever-pulling task under either a positive reinforcement or response-cost condition. The reinforcements in this case were pennies. Results indicated that children in the positive reinforcement condition completed the task in significantly less time than did those in the response-cost condition. Also, children exhibited a preference for the positive reinforcement over the response-cost procedure. These findings were replicated in a study by Sattler, Betz, and Eubanks in 1979.

A study by Brent and Routh (1978), however, favored response-cost over positive reinforcement. These researchers had 30 reading-disabled fourth grade children complete a word-recognition task under either a positive reinforcement condition, a response-cost condition, or a control condition. The reinforcements in this case were nickels. It was found that, while both the positive reinforcement condition and the response-cost condition led to a significant increase in response latency as compared to the control condition, only the response-cost condition led to a significant decrease in reading errors.

Holt and Hobbs (1979) compared the effects of token reinforcement, response-cost, feedback regarding the accuracy of each response, and a control condition on the test performance of 80 institutionalized delinquent adolescent boys. They found that, while individuals in both the token reinforcement condition and the response-cost condition achieved significantly higher test scores than did those in the feedback and control conditions, there was no significant difference between the effects of token reinforcement and response-cost. A study by Whitehurst (1969) also found that there
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was no significant difference in the relative effectiveness of token reinforcement and response-cost on a discrimination task with 60 children between the ages of five and nine. McLaughlin and Malaby (1974) investigated the effects of token reinforcement, response-cost, and a combination of token reinforcement and response-cost on the completion of homework assignments in a class of fifth and sixth grade children. The data revealed that the combination procedure was more effective than either token reinforcement or response-cost alone.

While this does not constitute an exhaustive review of the existing research, it does nonetheless convey the point that research in this area has produced conflicting results.

As can be seen in the studies cited above, much of the research that has been conducted in this area has focused on children and special need populations such as children with reading disabilities (e.g., Brent & Routh, 1978), emotional disturbances (e.g., Nelson, Finch, & Hooke, 1975), high levels of disruptive behaviours (e.g., Conyers, Miltenberger, Maki, Barenz, Jurgens, Sailer, Haugen, & Kopp, 2004), retardation (e.g., Harris & Tramontana, 1973), autism (e.g., Pelios, MacDuff, & Axelrod, 2003), etc. Little research, however, has been done regarding the effects of these procedures on normal adult populations. Because these procedures are not solely applied to children and special need populations, and are used with adults as well, it is important not to neglect this population. Clearly this is an issue that merits further study. The purpose of the present experiment is to do just that.
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While positive reinforcement and response-cost procedures can be used to try to increase or decrease the occurrence of almost any type of behaviour, the present experiment will focus on the effect of these procedures on task performance. Specifically, the present experiment will investigate the relative effects of positive reinforcement, response-cost, and a combination of the two on the performance of adult participants on anagram tasks of variable difficulty. Performance will be measured by both the number of correct responses and the time spent on the task. Although no research was found concerning the interaction of these procedures with variable task difficulty, one cannot assume that the effects of these procedures are uniform across all tasks. It is important not only to gain a better understanding of the effects of these procedures, but also the circumstances under which they may be more or less effective. The present experiment is a step in that direction.

Because the existing research in this area does not provide a strong basis for a directional hypothesis, the present experiment will serve as an exploratory analysis with no specific predictions. The hope is that this experiment will help clear up some of the uncertainty surrounding this topic.

Method

Participants

A total of 28 participants completed this experiment. Participation was entirely voluntary and, besides a minimum required age of 16 years, no special characteristics were required for participation. This experiment was conducted in the cities of Owen
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Sound and London, Ontario, Canada, so participants were residents of or visitors to one of these two cities. A convenience sample was used for this experiment. Participants were largely friends, relatives, and acquaintances of the researcher who were personally invited to participate. Participants were both males (n=11) and females (n=17), and ranged from 17 to 75 years of age. They were predominantly Caucasian, but varied with respect to level of education, socio-economic status, etc.

Materials

Materials used in the present experiment consisted of a consent form, two sets of anagram problems, three sets of instructions for the anagram task, individually wrapped candies to serve as reinforcements, a stopwatch to time participants' performance on the task, and a debriefing form explaining the purpose of the present experiment as well as some of the background research.

The consent form briefly explained the nature and purpose of the experiment as well as the measures taken to ensure confidentiality. It was also explicitly stated that the researcher would be present during all testing and would be aware of the participant’s performance on the task. It was suggested that if the individual was uncomfortable with this, that he/she may wish to pass on this experiment.

Two separate sets of anagram problems were used in this experiment, both of which can be found in Appendix A of this report. One set is comprised of 10 relatively easy anagrams and the other is comprised of 10 relatively difficult anagrams. These anagrams were created by the researcher for the purpose of the present experiment.
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Judgment regarding the level of difficulty was based largely on the number of letters contained in the anagrams.

Instructions for the anagram task came in three versions: one for the positive reinforcement groups, one for the response-cost groups, and one for the combination positive reinforcement and response-cost groups. While the explanation of the anagram task itself is same in each version, what differs is the explanation of the method of reinforcement and/or punishment. The version for the positive reinforcement condition, which can be found in Appendix B at the end of this report, states that participants will receive two pieces of candy for each correct response on the anagram task and that they will not receive any candy for incorrect responses. The version for the response-cost condition, which can be found in Appendix C of this report, states that participants will begin with 20 pieces of candy and will lose two for every incorrect response on the anagram task. Finally, the version for the combination positive reinforcement and response-cost condition can be found in Appendix D of this report. It states that participants will begin with 10 pieces of candy, will gain one additional piece of candy for each correct response, and will also lose one piece of candy for each incorrect response on the task.

Procedure

Participants were tested individually in a quiet space. The researcher was present during all testing. After reading and signing the consent form, stating that they understood and agreed to participate in the experiment, participants were randomly
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assigned to one of the six conditions with the roll of a die. The six conditions were as follows: positive reinforcement/easy task, positive reinforcement/difficult task, response-cost/easy task, response-cost/difficult task, positive reinforcement and response-cost combined/easy task, and positive reinforcement and response-cost combined/difficult task. Participants were given the sheet of instructions corresponding their particular condition. After reading these instructions, participants completed a practice anagram to ensure that they understood the task. They were also given the opportunity to ask questions if they needed further clarification. Before beginning the anagram task, participants in the positive reinforcement groups were given 20 candies. Participants in the combination positive reinforcement and response-cost groups were given 10 candies. All participants were given a blank sheet of paper should they wish to work on the task on paper. Participants were shown one anagram at a time on a separate piece of paper, and, although they were timed, they were given an unlimited amount of time to spend on each one. The timer began when they were shown the first anagram. When they had a response or stated that they wished to give up on an anagram and move on to the next, they were told either "yes" for a correct response or "no" for an incorrect response or skipped anagram. If they were in one of the positive reinforcement groups, they were given two candies for a correct response and did not gain or lose any candy for an incorrect response. If they were in one of the response-cost groups, no candy was given or taken away for a correct response, but two candies were taken away for an incorrect response. If they were in one of the combination positive reinforcement and response-
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cost groups, they were given one piece of candy for a correct response and lost one piece of candy for an incorrect response. This was repeated for each of the 10 anagrams. Reinforcements were given or taken away immediately following each response. When all 10 anagrams had been attempted, the timer was stopped and a record was made of the total amount of time spent on the task and the total number of correct responses. Regardless of condition, each participant had the opportunity to earn 20 candies if they successfully solved all 10 anagrams, and zero candies if they failed to solve all 10 anagrams. Participants were given a debriefing form, were again given the opportunity to ask any questions, and, if they wanted, were told the correct responses to any anagrams that they had missed.

Results

Statistical analyses were conducted with the data from a total of 28 participants. There were either four or five participants in each of the six conditions. The raw data is presented in Appendix E at the end of this report.

A between-subjects 2 x 3 MANOVA was conducted to determine the effects of the two independent variables on the two dependent variables. The independent variables were task difficulty (easy/difficult) and type of procedure (positive reinforcement/response-cost/combination positive reinforcement and response-cost). The two dependent variables were the number of correct responses out of a possible ten and the total time spent on the anagram task measured in minutes. The results of this analysis were largely insignificant. The only significant effect was the main effect for task
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difficulty ($F(2, 21) = 13.07, p = .00$). Task difficulty was found to be significantly related to both time ($F(1,22) = 17.27, p = .00$) and number of correct responses ($F(1,22) = 17.88, p = .00$). The main effect for type of procedure was not significant ($F(4,44) = .64, p = .64$). Type of procedure was not significantly related to time ($F(2,22) = 1.35, p = .28$) or number of correct responses ($F(2,22) = .12, p = .89$). The interaction effect of task difficulty and type of procedure was also not significant ($F(4,44) = .76, p = .56$); not with time ($F(2,22) = 1.59, p = .23$) nor with number of correct responses ($F(2,22) = .20, p = .82$). With both the main effect of type of procedure and the interaction effect, the effect was stronger with time than it was with number of correct responses, although neither was significant.

As an additional analysis, the two dependent variables were combined as a rate of correct responses per minute. A single-factor ANOVA was performed with the two independent variables and the rate of correct responses per minute. Again, the main effect for task difficulty was significant ($F(1,22) = 9.48, p = .01$), but the main effect for type of procedure was not significant ($F(2,22) = .87, p = .43$), nor was the interaction effect of task difficulty and type of procedure ($F(2,22) = .16, p = .85$).

Means were largely the same in all conditions.

Discussion

The present experiment investigated the relative effects of positive reinforcement, response-cost, and a combination of positive reinforcement and response-cost on task performance. The level of difficulty of the task was also manipulated to determine
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whether the various types of procedures may be more or less effective with an easy relative to a difficult task. Because the existing research that has compared the effects of these procedures has produced conflicting results, with different studies favoring each of the different types of procedures, and others finding no significant differences between the procedures, and because none of these studies involved variable task difficulty, no specific hypotheses were made in the present experiment. The results were largely insignificant and did not favour any one type of procedure over any of the others, in neither the easy nor the difficult task conditions.

The only significant effect that was found in the present experiment was for task difficulty. Task difficulty was found to be significantly related to both the amount of time spent on the task and the number of correct responses. However, this finding is not of great consequence. It is not surprising that individuals would spend more time and make more errors on a difficult relative to an easy task. What was of more interest in the present experiment was the potential main effect for type of procedure and the potential interaction effect of task difficulty and type of procedure on task performance. However, these effects were not significant in the present experiment.

The results of the present experiment can be explained in two ways. One possibility is that the three procedures studied in the present experiment really do not have significantly different effects on task performance. This is a legitimate possibility, one that would be not be inconsistent with the findings of Holt and Hobbs (1979) and Whitehurst (1969), who studied the relative effects of positive reinforcement and
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response-cost on task performance and found no significant differences between the two, although they did not include the combination procedure in their studies. While this is certainly one possible explanation, it is not the only one. It is also possible that certain aspects of the present experiment may have interfered with the results. For example, sampling and control were perhaps not ideal in the present experiment.

In terms of sampling, the size of the sample used in the present experiment was somewhat small. Considering there were six different conditions, the ideal sample size would be at least 60 participants. However, the present experiment only had 28 participants. Due to the small scale of this experiment, certain practical issues, such as time constraints and financial limitations, limited the number of participants that could realistically be tested. When the sample size reached 28 participants, statistical analyses were conducted and, as the results were far from significant, it was decided that testing more participants would not be worthwhile. While the present experiment was unable to do so, it is recommended that future experiments of this nature use a much larger sample size.

Also in terms of sampling, it is not clear that the sample used in the present experiment was representative of the larger population. A convenience sample was used, and participants were largely the researcher's own friends, relatives, and acquaintances. Because the researcher may tend to associate with certain types of individuals rather than others, the generalizability of the results is uncertain.

In terms of control issues, two potential confounding variables in the present
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experiment include the time and location of testing. Not all participants were tested at the same time of day, nor were they all tested in the same environment. It is possible that these factors could have affected the results in some way. For example, participants may have been more alert and better able to concentrate at certain times of the day than at others. Also, because the reinforcements were candies in this experiment, certain participants may have been more or less hungry than others depending on the time of testing, and this may have increased or decreased their motivation to work for the reinforcements. Both of these factors could potentially have skewed the results. This is also the case for testing environment, as this was not held constant across participants. Although an effort was made to test all participants in a relatively quiet environment, other factors may have distinguished one environment from another. For example, some participants were tested in their homes, some were tested in the homes of others, and others were tested in more public environments such as the library or an empty classroom. Participants may have been more comfortable in some environments than in others, so this could perhaps have affected the results. In future experiments, these issues should be controlled in order to avoid potential confounds.

Although time and location of testing could have been better controlled in the present experiment, other aspects of the experiment were controlled. For example, the same researcher conducted all testing, and the same reinforcements were used for all participants. Also, verbal feedback was held constant across all conditions. During the task, participants were told “yes” for correct responses and “no” for incorrect responses.
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or skipped anagrams. No other verbal feedback was given during the task. Besides the two independent variables of task difficulty and method of reinforcement and/or punishment, all participants completed the same procedure regardless of which condition they were assigned to. Also, participants were randomly assigned to one of the six conditions in order to reduce the likelihood of characteristic differences between groups.

Despite the efforts made in terms of control, other issues arose in the present experiment that may have skewed the results. For example, not all participants were particularly interested in the candies that were used for reinforcements. It is very likely that this could have impacted the results, as the whole idea behind positive reinforcement and response-cost procedures is to give or take away desirable stimuli. If the stimuli were not desirable to the participant, their presentation or withdrawal would likely not be particularly motivating. Research has consistently shown that the subjective quality of reinforcements and punishments, and therefore the motivation to respond, is an important factor in determining the effectiveness of these procedures (Mazur, 2001). In order to resolve this problem, participants could be given the choice between a number of different reinforcements so that they could choose one that was desirable for them, or they could be given tokens to later trade for items of their choice. Perhaps the best solution would be to use money as reinforcements, as most, if not all, of the participants would likely find it to be quite desirable. Because these are adult participants and not young children, the total potential earnings would likely have to be in the range of ten dollars in order to be sufficiently motivating. This, unfortunately, was not feasible in the
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present experiment due to financial limitations. It is, however, recommended for future experiments whenever possible.

Another issue that arose during the present experiment was that, because the researcher was present during all testing, many participants seemed to be concerned about what the researcher might think of their performance on the task. This effect was perhaps even amplified because most of the participants knew the researcher, and had some form of relationship with her outside of the experiment. This could have skewed the results as participants may have been overly anxious or overly driven to impress the researcher, and the reinforcement and/or punishment may not have had as much of an effect as it may otherwise have had. Including a control condition, in which participants would not be reinforced or punished for their performance on the task, would have been a good way to determine whether the reinforcement and/or punishment even had an effect or whether it was mainly the presence of the researcher or a simple drive to succeed that motivated participants in their performance on the task. In the future, it is recommended that a control condition be added to the experiment. Also, this issue could be resolved by either having the researcher test only strangers, or, preferably, by arranging the experiment so that the participant could perform the task while alone, perhaps with some sort of automated system of reinforcement presentation and withdrawal.

Other ideas for future research include the comparison of other procedures, such as negative reinforcement—where aversive stimuli are removed in order to increase the occurrence of certain behaviours—and positive punishment—where aversive stimuli are
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presented in order to decrease the occurrence of certain behaviours (Mazur, 2001). While these two procedures were not investigated in the present experiment for ethical and practical reasons, it would nonetheless be interesting to compare the effectiveness of each of the different types of procedures, and perhaps even different combinations of each of them, on task performance with variable task difficulty. A study by Jackson and Molloy (1983) compared the effects of positive self-reinforcement, negative self-reinforcement, positive self-punishment, and negative self-punishment on arithmetic problem-solving using five cent coins as reinforcements and noise as the aversive stimulus. They found that the participants in both of the self-reinforcement conditions attempted more problems, whereas those in both of the self-punishment conditions were more accurate. While this is a good starting point, further research is recommended as no other researchers have since replicated the Jackson and Molloy (1983) study, and the researchers did not investigate any combination procedures, nor did they include the variable of task difficulty.

Another idea for future research is an investigation of the relative effectiveness of the different types of procedures using different schedules of reinforcement and/or punishment. For example, rather than reinforcing or punishing every response, studies could be conducted in which reinforcements are presented or withdrawn on any one of the other schedules, such as fixed-ratio, variable-ratio, fixed-interval, or variable-ratio schedules. Because reinforcements and/or punishments may not be distributed after every response in real life settings, such an investigation could be quite useful. While these
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schedules have been widely studied, a comparison of the effectiveness of the different reinforcement and/or punishment procedures with these different schedules has not been investigated, and could be quite informative.

Further research could also be conducted to investigate the effect of variables other than task difficulty on task performance under the various reinforcement and/or punishment conditions. While some existing research in this area has investigated some of these variables, such as anxiety (e.g. Trent, 1983), impulsiveness (Nelson, Finch, & Hooke, 1975), and level of intelligence (e.g. Harris & Tramontana, 1973), many variables remain unstudied.

A final idea for future research stems from the observation that, in the present experiment, there appeared to be more of an effect—both in terms of the main effect for type of procedure and in terms of the interaction effect—with the dependent variable of time rather than number of correct responses. Future studies, therefore, may be better served to focus on time as the dependent variable. For example, studies could be done in which the task depends more on perseverance than on skill or knowledge. Simple repetitive tasks could be used and researchers could compare the amount of time that participants in the different reinforcement and/or punishment conditions spend on the task before quitting. While this could potentially be a costly and time-consuming study, it would nonetheless be very interesting and instructive.

Clearly, there are numerous possibilities for future research in this area and unfortunately the ambiguity surrounding the relative effectiveness of the various
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procedures of reinforcement and/or punishment remains unresolved. Because these procedures are so common and are applicable in so many different situations, it is important to gain a better understanding of which procedures are most effective and under what circumstances. Only more research will bring us closer to this goal.
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References


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Appendix A

Anagrams

Easy Anagrams:
1) UHESO
2) SEOT
3) OJEK
4) VEIRR
5) TLHGI
6) YESK
7) OROFL
8) BKEI
9) TNYOCRU
10) ALHL

Difficult Anagrams:
1) RYSIHOT
2) IUNLDCED
3) NDCSEO
4) OIDETFININ
5) UMICSAL
6) NOSASE
7) LSOICA
8) IIMDECNE
9) CLUACIM
10) ATINGLK

Solutions:
HOUSE
TOES
JOKE
RIVER
LIGHT
KEYS
FLOOR
BIKE
COUNTRY
HALL

Solutions:
HISTORY
INCLUDED
SECOND
DEFINITION
MUSICAL
SEASON
SOCIAL
MEDICINE
CALCIUM
TALKING
Positive Reinforcement

Task Instructions

This is an anagram task. The letters have been scrambled, and your task is to unscramble the letters in each anagram to obtain a valid English word (one word with no spaces). You must use ALL of the letters presented. There is only one correct answer for each anagram. You may use a pen and paper for this task.

There are a total of 10 anagrams. You will be presented with one at a time. You may spend as much time as you like on each anagram. When you think you have the answer, please let me know and I will check to see if it is correct. If your answer is correct I will simply say “yes” and if it is incorrect I will simply say “no.” You can only make one final guess for each anagram. You may choose to skip an anagram if you wish. This will count as an incorrect response. You may not return to a previous anagram once you have moved on to the next.

You will receive two pieces of candy for each correct response. You will not receive anything for incorrect responses. There are a total of 10 anagrams, so if you get them all correct you will get 20 pieces of candy. If you get them all wrong you will not get any candy.

Before you begin, try the practice anagram below to make sure that you understand the task:

TBLE → _____
Appendix C

Response-Cost

Task Instructions

This is an anagram task. The letters have been scrambled, and your task is to unscramble the letters in each anagram to obtain a valid English word (one word with no spaces). You must use ALL of the letters presented. There is only one correct answer for each anagram. You may use a pen and paper for this task.

There are a total of 10 anagrams. You will be presented with one at a time. You may spend as much time as you like on each anagram. When you think you have the answer, please let me know and I will check to see if it is correct. If your answer is correct I will simply say “yes” and if it is incorrect I will simply say “no.” You can only make one final guess for each anagram. You may choose to skip an anagram if you wish. This will count as an incorrect response. You may not return to a previous anagram once you have moved on to the next.

You will begin with 20 pieces of candy. I will take two away for each incorrect response. There are a total of 10 anagrams, so if you get them all correct you will get to keep all 20 pieces of candy. If you get them all wrong you will not get any candy.

Before you begin, try the practice anagram below to make sure that you understand the task:

TBLE  →  ___ ___ ___
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Appendix D

Combination Positive Reinforcement and Response-Cost

Task Instructions

This is an anagram task. The letters have been scrambled, and your task is to unscramble the letters in each anagram to obtain a valid English word (one word with no spaces). You must use ALL of the letters presented. There is only one correct answer for each anagram. You may use a pen and paper for this task.

There are a total of 10 anagrams. You will be presented with one at a time. You may spend as much time as you like on each anagram. When you think you have the answer, please let me know and I will check to see if it is correct. If your answer is correct I will simply say “yes” and if it is incorrect I will simply say “no.” You can only make one final guess for each anagram. You may choose to skip an anagram if you wish. This will count as an incorrect response. You may not return to a previous anagram once you have moved on to the next.

You will begin with 10 pieces of candy. I will give you one more piece of candy for each correct response. I will also take one away for each incorrect response. There are a total of 10 anagrams, so if you get them all correct you will get 20 pieces of candy. If you get them all wrong you will not get any candy.

Before you begin, try the practice anagram below to make sure that you understand the task:

TBLE → ___ ___ ___
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Appendix E

Raw Data

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<thead>
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<th>Participant</th>
<th>Procedure</th>
<th>Task Difficulty</th>
<th>Task Number</th>
<th>Time (min)</th>
<th>Response Rate</th>
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<td>Easy</td>
<td>9</td>
<td>6.03</td>
<td>1.49</td>
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<tr>
<td>2</td>
<td>Pos Reinf</td>
<td>Easy</td>
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<td>3.17</td>
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<td>Pos Reinf</td>
<td>Easy</td>
<td>9</td>
<td>2.03</td>
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<tr>
<td>5</td>
<td>Pos Reinf</td>
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<tr>
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*Note.* “Type of Procedure” includes positive reinforcement, response-cost, and a combination of positive reinforcement and response-cost. “Task Difficulty” refers to whether the participant received a set of relatively easy anagram problems or a set of relatively difficult anagram problems. “Number Correct” is the total number of correct anagram solutions out of a possible 10. “Time” is the total amount of time in minutes taken to attempt all 10 anagrams. “Response Rate” represents the number of correct responses per minute. A higher value corresponds to a faster rate of accurate responding.