AMOUNT OF CHANGE VERSUS SIGNIFICANT CUE IN DISCRIMINATION

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TABLE OF CONTENTS

LIST OF TABLES

CHAPTER I

LITERATURE REVIEW

The idea of discrimination may be used as a tool to deal with the partial reinforcement effect (PRE) at both the objective and theoretical levels. At the objective level it may be used to describe the nature of the situation which will affect extinction phenomena. At the theoretical level it may be used as a mediating variable to explain why a given set of circumstances are followed by a given extinction phenomenon.

The first use of the idea of discrimination to deal with the PRE is ordinarily credited to Mowrer and Jones (1945). They trained rats to bar-press on both continuous and discontinuous schedules, their results showing that the use of a discontinuous reinforcement schedule increased resistance to extinction. These authors offered two explanations for this. One was in terms of the response-unit hypothesis, defining a response as the total behavior leading to a reward and not as an isolated movement, or bar-press. The second explanation was in terms of discrimination, suggesting that the animal cannot discriminate as easily between acquisition and extinction if the rewards have been coming intermittently as when they are continuous. Thus they write of discrimination as a learned, subjective (theoretical) response of the organism which is structured by a series of objectively described training situations. In this case the theory adds nothing but explanation

to the system since it is little more than a name for a mediating variable which is inferred from the objective situation and data.

Bitterman, Fedderson, and Tyler (1953) used a behavioristic way of structuring the experiment without appealing to subjective phenomena. The experiment was structured entirely in terms of inputs and outputs. It was designed so there was a change in the stimulus input when extinction started allowing the organisms to discriminate and use the discrimination for purposes of adaptive behavior but the nature of the discrimination was not considered at all. These experimenters divided their experimental animals into two groups. For Group I the interior of the goal box was the same color on all acquisition trials, while for Group II it was one color (black or white) on reinforced trials and the opposite color on nonreinforced trials. One-half the animals were extinguished with the goal box the same color on extinction trials as that reinforced on acquisition trials (Groups I-S and II-S), and one-half the animals were extinguished in a goal box of an opposite color to the goal box which had been reinforced during acquisition (I-N and II-N).

The results in comparing mean log time during extinction between Group I-S and Group I-N support the concept of secondary reinforcement, as Group I-S showed greater resistance to extinction than Group I-N. However, the mean log time for Group II-N was significantly less than for Group II-S. The Group II animals which found a previously nonreinforced goal box showed significantly more resistance to extinction than the rats which encountered the previously reinforced goal box. This cannot be explained by a concept of secondary reinforcement, but it is understandable by using the experimenters' hypothesis "that rate of

extinction is inversely related to the similarity between training and extinction" (p. 456).

Since then the idea of discrimination has been used in both objective and theoretical ways, sometimes one use drifting into the other. Elam, Tyler, and Bitterman (1954) in a replication of the above experiment using rats reinforced during training in a goal box of one color and nonreinforced in a goal box of an opposite color obtained the same results as Bitterman, Fedderson, and Tyler (1953). They stated that the discrimination "may be based upon learning about nonreinforcement and about stimuli associated with it," (p. 384) and that the "learning influences the animal's perception of the transition from training to extinction and hence (by the discrimination hypothesis) the stability of response" (p. 383).

Mowrer (1960) discussed the discrimination hypothesis in objective terms, explaining it by saying that:

> It seems that the discrimination hypothesis and the counter-conditioning hypothesis are, in reality, one and the same, the only difference being that one is formulated in 'cognitive' and the other in affective-dynamic terms (p. 477).

Mowrer adds an affective dimension but otherwise maintains a behavioristic outlook in commenting on the Bitterman, Fedderson, and Tyler (1953) experiment. He referred to the animals "'hoping' and responding" (p. 463) if they met extinction conditions like their training situation while the ones who met new conditions entering the extinction period "reacted to extinction as extinction, rather than as continued acquisition" (p. 464).

While Tolman (1932, 1951) did not use the term discrimination in discussing extinction, his research is pertinent since the idea behind nonresponse extinction is that a significant cue will enable the

organism to respond intelligently to the cues given him in the extinction situation. Kendler (1971) reacts in much the same way writing, "Cognitive control . . . suggests that the cause of a response is the manner in which the organism interprets available information" (p. 962).

Using male college students, Bridger and Mandel (1965) informed some of the subjects when extinction would begin (no further shock) and did not inform the other subjects. The informed subjects showed less resistance to extinction. The authors concluded that in a classical conditioning situation discrimination does reduce resistance to extinction, after stating in the introduction that:

> An adequate evaluation of the explanatory power of the discrimination hypothesis has not been presented due to a failure to obtain a measure of S's ability to discriminate between acquisition and extinction which is independent of the very response process to which the hypothesis is directed, i.e., resistance to extinction (p. 476).

In a study of the generalized imitation effect, Steinman (1970) found that, although the subjects were discriminating between imitative responses which were reinforced versus nonreinforced, they continued to imitate the nonreinforced, as well as the reinforced, responses. Nonreinforced responses that were similar to reinforced responses were more likely to be imitated than dissimilar responses. When the children were told not to respond if they were not to be rewarded for doing so, much of the imitative behavior of nonreinforced responses ceased, but he gave no theoretical discussion of his results.

Bandura and Barab (1971) in another study of the imitation effect flatly talk about discrimination in a theoretical sense saying that cues acquire informative value.

Gladstone (1966b) used three treatment groups of college age subjects. All subjects were trained on the same fixed-interval and variable-ratio schedule. Past learning was not a part of the experimental situation although it was assumed that all of the subjects had past experiences which gave them the critical ability to discriminate. In one treatment group, the subjects could see the ten rewards in the reservoir, in the second treatment group the rewards were hidden from the subject, and in the third treatment twenty rewards were visible but only ten were emitted. The subjects in the first treatment group gave significantly fewer extinction responses than those in the second, and those in the second treatment group gave significantly fewer responses than those in the third, who had visible, but unavailable, rewards. Gladstone concluded that, with human beings, a better prediction of behavior is possible with cognitive, rather than Skinnerian, concepts.

In his next experiment Gladstone (1966a) used children, and the same apparatus without regard for secondary reinforcement effects. The equipment dispenses rewards on the same variable-ratio schedule for all groups. With the two and one-half to three and one-half age group there was no significant difference between extinction responses in a treatment in which the child could see that there were no more rewards in the equipment and a treatment in which the lack of further rewards was not visible. However, with children in the four and one-half to five and one-half year age group there were significantly fewer extinction responses in the condition with apparent lack of further rewards than in the condition in which all rewards were hidden. He concluded that the younger children performed behavioristically while the older ones performed in a cognitive manner. As part of the same experiment

Gladstone used college age subjects in three treatment conditions. He found that the mean number of responses in a condition in which the empty reward reservoir was visible was significantly less than in a condition in which all rewards, and lack of available rewards, were concealed from the subject. Subjects in another treatment group had concealed rewards; however, an irrelevant stimulus (light) appeared between the training and extinction periods. The comparison between this condition (in which the empty reward reservoir was obvious) and the alternative condition was not statistically significant, although the total number of responses was less in the condition in which the lack of further reinforcements was visible.

In a replication of Gladstone's (1966a) experiment, Gladstone and Miller (1968) pitted the condition in which the rewards were not visible and a light appeared when extinction started versus the condition in which the lack of further rewards was visible. They found that the responses were significantly less at the .01 level in the condition with obvious lack of further rewards than in the condition where the reward reservoir was not visible but a light came on. The authors concluded that a cognitive interpretation is "much more comfortable" (p. 38) than a behavioristic one.

Conclusions

The concept of discrimination has been shown to be a more useful tool for explaining, predicting, and controlling the partial reinforcement effect than other concepts. However, no test has been conducted of the comparative power of the behavioristic versus the cognitive form of the concept.

CHAPTER II

METHOD

Rationale

This experiment is designed specifically to test the behavioristic and cognitive ways of reacting to discrimination as a way of dealing with the PRE. The behavioristic form is that extinction will occur more rapidly if there is a larger change between the learning and extinction situations. The cognitive form is that the significance of the change is the effective variable.

Equipment

The apparatus consisted of three lights controlled by a rheostat which could be used to control the brightness of the lights, a rat pellet feeder with ten BBs (instead of pellets), a cover on the pellet feeder which made the BBs invisible to the subject, a telegraph key by which the subject operated the equipment, a programmer which controlled the apparatus, and a counter which began counting extinction responses when the last reward fell. The feeder was set on a variable ratio schedule and the programmer could be set by E to turn on the scheduled light or lights at the beginning of the extinction period. Blankets were put over the windows to control the room for brightness.

Procedures

Subjects

The subjects were 72 college students drawn from Introductory Psychology classes.

Subject-equipment Interaction

To test the subject-equipment interaction twenty students were asked to go through the training period but to stop when the light came on. Nine stopped at zero and 11 at one, indicating that some subjects were responding so rapidly that due to physiological response time or some other factor they were unable to stop at zero.

Preliminary Experiment

The extinction experiment itself called for two lights with the same brightness as one light and for three lights with the same brightness as one light. These lights were controlled for brightness by the rheostat operated by E. To determine that the two dim lights appeared as subjectively bright as one light and that the three dim lights were as bright as one light, college sophomores shown the single light and the multiple lights were asked to "tell me when these lights are as bright as this light," after which the brightness of the multiple lights was varied. Means of the rheostat settings which were obtained were used as the settings for the dim lights.

Conditions

All subjects were trained on a variable-ratio schedule (5:1), and

in all the treatment groups the reward reservoir was concealed.

The six extinction conditions of the six groups were:

1. There was no difference between acquisition and extinction.
2. One light came on and stayed on at the beginning of the extinction period.
3. Two lights came on and stayed on at the beginning of the extinction period.
4. Three lights came on and stayed on at the beginning of the extinction period.
5. Two lights as subjectively bright as one light came on and stayed on at the beginning of the extinction period.
6. Three lights as subjectively bright as one light came on and stayed on at the beginning of the extinction period.

Each light in groups three and four was as bright as the light in group two, e.g., the two lights used in condition three used twice as much wattage as the one light used in condition two.

Instructions

The subjects were taken individually to the experimental room. The conditions were rotated so that the first subject was placed in the first condition, the next in the second, the seventh subject was assigned to the first treatment group, etc.

The experimenter gave the subject the following instructions:

> There are no tricks in this experiment. Everything is just as it appears to be. We are trying to see if some people act in a way which doesn't make any sense. We expect you to act sensibly. Just follow the instructions in a way which makes sense to you.

> Your task in this experiment will be to operate this machine. Here is how it works. Push down on this telegraph key and a small BB will drop into this cup, like this / E demonstrates/. Later you will be given one cent for every BB you have. You will have one-tenth of a cent taken away for each time you push the key. Do you understand what you are to do? / E may repeat the essential instructions but questions as to the nature of the experiment will be answered pleasantly with the phrase "I am not allowed to tell you any more about the experiment. Just act as sensibly as you can."/ You may start now. Please tell me when you are through.

E responds to S's question, "Can I stop now?" with "It's up to you." When S says he is through E will give the reward to S in exchange for the number of BBs in the reward cup. If S obviously has stopped but does not say so, say "Are you through?" If S indicates he is, give him the reward.

E asks S why he stopped responding and records S's answer. Say, "Please do not discuss this experiment with anyone else." E then records the number of extinction responses showing on the counter.

CHAPTER III

ANALYSIS AND CONCLUSIONS

Extinction was measured by the number of responses after the last reward fell. Non-parametric tests were used to find the significance of differences because the response measurers were ordinal but not normally distributed.

The Mann-Whitney U test and the Kruskal-Wallis test were used to detect significance of the difference among the various treatments. The Mann-Whitney U test is a good alternative to the t test, while the Kruskal-Wallis is used as an alternative to the F test (Siegel, 1956).

The Mann-Whitney U test was used to test the significance of the difference between the cue and no cue groups. A z of -2.6593 was obtained which is significant at less than the .01 level.

The Kruskal-Wallis test was used to test for possible significance of difference among the conditions using lights. An H of 6.6120 was obtained, with a probability less than .20.

The results of the statistical test between the light and no light treatments indicate that the difference introduced at the beginning of the extinction situation was used by the subjects to discriminate, and the lack of significant differences among the five cue groups indicates that the amount of difference was not the significant factor.

Since discrimination did take place and since it was not based on the amount of cue, the theory with which the experiment was structured,

that the subjects were discriminating in terms of the significance of the cue, is supported.

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APPENDIX

TABLE I

RANKS AND TOTAL RANK FOR EACH GROUP WHERE RANK IS CALCULATED WITHOUT REGARD FOR GROUP: SIX GROUPS

Lights	0	1	2	3	2/1*	3/1*
	59.0	62.0	70.0	39.5	39.5	30.5
	71.0	30.5	9.0	9.0	30.5	51.5
	51.5	20.5	55.0	20.5	14.5	20.5
	60.0	30.5	44.0	64.5	14.5	39.5
	72.0	61.0	44.0	68.0	3.5	20.5
	25.0	14.5	30.5	25.0	9.0	39.5
	39.5	20.5	53.5	20.5	9.0	30.5
	30.5	58.0	69.0	25.0	66.0	14.5
	53.5	3.5	3.5	56.0	9.0	57.0
	35.5	47.0	44.0	3.5	3.5	17.0
	67.0	63.0	12.0	64.5	47.0	35.5
	49.5	47.0	39.5	30.5	3.5	49.5
Total rank per group	614.0	458.0	474.0	426.5	249.5	406.0
N / group	12	12	12	12	12	12

*Multiple lights subjectively estimated to give as much light as a single light.

TABLE II

RANKS AND TOTAL RANK FOR EACH GROUP WHERE RANK IS CALCULATED WITHOUT REGARD FOR GROUP: FIVE GROUPS

Lights	1	2	3	2/1*	3/1*
	53.0	60.0	36.0	36.0	29.0
	29.0	9.0	9.0	29.0	46.0
	20.5	48.0	20.5	14.5	20.5
	29.0	40.0	55.5	14.5	36.0
	52.0	40.0	58.0	3.5	20.5
	14.5	29.0	24.5	9.0	36.0
	20.5	47.0	20.5	9.0	29.0
	51.0	59.0	24.5	57.0	14.5
	3.5	3.5	49.0	9.0	50.0
	43.0	40.0	3.5	3.5	17.0
	54.0	12.0	55.5	43.0	33.0
	43.0	36.0	29.0	3.5	45.0
Total rank per group	413.0	423.5	385.5	231.5	376.5
N / group	12	12	12	12	12

*Multiple lights subjectively estimated to give as much light as a single light.

TABLE III

RAW DATA

Lights	0	1	2	3	2/1*	3/1*
	21	25	39	10	10	8
	44	8	2	2	8	15
	15	6	17	6	4	6
	22	8	12	31	4	10
	344**	24	12	37	0	6
	7	4	8	7	2	10
	10	6	16	6	2	8
	8	20	38	7	35	4
	16	0	0	18	2	19
	9	13	12	0	0	5
	36	26	3	31	13	9
	14	13	10	8	0	14

*Multiple lights subjectively interpreted to give as much light as a single light.
**E stopped S.

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