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A STUDY OF ACQUISITION AND EXTINCTION OF PROBABILITY LEARNING OF MENTALLY RETARDED SUBJECTS

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CHAPTER I

INTRODUCTION AND PROBLEM

The learning process has tempted man's curiosity since the earliest days of history. "Aristotle the famous Greek philosopher who wrote on biological topics, proposed a number of rather simple principles to explain the manner in which learning takes place."[1] Studies on learning are shared by physiologists, biophysicists, teachers, parents, educational researchers, and others interested in the process of how humans learn. Psychologists who became interested in learning theories were such pioneers as Ebbinghaus, Bryan and Harter, and Thorndike.[2] Since this time much information has been collected relevant to the situations under which man learns new behaviors and discards ones that he no longer needs. Even though such studies are numerous, one important aspect in educational research that has been neglected is the total learning process of the mentally retarded. Learning is a

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[1] Raymond G. Kuhlen and George G. Thompson (ed.), Psychological Studies of Human Development (New York: Appleton-Century-Crofts, 1970), p. 144.

[2] Ernest R. Hilgard and Gordon H. Bower, Theories of Learning (New York: Appleton-Century-Crofts, 1966), p. 1.

complex process; one which historically has been explained by conflicting theories. This unfortunate situation has created and perpetuated theoretical assumptions about mentally subnormal persons that have not been empirically tested.

Even though the concept of mental deficiency has existed for centuries, it is doubtful if most social scientists would agree on a single definition of mental retardation. There is a general agreement that it refers to both the quantitative and qualitative impairment of the functioning organism's overall efficiency which results in social incompetence.[3] Since the competence of an organism depends heavily upon its learning capacity, the acquisition and extinction processes seem to be vital components in understanding the overall functioning of a retarded person. Even though the knowledge we possess about the process of learning in normal children is not complete, regrettably we know even less about the learning process in retarded children.

This study investigated various aspects of resistance to extinction as a function of schedules of reinforcement during acquisition of a probability learning task. It also noted the effects of age and sex upon acquisition and extinction.

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[3] Joseph R. Deacon, "Mental Retardation and the Role of the Social Worker," M-R Quarterly, 1967, Vol. 1, 7-8, pp. 13-14.

Learning according to Hilgard and Bower[4] is the process in which an activity originates or is changed by reacting to an encountered situation, provided that the characteristics of the change cannot be explained on the basis of maturation. Illustrations of this would be: memorization, acquisition of vocabulary, social attitudes, prejudices, preferences, and skills used in everyday living.

There are many categories of human learning. These are only identifiable as the result of research activities rather than empirically tested classifications. One such category is probability learning.

Stevenson and Zigler[5] state that probability learning is evident when an individual is faced with alternative ways of acting, none of which are always successful in enabling him to reach his desired goal. He then tends with the passage of time, to try different courses of responding. When the alternatives are limited the S responds to a particular one in approximate proportion to the percentage of times it has been previously reinforced. The experimenter manipulates, in random fashion, the set of alternative responses available to the subject. This permits no real pattern by which the subject can precisely predict which event will occur.[6]

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[4]Hilgard and Bower, op. cit., p. 2.

[5]Harold W. Stevenson and Edward F. Zigler, "Probability Learning in Children," Journal of Experimental Psychology, 1958, Vol. 56, pp. 185-192.

[6]Hilgard and Bower, op. cit., p. 348.

The simplest form of probability learning is the two-choice situation. In this arrangement we let A_1 and A_2 denote the subjects two predictive responses and E_1 and E_2 the two events from which the subject will choose. The experimenter chooses the schedules of reinforcement and may show either E_1 or E_2 on any given trial. For example, he may choose the probability of an E_1 on the n^{th} trial to (a) be a constant, (b) increase or decrease in some systematic manner as trials proceed, (c) vary depending on the response of trial n, or (d) vary depending on the response or reinforcement event that occurred a few trials back in the sequence.[7] When the average proportion of A_1 responses over a long-term average is equal to the average proportion of E_1 events, the general implication is that the occurrence of A_1 is equal to E_1 on any set of trials.

Many research studies have been conducted on probability learning in the two-choice paradigm. The accumulated materials show that most are lacking in factual interpretations and are in fact only concepts and assumptions which lead to generalizations of numerous theories.[8]

Partial reinforcement is of considerable importance in the influence it has on resistance to extinction. Marx states, "it has been found repeatedly that resistance is

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[7] Ibid.

[8] W. K. Estes, "Probability Learning," in Categories of Human Learning, ed. by A. W. Melton (New York: Academic Press, 1964), p. 90.

greater under partial reinforcement."[9] Skinner[10] says that conditioning is the only measure of extinction.

Several theories have been proposed to explain the influence of partial reinforcement on resistance to extinction. Three of these theories are:

1. Discrimination hypotheses theory
2. Expectancy theory
3. Frustration hypothesis

Discrimination Hypotheses Theory.--According to this theory extinction is somewhat retarded by any acquisition procedure which makes it difficult for the individual to discriminate between training and extinction. Extinction which follows partial reinforcement is slow because of the expectancy that reinforcement will not occur on every trial.[11] It is for this reason that extinction after partial reinforcement is more difficult to perceive than extinction which occurs after continuous reinforcement.

Expectancy Theory.--The original statement of this hypothesis was that conditioning consisted of the development of an expectancy by the organism in proportion to the degree of reinforcement. When there is a shift from full reinforcement to full non-reinforcement the subject expects no

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[9] Melvin H. Marx (ed.), Learning: Interactions (Toronto: The Macmillan Co., 1970), p. 332.

[10] Hilgard and Bower, op. cit., p. 141.

[11] Ibid., p. 318.

reappearance of reinforcement during extinction. After partial reinforcement extinction is retarded by the subject's expectation that there will be periodic reinforcement reintroduced.[12] Following this line of thought the subject expects that there will eventually be more reinforcement.

Frustration Hypothesis.--This explanation of partial reinforcement relies on the assumption that frustration is capable of strengthening the response which follows non-reinforcement. If this is true partial reinforcement on non-reinforced trials should strengthen behavior during training. There is reason to believe that frustration drive is conditionable and if so would carry over as resistance to extinction.[13] The assumption that extinction sometimes creates a motivational state of frustration has led to predictions of three general kinds:

> (1) Since it is assumed to be a motive, frustration should be capable of energizing behavior; that is, performance following frustration should be more vigorous than would have occurred without it. (2) Most if not all motives have associated drive stimuli. Frustrating an animal, therefore, might be expected to produce cues which could be made the condition for some learned act. (3) Since frustration, introspectively, is aversive, analogues to escape and avoidance should be demonstrable.[14]

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[12] V. F. Sheffield, "Extinction as a Function of Partial Reinforcement and Distribution of Practice," Journal of Experimental Psychology, 1949, Vol. 39, pp. 512-513.

[13] E. R. Hilgard and D. G. Marquis, Conditioning and Learning (Revised by G. A. Kimble), (New York: Appleton-Century-Crofts, Inc., 1961), pp. 309-311.

[14] Ibid., p. 309.

Interpretations of this hypothesis suggest that the effect of frustration is to increase motivation. This increase in motivation is mainly to strengthen irrelevant and interfering responses produced by frustration. With increased practice the interfering responses tend to disappear since they are not reinforced, therefore, behavior is more limited to the consistently reinforced trials.

Statement of the Problem

The following research questions were formulated:

1. Is there a difference in rate of acquisition and extinction as a function of differential schedules of reinforcement in a two-choice probability learning paradigm in institutionalized mentally retarded persons?

2. Will resistance to extinction in a two-choice probability learning situation be affected when cues and reinforcement which are present during acquisition are removed during extinction?

The following null hypotheses were tested:

H_o-1 There are no significant differences in rate of acquisition among the six schedules of reinforcement--50 crf, 60 crf, 70 crf, 80 crf, 90 crf, and 100 crf.

H_o-2 There are no significant differences in resistance to extinction among the six schedules of reinforcement--50 crf, 60 crf, 70 crf, 80 crf, 90 crf, and 100 crf.

H_o-3 There are no significant differences in rate of acquisition as a function of age among the six schedules of reinforcement--50 crf, 60 crf, 70 crf, 80 crf, 90 crf, and 100 crf.

H_o-4 There are no significant differences in resistance to extinction as a function of age among the six schedules of reinforcement--50 crf, 60 crf, 70 crf, 80 crf, 90 crf, and 100 crf.

H_o-5 There are no significant differences in rate of acquisition as a function of sex among the six schedules of reinforcement--50 crf, 60 crf, 70 crf, 80 crf, 90 crf, and 100 crf.

H_o-6 There are no significant differences in resistance to extinction as a function of sex among the six schedules of reinforcement--50 crf, 60 crf, 70 crf, 80 crf, 90 crf, and 100 crf.

Summary

Some limitations of this study should be noted:

1. Inferences can be made only to similar schedules of reinforcements.

2. Since a two-choice paradigm is to be used, inferences can be made only to similar probability learning situations.

3. Samples are to be taken from the Pauls Valley State School and randomly assigned to groups, therefore inferences can be made only to similar groups.

4. I.Q. was deliberately confounded across groups.

5. Only retarded subjects were used, therefore, no conparison can be made with normal populations.

6. Since the inter-trial interval was held constant, effects of variation cannot be determined.

7. Since levels of criteria for both acquisition and extinction were constant, inferences can only be made to those levels.

CHAPTER II

REVIEW OF LITERATURE

A review of the literature indicates that total control of all factors involved in the effects of reinforcement on acquisition and extinction is virtually impossible. Rather, it appears that each experiment or study acknowledges limitations caused by factors that are free to act and interact which often causes considerable error in the obtained results. This error can be minimized if the experimenter is able to control the major factors involved in contributing to this discrepancy.

Acquisition is a basic process assumed to operate in the total learning process. It is reflected in several different response measures, the most common which are:

> (a) probability of occurrence, expressed as the percentage of trials on which a given subject produces a conditioned response, or the percentage of subjects given a conditioned response on a given trial; (b) latency, the time between the presentation of a signal and the occurrence of a conditioned response; (c) response speed, the reciprocal of some time measure such as latency; (d) rate of responding, the number of conditioned responses produced in some standard period of time; (e) response magnitude, some measure which reflects the vigor of a response on trials when it occurs, and (f) resistance to extinction, the resistance of response strength to conditioned stimulus when the usual reinforcement is removed.[15]

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[15] W. K. Estes and J. H. Straughan, "Analysis of a Verbal Conditioning Situation in Terms of Statistical Learning Theory," Journal of Experimental Psychology, 1954, Vol. 47, pp. 225-234.

Studies were done by Anderson and Grant, 1957; Estes, 1954, Estes and Straughan, 1954; Humphreys, 1939; Grand, Hake and Harnseth, 1951; Jarvik, 1951; and Neimark, 1956 investigating the probability of learning in normal subjects.[16] The following is a summary of these studies:

> It has been found that S's tend to match the stimulus probabilities with their guesses. At the same time, it has been found that under certain conditions S's tend to maximize their frequency of choosing the more frequently reinforced stimulus.[17]

Studies in Mental Retardation--A Longitudinal Review

Experimental research in the field of mental retardation has been on the increase in the past two decades. This has been especially true regarding learning characteristics. McPherson reviewed the studies on learning in retarded individuals, performed between the years of 1907 and 1948. Only those subjects who have been demonstrated by psychometric criteria to be subnormal were included in her studies. McPherson summarizes these studies in the statement:

> The outstanding impression gained from this review of learning in the subnormal is one of lack of information. The actual experiments have been few, the number of subjects small, the tasks to be learned heterogeneous within a narrow range, and the motivational factors inadequately controlled. The results of this review serve not so much as an aid to the technician in meeting clinical problems but as a reminder to the experimentalist.[18]

[16] Kuhlen and Thompson, *op. cit.*, pp. 152-163.

[17] *Ibid.*, p. 153.

[18] Marion W. McPherson, "A Survey of Experimental Studies of Learning in Individuals Who Achieve Subnormal Ratings on Standardized Psychometric Measures," *American Journal of Mental Deficiency*, LII-LIII, (1948), p. 252.

McPherson again reviewed the literature in 1958 covering the period from 1943 to 1957. This review covered fourteen studies dealing with learning in the mentally defective. The studies were not concerned with meaning as related to learning tasks nor were they school oriented.

In summary of her later review she stated:

> The review reveals a diversity of methodology and of results. Some papers highlight a slow, arduous learning process among mental defectives whereas others point to more skill in acquisition than is ordinarily assumed.[19]

Since McPherson's 1958 review, there have been several studies investigating the differences between learning processes in normal and subnormal persons. Most of these studies have compared normals and subnormals of equal mental ages using paired-associates techniques. Only one study using one of the probability learning techniques with retardates has been performed to date.

Acquisition and Resistance to Extinction as Affected by Amounts of Reinforcement

A study by Zeaman[20] of seven groups of white rats revealed that greater resistance to extinction is positively related to the amount of reinforcement on acquisition trials. He suggests that extinction should be regarded as a reduction

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[19]Marion W. McPherson, "Learning and Mental Deficiency," American Journal of Mental Deficiency, LXII, (1958), p. 877.

[20]D. Zeaman, "Response Latency as a Function of the Amount of Reinforcement," Journal of Experimental Psychology, 1949, Vol. 39, pp. 466-483.

in amount of reinforcement which results in a reduction in habit strength.

Harris and Nygaard[21] conducted a study on three groups of albino rats (A, B, C) giving full reinforcement on 45, 90, and 360 trials respectively. Their findings revealed that as the number of reinforcements increased the number of responses to extinction increased.

Most learning theorists would agree that the more times a response has been reinforced, a greater resistance to extinction is developed requiring more non-reinforced trials for extinction.[22]

Effects of Scheduled Partial and Continuous Reinforcement on Acquisition and Resistance to Extinction

Hill and Spear[23] compared extinction after using five schedules of reinforcement with both partial and continuous reinforcement. Ten groups, with ten subjects each, of native female albino rats were given (8, 50 percent), (8, 100 percent), (16, 50 percent), (16, 100 percent), (32, 50 percent), (32,

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[21] P. Harris and J. E. Nygaard, "Resistance to Extinction and Number of Reinforcements," Psychological Reports, 1961, Vol. 8, pp. 233-234.

[22] A. J. North and D. T. Stimmel, "Extinction of an Instrumental Response Following a Large Number of Reinforcements," quoting from Harris and Nygaard, Psychological Reports, 1960, Vol. 6, pp. 172-179.

[23] W. F. Hill and N. E. Spear, "Extinction in a Runway as a Function of Acquisition Level and Reinforcement Percentage," Journal of Experimental Psychology, 1963, Vol. 65, pp. 495-500.

100 percent), (64, 50 percent), (64, 100 percent), (128, 50 percent), and (128, 100 percent) training trials and reinforcement respectively. Acquisition for the groups receiving 8, 16, and 32 trials were completed in one day with the remainder receiving 32 trials per day until completion of training. The inter-trial interval in both acquisition and extinction phases was 30 seconds.

The study indicated that the 100 percent group ran faster early in acquisition and the 50 percent group ran faster later in acquisition. These results proved not to be statistically significant. The partial reinforcement effect was present during extinction but weak. Groups with overtraining started at a higher level but dropped more rapidly. The 100 percent groups seemed to reach a common asymptote more easily than the 50 percent groups. This seems to support the idea that resistance to extinction is directly related to the number of acquisition trials and amount of reinforcement.

Jenkins and Rigby[24] measured resistance to extinction after a schedule of partial reinforcement as compared to continuous reinforcement (of the bar-pressing habit in rats). The results of this experiment indicated that (a) during conditioning the rate of responding was highest for the group

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[24] W. O. Jenkins and M. K. Rigby, "Partial (Periodic) Versus Continuous Reinforcement in Resistance to Extinction," Journal of Comparative and Physiological Psychology, 1950, Vol. 43, pp. 30-40.

with continuous reinforcement, and (b) more responses were emitted during extinction for the partial than for the continuously reinforced groups. This is contrary to some arguments that number of reinforcements is the important factor in influencing resistance to extinction.

Myer[25] conducted a study to determine the effects of partial reinforcement upon an operant response of children. The apparatus was a box with a clown's face painted on it. When the nose was pressed a token was delivered from its mouth. The token was then inserted into the clown's ear and the nose pressed again. This time candy came from its mouth.

The 140 subjects were divided into 14 groups. Eight groups received 20 conditioning trials with various combinations of 50 percent and 100 percent reinforcement. Four groups received 100 percent token reinforcement for 10 conditioning trials. The thirteenth group received 20 training trials with 100 percent candy reinforcement. The last group was a control group for the secondary reinforcing characteristics of the tokens. There was no candy reinforcement for this group.

Each training trial was 10 seconds with a 3 second inter-trial interval. No candy was awarded in any group during extinction. Eight groups were extinguished with tokens;

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[25] N. A. Myer, "Extinction Following Partial and Continuous Primary and Secondary Reinforcement," Journal of Experimental Psychology, 1960, Vol. 60, pp. 172-179.

the other groups with no-tokens. Each child received 40 5-second extinction trials. The results were as follows:

> (1) Groups given 100 percent candy reinforcement during training extinguished faster than those given 50 percent candy reinforcement, (2) the 50 percent token reinforced groups took half the number of trials when the number of token reinforcements was held constant, (3) there was no difference in resistance to extinction between those given 20 and 10 trials with 100 percent token reinforcement, and (4) groups receiving reinforcement during extinction were more resistant to extinction than those receiving no-reinforcement.[26]

Yamaguchi[27] studied the effects of continuous and partial reinforcement on acquisition and extinction. He found very little difference in acquisition performance but a definite difference in their resistance to extinction. He noted that the continuous groups were less resistant.

Cotler and Nygaard[28] studied the effects of partial and continuous reinforcement sequences upon the resistance to extinction of humans in a choice task. Eighty four undergraduate students in psychology were assigned to one of four groups. In three groups partial reinforcement was given prior to, in the middle of, and following consistent reinforcement.

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[26] Ibid.

[27] H. G. Yamaguchi, "The Effect of Continuous, Partial and Varied Magnitude Reinforcement on Acquisition and Extinction," Journal of Experimental Psychology, 1961, Vol. 61, pp. 319-321.

[28] S. B. Colter and J. E. Nygaard, "Resistance to Extinction Following Sequences of Partial and Continuous Reinforcement in a Human Choice Task," Journal of Experimental Psychology, 1969, Vol. 84, pp. 113-119.

The fourth group received full reinforcement and was used for comparison only. It was noted that by altering the schedule of reinforcement it was possible to change _S_s response level. Resistance to extinction was higher in the three partially reinforced groups than the continuous group which is consistent to the findings of several other theorists.

Effects of Inter-Trial Interval on Acquisition And Resistance to Extinction

> An important factor in determining the rate of extinction is the length of pause between successive repetitions of the stimulus without reinforcement. The shorter the pause the more quickly will extinction of the reflex be obtained and in most instances a smaller number of repetitions will be required.[29]

Pavlov defines the index of the rate of extinction as the time elapsing between the start and end of the extinction trials.

Guthrie[30] challenges this theory and comments that it is the number of non-reinforced trials rather than the length of the inter-stimulation interval that is the key in determining extinction.

The relationship between the rate of extinction and inter-trial interval during acquisition and extinction was

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[29] I. P. Pavlov, _Conditioned Reflexes_, (Translated by G. V. Anrep), Oxford University Press, 1927, p. 52.

[30] J. M. Porter, Jr., "Experimental Extinction as a Function of the Interval Between Successive Non-Reinforced Elicitations," _Journal of General Psychology_, 1939, Vol. 20, pp. 109-134.

studied by Teichner.[31] His study was accomplished in two experimental learning experiments. Each experiment (involving hooded rats) provided training with a single inter-trial interval and then subjecting subgroups to experimental extinction using different inter-trial intervals. He found the following results:

1. The acquisition of the response strength was faster as the inter-trial interval increased in time.

2. Resistance to extinction was greater when the inter-trial intervals during learning and extinction were the same than when inter-trial intervals were different.

3. Massed extinction seemed to be faster than spaced extinction.

A Comparison of Probability Learning on Normal and Retarded Adolescents

A study by Stevenson and Zigler[32] on probability learning in normal and institutionalized mildly retarded adolescents of the same mental age reveals that both groups learn to respond to selectively reinforced alternatives in about the same way as do adults. They also found that it is possible to predict and manipulate the probabilities of different responses by special pre-experimental experiences that transfer to a later experimental situation.

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[31] W. H. Teichner, "Experimental Extinction as a Function of the Intertrial Intervals During Conditioning and Extinction," Journal of Experimental Psychology, 1952, Vol. 44, pp. 170-178.

[32] Stevenson and Zigler, *op. cit.*, pp. 185-192.

It is possible that one condition influencing whether or not a subject will maximize his guesses of the more frequently reinforced stimulus is the level of success a subject will accept in the task. If he will accept less than 100 percent success as a final outcome we can assume maximum behavior. On the basis of this analysis Stevenson and Zigler[33] hypothesized that we can expect different types of behavior with subjects who differ in the degree of success they have learned to expect. Normal subjects have learned on the basis of their everyday experience to expect a rather high degree of success. However, institutionalized retardates may have learned to expect and settle for lower degrees of success.

Their study consisted of 30 retarded children chosen at random from persons of appropriate MA and CA in residence at the Austin State School. They were of the familial type with none showing any gross motor or sensory disturbances. They were chosen so that their average MA would be comparable to that of the normal subjects being used in another part of the experiment. The apparatus consisted of a yellow vertical panel 22 inches long and 16 inches high on which was centered a row of three identical black knobs. The knobs released marbles which fell from the hole into a small enclosed box. For each subject one of the three knobs was designated as the correct knob. The particular knob that was correct yielded

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[33] Ibid.

reinforcement with the other two never being reinforced. In the three conditions the correct knob yielded 100 percent, 66 percent, and 33 percent reinforcement. Subjects were assigned at random to each of the three conditions. The subjects were given 80 trials and at the completion of the experiment subject was allowed to select a prize from several items.

An Analysis of Variance of data collected on the above study revealed that the three groups did not differ significantly in frequency of correct responses ($F=2.91$, $P> .05$). In a previous study of normal subjects they found a highly significant difference at this point. All three groups showed an increase in frequency of correct responses between the first and last 20 trials. The difference was significant at less than the .05 level for the 100 percent ($t=2.77$) and 33 percent groups ($t=2.48$) and at less than the .01 level for the 66 percent group ($t=6.69$). The retarded subjects had a greater change in performance between the first and last quarters of acquisition than the normal in both the 66 percent group ($t=3.52$, $p<.01$) and, with a one-tailed test, in the 33 percent group ($t=1.81$, $p<.05$).[34]

The total number of correct responses by the three groups of normal subjects receiving different schedules of reinforcement differed significantly while the three groups

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[34] Ibid.

of retardates tested under the same conditions did not. The two types of subjects differed in rate of learning under both 66 percent and 33 percent reinforcement, but not under the 100 percent. The subnormal child performed at a higher level in the 33 and 66 percent conditions than normals and at a comparable level in the 100 percent condition.

Summary

These studies show several significant factors affecting acquisition and extinction. Among these are amounts of reinforcement, level of training, inter-trial interval, and schedule and pattern of reinforcement. Most studies suggested that partial reinforcement was more resistant to extinction than continuous; that resistance to extinction was greater when the inter-trial intervals during conditioning and extinction were the same than when the inter-trial intervals were different; prolonged training reduces resistance to extinction since subjects have a better chance of detecting reinforcement patterns during acquisition; and conditioned responses extinguish more slowly the further the conditioning process advances.

CHAPTER III

METHOD

Selection of Subjects

The subjects used in this study were sixty mildly retarded boys and girls selected from the Pauls Valley State School ranging in chronological age from 150 to 295 months. They were all classified by the institution's diagnostic staff as familially retarded with a recent Stanford-Binet Intelligence Test or Wechsler Intelligence Scale available on each person.

The subjects were divided into two groups; Study I consisted of 24 subjects ranging in I.Q. from 50 to 72 with a mean I.Q. of 60 and a mean C.A. of 201 months, and Study II consisted of 36 subjects ranging in I.Q. from 50 to 76 with a mean I.Q. of 60 and a mean C.A. of 200 months. Except for matching on sex the participants were randomly assigned to the two studies.

Apparatus

The apparatus consisted of two 25W bulbs 15 inches apart, rear mounted on the horizontal midline of an upright 3 x 4 foot wooden board painted flat black. Green translucent glass screened each of the bulbs. The experimenter <u>E</u>

sat on the opposite side of the board from the subject S. The bulbs were actuated by a manual switch operated by the E.

General Instructions

General instructions given at the beginning of each session to S were to guess which of two lights (right or left) was to be turned on.[35] The inter-trial interval was 10 seconds. No information before, during, or after the session was made available to the subject. Extinction was carried out without the bulbs being actuated.

The examiner used individual record sheets, indicating the schedule to be followed in actuating the bulbs, for each subject. See Appendix II for additional information on each sheet. An extinction chart with numbers from one to 120 and two columns (R), (L) was used to record extinction trials (see Appendix II, Table 28). As the schedule of reinforcement increased, i.e., 50, 60, . . . n, the responses necessary for acquisition increased. All Ss received a minimum of 60 trials for acquisition. The learned response was considered extinguished when the subject guessed, in succession, one group of 10 "rights" in 20 consecutive trials. This resulted in 10 "right" guesses in 20 trials. The criterion for "no extinction" was 360 extinction trials in which the above was not met. The S was required to demonstrate (R)-(L) discrimination by pointing to the two bulbs respectively before starting the test.

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[35]For the schedule followed by the experimenter in actuating the bulbs see Appendix II.

Instructions to Subjects

"This is a guessing game. It has nothing to do with intelligence or personality, nor will it affect, in any way, your position, status, or length of stay at the school. It is not connected to any other testing or evaluation procedure in which you are presently engaged.

I want you to guess which of these two lights I am going to turn on. I will say 'guess' and you will say either 'right' or 'left' to indicate your choice. If your guess matches mine, I will say 'correct' and give you credit by marking your response on a special chart. At the end of this session, we will receive an 'M and M' piece of candy for every correct answer. Do you have any questions before we begin?"

There was a three minute rest period between the conclusion of the training trials and beginning of the extinction process in Study II. The following was read to each S before continuing: "I want you to continue guessing as before, either 'right or left.' However, this time I will not turn on the lights and there will not be any 'correct' or 'incorrect' responses. You will not be receiving 'M and M' candy on these guesses. Please do not make any regular pattern in your guesses such as, R-L-R-L-R-L. Do you have any questions before we begin?"

Description of the Research

The research was constructed in two separate studies.

Study I.--This was a pilot study to determine the number of trials required under each schedule to reach a pre-set criterion of acquisition. No extinction trials were given to these subjects. Twenty four Ss were randomly assigned to six groups (1, 2, 3, 4, 5, 6) of four in each group.

Group 1 received 50 percent continuous reinforcement (0.5-0.5 crf), Ss 1 and 3 had probability of occurrence (PR) of left (L) set at 0.5; Ss 2 and 4 had (PR) of (R) set at 0.5. Acquisition was considered complete when S met the pre-set criterion of 5 correct out of any 10 consecutive trials.

Group 2 received 60 percent (0.6-0.4 crf), Ss 5 and 7 (PR) of (L) set at 0.6; Ss 6 and 8 had (PR) of (R) set at 0.6. Acquisition required (PR) 6 out of any 10 consecutive trials.

Group 3 received 70 percent (0.7-0.3 crf), Ss 9 and 11 had (PR) of (L) set at 0.7; Ss 10 and 12 had (PR) of (R) set at 0.7. Acquisition required (PR) of 7 out of any 10 consecutive trials.

Group 4 received 80 percent (0.8-0.2 crf), Ss 13 and 15 had (PR) of (L) set at 0.8; Ss 14 and 16 had (PR) of (R) set at 0.8. Acquisition required (PR) of 8 out of any 10 consecutive trials.

Group 5 received 90 percent (0.9-0.1 crf), Ss 17 and 19 had (PR) of (L) set at 0.9; Ss 18 and 20 had (PR) of (R) set at 0.9. Acquisition required (PR) of 9 out of any 10 consecutive trials.

Group 6 received 100 percent (1.0-0.0 crf), Ss 21 and 23 had (PR) of (L) set at 1.0; Ss 22 and 24 had (PR) of (R) set at 1.0. Acquisition required (PR) of 10 consecutive correct responses.

Study II.--This study was dependent upon data gathered from Study I to determine the number of trials required for acquisition. Thirty six Ss were randomly assigned to six groups (7, 8, 9, 10, 11, 12) of six in each group. The first part of this study was a repetition of Study I using different Ss but the same (PR) for the six groups. The criteria and process for extinction are described in "general instructions." This formed the second part of Study II.

CHAPTER IV

RESULTS AND DISCUSSION

This chapter is an analysis and summary of the data for Study I and Study II, and a general discussion relating the findings to the relevant theory and hypothesis.

Results

Study I

This study was designed to determine the number of trials required to reach the probability level for acquisition in each of the six schedules of reinforcement, 50 crf, 60 crf, 70 crf, 80 crf, 90 crf, and 100 crf. Table 1 shows the number of trials under each schedule it took the 24 Ss to reach pre-set criteria for learning the desired pattern. Attention should be given to the 70 crf group since this was the most difficult schedule to learn in both studies. The 50 crf group acquired acquisition first indicating that this level may be by chance alone since the probability of guess is $(0.5)^2 + (0.5)^2$. This results in a 50 percent guessing situation. It should also be noted that the 70, 80, and 90 crf groups had more difficulty in learning the desired pattern. Figure 1 is a graph of data collected from Table 1 showing the above observations. A Kruskal-Wallis One Way

TABLE 1

SCHEDULES OF REINFORCEMENT VS. NUMBER OF TRIALS FOR ACQUISITION--STUDY I

	50 crf	60 crf	70 crf	80 crf	90 crf	100 crf
	10	10	24	20	49	16
	10	10	19	40	23	13
	10	10	46	31	32	12
	10	14	48	31	23	12
Σ	40	44	137	122	127	53
$\overline{X}$	10	11	34.25	30.50	31.75	13.25
ΣR_j	16	23	75	72	75	39
	H = +18.75		df = 5	p <.01	Two Tailed	

FIGURE 1

GRAPHICAL REPRESENTATION OF TABLE 1

Analysis of Variance by Ranks was run on the data obtained from Table 1 to determine the differential effects of reinforcement on acquisition. The results of this analysis are listed on the same table and indicate that there is a significant difference among the six schedules of reinforcement, H = +18.75 ($p<.01$).

Table 2 is a comparison of age with number of trials for acquisition to determine if age has any effect on the rate in which a S acquires the patterned schedule. The two younger groups (CA--14.0, 15.8) made acquisition with slightly fewer trials than did the two older groups (CA--17.4, 19.7). A Kruskal-Wallis One Way Analysis of Variance by Ranks indicated that there was no significant difference (p=N.S.), therefore, age did not influence the rate of acquisition.

TABLE 2

AGE OF SUBJECT VS. NUMBER OF TRIALS FOR ACQUISITION--STUDY I*

	Column A	Column B	Column C	Column D
	14.0	15.8	17.4	19.7
	10	10	10	10
	10	10	10	14
	24	19	46	48
	20	40	31	31
	49	23	32	23
	16	13	12	12
Σ	129	115	141	138
$\overline{X}$	21.50	19.17	23.52	23.0
ΣR_j	75	67.50	77	80.50
	H = +0.30	df = 3	p>.95	Two Tailed

*Acq. = 60 Trials, N = 24, Cols. = 4.

Table 3 compares sex with the number of trials for acquisition. Even though the $\overline{X}$ number of trials indicates that males took less trials, a Mann-Whitney U Test run on the two groups revealed that there were no significant differences--U = 44.5 (p=N.S.)--between male and female Ss in their ability to grasp the criteria for acquisition.

TABLE 3

SEX OF SUBJECT VS. NUMBER OF TRIALS FOR ACQUISITION--STUDY I*

	Male		Female
	10		10
	10		19
	10		46
	10		48
	10		20
	10		49
	14		32
	24		16
	40		13
	31		12
	31		
	23		
	23		
	12		
Σ	258		265
$\overline{X}$	18.43		26.50
ΣR_j	149.50		150.50
	U = 44.5	p >.1	Two Tailed

*Acq. = 60 Trials, N = 24, Cols. = 2.

Table 4 indicates the number of correct responses at each of the six schedules of reinforcement. It should be noted that the 70 and 100 crf groups had means of 29.0 and 57.0 respectively, indicating a more difficult schedule at the 70 crf and less difficulty at the 100 crf. Figure 2 presents this data in graphic form. The x's in Appendix II, Table 12, represent the trials at which the Ss were reinforced.

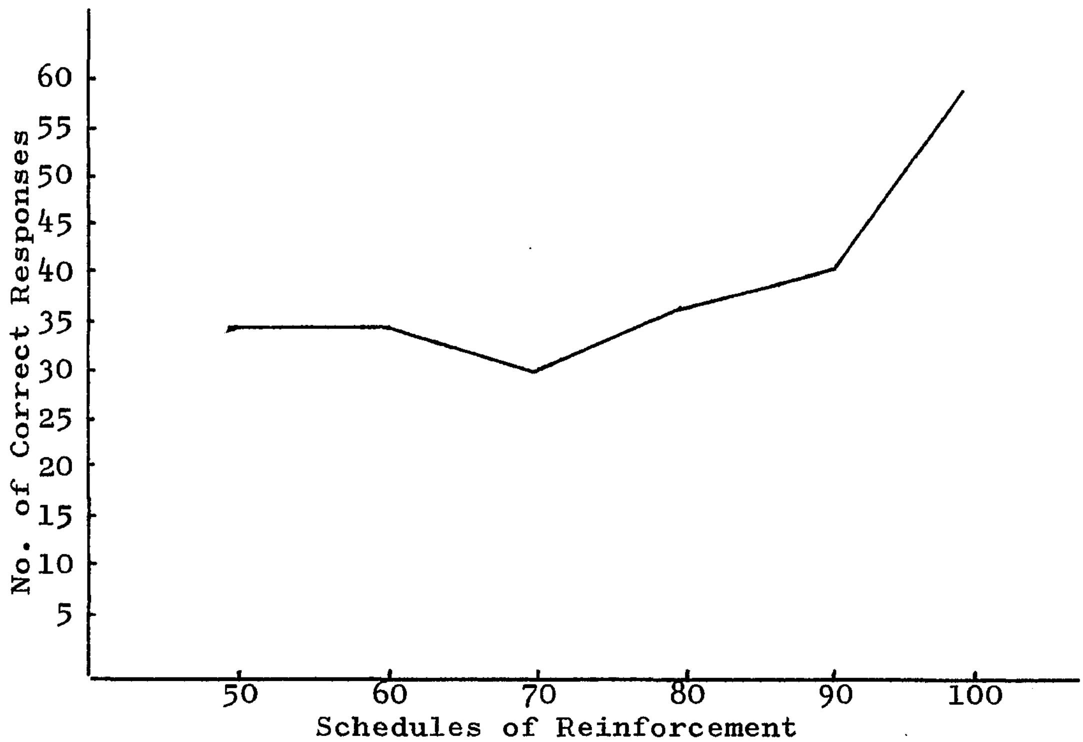
TABLE 4

SCHEDULES OF REINFORCEMENT VS. NUMBER OF CORRECT RESPONSES--STUDY I

	50 crf	60 crf	70 crf	80 crf	90 crf	100 crf
	36	34	27	36	31	55
	33	32	29	29	42	57
	38	41	31	40	41	58
	30	30	29	36	44	58
Σ	137	137	116	141	158	228
$\overline{X}$	34.25	34.25	29.0	35.25	39.5	57.0

FIGURE 2

GRAPHICAL REPRESENTATION OF TABLE 4



Study II

The first part of the study was identical to Study I, which determined the number of trials required at each schedule to reach the criteria for acquisition. One question then to be answered in Study II is whether acquisition did take place and make comparisons with Study I to determine if the number of trials were significantly beyond the probability of chance alone. It is interesting to note the similarity between Study I and Study II, Table 1 and 5 respectively. In both studies the 70 crf groups took more trials to accomplish acquisition and the 50 crf group took less trials. Table 5 presents acquisition data. All 36 Ss reached criterion in 60 or less trials which was determined from Study I. A Kruskal-Wallis One Way Analysis of Variance by Ranks was run on the data obtained. The results of this analysis are significant (H=+16.125, p<.01).

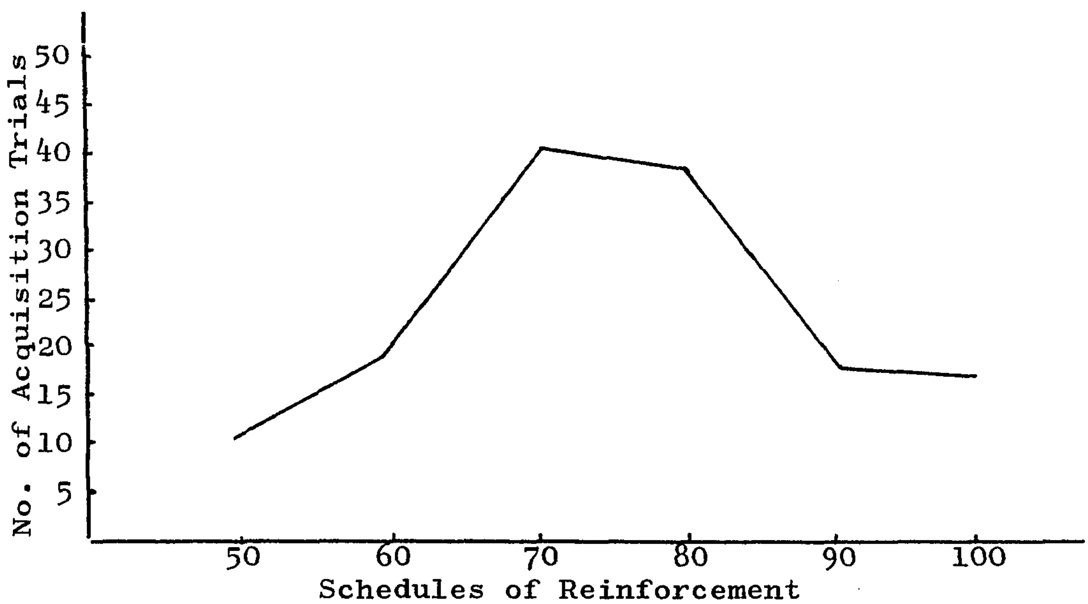
TABLE 5

SCHEDULE OF REINFORCEMENT VS. NUMBER OF ACQUISITION TRIALS--STUDY II

	50 crf	60 crf	70 crf	80 crf	90 crf	100 crf
	12	14	29	27	23	12
	10	10	43	19	16	23
	10	11	30	39	12	12
	10	57	43	60	28	13
	15	13	53	28	14	29
	10	13	45	50	18	13
Σ	67	118	243	223	111	102
$\overline{X}$	11.17	19.67	40.50	37.17	18.50	17.00
ΣR_j	31.5	84.5	181.5	165.5	101	78
	H = +16.125		df = 5	p<.01		Two Tailed

FIGURE 3

GRAPHICAL REPRESENTATION OF TABLE 5



Another question to be answered in this study is whether extinction does take place when reinforcement is stopped and lights are no longer turned on. Table 6 presents data relevant to this question. With the exception of four subjects, one each in the 80 and 90 crf and two in the 100 crf, all <u>S</u>s did extinguish in less than 360 trials. The 50, 60 and 70 crf's extinguished at about the same rate. In terms of resistance to extinction, these groups were least resistant. Next were the 80, 90, and 100 crf's in that order. To test for significance a Kruskal-Wallis One Way Analysis of Variance was used. The result was significant , H = +13.787 ($p < .02$). Figure 4 is a graph plotting schedule of reinforcement vs. number of extinction trials. It reveals that there is a definite sharp increase in resistance to extinction above the 70 crf group.

TABLE 6

SCHEDULE OF REINFORCEMENT VS. NUMBER OF EXTINCTION TRIALS--STUDY II

	50 crf	60 crf	70 crf	80 crf	90 crf	100 crf
	20	20	20	24	160	21
	22	21	20	360	20	360
	24	20	20	52	40	130
	20	20	24	20	360	160
	20	20	48	45	20	22
	20	20	31	39	40	360
Σ	126	121	163	540	640	1053
$\overline{X}$	21.0	20.17	27.17	90.0	106.67	175.5
ΣR_j	71.5	56.50	96.0	143.5	133.0	165.5
	H = +13.787		df = 5		p<.02	Two Tailed

FIGURE 4

GRAPHICAL REPRESENTATION OF TABLE 6

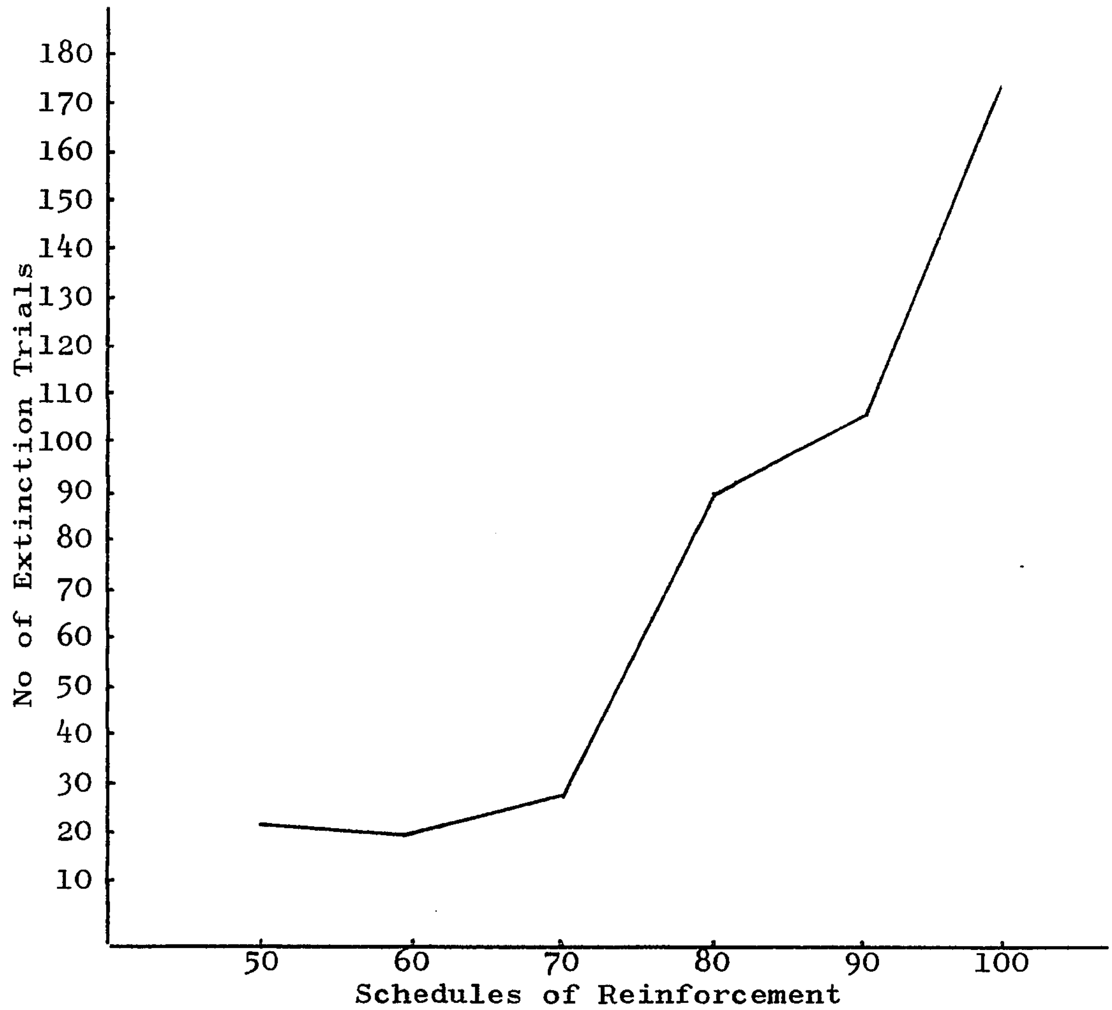


Table 7 compares the effects of age on the number of trials for acquisition at each of the six age levels. Six columns (E, F, G, H, I, J) with mean chronological ages of 14.2, 15.0, 15.8, 17.0, 18.0, and 20.8 respectively are given. It should be noted that Column H (CA--17.0) took considerably more trials than any of the other groups. A Kruskal-Wallis One Way Analysis of Variance showed that these differences were not significant. This compares favorably with Table 2 in Study I.

TABLE 7

AGE OF SUBJECT VS. NUMBER OF TRIALS FOR ACQUISITION--STUDY II*

	Column E	Column F	Column G	Column H	Column I	Column J
$\overline{X}_{ca}$	14.2	15.0	15.8	17.0	18.0	20.8
	12	10	10	10	15	10
	14	10	11	57	13	13
	29	43	30	43	53	45
	27	19	39	60	28	50
	23	16	12	28	14	18
	12	23	12	13	29	13
Σ	117	121	114	211	152	149
$\overline{X}$	19.5	20.17	19.0	35.17	25.33	24.9
ΣR_j	103.5	96.0	83.0	141.0	130.0	112.0
	H = +3.21			df = 5		p>.50

*Acq. = 60 Trials, N = 36, Cols. = 6.

Another question to be answered is whether age of Ss affects the number of trials needed for extinction. Again six columns with identical $\overline{X}_{ca}$'s as Table 7 are given. Table 8 helps answer this question. Columns F (CA--15.0) and H (CA--17.0) took more trials respectively to extinguish than did the other four ages. Only four of the 36 S did not extinguish. "No extinction" was considered at 360 trials. A Kruskal-Wallis One Way Analysis of Variance noted no significance of age in relation to rate of extinction.

TABLE 8

AGE OF SUBJECT VS. NUMBER OF TRIALS FOR EXTINCTION--STUDY II*

	Column E	Column F	Column G	Column H	Column I	Column J
$\overline{X}_{ca}$	14.2	15.0	15.8	17.0	18.0	20.8
	20	22	24	20	20	20
	20	21	20	20	20	20
	20	20	20	24	48	31
	24	360	52	20	45	39
	160	20	40	360	20	40
	21	360	130	160	22	360
Σ	265	803	286	604	175	510
$\overline{X}$	44.17	133.83	47.67	100.7	29.33	85.0
ΣR_j	93.0	120.0	121.0	111.0	97.50	123.0
	H = +0.969			df = 5		p>.95

*Ext. = 360 Trials, N = 36, Cols. 6

Table 9 (Study II) presents the number of trials for acquisition under the six schedules of reinforcement vs. sex of Ss. A Mann-Whitney U was conducted on the data of Table 9. The results indicate that there were no significant differences between male and female Ss in their ability to reach criterion for acquisition.

A second study of "sex of subject" was in relation to the number of trials for extinction. A Mann-Whitney U Test run on the two groups of equal N's indicated no significant differences. (See Table 10.)

TABLE 9

SEX OF SUBJECT VS. NUMBER OF TRIALS FOR ACQUISITION--STUDY II*

	Male		Female
	12		10
	10		10
	10		15
	11		14
	57		10
	13		13
	43		29
	30		43
	53		45
	27		39
	19		28
	60		50
	16		23
	12		28
	14		12
	18		23
	12		29
	13		13
Σ	430		434
$\overline{X}$	23.88		24.11
ΣR_j	321.5		344.50
	U = 170.5	p>.1	Two Tailed

*Acq. = 60, N = 36, Cols. = 2.

TABLE 10

SEX OF SUBJECT VS. NUMBER OF TRIALS FOR EXTINCTION--STUDY II*

	Male		Female
	20		24
	22		20
	20		20
	20		20
	20		21
	20		20
	20		20
	20		24
	48		31
	24		52
	20		45
	20		39
	40		160
	20		360
	40		21
	130		360
	160		22
	360		360
Σ	1024		1619
$\overline{X}$	56.88		89.94
ΣR_j	294.50		371.50
	U = 123.5	p>.1	Two Tailed

*Ext. = 360 Trials Max., N = 36, Cols. = 2.

Table 11 indicates the number of correct responses at each of the six schedules of reinforcement. The 60 crf group had slightly fewer correct responses, but compares favorably with the 50, 70, and 80 crf. The 90 and 100 percent continuous reinforcement groups show a sharp increase in the number of correct responses. We could expect this since the pattern was learned very quickly and all guesses were to the reinforced light. Figure 5 is a graph indicating the number of correct responses at each of the six schedules of reinforcement. The x's in Appendix II, Table 13, represent the trials at which the Ss were reinforced.

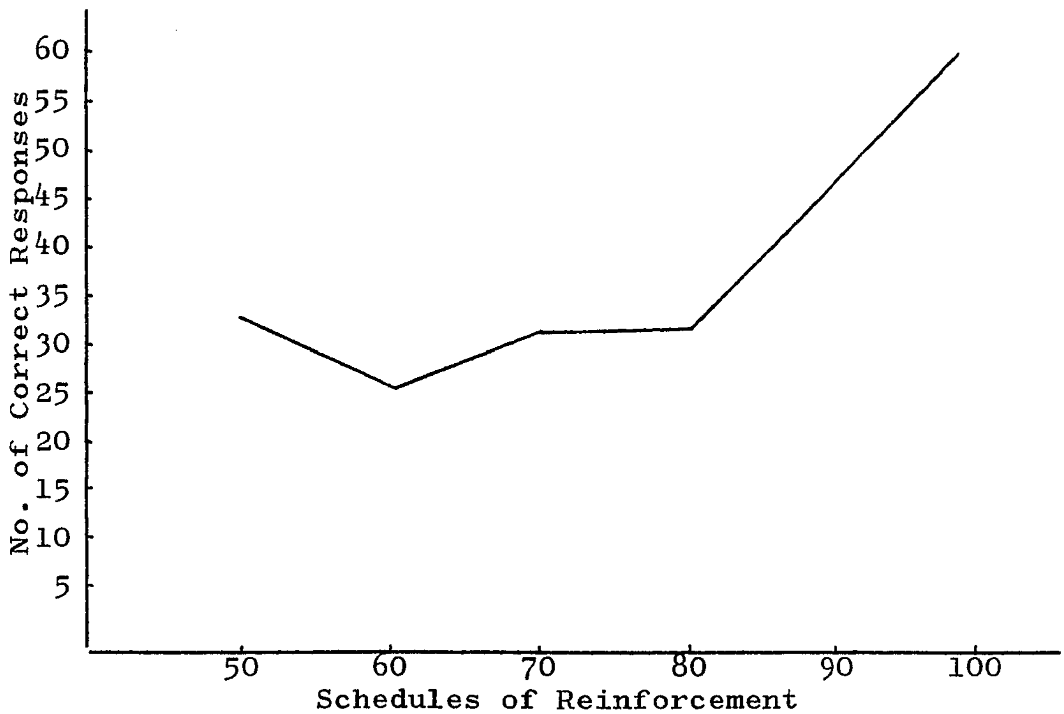
TABLE 11

SCHEDULE OF REINFORCEMENT VS. NUMBER OF CORRECT RESPONSES--STUDY II

	50 crf	60 crf	70 crf	80 crf	90 crf	100 crf
	37	32	38	29	48	59
	32	22	29	40	49	54
	23	32	37	29	48	59
	36	30	29	27	45	57
	34	20	32	35	43	48
	37	31	25	28	43	58
Σ	199	167	190	188	276	335
$\bar{X}$	33.17	26.83	31.67	31.34	46.00	55.83

FIGURE 5

GRAPHICAL REPRESENTATION OF TABLE 11



Summary

The following statements summarize the more pertinent findings.

1. In Study II, extinction in the two-choice probability learning situation took place when reinforcement, both verbal and visual, was discontinued.

2. In Study II, extinction of the learned response in the two-choice probability learning situation occurred in patterns related to the six schedules of reinforcement.

3. In Study II, age of the subject had no effect on the number of trials for extinction.

4. Sex of the subject was not significant in determining the number of trials for extinction in Study II.

TABLE 12

A COMPARISON OF SUBJECTS WITHIN GROUPS IN STUDY I

		Column A	Column B	Column C	Column D	Row $\overline{X}$	SCH
Group 1	S	1	2	3	4	--	--
	CA	14-3	16-10	17-5	18-8	16.8	0.5
	IQ	51	66	55	68	60	--
Group 2	S	5	6	7	8	--	--
	CA	14-1	15-9	17-8	18-5	16.5	0.6
	IQ	56	72	50	61	60	--
Group 3	S	9	10	11	12	--	--
	CA	14-4	15-10	17-3	20-2	16.6	0.7
	IQ	61	64	63	61	62	--
Group 4	S	13	14	15	16	--	--
	CA	12-11	15-9	17-8	19-10	16.6	0.8
	IQ	64	51	63	56	59	--
Group 5	S	17	18	19	20	--	--
	CA	14-0	15-5	16-8	22-0	17.0	0.9
	IQ	62	60	59	58	60	--
Group 6	S	21	22	23	24	--	--
	CA	14-7	15-3	17-7	18-9	16.6	1.0
	IQ	63	54	51	72	60	--
Column $\overline{X}$	$\overline{X}_{CA}$	14.0	15.8	17.4	19.7	--	--
	$\overline{X}_{IQ}$	60	61	57	63	--	--

$\overline{X}_{IQ} = 60$

$\overline{X}_{CA} = 16.8$

TABLE 13

A COMPARISON OF SUBJECTS WITHIN GROUPS IN STUDY II

		Column E	Column F	Column G	Column H	Column I	Column J	Row $\overline{X}$	SCH
Group 7	S	25	26	27	28	29	30	--	--
	CA	13-10	15-7	15-6	16-5	18-2	20-2	16.6	0.5
	IQ	56	62	54	53	68	66	60	--
Group 8	S	31	32	33	34	35	36	--	--
	CA	13-6	17-0	17-1	18-5	17-2	22-1	17.0	0.6
	IQ	56	56	59	76	55	59	60	--
Group 9	S	37	38	39	40	41	42	--	--
	CA	15-2	15-6	15-11	16-8	17-5	19-10	16.8	0.7
	IQ	50	62	54	72	68	57	61	--
Group 10	S	43	44	45	46	47	48	--	--
	CA	14-9	12-6	16-10	16-10	17-3	21-1	16.6	0.8
	IQ	58	65	64	55	57	61	60	--
Group 11	S	49	50	51	52	53	54	--	--
	CA	14-7	14-5	13-1	16-6	17-7	21-11	16.4	0.9
	IQ	63	53	65	59	61	59	60	--
Group 12	S	55	56	57	58	59	60	--	--
	CA	13-2	14-9	16-2	16-11	20-5	19-5	16.8	1.0
	IQ	52	64	56	61	58	76	61	--
Column $\overline{X}$	$\overline{X}_{CA}$	14.2	15.0	15.8	17.0	18.0	20.8	--	--
	$\overline{X}_{IQ}$	56	60	59	63	61	63	--	--

$\overline{X}_{IQ} = 60$

$\overline{X}_{CA} = 16.7$

5. In both Studies I and II, the six different schedules of reinforcement were significantly different as to the number of trials required for acquisition.

6. In both Studies I and II, age had no effect on the number of trials required for acquisition.

7. Sex of the subject was not significant in determining the number of trials required for acquisition in both Studies I and II.

8. The number of correct responses in both Studies under each schedule of reinforcement were very similar.

Discussion

In the present study, number of trials for acquisition was found to be least at both extremes of the schedule and more difficult in the mid-ranges: 70 and 80 percent reinforcement level. The lower extreme of 50 percent reinforcement may be explained by guessing since the probability of chance alone is 50 percent. At the upper extreme of 100 percent the pattern was almost immediately detected when the S noted only one light was being actuated. In the mid-ranges the problem was apparently due to the confusion of interjecting an occasional (L) or (R) light (number depending on the schedule) which made the pattern more difficult to conceive. One major finding was that age did not effect the rate of acquisition. This may be attributable to the population used for this study. The range in mental age from 14 to 20 for the retardate is more restricted than that of a normal population, therefore, conceptualization of a pre-set pattern for the retardate may be very nearly the same for both age extremes.

Another important concept of this study was the way in which extinction occurred. Theoretically, extinction following continuous reinforcement should be rather rapid. This prediction is made by the discrimination and expectancy theorists. They predict greater resistance to extinction following partial reinforcement rather than continuous. Analysis of the present research revealed that extinction did take place in a pattern related to the six schedules of reinforcement. As the percentage of reinforcement increased, the number of trials for extinction increased. This indicates that as reinforcement increases resistance to extinction increases. This seems to answer the second of the original questions of the study: Will resistance to extinction in a two-choice probability learning situation be affected when cues and reinforcement which are present during acquisition are removed during extinction?

The results of this research revealed good internal consistency. Similarity existed among the subjects at each reinforcement schedule. _S_s apparently understood and reacted to the experimental situation in much the same way in both Studies. It should be noted that the same pattern of learning was followed during the acquisition phase of both Studies. This again suggests internal consistency between Studies I and II.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

This chapter presents a summary of the entire study. Each hypothesis will be examined and recommendations for further research will be made.

Summary

Purpose of the Study

Several studies have been conducted to explain the relationship between acquisition and extinction with some following existing theories and others leading to the formulation of new ones. Recognizing these controversies, this study proposes to test the effects of different schedules of reinforcement upon acquisition and extinction in a two-choice probability learning situation. It examined the effects of schedules of reinforcement of acquisition and extinction in the absence of reinforcement cues.

Statistical Treatment of the Data

For statistical formulas and notations, Siegel[36] and Ferguson[37] were used. Six schedules of reinforcement:

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[36] S. Siegel, Nonparametric Statistics for the Behavioral Sciences (New York: McGraw-Hill Book Co., Inc.), 1956.

[37] G. A. Ferguson, Statistical Analysis in Psychology and Education (New York: McGraw-Hill Book Co., Inc.), 1959.

50 crf, 60 crf, 70 crf, 80 crf, 90 crf, and 100 crf, were compared for their effects upon acquisition and extinction. The following hypotheses were tested:

H_o-1 The Kruskal-Wallis One Way Analysis of Variance by Ranks was used to test this hypothesis which states: There are no significant differences in rate of acquisition among the six schedules of reinforcement--50 crf, 60 crf, 70 crf, 80 crf, 90 crf, and 100 crf. The "H" value was +16.125 which was significant at the .01 level, therefore, Hypothesis 1 is rejected (see Table 5 and Figure 3).

H_o-2 This hypothesis states: There are no significant differences in resistance to extinction among the six schedules of reinforcement--50 crf, 60 crf, 70 crf, 80 crf, 90 crf, and 100 crf. A Kruskal-Wallis One Way Analysis of Variance by Ranks was used to test this null hypothesis. The results indicated significance with an "H" value of +13.787 ($p<.02$), therefore Hypothesis 2 is rejected.

H_o-3 states: There are no significant differences in rate of acquisition as a function of age among the six schedules of reinforcement--50 crf, 60 crf, 70 crf, 80 crf, 90 crf, and 100 crf. Table 7 gives the results of this hypothesis. A Kruskal-Wallis One Way Analysis of Variance by Ranks resulted in an "H" value of 3.21 ($p>.5$) which is not significant at the 5 percent level, therefore, H_o-3 cannot be rejected (see Table 7).

H_o-4 The Kruskal-Wallis One Way Analysis of Variance by Ranks was used to test this hypothesis which states: There are no significant differences in resistance to extinction as a function of age among the six schedules of reinforcement--50 crf, 60 crf, 70 crf, 80 crf, 90 crf, and 100 crf. The "H" value was 0.969 ($p>.95$) which results in no significance. This hypothesis cannot be rejected (see Table 8).

H_o-5 states: There are no significant differences in rate of acquisition as a function of sex among the six schedules of reinforcement--50 crf, 60 crf, 70 crf, 80 crf, 90 crf, and 100 crf. A Mann-Whitney U Test was used to test this hypothesis. The findings were not significant, U = 170.5 ($p>.1$), therefore this hypothesis cannot be rejected (see Table 9).

H_o-6 The Mann-Whitney U Test was used to test this hypothesis which states: There are no significant differences in resistance to extinction as a function of sex among the six schedules of reinforcement--50 crf, 60 crf, 70 crf, 80 crf, 90 crf, and 100 crf. Table 10 reveals that there is no significance, U = 123.5 ($p>.1$): H_o-6 cannot be rejected.

Conclusions

The following conclusions appear to be valid, given the limitations of this study:

1. Rate of acquisition is affected by reinforcement in a pattern related to the schedule.

2. The two sexes show no significant differences in regard to acquisition.

3. There are no significant differences in the rate of acquisition as a function of age.

4. Extinction occurs in patterns related to the schedules of reinforcement.

5. The two sexes show no significant differences in regard to extinction.

6. There are no significant differences in the rate of extinction as a function of chronological age.

Recommendations

These findings appear to have implications to educators, as well as psychologists, concerned with the development of the mentally retarded child. It has been suggested, but not empirically tested, that once a retarded child accepts failure as a way of life, this learned pattern cannot be extinguished. The present study indicates that learned patterns can be extinguished, but the rate of extinction will be dependent upon the amount and schedule of reinforcements that lead to the desired behavior. As the schedule of reinforcement in the present study approached 100 percent continuous reinforcement, resistance to extinction increased.[38] Given this population of subjects, and with a probability learning task, this method of reinforcement should be used with caution. It may be that this will have useful implications to those interested in behavior modification with the retarded.

Recommendations for Future Study

The following are suggestions for future study:

1. Different schedules of reinforcement could be compared to determine their effects upon acquisition and extinction in a retarded population.

2. A three-choice learning situation, (left-middle-right), could be used, noting correlations with the standard two-choice paradigm.

3. This same experiment or one very similar could be replicated at another institution for the mentally retarded.

4. A study matching chronological ages and mental ages across groups could be conducted to test the effects of I.Q. on acquisition and extinction.

5. A comparison of normal and mentally retarded adolescence with matched mental ages could be conducted.

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[38] This is in direct opposition to the literature, which would predict that the most rapid extinction is to continuous reinforcement.

6. The inter-trial interval could be varied in order to determine its effect upon acquisition and extinction.

7. Different criteria for acquisition and extinction could be used to compare both rate and resistance respectively.

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APPENDIX I

GLOSSARY

GLOSSARY

Acquisition: The gradual strengthing of a learned response; acquiring a pattern of behavior (Reference No. 1, p. 762).

Asymptote: A mathematical term indicating the limiting value which is approached by some dependent variable as the independent variable increases; for example, in the hyperbola xy=1, y approaches an asymptote of zero as x increases (Reference No. 2, p. 185).

Conditioning: Training which results in the formation of conditioned responses (Reference No. 3, p. 495).

Conditioned Response: That response which is elicited by the conditioned stimulus (Reference No. 3, p. 495).

Conditioned Stimulus: The condition which elicits a response (Reference No. 3, p. 495).

Continuous Reinforcement: Reinforcement of all correct responses (Reference No. 1, p. 760).

Discrimination Hypothesis Theory: See page 5.

Expectancy Theory: See page 5.

Extinction: The procedure of presenting the conditioned stimulus without the usual reinforcement (Reference No. 4, p. 479).

Frustration Hypothesis: See page 6.

Intelligence--I.Q.: An expression of an individual's ability level at a given point in time, in relation to his age norms (Reference No. 6, p. 211).

Latency: A response measure (See page 9).

Learning: A relative permanent change in behavior and response potentiality which occurs as a result of reinforced practices (Reference No. 4, p. 481, also see footnote 4).

Mental Deficiency: See footnote 3.

Mental Retardation: See mental deficiency.

Partial Reinforcement: See page 5.

Positive Reinforcement: See page 3.

Probability Learning: See footnote 7.

Probability of Occurrence (PR): A response measure (see p. 9).

Rate of Responding: A response measure (see p. 9).

Reinforcement: A response measure (see p. 10).

Response Magnitude: A response measure (see p. 9).

Response Speed: A response measure (see p. 9).

Schedule of Reinforcement: Some specified sequence of partial or continuous reinforcement (Reference No. 4, p. 162).

Social Incompetence: Inability to make proper social adjustment; the starting point of the inquiry and the primary point of reference in dealing with most cases of mental retardation (Reference No. 5, p. 158).

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APPENDIX II

TABLES, PROBABILITY SCHEDULES, AND EXTINCTION CHARTS

TABLE 14

RESPONSES THAT WERE REINFORCED WITHIN EACH BLOCK--STUDY I*

S	Sch.	BL 1 1234567890	BL 2 1234567890	BL 3 1234567890	BL 4 1234567890	BL 5 1234567890	BL 6 1234567890
1	.5L	xxxxx x	x xx x	x x	xx xx xx	xxx x x	x
2	.5R	xxxx xx	x x xx x	x x xx x	xx xxxx	x x xxx x	xx x xx
3	.5L	x xxxx	xxxxxxx xx	x xxx x	xxxxxxx	x xx xx xx	x x x x x
4	.5R	x x xxxx	xxx xxx	xx xx	xx xx	x x xx	xx x x xx
5	.6L	xx xxx xx	xx x	xxx x	x xx xxxx	xx x xx	xxxxx xx x
6	.6R	x xx xxxx	xx xxx	xxxx xx	x xxx	xxx xx	xxx xx
7	.6L	x x xxxx	xx x xxxxx	xxxx xxx	x xx xxxxx	xxxxx xx	xxx x x
8	.6R	x x xx x	x x x	xxxx x	xxx x xx	x x xx	x x xxxxx
9	.7L	xx x x	xxxxx x	xxx xx	x xx xx x	x x x	xx x
10	.7R	xx x x x	x x x	x x xxxx	xx x xx	x xxxx xx	xx x
11	.7L	xxx xxxx	xxx x	x xx x	x x x	xxxxxx	xxxxxx x
12	.7R	xx x x	xx xxx	x x x	x x xxxx	x xx x	xxxx x xx
13	.8L	xx	x xx xxx	xxxxx xx	xxxx xx x	xx x xxx	xxxx xxxx
14	.8R	xxx	x x x x	x	x xx x x	xxxxxxx xx	x xx x xxx
15	.8L	xxx x	x x xx x x	x xxxxx xx	xxxxx xx x	x x x xxxx	xxxx xxx
16	.8R	xxx x	x x xx	x xxxx	xxxxx x x	xxx x xxxx	xxxx xxxx
17	.9L	xxx x x	x x xx xx	x xx x x	xxx x x x	xxxxxxxx	xxxxxxxx
18	.9R	x x xx	x xxxxxx	xxxxx xxx	xx xxxxx	x xxxxxxx	xxxxxxxx
19	.9L	x x x x	xx xxx x	x xxx xx x	xxx xxxxx	xxxxxxxxx	xxxxxx x
20	.9R	x x xx	x x xxxxx	xxxxx xxxx	xx xxxxxx	xxxxxxx	xxxxxxxx x
21	1.L	xx x xxxx	xxxxxxxxxx	xx xxxxxxx	xx xxxxxxx	xxxxxxxxxx	xxxxxxxxxx
22	1.R	x xxxxxxx	xxxxxxxxxx	x xxxxxxxx	xxxxxxxxxx	xxxxxxxxxx	xxxxxxxxxx
23	1.L	xxxxxxxx	xxxxxxxxxx	xxxxxxxxxx	xxxxxxxxxx	xxxxxxxxxx	xxxxxxxxxx
24	1.R	xxxxxxxx	xxxxxxxxxx	xxxxxxxxxx	xxxxxxxxxx	xxxxxxxxxx	xxxxxxxxxx

*Acq. = 60 trials, 6 blocks; N = 2.

Note: L = Left Light Predominant
R = Right Light Predominant

TABLE 15

RESPONSES THAT WERE REINFORCED WITHIN EACH BLOCK--STUDY II*

S	Sch.	BL 1 1234567890	BL 2 1234567890	BL 3 1234567890	BL 4 1234567890	BL 5 1234567890	BL 6 1234567890
1	.5L	xxx xxxx	xxx xxx xx	x xxx xx x	xxxxx x	x x xx	xx x x x
2	.5R	xx	xxxxx	x xxxx x	x x xxx	xxx xx x	xxxxxxxx
3	.5L	x x xx	xx xx xx	x	xxxx x	x x	xx x xx
4	.5R	xxxx xxxx	xxx xxx	xxxx	xxxxx xxx	x xxx xx	xx xx
5	.5L	x x xxx	xxx xx x	xxxx x	xx xx x x	xxxxx x	x x xxxx
6	.5R	x xxx xxxx	xxx xxx	x xxxx	xxxxx x	x xxx xx	xx x x x x
7	.6L	x x xx xx	xx x x xxx	xxxx x	xx x	xxx xx x	x xxxx
8	.6R	x x	x x	xxxx x	xxx x	x x x	xx x xxx
9	.6L	x xxxx	xx xx x x	x xxx x x	x x xxx	x xxx x	x xxx x
10	.6R	x x xx xx	xxxx	x x x	xxxxxxx	x xxx	x xxxxx
11	.6L	x	xxx	x x x	xxx x	x x x	x x xx x x
12	.6R	x xx xxxx	xx x xx	x xx	x xx	x xxx x	x xxxxxxx
13	.7L	xxx xx xx	xxx x x	x xxxxxxx	xxx x xxx	x x x	x xxxxxxx
14	.7R	xxx x x	x xxxx	x xx x	x x x	x xx xx	xxx xxxx
15	.7L	xxx xx xx	xxxxxx	x xxxx x x	xx x x	x x xxx x	xxxxxxx
16	.7R	xxxx x	x x	x xxx	xxx x x	xx xxx	x xxxxxx x
17	.7L	xxxxx x x	xx x x	x x xxxxx	x x x x	x x xx	xxx xxx
18	.7R	x xx	x x x x	xx	x xx x	xx xxxxx	xx x xx
19	.8L	x x x x	x x xxx	xx xx x	xxxxx	xxx xx	xxxx x
20	.8R	xx x xx x	xx xxx	xxxxxx x	xxxx xx x	xxx x x xx	xxxx xxxx
21	.8L	x x x	x x xxx	x xx x	x xx xx x	xx x	x x xxxxxx
22	.8R	x xx x	xxx x	x x x	x x xxx	x xx	xxxx x xxx
23	.8L	x x xxx	x x x	xxx xx xx	xxxxx xx x	xxxxx x x	xx x xx
24	.8R	x xxx xx	xx x x	xxxx x x	xx xx	x x xxxx	xxxxx xx
25	.9L	x x xxx	x xxx xxx	xxxxx xxxx	xxx xxxxxx	x xxxxxxxx	xxxxxxxx x
26	.9R	xx x xxxx	x xxxxxxx	xxxx xxx	xxx xxxxxx	x xxxxxxxx	xxxxxxxx x
27	.9L	x xxxxxx	x xxxxxxxx	xxxxx xx	xxx xxxxx	x xxxxxxxx	x xxxxxx x
28	.9R	xx x x x	x xx x xx	xxxxx xxx	xxx x xxxx	x xxxxxxxx	xxxxxxxx x
29	.9L	x xx xxx	x xxxx xx	xxxxx xxx	xxx xxxxx	x xxx xx	xx xxxxx x
30	.9R	x x x x xx	x xxxxx x	xxxxx xxx	xxx xxxxx	x xxxxxx	x xxxxx x

*Acq. = 60 trials, 6 blocks; N = 36.

TABLE 15--Continued

S	Sch.	BL 1 1234567890	BL 2 1234567890	BL 3 1234567890	BL 4 1234567890	BL 5 1234567890	BL 6 1234567890
31	1.L	x xxxxxxxx	xxxxxxxxxx	xxxxxxxxxx	xxxxxxxxxx	xxxxxxxxxx	xxxxxxxxxx
32	1.R	x x x x x	xx xxxxxxx	xxxxxxxxxx	xxxxxxxxxx	xxxxxxxxxx	xxxxxxxxxx
33	1.L	x xxxxxxxx	xxxxxxxxxx	xxxxxxxxxx	xxxxxxxxxx	xxxxxxxxxx	xxxxxxxxxx
34	1.R	x xxxxx x	xxxxxxxxxx	xxxxxxxxxx	xxxxxxxxxx	xxxxxxxxxx	xxxxxxxxxx
35	1.L	x x x	xx xx x	xxxxxxxxxx	xxxxxxxxxx	xxxxxxxxxx	xxxxxxxxxx
36	1.R	x xxxxxxx	xxxxxxxxxx	xxxxxxxxxx	xxxxxxxxxx	xxxxxxxxxx	xxxxxxxxxx

TABLE 16

NUMBER OF CORRECT RESPONSES WITHIN EACH BLOCK--STUDY I*

No. of Responses with Left Light Reinforced								No. of Responses with Right Light Reinforced							
S	Sch.	BL 1	BL 2	BL 3	BL 4	BL 5	BL 6	S	Sch.	BL 1	BL 2	BL 3	BL 4	BL 5	BL 6
1	0.5	6	4	2	6	5	1	2	0.5	6	5	5	6	6	5
3	0.5	5	9	5	7	7	5	4	0.5	6	6	4	4	4	6
5	0.6	7	3	4	7	5	8	6	0.6	7	5	6	4	5	5
7	0.6	6	8	7	8	7	5	8	0.6	5	3	5	6	4	7
9	0.7	4	6	5	6	3	3	10	0.7	5	3	6	5	7	3
11	0.7	7	4	4	3	6	7	12	0.7	4	5	3	6	4	7
13	0.8	2	6	7	7	6	8	14	0.8	3	4	1	5	9	7
15	0.8	4	6	8	8	7	7	16	0.8	4	4	5	7	8	8
17	0.9	5	6	5	6	8	8	18	0.9	4	7	8	7	8	8
19	0.9	4	6	7	8	9	7	20	0.9	4	7	9	8	7	9
21	1.0	7	10	9	9	10	10	22	1.0	8	10	9	10	10	10
23	1.0	8	10	10	10	10	10	24	1.0	8	10	10	10	10	10
		65	78	73	85	83	79			64	69	71	78	82	85
	$\bar{X}$	5.42	6.50	6.08	7.08	6.92	6.58		$\bar{X}$	5.33	5.75	5.92	6.50	6.83	7.08

*Acq. = 60 trials, 6 blocks; N = 24.

TABLE 17

NUMBER OF CORRECT RESPONSES WITHIN EACH BLOCK--STUDY II*

No. of Responses with Left Light Reinforced								No. of Responses with Right Light Reinforced							
S	Sch.	BL 1	BL 2	BL 3	BL 4	BL 5	BL 6	S	Sch.	BL 1	BL 2	BL 3	BL 4	BL 5	BL 6
1	0.5	7	8	7	6	4	5	2	0.5	2	5	6	5	6	8
3	0.5	4	6	1	5	2	5	4	0.5	8	6	4	8	6	4
5	0.5	5	6	5	6	6	6	6	0.5	8	6	5	6	6	6
7	0.6	6	7	5	3	6	5	8	0.6	2	2	5	4	3	6
9	0.6	5	6	6	5	5	5	10	0.6	6	4	3	7	4	6
11	0.6	1	3	3	4	3	6	12	0.6	7	5	3	3	5	8
13	0.7	7	5	8	7	3	8	14	0.7	5	5	4	3	5	7
15	0.7	7	6	7	4	6	7	16	0.7	5	2	4	5	5	8
17	0.7	7	4	7	4	4	6	18	0.7	3	4	2	4	7	5
19	0.8	4	5	5	5	5	5	20	0.8	6	5	7	7	7	8
21	0.8	3	5	4	6	3	8	22	0.8	4	4	3	5	3	8
23	0.8	5	3	7	8	7	5	24	0.8	6	4	6	4	6	7
25	0.9	5	7	9	9	9	9	26	0.9	7	8	7	9	9	9
27	0.9	7	9	7	8	9	8	28	0.9	5	6	8	8	9	9
29	0.9	6	7	8	8	6	8	30	0.9	6	7	8	8	7	7
31	1.0	9	10	10	10	10	10	32	1.0	5	9	10	10	10	10
33	1.0	9	10	10	10	10	10	34	1.0	7	10	10	10	9	10
35	1.0	3	5	10	10	10	10	36	1.0	8	10	10	10	10	10
		100	112	119	118	108	120			100	102	105	116	117	136
	$\overline{X}$	5.55	6.22	6.61	6.56	6.00	6.67		$\overline{X}$	5.55	5.67	5.83	6.44	6.61	7.55

*Acq. = 60 trials, 6 blocks; N = 36.

The schedule followed by the experimenter in actuating the bulbs; (Probability of occurrence of "left" (L) set as indicated)

TABLE 18

STUDY ____________ ACQ ____________ EXT ____________

S# ____________ Gp# ____________ Schedule .5

Trial	LT	CR	Trial	LT	CR	Trial	LT	CR
1......	L	____	31......	L	____	61......	L	____
2......	L	____	32......	R	____	62......	R	____
3......	R	____	33......	L	____	63......	R	____
4......	L	____	34......	R	____	64......	L	____
5......	R	____	35......	L	____	65......	R	____
6......	R	____	36......	L	____	66......	R	____
7......	R	____	37......	R	____	67......	L	____
8......	L	____	38......	R	____	68......	L	____
9......	R	____	39......	L	____	69......	R	____
10......	L	____	40......	R	____	70......	L	____
11......	R	____	41......	L	____	71......	R	____
12......	L	____	42......	L	____	72......	R	____
13......	R	____	43......	L	____	73......	R	____
14......	R	____	44......	R	____	74......	L	____
15......	L	____	45......	R	____	75......	L	____
16......	R	____	46......	L	____	76......	R	____
17......	L	____	47......	R	____	77......	L	____
18......	L	____	48......	R	____	78......	L	____
19......	R	____	49......	R	____	79......	R	____
20......	L	____	50......	L	____	80......	L	____
21......	R	____	51......	R	____	81......	L	____
22......	R	____	52......	L	____	82......	R	____
23......	L	____	53......	L	____	83......	L	____
24......	R	____	54......	R	____	84......	R	____
25......	L	____	55......	R	____	85......	R	____
26......	L	____	56......	L	____	86......	L	____
27......	R	____	57......	L	____	87......	R	____
28......	L	____	58......	R	____	88......	L	____
29......	L	____	59......	R	____	89......	L	____
30......	R	____	60......	L	____	90......	R	____

The schedule followed by the experimenter in actuating the bulbs; (Probability of occurrence of "right" (R) set as indicated)

TABLE 19

STUDY__________ ACQ__________ EXT__________

S# __________ Gp#__________ Schedule .5

Trial	LT	CR	Trial	LT	CR	Trial	LT	CR
1......	R	____	31......	R	____	61......	R	____
2......	R	____	32......	L	____	62......	L	____
3......	L	____	33......	R	____	63......	L	____
4......	R	____	34......	L	____	64......	R	____
5......	L	____	35......	R	____	65......	L	____
6......	L	____	36......	R	____	66......	L	____
7......	L	____	37......	L	____	67......	R	____
8......	R	____	38......	L	____	68......	R	____
9......	L	____	39......	R	____	69......	L	____
10......	R	____	40......	L	____	70......	R	____
11......	L	____	41......	R	____	71......	L	____
12......	R	____	42......	R	____	72......	L	____
13......	L	____	43......	R	____	73......	L	____
14......	L	____	44......	L	____	74......	R	____
15......	R	____	45......	L	____	75......	R	____
16......	L	____	46......	R	____	76......	L	____
17......	R	____	47......	L	____	77......	R	____
18......	R	____	48......	L	____	78......	R	____
19......	L	____	49......	L	____	79......	L	____
20......	R	____	50......	R	____	80......	R	____
21......	L	____	51......	L	____	81......	R	____
22......	L	____	52......	R	____	82......	L	____
23......	R	____	53......	R	____	83......	R	____
24......	L	____	54......	L	____	84......	L	____
25......	R	____	55......	L	____	85......	L	____
26......	R	____	56......	R	____	86......	R	____
27......	L	____	57......	R	____	87......	L	____
28......	R	____	58......	L	____	88......	R	____
29......	R	____	59......	L	____	89......	R	____
30......	L	____	60......	R	____	90......	L	____

The schedule followed by the experimenter in actuating the bulbs; (Probability of occurrence of "left" (L) set as indicated)

TABLE 20

STUDY ________ ACQ ________ EXT ________

S# ________ Gp# ________ Schedule .6

Trial	LT	CR	Trial	LT	CR	Trial	LT	CR
1......	L		31......	L		61......	L	
2......	L		32......	L		62......	R	
3......	R		33......	L		63......	L	
4......	L		34......	R		64......	L	
5......	L		35......	R		65......	R	
6......	R		36......	L		66......	L	
7......	L		37......	R		67......	L	
8......	R		38......	L		68......	R	
9......	L		39......	R		69......	R	
10......	R		40......	L		70......	L	
11......	L		41......	L		71......	L	
12......	R		42......	L		72......	R	
13......	R		43......	R		73......	L	
14......	L		44......	L		74......	R	
15......	L		45......	R		75......	L	
16......	L		46......	L		76......	R	
17......	R		47......	L		77......	L	
18......	L		48......	L		78......	R	
19......	R		49......	R		79......	L	
20......	L		50......	R		80......	L	
21......	R		51......	L		81......	L	
22......	L		52......	R		82......	L	
23......	R		53......	L		83......	R	
24......	L		54......	L		84......	L	
25......	L		55......	R		85......	R	
26......	R		56......	L		86......	L	
27......	L		57......	L		87......	R	
28......	R		58......	R		88......	L	
29......	L		59......	R		89......	R	
30......	L		60......	L		90......	L	

The schedule followed by the experimenter in actuating the bulbs; (Probability of occurrence of "right" (R) set as indicated)

TABLE 21

STUDY__________ ACQ__________ EXT__________

S# __________ Gp#__________ Schedule .6

Trial	LT	CR	Trial	LT	CR	Trial	LT	CR
1......	R		31......	R		61......	R	
2......	R		32......	R		62......	L	
3......	L		33......	R		63......	R	
4......	R		34......	L		64......	R	
5......	R		35......	L		65......	L	
6......	L		36......	R		66......	R	
7......	R		37......	L		67......	R	
8......	L		38......	R		68......	L	
9......	R		39......	L		69......	L	
10......	L		40......	R		70......	R	
11......	R		41......	R		71......	R	
12......	L		42......	R		72......	L	
13......	L		43......	L		73......	R	
14......	R		44......	R		74......	L	
15......	R		45......	L		75......	R	
16......	R		46......	R		76......	L	
17......	L		47......	R		77......	R	
18......	R		48......	R		78......	L	
19......	L		49......	L		79......	R	
20......	R		50......	L		80......	R	
21......	L		51......	R		81......	R	
22......	R		52......	L		82......	R	
23......	L		53......	R		83......	L	
24......	R		54......	R		84......	R	
25......	R		55......	L		85......	L	
26......	L		56......	R		86......	R	
27......	R		57......	R		87......	L	
28......	L		58......	L		88......	R	
29......	R		59......	L		89......	L	
30......	R		60......	R		90......	R	

The schedule followed by the experimenter in actuating the bulbs; (Probability of occurrence of "left" (L) set as indicated)

TABLE 22

STUDY ______ ACQ ______ EXT ______
S# ______ Gp# ______ Schedule .7

Trial	LT	CR	Trial	LT	CR	Trial	LT	CR
1......	L		31......	L		61......	L	
2......	R		32......	R		62......	R	
3......	L		33......	L		63......	L	
4......	L		34......	L		64......	L	
5......	R		35......	R		65......	L	
6......	L		36......	L		66......	L	
7......	L		37......	L		67......	R	
8......	R		38......	R		68......	L	
9......	L		39......	L		69......	R	
10......	L		40......	L		70......	L	
11......	L		41......	R		71......	R	
12......	R		42......	R		72......	L	
13......	L		43......	L		73......	L	
14......	R		44......	L		74......	L	
15......	L		45......	L		75......	L	
16......	R		46......	L		76......	R	
17......	L		47......	R		77......	L	
18......	L		48......	L		78......	L	
19......	L		49......	L		79......	L	
20......	L		50......	L		80......	R	
21......	L		51......	L				
22......	L		52......	L		82......	L	
23......	L		53......	L		83......	L	
24......	R		54......	R		84......	R	
25......	L		55......	L		85......	L	
26......	R		56......	R		86......	R	
27......	R		57......	L		87......	L	
28......	L		58......	R		88......	L	
29......	L		59......	L		89......	L	
30......	L		60......	L		90......	R	

The schedule followed by the experimenter in actuating the bulbs; (Probability of occurrence of "right" (R) set as indicated)

TABLE 23

STUDY____________ ACQ____________ EXT____________
S# ____________ Gp#____________ Schedule .7

Trial	LT	CR	Trial	LT	CR	Trial	LT	CR
1......	R		31......	R		61......	R	
2......	L		32......	L		62......	L	
3......	R		33......	R		63......	R	
4......	R		34......	R		64......	R	
5......	L		35......	L		65......	R	
6......	R		36......	R		66......	R	
7......	R		37......	R		67......	L	
8......	L		38......	L		68......	R	
9......	R		39......	R		69......	L	
10......	R		40......	R		70......	R	
11......	R		41......	L		71......	L	
12......	L		42......	L		72......	R	
13......	R		43......	R		73......	R	
14......	L		44......	R		74......	R	
15......	R		45......	R		75......	R	
16......	L		46......	R		76......	L	
17......	R		47......	L		77......	R	
18......	R		48......	R		78......	R	
19......	R		49......	R		79......	R	
20......	R		50......	R		80......	L	
21......	R		51......	R		81......	R	
22......	R		52......	R		82......	R	
23......	R		53......	R		83......	R	
24......	L		54......	L		84......	L	
25......	R		55......	R		85......	R	
26......	L		56......	L		86......	L	
27......	L		57......	R		87......	R	
28......	R		58......	L		88......	R	
29......	R		59......	R		89......	R	
30......	R		60......	R		90......	L	

The schedule followed by the experimenter in actuating the bulbs; (Probability of occurrence of "left" (L) set as indicated)

TABLE 24

STUDY______ ACQ______ EXT______
S#______ Gp#______ Schedule .8

Trial	LT	RR	Trial	LT	RR	Trial	LT	RR
1......	L	____	31......	L	____	61......	L	____
2......	L	____	32......	L	____	62......	R	____
3......	R	____	33......	L	____	63......	L	____
4......	L	____	34......	L	____	64......	R	____
5......	L	____	35......	L	____	65......	L	____
6......	L	____	36......	R	____	66......	L	____
7......	R	____	37......	L	____	67......	L	____
8......	L	____	38......	L	____	68......	L	____
9......	L	____	39......	R	____	69......	L	____
10......	L	____	40......	L	____	70......	L	____
11......	L	____	41......	L	____	71......	R	____
12......	R	____	42......	L	____	72......	L	____
13......	L	____	43......	L	____	73......	L	____
14......	L	____	44......	R	____	74......	L	____
15......	L	____	45......	L	____	75......	L	____
16......	R	____	46......	R	____	76......	L	____
17......	L	____	47......	L	____	77......	L	____
18......	L	____	48......	L	____	78......	L	____
19......	L	____	49......	L	____	79......	L	____
20......	L	____	50......	L	____	80......	R	____
21......	R	____	51......	L	____	81......	L	____
22......	L	____	52......	L	____	82......	L	____
23......	L	____	53......	L	____	83......	L	____
24......	L	____	54......	L	____	84......	R	____
25......	L	____	55......	R	____	85......	L	____
26......	L	____	56......	R	____	86......	L	____
27......	L	____	57......	L	____	87......	R	____
28......	R	____	58......	L	____	88......	L	____
29......	L	____	59......	L	____	89......	L	____
30......	L	____	60......	L	____	90......	L	____

The schedule followed by the experimenter in actuating the bulbs; (Probability of occurrence of "right" (R) set as indicated)

TABLE 25

STUDY ________ ACQ ________ EXT ________
S# ________ Gp# ________ Schedule .8

Trial	LT	RR	Trial	LT	RR	Trial	LT	RR
1......	R		31......	R		61......	R	
2......	R		32......	R		62......	L	
3......	L		33......	R		63......	R	
4......	R		34......	R		64......	L	
5......	R		35......	R		65......	R	
6......	R		36......	L		66......	R	
7......	L		37......	R		67......	R	
8......	R		38......	R		68......	R	
9......	R		39......	L		69......	R	
10......	R		40......	R		70......	R	
11......	R		41......	R		71......	L	
12......	L		42......	R		72......	R	
13......	R		43......	R		73......	R	
14......	R		44......	L		74......	R	
15......	R		45......	R		75......	R	
16......	L		46......	L		76......	R	
17......	R		47......	R		77......	R	
18......	R		48......	R		78......	R	
19......	R		49......	R		79......	R	
20......	R		50......	R		80......	L	
21......	L		51......	R		81......	R	
22......	R		52......	R		82......	R	
23......	R		53......	R		83......	R	
24......	R		54......	R		84......	L	
25......	R		55......	L		85......	R	
26......	R		56......	L		86......	R	
27......	R		57......	R		87......	L	
28......	L		58......	R		88......	R	
29......	R		59......	R		89......	R	
30......	R		60......	R		90......	R	

The schedule followed by the experimenter in actuating the bulbs; (Probability of occurrence of "left" (L) set as indicated)

TABLE 26

STUDY	____	ACQ	____	EXT	____
S#	____	Gp#	____	Schedule	.9

Trial	LT	RR	Trial	LT	RR	Trial	LT	RR
1......	L		31......	L		61......	L	
2......	L		32......	L		62......	L	
3......	R		33......	L		63......	L	
4......	L		34......	R		64......	L	
5......	L		35......	L		65......	L	
6......	L		36......	L		66......	L	
7......	L		37......	L		67......	R	
8......	L		38......	L		68......	L	
9......	L		39......	L		69......	L	
10......	L		40......	L		70......	L	
11......	L		41......	L		71......	L	
12......	R		42......	R		72......	L	
13......	L		43......	L		73......	L	
14......	L		44......	L		74......	L	
15......	L		45......	L		75......	R	
16......	L		46......	L		76......	L	
17......	L		47......	L		77......	L	
18......	L		48......	L		78......	L	
19......	L		49......	L		79......	L	
20......	L		50......	L		80......	L	
21......	L		51......	L		81......	L	
22......	L		52......	L		82......	L	
23......	L		53......	L		83......	L	
24......	L		54......	L		84......	R	
25......	L		55......	L		85......	L	
26......	R		56......	L		86......	L	
27......	L		57......	L		87......	L	
28......	L		58......	L		88......	L	
29......	L		59......	R		89......	L	
30......	L		60......	L		90......	L	

The schedule followed by the experimenter in actuating the bulbs; (Probability of occurrence of "right" (R) set as indicated)

TABLE 27

STUDY______ ACQ______ EXT______
S#______ Gp#______ Schedule .9

Trial	LT	RR	Trial	LT	RR	Trial	LT	RR
1......	R	____	31......	R	____	61......	R	____
2......	R	____	32......	R	____	62......	R	____
3......	L	____	33......	R	____	63......	R	____
4......	R	____	34......	L	____	64......	R	____
5......	R	____	35......	R	____	65......	R	____
6......	R	____	36......	R	____	66......	R	____
7......	R	____	37......	R	____	67......	L	____
8......	R	____	38......	R	____	68......	R	____
9......	R	____	39......	R	____	69......	R	____
10......	R	____	40......	R	____	70......	R	____
11......	R	____	41......	R	____	71......	R	____
12......	L	____	42......	L	____	72......	R	____
13......	R	____	43......	R	____	73......	R	____
14......	R	____	44......	R	____	74......	R	____
15......	R	____	45......	R	____	75......	L	____
16......	R	____	46......	R	____	76......	R	____
17......	R	____	47......	R	____	77......	R	____
18......	R	____	48......	R	____	78......	R	____
19......	R	____	49......	R	____	79......	R	____
20......	R	____	50......	R	____	80......	R	____
21......	R	____	51......	R	____	81......	R	____
22......	R	____	52......	R	____	82......	R	____
23......	R	____	53......	R	____	83......	R	____
24......	R	____	54......	R	____	84......	L	____
25......	R	____	55......	R	____	85......	R	____
26......	L	____	56......	R	____	86......	R	____
27......	R	____	57......	R	____	87......	R	____
28......	R	____	58......	R	____	88......	R	____
29......	R	____	59......	L	____	89......	R	____
30......	R	____	60......	R	____	90......	R	____

The schedule followed by the experimenter in actuating the bulbs; (Probability of occurrence of "left" (L) set as indicated)

TABLE 28

STUDY__________ ACQ__________ EXT__________

S# __________ Gp#__________ Schedule 1.0

Trial	LT	RR	Trial	LT	RR	Trial	LT	RR
1......	L		31......	L		61......	L	
2......	L		32......	L		62......	L	
3......	L		33......	L		63......	L	
4......	L		34......	L		64......	L	
5......	L		35......	L		65......	L	
6......	L		36......	L		66......	L	
7......	L		37......	L		67......	L	
8......	L		38......	L		68......	L	
9......	L		39......	L		69......	L	
10......	L		40......	L		70......	L	
11......	L		41......	L		71......	L	
12......	L		42......	L		72......	L	
13......	L		43......	L		73......	L	
14......	L		44......	L		74......	L	
15......	L		45......	L		75......	L	
16......	L		46......	L		76......	L	
17......	L		47......	L		77......	L	
18......	L		48......	L		78......	L	
19......	L		49......	L		79......	L	
20......	L		50......	L		80......	L	
21......	L		51......	L		81......	L	
22......	L		52......	L		82......	L	
23......	L		53......	L		83......	L	
24......	L		54......	L		84......	L	
25......	L		55......	L		85......	L	
26......	L		56......	L		86......	L	
27......	L		57......	L		87......	L	
28......	L		58......	L		88......	L	
29......	L		59......	L		89......	L	
30......	L		60......	L		90......	L	

The schedule followed by the experimenter in actuating the bulbs; (Probability of occurrence of "right" (R) set as indicated)

TABLE 29

STUDY ______ ACQ ______ EXT ______

S# ______ Gp# ______ Schedule 1.0

Trial	LT	RR	Trials	LT	RR	Trials	LT	RR
1......	R	____	31......	R	____	61......	R	____
2......	R	____	32......	R	____	62......	R	____
3......	R	____	33......	R	____	63......	R	____
4......	R	____	34......	R	____	64......	R	____
5......	R	____	35......	R	____	65......	R	____
6......	R	____	36......	R	____	66......	R	____
7......	R	____	37......	R	____	67......	R	____
8......	R	____	38......	R	____	68......	R	____
9......	R	____	39......	R	____	69......	R	____
10......	R	____	40......	R	____	70......	R	____
11......	R	____	41......	R	____	71......	R	____
12......	R	____	42......	R	____	72......	R	____
13......	R	____	43......	R	____	73......	R	____
14......	R	____	44......	R	____	74......	R	____
15......	R	____	45......	R	____	75......	R	____
16......	R	____	46......	R	____	76......	R	____
17......	R	____	47......	R	____	77......	R	____
18......	R	____	48......	R	____	78......	R	____
19......	R	____	49......	R	____	79......	R	____
20......	R	____	50......	R	____	80......	R	____
21......	R	____	51......	R	____	81......	R	____
22......	R	____	52......	R	____	82......	R	____
23......	R	____	53......	R	____	83......	R	____
24......	R	____	54......	R	____	84......	R	____
25......	R	____	55......	R	____	85......	R	____
26......	R	____	56......	R	____	86......	R	____
27......	R	____	57......	R	____	87......	R	____
28......	R	____	58......	R	____	88......	R	____
29......	R	____	59......	R	____	89......	R	____
30......	R	____	60......	R	____	90......	R	____

TABLE 30

EXTINCTION CHART

Subject:________ Group:________ Ext. Trials:________

	L	R		L	R		L	R		L	R
1.			31.			61.			91.		
2.			32.			62.			92.		
3.			33.			63.			93.		
4.			34.			64.			94.		
5.			35.			65.			95.		
6.			36.			66.			96.		
7.			37.			67.			97.		
8.			38.			68.			98.		
9.			39.			69.			99.		
10.			40.			70.			100.		
11.			41.			71.			101.		
12.			42.			72.			102.		
13.			43.			73.			103.		
14.			44.			74.			104.		
15.			45.			75.			105.		
16.			46.			76.			106.		
17.			47.			77.			107.		
18.			48.			78.			108.		
19.			49.			79.			109.		
20.			50.			80.			110.		
21.			51.			81.			111.		
22.			52.			82.			112.		
23.			53.			83.			113.		
24.			54.			84.			114.		
25.			55.			85.			115.		
26.			56.			86.			116.		
27.			57.			87.			117.		
28.			58.			88.			118.		
29.			59.			89.			119.		
30.			60.			90.			120.		