THE EFFECTS ON EXTINCTION OF VARYING SCHEDULES AND MAGNITUDES OF REINFORCEMENT

A Thesis

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R.T.M.

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Chapter 1

INTRODUCTION

The purpose of this study was to find the effects of reversing a schedule of reinforcement and using two different magnitudes of reinforcement on the number of responses to extinction. Also included in this chapter are: theoretical formulation, statement of the problem, statement of the hypothesis, purpose of the study, and definition of terms pertinent to the study.

THEORETICAL FORMULATION

In relation to this study, cognitive theories[1] would predict that a program of partial reinforcement would build an expectancy of reward that is more resistant to change during extinction than the expectancy built up by continuous reinforcement. These theories would also predict that continuous after partial reinforcement would increase the expectancy, and increase resistance to extinction.

Stimulus-response theory would predict that continuous reinforcement following partial reinforcement should not reduce resistance to extinction, because the reinforcement has not changed, only the rate of

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[1]L. G. Humphreys, "The Effect of Random Alternation of Reinforcement on the Acquisition and Extinction of Conditioned Eye Lid Reactions," Journal of Experimental Psychology, XXV (1939), 141-158.

reinforcement. This theory is in accordance with Skinner's[2] concept of the "reflex reserve", which states that the "reserve" built up after a program of partial reinforcement is larger than that built up after a program of continuous reinforcement. The "reserve" is measured by extinction, and the larger the reserve the greater the resistance to extinction. This theory led to the formulation of the concept of the partial reinforcement effect, in which resistance to extinction is greater after partial reinforcement than after continuous reinforcement.

THE PROBLEM

Most of the studies which are cited in the following chapter have not dealt with the process of extinction in human beings. Also, most of the studies have not dealt with the aspect of varying the amount of reinforcement. The studies have also, as a rule, either used a variable interval schedule or used thicker, that is, more reinforcers within the schedule, or longer acquisition schedules than this study proposed to use.

Statement of the Problem

Is there a significant difference in the number of extinction responses of subjects responding to a schedule of partial before continuous reinforcement with two different magnitudes of reinforcement, and subjects responding to the two different magnitudes of reinforcement but responding to a schedule of continuous before partial reinforcement?

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[2]B. F. Skinner, The Behavior of Organisms (New York: Appleton-Century-Crofts, 1938).

Statement of the Hypothesis (Null)

There is no significant difference in the number of extinction responses of subjects responding to a schedule of partial before continuous reinforcement with two different magnitudes of reinforcement and subjects responding to the two different magnitudes of reinforcement but responding to a schedule of continuous before partial reinforcement.

Purpose of the Study

The purpose of this study was to find out if human subjects would respond differently in extinction after an acquisition schedule of continuous before partial reinforcement with two different magnitudes of reinforcement, than to an acquisition schedule of partial before continuous reinforcement with the two different magnitudes of reinforcement.

Significance of the Study

It has been found that most of the research in this area has been done with non-human subjects, i.e., pigeons and rats. Past studies have not investigated the combination of variables which this study investigated, that is, the reversal of one schedule and utilization of two different magnitudes of reinforcement. Also, the study may be useful in an applied setting if there is an indication that extinction can be enhanced, or shortened, by the addition of a continuous reinforcement schedule after a series of partial reinforcement relative to continuous reinforcement followed by partial reinforcement.

DEFINITION OF TERMS

Following are definitions of terms pertinent to this study. Quotations are the author's.[3]

Partial Reinforcement (PRE)

For purposes of the study, a schedule of variable ratio reinforcement was used during which approximately every fifth correct response was reinforced.

Continuous Reinforcement

Continuous reinforcement is a schedule of reinforcement in which every correct response is reinforced.

Partial Reinforcement-Continuous Reinforcement (PR-CR)

This is an acquisition schedule of partial followed by continuous reinforcement.

Continuous Reinforcement-Partial Reinforcement (CR-PR)

This is an acquisition schedule of continuous followed by partial reinforcement.

Variable Ratio

Variable ratio is a schedule of reinforcement in which correct responses are reinforced on the average of a certain number of correct responses.

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[3] B. B. Wolman, Dictionary of Behavioral Science (New York: VanNostrand Reinholt Co., 1974).

Magnitude

The amount of reinforcement that each individual receives for a specific task; in this case, one or ten cents per token is referred to as a magnitude.

Extinction

Extinction refers to the gradual diminution of a conditioned response resulting from the withholding of the unconditioned stimulus or the instrumental reward.

Partial Reinforcement Effect

Partial reinforcement effect refers to the hypothesis that partial reinforcement leads to greater resistance to extinction than continuous reinforcement.

Reinforcer

A reinforcer is any stimulus that increases the frequency of a specific behavior.

Resistance to Extinction

For purposes of this study, resistance to extinction will be measured by the number of responses made after the last reinforcement is presented, until the subject no longer responds for a period of fifteen seconds, or until the subject indicates that he is through responding, whichever occurs first.

LIMITATIONS OF THE STUDY

The sample utilized in this study was small and restricted, that is, the subjects were forty college students, which of course is a

selective group of subjects. Also, most of the studies reviewed dealt with animal subjects, and since this study utilized human subjects, past studies' results may have limited applicability to this study.

Chapter 2

REVIEW OF RELATED LITERATURE

In this review of previous studies, the abbreviations "PR" and "CR" are used in all instances to stand for Partial Reinforcement and Continuous Reinforcement.

Keller[1] found that partial reinforcement was more resistant to extinction than continuous reinforcement, which accounted for the partial reinforcement effect observed. The subjects in the study were rats, running in a straight alley for food. The results showed the groups to be arranged non-significantly overall in the order PR-CR CR-PR, but significantly in the first five minutes in this same order.

Contrasting the hypotheses made by the S-R theorists and the cognitive theorists regarding extinction following different acquisition schedules was the purpose of a study by Likely.[2] The subjects in this study were rats and the reinforcement was water obtained by pressing a bar. In resistance to extinction, the groups were arranged non-significantly in the following order: PR-CR>CR-PR>PR>CR. The cumulative response extinction curves for each group showed the PR-CR group

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[1]F. S. Keller, "The Effect of Sequence of Continuous and Periodic Reinforcement Upon the Reflex Reserve," Journal of Experimental Psychology, XXVII (1940), 559-565.

[2]F. A. Likely, "Relative Resistance to Extinction of a Periodic and Continuous Reinforcement Separately and in Combination," The Journal of General Psychology, LVIII (1958), 165-187.

consistently superior overall with the highest initial rate of extinction, replicating the findings of Keller.[3]

In two studies, Jenkins[4] noted that the previous studies by Keller and Likely failed to demonstrate decreased resistance to extinction when CR was added to PR, but no conclusions could be reached, since no PRE was demonstrated for PR versus CR separately. In the first of Jenkins' experiments, the location of PR was varied within a series of CR trials to assess the effects of prior amounts of CR on resistance to extinction while keeping the total amount of training constant. The results showed PR-CR>CR-PR significant. The subjects in both studies were pigeons, and the apparatus was one which utilized a key peck mechanism in a discrete trial procedure. The reinforcement was access to grain. The second Jenkins study[5] also revealed that increasing PR sessions significantly increases extinction responding, but no further increase was noted after increasing trials again. The conclusion reached was that added CR after PR increases resistance to extinction, but the addition of more PR elevated extinction responding equal to that due to additional CR. Jenkins also concluded that the interaction of PR with CR resulted in an increased PRE as compared to PR alone.

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[3]Keller, loc. cit.

[4]H. M. Jenkins, "Resistance to Extinction When Partial Reinforcement is Followed by Regular Reinforcement," Journal of Experimental Psychology, LXIV (1962), 441-450.

[5]Ibid.

Spradlin[6] investigated the effects of different schedules of reinforcement and their subsequent effects on extinction behavior. The subjects were mentally retarded children, and the reward used was candy obtained from a lever-pull apparatus. The results showed the groups to be arranged non-significantly in the following order: PR-CR CR-PR.

A study in which training was given on the day prior to the extinction trials was done by Sutherland, Mackintosh and Wolfe.[7] The subjects in the study were rats which ran down a straight alley for food. The results indicated that the PR groups extinguished significantly more slowly than the CR groups, and that placing CR before PR reduced resistance to extinction as compared to PR alone. Most importantly, the group PR-CR extinguished significantly more slowly than the group CR-PR. That is, PR-CR CR-PR was significant overall.

In 1969, Cotler and Nygaard[8] investigated the effects on extinction of placing PR in a series of CR trials. Analysis of early versus late extinction performance showed that during the first thirty trials, group CR-CR-PR made significantly more responses and group CR-CR-CR the least. The subjects in the experiment were undergraduate students of psychology, and the task was one utilizing a discrete trial procedure in

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[6]J. Spradlin, "Effects of Reinforcement Schedules on Extinction in Severely Mentally Retarded Children," American Journal of Mental Deficiency, LXVI (1962), 634-640. (Abstract)

[7]N. Sutherland, N. Mackintosh, and J. Wolfe, "Extinction as a Function of the Order of Partial and Consistent Reinforcement," Journal of Experimental Psychology, LXIX (1965), 56-59.

[8]S. B. Cotler and J. E. Nygaard, "Resistance to Extinction Following Sequences of Partial and Continuous Reinforcement in a Human Choice Task," Journal of Experimental Psychology, II (1969), 270-274.

which the subjects guessed whether a white unreinforced light would be turned on, or if a green reinforced light would come on after they pressed a telegraph key. The reinforcement used was not noted. The results showed CR-PR>PR-CR significant for the first thirty trials, but for the last twenty trials, there was no difference between the groups.

During acquisition, Theios[9] found that CR resulted in significantly faster running speeds than PR, but that when PR groups were shifted to CR, performance approximately equalled that of the PR groups. The subjects in the study were rats running in a straight alley for food. The data in extinction showed the usual PRE with the curves for the two CR-only groups being very similar, with a fast drop in responding in extinction, as were the curves of the PR groups. The PR groups showed a much slower drop in responding in extinction, and the results were significant in the following order: CR-PR>PR-CR.

Hothersall[10] noted that in order to have subjects respond during PR trials CR has often been used initially, followed by the PR schedule in question. The study examined how differing amounts of PR affect resistance to extinction. The subjects in the study were rats, bar pressing for food. It was concluded that placing CR prior to PR reduced resistance to extinction, with the two groups arranged significantly in the following order: CR-PR>PR-CR.

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[9]J. Theios and R. McGinnis, "Partial Reinforcement Before and After Continuous Reinforcement," Journal of Experimental Psychology, LXXIII (1967), 479-481.

[10]D. Hothersall, "Resistance to Extinction When Continuous Reinforcement is Followed by Partial Reinforcement," Journal of Experimental Psychology, LXXII, No. 1 (1966), 109-112.

In summary, the preceding studies found the two conditions, CR-PR and PR-CR, to be roughly equal in resistance to extinction. The following studies have taken into account the results of other studies regarding schedules, and have added the additional variable of magnitude of reinforcement.

Utilizing five different magnitudes of reinforcement, Zeaman[11] found that response strength increased with the quantity of reinforcement. The subjects were rats running in an alley for food. The data showed that the larger quantities of reinforcement led to fewer responses to extinction.

Logan[12,13] stated that response strength was affected by varying the amount of reinforcement, and that it did not take much of an increase in reinforcment to increase the response strength and lengthen extinction. Logan also stated that the response strength increase is a negatively accelerated function.

In a study using rats in a discrete bar-pressing task, Davenport and Flaherty[14] found that there existed a "reversed magnitude-extinction effect", in that lower magnitudes led to a longer extinction process than higher magnitudes of reinforcement.

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[11]D. Zeaman, "Response Latency as a Function of the Amount of Reinforcement," Journal of Experimental Psychology, XXXIX (1949), 466-483.

[12]F. A. Logan, Incentive (New Haven, Conn.: Yale University Press, 1960).

[13]F. A. Logan, Fundamentals of Learning and Motivation (Dubuque, Iowa: Wm. C. Brown, 1969).

[14]D. P. Davenport and C. F. Flaherty, "Extinction of Differential Reward Magnitude Discrimination in a Discrete Bar-Pressing Situation," Psychonomic Science (1969), 29-30. (Abstract)

In summary, the studies presented found that response strength was not necessarily increased with increases in magnitudes of reinforcement. These studies have limited applicability to this experiment because most of the subjects were non-human.

Chapter 3

SAMPLE AND PROCEDURES

The objective of the methods and procedures used was to investigate whether or not there would be a significant difference in the number of extinction responses of subjects responding to a schedule of partial reinforcement followed by continuous reinforcement with two different magnitudes of reinforcement, and subjects responding to a schedule of continuous reinforcement followed by partial reinforcement with the two different magnitudes of reinforcement. This chapter includes: population and subjects, apparatus, procedure, and method of data analysis.

SUBJECTS

The subjects for this experiment were students at Emporia Kansas State College enrolled in lower level psychology courses. They were asked to participate in the study by the instructors of their individual classes, and were not told the nature or purpose of the study.

Each of forty male and female volunteers were randomly assigned to one of four groups by having the experimenter pull slips of paper labeled A, B, C, or D from a cup. The letters corresponded to a specific schedule and magnitude of reinforcement (A = PR-CR, 1¢; B = PR-CR, 10¢; C = CR-PR, 1¢; D = CR-PR, 10¢).

APPARATUS

There was a 56x28x56 cm. apparatus used, with a small clear plastic lever and a token receiver protruding from the front. Small tokens were dispensed through a tube to the token receiver next to the lever on the front of the apparatus.

Schedules were programmed on 16mm. film by punching eighth-inch holes in the center of the filmstrip. The holes allowed a stylus to fall through and make electrical contact when they occurred under the stylus, which ordinarily rested on the film. Two automatic counters were attached to the top-rear of the apparatus, one to record the total number of responses and the other to record the number of reinforcers dispensed.

A cumulative recorder was connected to the apparatus in order to keep an accurate record of the extinction pattern and the number of responses to extinction of each subject. This record provided the data to be analyzed.

PROCEDURE

Subjects were seated in front of, and the experimenter behind, the apparatus. The experimenter was not visible to the subject. The experimenter handed the subject a card of typed instructions, which read as follows:

> At times when you push the lever, a token will drop into the container at the end of the tube in front of you. Take each token as it falls and place it in the cup at your right. Each token is worth <u>one cent</u>, which will be paid to you at the end of this session.
>
> Please inform the experimenter when you are through.

The wording of the instruction cards was essentially the same, except that the members of the opposite groups were informed that the tokens would be worth ten cents each.

Any questions of other than an instructional nature were deferred until the subject had completed the task. Following the reading of the instructions, the subject was asked if he understood what he was to do; if he responded that he did not, the instructions were explained to him.

The acquisition schedule was a VR5 schedule mixed with a continuous reinforcement schedule, which was reversible in order to place the continuous reinforcement either before or at the end of the total schedule. This schedule required fifty-five correct responses before the extinction phase began; five continuous and fifty VR, or fifty VR and five continuous.

Extinction was considered complete when there was no responding over a fifteen second period, or when the subject said that he was through. When one of the above criteria had been reached, the subject counted the tokens and received the appropriate amount of money. Before leaving, each subject was asked not to tell others about the experiment, hopefully preventing any preconceived notions about the experiment being brought into the experimental situation by future subjects.

Any subjects not completing the acquisition schedule were excluded from the study. Also, any subjects whose records could not be read accurately were excluded.

DATA ANALYSIS

An analysis of variance was used to analyze the data from this experiment. The F ratios for the analysis of variance were computed according to the following formula. Results of this analysis follow in Chapter 4.

$$\text{(schedule)} \quad a = \Sigma^{a}(\Sigma^{b}\Sigma^{n}X)^{2}/bn$$

$$\text{(magnitude)} \quad b = \Sigma^{b}(\Sigma^{a}\Sigma^{n}X)^{2}/an$$

$$\text{(interaction)} \quad ab = \Sigma^{a}\Sigma^{b}(\Sigma^{n}X)^{2}/n$$

Chapter 4

ANALYSIS OF DATA

This study was designed to investigate whether subjects responding to a schedule of partial reinforcement before continuous reinforcement with two different magnitudes of reinforcement would differ significantly in the number of responses to extinction from subjects responding to a schedule of continuous reinforcement before partial reinforcement with the two different magnitudes of reinforcement. This chapter includes a discussion of the statistical analysis, the results of that analysis, a table of means for the subjects, and the analysis of variance table.

STATISTICAL ANALYSIS

The statistical data presented in the following discussion and tables represent the number of extinction responses of the forty subjects utilized in this study. The method utilized was an analysis of variance. The null hypothesis under investigation was:

> There will be no significant difference between the number of extinction responses of subjects responding to a schedule of Partial before Continuous Reinforcement with two different magnitudes of reinforcement, and subjects responding to a schedule of Continuous before Partial Reinforcement with the two different magnitudes of reinforcement.

On the basis of an analysis of variance, the null hypothesis was accepted. The results were shown to be non-significant at either the .05 level or the .01 level. No main effect was found for variable A, B, or for interaction between the two. Graphic representation of the results follows.

Table 1

Means and Standard Deviations for the Number of Responses to Extinction, According to Schedule and Magnitude of Reinforcement

	Mean	Standard deviation
PR-CR, 1¢	53.0	37.80
PR-CR, 10¢	65.5	47.16
CR-PR, 1¢	68.3	35.78
CR-PR, 10¢	47.8	24.69

Table 2

Analysis of Variance Source Table of Mean Extinction Scores

Source	DF	SS	MS	F	P
A (Schedule)	1	14.40	14.40	.009	N.S.
B (Magnitude of Reinforcement)	1	160.00	160.00	.104	N.S.
AB (Interaction)	1	2722.50	2722.50	1.768	N.S.
S (AB error)	36	55426.20	1539.62	--	--
Total	39	58323.10	--	--	--

In order for the results to have been significant at the .05 level, the F value would have had to be 4.12. Significance at the .01 level would have required a value of 7.42. For raw data, see Appendix 1.

Chapter 5

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS FOR FURTHER STUDY

The null hypothesis was accepted as a result of the statistical analysis. In the following sections, the summary, conclusions and limitations of this study, and recommendations for further study are presented.

SUMMARY

This study investigated the possibility that there would be a difference between the number of responses to extinction of subjects responding to a schedule of partial before continuous reinforcement with two different magnitudes of reinforcement and subjects responding to a schedule of continuous before partial reinforcement with the two different magnitudes of reinforcement. The results showed no significant differences, either between schedules or between different magnitudes of reinforcement, as determined by subjecting the data to an analysis of variance. It is not known whether further experiments utilizing the recommendations presented would show significant differences in results, but the hypothesis merits further study. Data from this study are not conclusive enough to form a basis for broad generalizations concerning schedules or magnitudes of reinforcement.

CONCLUSIONS

Most studies similar to this one have been conducted with non-human subjects, and have not investigated the combination of variables, i.e., mixed schedules and varying magnitudes, with which this study was concerned. The majority of the studies were done with rats and pigeons and they found that partial reinforcement schedules led to a greater resistance to extinction than continuous reinforcement schedules. This study did not replicate the results of any of the studies mentioned.

Spradlin's study[1] was done with retarded children, but the results did not show a significant difference between schedules. It was the only relevant human subject study that a search of the literature revealed. The results showed no significance with the human subjects in this experiment.

The studies utilizing the additional variable of magnitude of reinforcement found, as a rule, that the smaller amounts of reinforcement led to a greater resistance to extinction. Indeed, Zeaman[2] found that the larger the magnitude of reinforcement, the smaller the number of responses to extinction. The Davenport and Flaherty experiment[3] found the same inverse magnitude of reinforcement-number of extinction

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[1]J. Spradlin, "Effects of Reinforcement Schedules on Extinction in Severely Mentally Retarded Children," American Journal of Mental Deficiency, LXVI (1962), 634-640. (Abstract)

[2]D. Zeaman, "Response Latency as a Function of the Amount of Reinforcement," Journal of Experimental Psychology, XXXIX (1949), 466-483.

[3]D. P. Davenport and C. F. Flaherty, "Extinction of Differential Reward Magnitude Discrimination in a Discrete Bar-Pressing Situation," Psychonomic Science (1969), 29-30. (Abstract)

responses relationship. This study found no such magnitude-response relationship.

The prediction of cognitive theorists,[4] stating that partial reinforcement schedules should lead to greater resistance to extinction, was not supported during the course of this study. Neither was the other hypothesis attributed to cognitive theorists concerning the arrangement of a schedule of partial reinforcement followed by a block of continuous reinforcement leading to greater resistance to extinction. Possible explanations concerning the results follow.

It was believed that, for the purposes of this study, the difference between one and ten cents would be enough to cause a significant difference between the number of extinction responses of the subjects tested. Since the results did not show a difference, possibly the differential between the two magnitudes was not sufficient. Also, the absolute magnitudes may need to be much larger to make any difference at all in the data.

The schedules in this study involved the reversal, in order, of one schedule of reinforcement. The schedule was a mixed VR5-continuous schedule with continuous reinforcement either before or after the partial reinforcement. It is entirely possible that a longer block of continuous reinforcement would have caused a stronger resistance to extinction, since the position of the block of continuous reinforcement had no effect on the data. It is also possible that a longer or thicker

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[4]L. G. Humphreys, "The Effect of Random Alternation of Reinforcement on the Acquisition and Extinction of Conditioned Eye Lid Reactions," Journal of Experimental Psychology, XXV (1939), 141-158.

schedule, that is, more reinforcers within the schedule of partial reinforcement, would have had the same effect on the results.

The schedules for the study were chosen because, from the experimenter's past experience with a similar study, they were determined to be of sufficient length to allow for a high percentage of acquisition schedule completion. It is conceivable that the partial reinforcement schedule was too thin, that is, the number of reinforcers was too small; or that the schedule was too short, not allowing for sufficient response strength to be established before extinction was initiated. Also, a VI schedule or a different VR schedule could have a different effect on the data. This variable could have caused a smaller number of responses into extinction, thereby biasing the results in a negative direction.

The sample was chosen specifically because it was assumed to be experimentally naive. Possibly, the subjects could have learned about extinction experiments in their basic psychology classes before taking part in the experiment, thereby causing them to try harder and inflating the data for the extinction results.

Past research[5] has shown that mere participation in an experiment can cause subjects to work harder. If this principle held true in this study, it is conceivable that neither the schedule nor the reinforcer used had any effect at all on the subjects' behavior, but that other influences biased the data. An "experimenter bias effect"[6]

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[5]Robert Rosenthal, "The Volunteer Subject," Human Relations, XVIII (1965), 389-406.

[6]Robert Rosenthal, Experimenter Bias Effects in Behavioral Research (New York: Appleton-Century-Crofts, 1966).

could not be totally ruled out. The type of person who volunteers to be an experimental subject may also have affected the data in a positive direction. These persons tend to be eager either for the experience or for whatever gains may be made by their participation, and in this manner, they may have tried harder than a randomly drawn sample from a larger population, causing a variation in extinction data.

Subjects in this study were drawn from a college student population, which ordinarily is from a slightly higher income bracket and social class than the general public. They, therefore, probably had ready access to some source of income, and placed less value on the individual amounts of reinforcement which this study made available to them. This fact may have caused the magnitude of reinforcement not to have had any significant effect on how hard they worked during the course of this experiment.

RECOMMENDATIONS FOR FURTHER STUDY

A study could be designed to utilize larger magnitudes of reinforcement, thereby influencing the value placed on each individual reinforcer by the subject. If schedules could be either exclusively continuous or partial in delivery of reinforcement, possible hypotheses concerning the partial reinforcement effect could be more clearly investigated. These schedules would have to be subjected to experimental tests to determine the appropriateness of their lengths to the effects on extinction, because schedules that are too long tend to adversely affect data and schedules that are too short do not allow a sufficient number of responses to take place for the schedule to affect the extinction process. An interesting variation would entail utilizing a

variable interval or fixed interval schedule, to see how extinction would be affected.

In order for generalizations to be drawn to a larger population, the sample should be greatly enlarged. Also, a wider, random sample should be drawn in order to cancel any volunteer effects that might bias the results. In the process of drawing this wider sample, the possibility of drawing experimentally sophisticated subjects would be lessened or negated altogether.

A study could be undertaken utilizing two different magnitudes of reinforcement which would be alternately or randomly dispensed within either a program of pure partial reinforcement or a mixed schedule such as the one used in this study. The experimenter could then make some hypotheses concerning an "expectation effect" and its effects on extinction. Tokens of different values could be alternated, and if the difference between the magnitudes was sufficient, other hypotheses could be made.

BIBLIOGRAPHY

BIBLIOGRAPHY

Bosse, Paul L. "Effects on Extinction of Placing Differing Numbers of Continuously Reinforced Trials Prior To or After Differing Numbers of Partially Reinforced Trials." Unpublished Doctoral dissertation proposal, 1973.

Cotler, S. B., and J. E. Nygaard. "Resistance to Extinction Following Sequences of Partial and Continuous Reinforcement in a Human Choice Task," Journal of Experimental Psychology, II (1969), 270-274.

Davenport, D. P. and C. F. Flaherty. "Extinction of Differential Reward Magnitude Discrimination in a Discrete Bar-Pressing Situation," Psychonomic Science (1969), 29-30. (Abstract)

Hothersall, D. "Resistance to Extinction When Continuous Reinforcement is Followed by Partial Reinforcement," Journal of Experimental Psychology, LXXII, No. 1 (1966), 109-112.

Humphreys, L. G. "The Effect of Random Alternation of Reinforcement on the Acquisition and Extinction of Conditioned Eye Lid Reactions," Journal of Experimental Psychology, XXV (1939), 141-158.

Jenkins, H. M. "Resistance to Extinction When Partial Reinforcement is Followed by Regular Reinforcement," Journal of Experimental Psychology, LXIV (1962), 441-450.

Keller, F. S. "The Effect of Sequence of Continuous and Periodic Reinforcement Upon the Reflex Reserve," Journal of Experimental Psychology, XXVII (1940), 559-565.

Likely, F. A. "Relative Resistance to Extinction of a Periodic and Continuous Reinforcement Separately and in Combination," The Journal of General Psychology, LVIII (1958), 165-187.

Logan, F. A. Fundamentals of Learning and Motivation. Dubuque, Iowa: William C. Brown, 1969.

_____. Incentive. New Haven, Conn.: Yale University Press, 1960.

Rosenthal, Robert. Experimenter Bias Effects in Behavioral Research. New York: Appleton-Century-Crofts, 1966.

_____. "The Volunteer Subject," Human Relations, XVIII (1965), 389-406.

Spradlin, J. "Effects of Reinforcement Schedules on Extinction in Severely Mentally Retarded Children," American Journal of Mental Deficiency, LXVI (1962), 634-640. (Abstract)

Sutherland, N., N. Mackintosh, and J. Wolfe. "Extinction as a Function of the Order of Partial and Consistent Reinforcement," Journal of Experimental Psychology, LXIX (1965), 56-59.

Theios, J. and R. McGinnis. "Partial Reinforcement Before and After Continuous Reinforcement," Journal of Experimental Psychology, LXXIII (1967), 479-481.

Wolman, B. B. Dictionary of Behavioral Science. New York: VanNostrand Reinholt Co., 1974.

Zeaman, D. "Response Latency as a Function of the Amount of Reinforcement," Journal of Experimental Psychology, XXXIX (1949), 466-483.

APPENDIX

Subjects' Raw Data Utilized in the Analysis of Variance

	PR-CR	CR-PR
One Cent	25	19
	74	29
	88	84
	16	87
	23	33
	50	72
	35	56
	41	123
	32	128
	146	52
Ten Cent	21	59
	35	57
	89	99
	99	37
	133	12
	17	33
	73	62
	147	21
	20	68
	21	30