

THE WITHIN-SUBJECTS PARTIAL REINFORCEMENT EXTINCTION EFFECT:
STIMULUS SIMILARITY AS A CONTROLLING FACTOR,


by

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LIST OF FIGURES

FIGURE 1. MEAN TRIAL RESPONSE LATENCY PLOTTED OVER 12 DAYS OF ACQUISITION AND FIVE DAYS OF EXTINCTION. 14

FIGURE 2. MEAN TRIAL LATENCY OF EXTINCTION RESPONSES FOR REPLICATIONS I AND II 18

TABLE OF CONTENTS

ACKNOWLEDGEMENTS. ii

LIST OF FIGURES iii

INTRODUCTION. 1

EXPERIMENT. 10

 Method 10

 Subjects. 10

 Apparatus 10

 Procedure 10

 Results. 12

 Discussion 20

REFERENCES. 24

VITA. 26

INTRODUCTION

Perhaps no other phenomenon in psychology has received as much empirical and theoretical attention as the partial reinforcement extinction effect (PREE). Investigators have marveled over the reliability of the effect in many situations and with many kinds of subjects (cf., Jenkins & Stanley, 1950; Lewis, 1960; and Robbins, 1971). The most common design used in PREE studies is the between-subjects design. In this situation, one group of subjects (Ss) receives continuous reinforcement (CRF) for each response during training while another group receives a certain percentage (usually 50%) of reinforcement for each response. During extinction, each group is then run in the same manner as before but without reward. What characterizes the between-Ss PREE is a maintenance of extinction responding of the partially reinforced (PR) Ss in contrast to a relatively rapid diminution in responding of the CRF group.

A less frequently used procedure for studying the PREE is the within-Ss design. In this situation a group of Ss receives both CRF for training responses made in the presence of one stimulus and PR for responses made in the presence of another stimulus. During extinction, all the Ss receive alternately both of the stimuli they received in training but responses to them are not reinforced. The results of this procedure are usually inconsistent with those found in between-Ss studies and have caused a great deal of consternation to many partial reinforcement theorists. Outcomes following the implementation of this design have yielded 1) stronger relative responding under the PR condition than under the CRF condition, 2) greater responding to the CRF stimulus than to the PR stimulus, and 3) no differences in responding to the two stimuli. Different

theorists have termed these outcomes respectively; "conventional PREE's" (Amsel, 1967), "reversed PREE's" (Pavlik & Carlton, 1965), and "generalized PREE's" (Mellgren & Dyck, 1972). It should also be noted that the term "generalized PREE" has also been used by other theorists (Amsel, 1967 and Brown & Logan, 1965) to describe a general elevation of extinction responding to the PR and CRF stimuli when compared to the extinction responding of a CRF control group. Several investigators have tried to assimilate these outcomes into their own theories with varying degrees of success. It is to these attempts that we now turn our attention.

Amsel (1967) reports the results of studies attempting to demonstrate a conventional PREE using a within-Ss design. The predominant outcome of these attempts, however, was the generalized PREE. This consisted of nondifferential responding to the PR and CRF stimuli during extinction which was, however, above the level of responding shown by a CRF control group and was believed to have been caused by generalization of anticipatory frustration from the PR to the CRF stimulus during the acquisition phase. This generalization of r_f - s_f to the CRF stimulus creates a mediated response chain similar to that associated with the PR stimulus during both acquisition and extinction. This in turn results in equivalent amounts of responding to each stimulus in the extinction phase. Amsel (1967) believed that increasing the relative control exercised by external stimuli over that exercised by mediational stimuli would yield the conventional effect. In attempting to demonstrate this, he preexposed his animals to the differential properties of the CRF and PR stimuli before the Ss began acquisition training. It was reasoned that, if predifferentiation enhanced stimulus discriminability, then the

conventional effect should occur in extinction. The three middle runway measures that were reported suggested such an outcome.

Using highly dissimilar goalbox lighting for discriminative stimuli; Pavlik, Carlton, and Hughes (1965) reported finding a conventional PREE for start measures of between-Ss control animals and a generalized effect for the within-Ss, experimental condition. Goal speed measures also yielded a conventional effect for the control condition, but a significant reversed PREE for the experimental group, i.e., relative superiority of responding to the CRF stimulus. Similarly, a reversed effect has been reported in the free operant situation (Pavlik & Carlton, 1965). It should be mentioned that within-Ss experiments in the free operant design have not exclusively yielded the reversed PREE. Pavlik, Carlton and Monte (1965) trained rats on a multiple CRF-VR3 reinforcement schedule holding responses in each schedule (Experiment I) and reinforcements in each schedule (Experiment II) constant. The extinction data in both experiments of the Pavlik, et al. study yielded a conventional PREE. Similarly, Hearst (1961) trained pigeons to peck at several colored stimuli with a CRF or particular VR schedule associated with each stimulus while holding the number of reinforcements obtained on each schedule constant. The results of this study also showed a conventional PREE. Using a discrete trial situation, Pavlik and Collier (1973), provided an operant analogue to the runway situation. The investigators studied a factorial combination of size of reward and percentage of reward associated with bar position and the presence of two compound external stimuli all in a within-Ss design. That is, each S was trained to respond on a FR 10 to each combination of reward size and schedule during each daily session.

The results showed greater resistance to extinction in the CRF condition than in the PR condition (a reversed PREE) irrespective of reward magnitude and greater resistance to extinction with large reward than with small reward irrespective of schedules. The primary interest of the Pavlik and Collier (1973) study is in its direct comparison to the traditional, between-Ss runway studies of schedules and reward magnitudes (Hulse, 1958; Wagner, 1961). The results of the Hulse experiment reveal greater resistance to extinction in the PR condition than in the CRF condition (a conventional PREE) irrespective of reward magnitude with greater resistance to extinction in the PR condition with large rewards and less resistance to extinction in the CRF condition with large rewards. As can be seen, within-Ss comparisons of schedules and reward magnitude tend to produce a reversed effect while between-Ss comparisons result in conventional effects-- a direct contrast to Amsel's (1967) predictions. Although Amsel has extended his theory to account for the within-Ss conventional and generalized PREE's, it is unclear how the frustration interpretation can account for these within-Ss reversed effects.

It now appears that the reversed PREE is a consequence of response suppression to the PR stimulus and a concomitant enhancement of responding to the CRF stimulus due to some preference toward the latter (Pavlik, Carlton, Lehr, & Hendriksen, 1967). Yet, the controlling aspects surrounding a particular PREE have yet to be fully specified. There is the possibility that other controlling factors are involved in the establishment of a particular within-Ss extinction effect. Of methodological and theoretical importance to the question of possible controlling factors is

an article by Mellgren and Dyck (1972). In an extension of Capaldi's (1967) sequential hypothesis of the PREE, these authors predict that the type of within-Ss effect obtained may be a function of where the transition from nonreinforced (N) to reinforced (R) trials occurs.

Mellgren and Dyck (1972) based their predictions on the assumptions that increases in resistance to extinction are due to N-R transitions and that, in a within-Ss design, the trace of nonreinforcement (S^N) might actually be part of a compound of the nonreinforcement trace (S^N) and cues present at the start of a trial following S^N . And it is this compound which supposedly controls behavior. Three experimental groups were used, differing only in which of two differentially colored alleyways reinforcement was given after an N trial. One alley was associated with PR and the other with CRF. After receiving S^N in the PR runway, Group S^N-C received reinforcement in the CRF alley, Group S^N-P in the PR alley, and Group S^N-PC received reinforcement equally often in both alleys. Based upon their assumptions, the authors predicted a reversed PREE for Group S^N-C , a conventional PREE for Group S^N-P , and a generalized PREE for Group S^N-PC . Although the effects were numerically small and restricted to extinction trials where the particular compounds received in acquisition occurred, the predictions were confirmed.

Collier, Steil, and Pavlik (1974) have provided an operant analogue to the Mellgren and Dyck (1972) study. These investigators also used three experimental groups, each receiving different types of N-R transitions. Instead of requiring a running response to differentially colored runways, the Ss were presented a combination of either left lever and a 4 click/sec noise or right lever and an 18 click/sec noise and were

required to bar press on a FR 10 schedule to complete a trial. The stimulus compounds were associated with either CRF or PR (50%) schedules, all Ss receiving both compounds and both schedules. The N-R transitions occurred under each combination of compounds and schedules respectively for each group. That is, for different groups of Ss, the R trial of the N-R transition occurred either during the CRF compound (Group C), the PR compound (Group P), or both compounds (Group C-P). The results, unlike those of Mellgren and Dyck, show the reversed PREE for every group-- not only for Group C. The important considerations of these two studies are that a reversed PREE can be predictably obtained from Capaldi's theory in the runway situation, and that the same pattern of results does not apparently occur in the lever pressing situation. This raises questions about the role of response topography in determining the outcome of within-Ss PREE's which are unanswered at the present time.

It is necessary at this point in the discussion of the theories of within-Ss PREE's to emphasize another major distinction between the within-Ss paradigm and the more traditional between-Ss situation. Subjects in the traditional design are confronted with only one of two possible sets of stimuli and reinforcement schedules. Animals in the within-Ss design are confronted with both of the schedules and both of the stimuli. The stimuli in the latter situation now take on discriminative properties which are useful to the S in predicting reward occurrence. This discrimination or selective attention of stimulus events may play a role in the production of a particular type of PREE.

In a recent review, Sutherland and Mackintosh (1971) proposed a theoretical explanation of discrimination and PRE behavior based upon

certain qualities of the environment (e.g., analyzers) which an animal might use in predicting the occurrence of reward. In the traditional between-Ss experiment, every aspect of the stimulus environment in the CRF condition is a perfect predictor of reinforcement. Therefore, a CRF S need only attend to any one particular analyzer in order to consistently predict reward. In the PR situation, however, no one analyzer could consistently predict reinforcement. The PR Ss, therefore, would probably examine a number of different analyzers until they found one which had a higher predictive value than the rest. However, a PR S will have examined several of these analyzers each having a certain predictive value, hence, the S may attend to more than one analyzer in the PR situation. This stems from the suggestion that the strength of an analyzer varies as a function of its predictability of reinforcement. According to the theory, resistance to extinction would be a function of both the strength of an analyzer used by S and the number of analyzers S had learned to use to predict reward during acquisition. Sutherland and Mackintosh (1971) can predict the conventional between-Ss PREE because, even though the CRF analyzer is stronger, there are more of the PR analyzers which have been attended to during acquisition and which the S examines in turn during extinction. This results in more behavioral persistence in the PR group. Although Sutherland and Mackintosh do not specifically address the within-Ss case, some interesting predictions can also be made for that situation. If, as is the case in the present study, all environmental aspects were constant save for the discriminative stimuli associated with the reinforcement schedules, then there would be only two relevant analyzers. The better predictor (the CRF

analyzer) would be most strongly learned during acquisition and would produce enhanced responding to the CRF stimulus during extinction-- a reversed PREE.

A second theory based on stimulus factors, specifically emphasizing the role of the discriminative stimuli in the within-Ss PREE paradigm, is that of Rashotte (1971). After reviewing the within-Ss PREE literature, Rashotte suggests that the variety of results reported may be a function of the relative discriminability of the discriminative stimuli used in the situation. To more closely examine this possibility, Rashotte (1971) suggests studying the function of stimulus discriminability, as it concerns the production of a particular PREE, by manipulating the difference between these stimuli along a single continuum. Along with this suggestion, several assumptions are made: 1) a certain "amount" of resistance to extinction associated with each stimulus, 2) there is more resistance to extinction associated with the PR stimulus than with the CRF stimulus, 3) resistance to extinction can generalize from the PR or the CRF stimulus to other stimuli as a function of similarity, 4) this generalization of response strength in extinction forms gradients about each stimulus, 5) the gradient is flatter about the PR stimulus than about the CRF stimulus, 6) when the stimuli on a single continuum are close together (but not identical) the gradients overlap, and 7) resistance to extinction to stimuli with overlapping gradients is determined by the algebraic sum of those gradients. These assumptions led Rashotte to predict that, when the stimuli are quite far apart, no overlap would occur and a conventional PREE would be produced. When the stimuli are sufficiently similar so that the PR gradient overlaps the

CRF stimulus, but the CRF gradient does not overlap the PRF stimulus, then the sum of the gradients would yield greater resistance to extinction to the CRF stimulus (a reversed PREE). When the stimuli are at some intermediate distance from each other, the summed gradients over each stimulus should be equal and a generalized PREE would result.

Since these notions appeared easily testable, three groups of Ss were given auditory stimuli varying along a single physical dimension, one stimulus associated with PR and the other with CRF. The difference between the stimuli received by the first group was small, moderate for the second group, and rather large for the third. The Rashotte (1971) predictions would lead to the expectation of increasing tendency for the occurrence of a conventional PREE and a decreasing tendency for a reversed PREE as stimulus difference increased, and vice versa. To test these expectations, the present study was undertaken.

Method

Subjects

Thirty male, black-hooded rats from the Virginia Polytechnic Institute and State University colony served as Ss. All the animals were experimentally naive and housed singly. At the outset of acquisition training, the Ss were about 95 days old.

Apparatus

A BRS-Foringer operant chamber equipped with two retractable levers and a 45 mg. pellet dispenser was used as the experimental apparatus. In addition to the regular programming equipment, two Sony cassette tape recorders (Model TC 60A) were used as stimulus generators. Presentation of stimuli was via a 5 in. speaker mounted inside the chamber. Trial sequences and associated stimulus and reinforcement events were controlled by a five-channel Teletype tape reader.

Procedure

During the 7 days prior to pretraining, all Ss were placed on a feeding regimen of 10 gm. of powdered laboratory chow per day (which continued throughout the experiment) and were handled for two minutes every day. Pretraining consisted of one day of magazine training, during which a total of 20 two-pellet reinforcements was delivered on a VI 30 sec schedule, and bar training. The rats were trained on the left bar (the right bar was always retracted) until stable FR 10 performance was established. After pretraining, the Ss were randomly assigned to three experimental groups (n=8) and one control group (n=6). All groups received a 4 clicks/sec (83 db) noise as a standard stimulus. Group 4-5 received a comparison stimulus of 5 clicks/sec; Group 4-9, 9 clicks/sec;

and Group 4-18, 18 clicks/sec. The control group also received the 18 clicks/sec comparison stimulus. For half the Ss in each experimental group the standard stimulus was paired with CRF and the comparison stimulus with PR (50%). For the remaining Ss in each experimental group the contingencies between stimuli and schedules were reversed. The control group Ss received CRF training in the presence of both of their auditory stimuli. In choosing the stimuli used in the present study, two pilot experiments were conducted in which one stimulus was associated with CRF and the other with no reward. The results indicated that the Ss could discriminate between a 4 clicks/sec noise and a 9 clicks/sec noise as well as between a 4 and an 18 clicks/sec noise, but could not discriminate between a 4 and a 5 clicks/sec noise. In addition, it was found that the Ss showed greater discrimination in the 4-18 condition than in the 4-9 condition.

Each experimental animal received 25 days of acquisition training (16 trials/day). Half of the trials in each session were CRF and half were PR. The trials sequences were arranged such that nonreinforced PR trials were followed equally often by reinforced PR and CRF trials. This procedure was indicated by Mellgren and Dyck (1972) to produce a generalized PREE rather than a conventional or reversed PREE. On each trial, the left bar was extended and one of the two stimuli turned on. After completion of the FR 10, the bar was retracted while the clicks continued for an additional 5 sec. A 20 sec. intertrial interval (ITI) then occurred during which neither bar nor discriminative stimuli was presented. On reinforced trials, four 45 mg. pellets were delivered simultaneously with lever retraction. Following acquisition training, all Ss

were given five days of extinction (16 trials/day). If an animal did not complete the FR 10 within 60 sec., the extinction trial automatically terminated, the ITI began, and a 60 sec. latency was recorded. On all trials during both acquisition and extinction training, latency was measured to the nearest 0.1 sec. from lever insertion to the tenth lever press and was automatically recorded by a print-out counter.

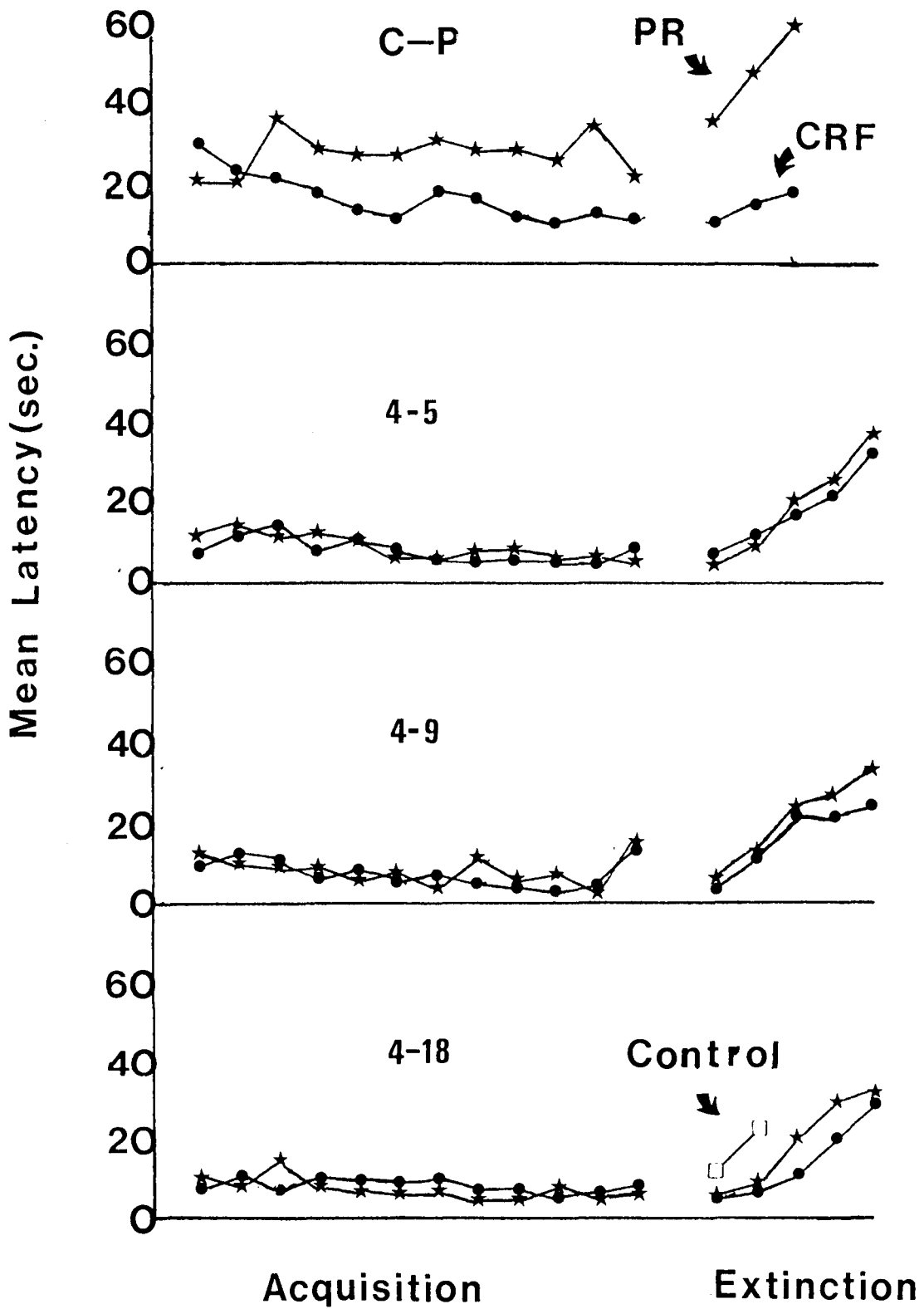
The study was run in two replications with four Ss per group. The CRF control Ss received only 8 trials/day and were run concurrently with the experimental groups in Replication II.

Results

The mean trial latencies of responding to the PR and CRF stimuli were compared for each group for the 25 days of acquisition using the Wilcoxon Matched-Pairs Signed-Ranks test. The comparison yielded nonsignificant differences between mean trial latencies of the two stimuli for Group 4-5 ($T = 132, p > .05$), Group 4-9 ($T = 162, p > .05$), and Group 4-18 ($T = 90, p > .05$). Only the last 12 days of acquisition for the three experimental groups is shown in Figure 1. This was done in order to more directly compare Group C-P data from Collier et. al. (1973) to that of the present study.

The rationale for including the data from the Collier et. al. (1973) study was to lend support to the findings that a reversed PREE can be shown in a situation in which the CRF and PR stimuli are highly dissimilar. The only methodological differences between Group C-P and Group 4-18 in the present study were fewer days of acquisition (12 vs. 25) and the use of bar position in addition to the auditory stimuli in the former study in contrast to only auditory stimuli in Group 4-18. The number of

Figure 1. Mean trial latency for Group C-P (Collier et. al., 1974) and for Groups 4-5, 4-9, 4-18, and CRF control. Only the last 12 days of acquisition along with the extinction data are shown for each experimental group.



trials (16/day) and the equal number of N-R transitions under the PR and CRF stimuli were the same in both experiments. It will be recalled that the intention of equating the number of N-R transitions in the present study was to closely resemble the methodology of the Group C-P in the Mellgren and Dyck (1972) study, and, in so doing, minimize the possibility of finding a conventional or reversed PREE (i.e., maximizing the chance of finding a generalized PREE). This, of course, was also the rationale behind the Group C-P in the Collier et. al. (1973) replication of Mellgren and Dyck. The extinction data for Groups C-P and 4-18 yielded reversed PREE's. As can be seen in Figure 1, the PREE was larger in Group C-P than in Group 4-18 suggesting that a reversed PREE can be obtained in a situation in which the PR and CRF stimuli are highly dissimilar and that the addition of an extra cue (e.g., bar position) can enhance the effect.

The extinction data for each S were analyzed in terms of mean latency per trial and in terms of the reciprocal of mean latency per trial for each day. Since it was found that both measures were comparable with respect to the analysis, only the mean latency data are reported. The initial analysis consisted of a four-way, mixed design analysis of variance with between-Ss factors of Groups (G) and Replications (R) and within-Ss factors of Schedules (S) and Days (D). The results of this analysis yielded only two significant main effects, Days ($F = 22.3$, $df = 4/72$, $p < .005$) and Schedules ($F = 4.7$, $df = 1/18$, $p < .05$). Significant effects were also found for the triple interactions, D x R x S ($F = 2.98$, $df = 4/72$, $p < .05$) and D x G x S ($F = 2.61$, $df = 8/72$, $p < .05$). Further, the quadruple interaction D x R x G x S was

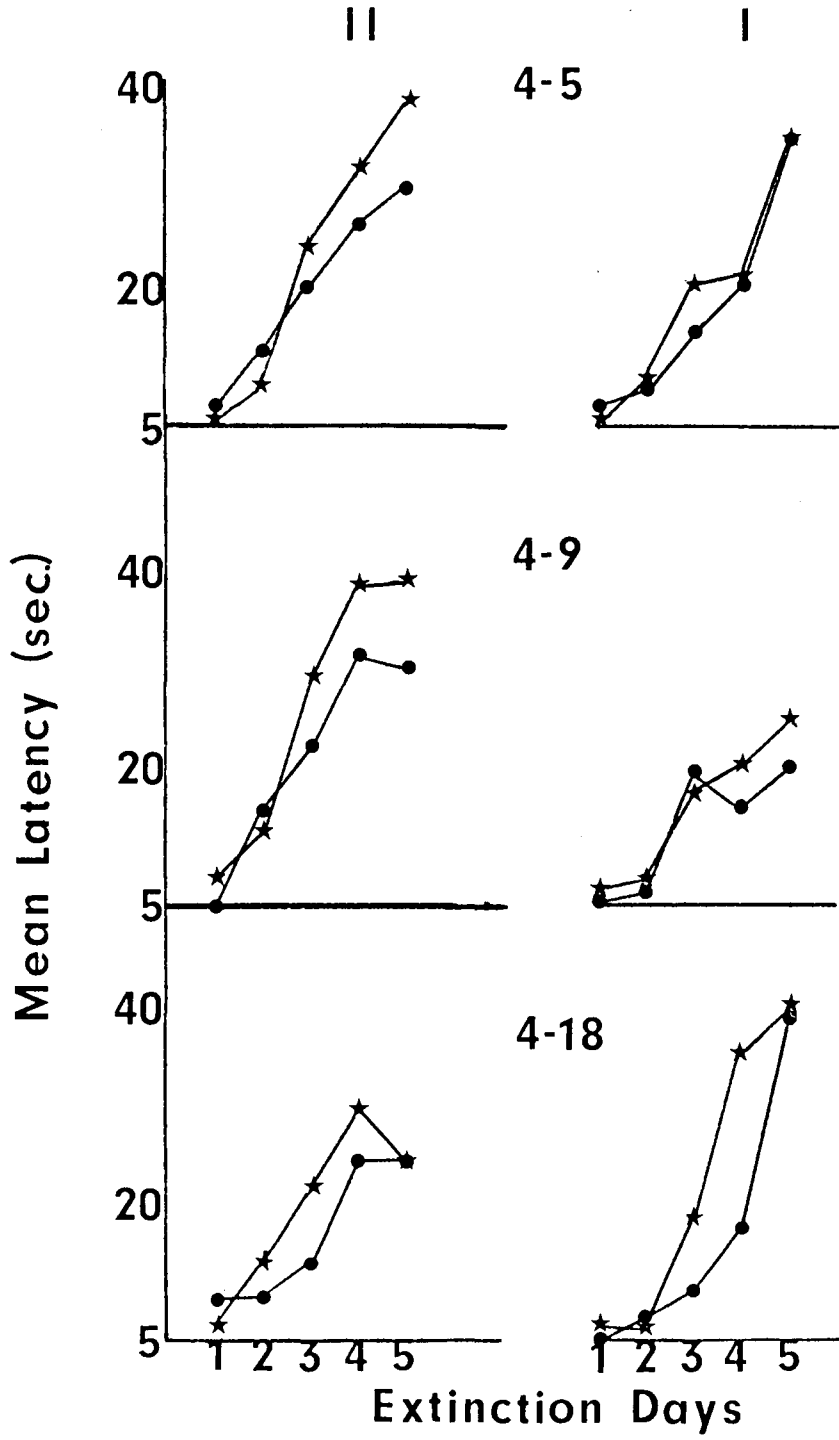
significant ($F = 3.29$, $df = 8/72$, $p < .01$).

Graphical analysis of the $D \times R \times S$ interaction reveals differential rates of extinction responding to the CRF and PR stimuli (schedules) across replications. When extinction scores are summed across groups, the differential responding appears on the third day of extinction and disappears on the fifth for Replication I. Differential responding also appears on Day Three for the second replication, but does not disappear. Indeed, the scores separate even further on subsequent extinction days. A similar type of analysis of the $D \times G \times S$ interaction reveals that, when the extinction scores are summed across replications, differential responding occurs on Days 3, 4, and 5 for Groups 4-5 and 4-9, but only on Days 3 and 4 for Group 4-18. On Day 5, the differential responding disappears in Group 4-18.

Graphical analysis of the $D \times R \times G \times S$ interaction reveals that it did not stem from any particular changes in the directions of the observed relationships, but from the appearance of differential extinction responding (in the reversed direction) to the CRF and PR stimuli occurring at different points for the different experimental groups and the fact that points in extinction at which this differential responding occurred differed from one replication to the next. As can be seen in Figure 2, PREE's during Replication I occurred on Days 2 and 3 for Group 4-5, on Days 4 and 5 for Group 4-9, and on Days 3 and 4 for Group 4-18. During Replication II, however, the reversed effects occurred on Days 3, 4, and 5 for both Group 4-5 and Group 4-9, while for Group 4-18 the effects showed up on Days 2, 3, and 4. Because of the comparability of the direction of the differential responding (i.e., always reversed), it

Figure 2. Graphical analysis of D x R x G x S interaction based on mean latency of extinction responding for each group for each replication.

Replication



seems legitimate to infer that this particular interaction occurred because of the disparities in the points at which reversed PREE's occurred between the replications together with the sensitivity of the within-Ss analysis. In view of this, it seems inappropriate to conclude that this interaction bears crucial significance to the effect of interest in this study-- the Schedules main effect.

Although Rashotte's (1971) hypothesis would predict, in terms of the present study, a reversed PREE for Group 4-5, a generalized PREE for Group 4-9, and a conventional PREE for Group 4-18, the graphical analysis of the present data and the combination of a significant Schedules main effect and a statistically nonsignificant G x S interaction suggested that this was not the case. To support the graphical analysis, a Wilcoxon was performed on the mean extinction scores averaged over days in which each S's mean latency on CRF trials was compared to that on PR trials. The results revealed a statistically nonsignificant ~~reversed~~ PREE for Group 4-5 ($T = 13, p > .05$) and significant differences in the direction of a reversed PREE for Group 4-9 ($T = 3, p < .05$) and Group 4-18 ($T = 1, p < .01$). These findings, while contrary to Rashotte's predictions, also suggest a trend of increasing reversed PREE's as a direct function of increasing stimulus dissimilarity; six out of eight Ss showing greater CRF responding in Group 4-5, 6.5 out of eight Ss showing greater CRF responding in Group 4-9, and seven out of eight Ss showing greater CRF responding in Group 4-18. The results of the Wilcoxon analysis suggest the presence of a G x S interaction in the analysis of variance, with greater Schedules effects occurring as stimulus dissimilarity increases. This interaction was not found to be significant, however.

A Wilcoxon was also performed on the control group data for the last three acquisition and all five extinction days, revealing no significant differences ($T = 9.5$, $p > .05$) in responding to the most divergent of the stimuli (4 and 18 clicks/sec) when they both signalled CRF. Scores were then pooled across stimuli for the control group and, after equating for number of trials, were compared to the extinction data for Group 4-18 by means of Mann-Whitney U tests. The results of the analysis indicated that resistance to extinction was greater to both the CRF and PR stimuli in Group 4-18 than in the CRF control group ($U = 5$ and 6 , respectively, $p < .01$). This comparison with the control group revealed an increased resistance to extinction in Group 4-18 in the presence of both the CRF stimulus and the PR stimulus which is similar to that described by Brown and Logan (1965) as a "generalized PREE."

Discussion

This experiment provides data which indicate relationships between stimulus similarity and the production of within-Ss PREE's. At all tested levels of stimulus similarity at least numerical reversed PREE's occurred. The original analysis of variance indicated equivalent magnitudes of the reversed PREE for each experimental group. However, non-parametric analysis suggested a trend of increasing magnitude of the reversed PREE as a function of increasing stimulus dissimilarity. All Ss in the experimental conditions showed greater resistance to extinction in both schedules than did the Ss in the CRF control condition.

The effect of any stimulus dissimilarity, then, in the present experimental paradigm, appears to be the production of a reversed PREE. Further, the effect of increasing the dissimilarity between the PR and

CRF stimuli appeared to result in increasing the magnitude of the reversed PREE. These effects of stimulus dissimilarity are clearly contrary to the predictions based on Rashotte's (1971) theory, which were that increasing the dissimilarity of the stimuli would tend to create a conventional PREE and that decreasing the dissimilarity of the stimuli would tend to create a reversed PREE. The extinction results of this experiment are also at odds with those reported for Group S^N -PC in the Mellgren and Dyck (1972) study. That is, while the number of N-R transitions in the presence of each stimulus was deliberately equated for all groups in the present study, only in one instance (Group 4-5) did a significant reversed PREE fail to occur (and the nonsignificant difference observed was in the direction of a reversed PREE). Mellgren and Dyck would have predicted a generalized PREE for all groups. Thus, while the implications of the present data substantially contradict those predictions of Rashotte (1971) and Mellgren and Dyck (1972), the question of why the reversed PREE occurs in this particular situation remains unanswered.

In light of the inconsistencies between the results of the present study and the predictions of Rashotte and Mellgren and Dyck, one might speculate that there might be other factors involved in the relationship between stimulus discriminability and the within-Ss PREE. In the optimal case, an animal would be able to make the fundamental discrimination between the reinforcement schedules (stimuli) and the discrimination between the transitional states of nonreward and reward trials. In this optimal condition, the S would invariably respond to the CRF stimulus much more strongly than to the PR stimulus, resulting in a reversed PREE.

If, for some reason, the S could not make the fundamental discrimination, but could make the discrimination between trials sequences, then a reversed PREE should also occur. However, if neither the fundamental discrimination nor the transition discrimination could be made by the S, extinction responding would most likely be similar to that evoked by a 75% reinforcement schedule. That is, nondifferential responding to the stimuli would result-- a generalized PREE. The probability of an animal making the fundamental discrimination depends upon the distance between the stimuli on a particular dimension, the modality of the stimuli, the physiological capabilities of the S, etc.; while the probability of a rat making the second type of discrimination depends to a large extent on the particular sequence of N and R trial presentation. Of course, all of these factors probably interact to such a degree that discovering which of the discriminations the S is making becomes exceedingly difficult, leaving the actual mechanism(s) of the discriminations a mystery.

Because the nature of the present design was such that the number of relevant stimuli associated with each schedule was the same and because the CRF stimuli in the present situation consistently predicted reinforcement while the PR stimulus did not, suggest that the reversed PREE results could be predicted by selective attention theory. However, since Sutherland and Mackintosh (1971) did not specifically discuss the within-Ss PREE paradigm in relationship to their theory, it is unlikely that the present findings will be of any significant importance to the theory as it now stands.

As is apparent, there are several problems associated with the determination of controlling factors affecting the production of a within-

Ss PREE. For instance, the large differences in the magnitude of the reversed PREE in the Collier et. al. (1974) study as compared to those reversed effects found in the present study suggest that a spatial dimension (e.g., bar position) in addition to the frequency dimension may be a controlling factor. The inconsistencies between the present study and Mellgren and Dyck may also suggest that certain methodological effects can act as controlling factors. Specifically, there are fewer irrelevant cues in the operant situation than in the runway. Further, there may be fewer cues associated with bar pressing than there are with the running response. Clearly, if any theory can incorporate any of these possible factors it is selective attention. Obviously, much more experimental work evaluating these possible controlling factors, including stimulus similarity, is needed in order to more fully understand what is involved in the production of the within-Ss extinction effects, especially the reversed PREE.

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THE WITHIN-SUBJECTS PARTIAL REINFORCEMENT EXTINCTION EFFECT:
STIMULUS SIMILARITY AS A CONTROLLING FACTOR

by

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(ABSTRACT)

Three groups of rats were trained and extinguished with continuous (CRF) and partial (PR) reinforcement in the presence of two auditory stimuli differing in amount of similarity along a frequency dimension. Results revealed that in the groups where stimulus similarity was least, a within-subjects reversed partial reinforcement extinction effect (PREE) was found. The results also suggest that as similarity between the stimuli associated with CRF and PR decreased, the magnitude of the reversed PREE increased. This result is in contrast to Rashotte's (1971) predictions concerning the type of PREE produced as stimulus similarity varies along a single dimension.