Reinforcer magnitude effects on a within-subjects reversed PRE

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Different groups of rats, given larger or smaller reinforcers, were trained in a within-Ss partial reinforcement paradigm which previously had generated reversed partial reinforcement effects. Based upon previous between-Ss studies of factorial combinations of reinforcement schedule with reinforcer magnitude, it was predicted that increasing reinforcer magnitude in the within-Ss paradigm would attenuate or eliminate the reversed PRE. The results confirm the prediction. A significant reversed PRE occurred with the smaller reinforcer, and no schedules effect upon extinction performance occurred with the larger reinforcer.

Rats given training on a multiple CRF-VR 3 reinforcement schedule in a free operant situation show greater resistance to extinction in the presence of the stimulus paired with CRF than in the stimulus paired with VR 3 (Pavlik & Carlton, 1965; Pavlik, Carlton, Lehr, & Hendrickson, 1967). This effect was termed a "reversed partial reinforcement effect," as it is the reverse of the conventional relationship between reinforcement schedule and resistance to extinction which almost invariably occurs when the relationship is studied with a between-Ss design. Although within-Ss reversed PREs have been reported occasionally in discrete-trial situations (e.g., Mellgren & Dyck, 1972; Pavlik, Carlton, & Hughes, 1965), the more common outcome of discrete-trial within-Ss studies of the problem has been the absence of any differential schedules effect on resistance to extinction (cf. Amsel, 1967).

It also should be noted that the reversed PRE does not always occur in free operant situations with within-Ss designs. The reversed effect apparently requires that the switch from one reinforcement schedule to the other be on a strict temporal basis (i.e., independent of S's responding). When the switch from one schedule to the other is made contingent upon S's making a required number of responses or taking a specified number of reinforcements, subsequent extinction performance yields a conventional PRE rather than the reversed effect (e.g., Hearst, 1961; Pavlik, Carlton, & Manto, 1965).

The present study investigated the role of reinforcer magnitude in the free operant, reversed PRE paradigm described by Pavlik & Carlton (1965). In that study a very small magnitude of reinforcer was used—one 45-mg Noyes pellet. In contrast, most within-Ss PRE studies in discrete-trial situations that have not yielded a reversed PRE have used rather larger reinforcer magnitudes, typically between 500 and 1,000 mg. This difference in the reinforcer magnitude parameter is of interest, since Hulse (1958) and Wagner (1961) have shown in discrete-trial, between-Ss experiments that the effects of reinforcer magnitude upon resistance to extinction are schedule-dependent. While larger reinforcers produce slightly greater resistance to extinction than do smaller reinforcers if training was with partial reinforcement, larger reinforcers produce lesser resistance to extinction than do smaller reinforcers if training was with CRF. If this pattern of results also occurs in the free operant, reversed PRE paradigm, increasing reinforcer magnitude within that paradigm should reduce the (greater) resistance to extinction of CRF responding and increase the (lesser) resistance to extinction of the partial reinforcement (VR 3) responding, thus attenuating, eliminating, or even reversing the reversed PRE seen with small reinforcers. This was the hypothesis under test in the present experiment.

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METHOD

Subjects

The Ss were 10 experimentally naive, male hooded rats from the local departmental colony. They were approximately 80 days old at the start of the experiment, were housed individually, and had ad lib access to water throughout the study.

Apparatus

A BRS test chamber and associated programming equipment was used. The test chamber was equipped with retractable levers (only the right-hand lever was used in this experiment) and a pellet dispenser programmable to dispense either one or four 45-mg Noyes pellets. The programmable compound stimulus conditions used consisted of (A) the combination of dim cue lights mounted over the bars and an 80-dB clicking noise (approximately 8/sec) or (B) the combination of fairly bright houselights and 80-dB white noise.

Procedure

The Ss were maintained on a daily food ration of 12 g of powdered Purina Chow, which was adjusted to include the weight of food taken in the test chamber. After 3 days' accommodation to the feeding schedule and gentling, all S received 3 days of magazine training (a total of 30 min and 60 one-pellet reinforcements) with the bar retracted, and 3 days of barpress training (a total of 170 reinforced barpresses). Following pretraining, Ss were assigned randomly to either large (four pellets) reward (Group L) or small (one pellet) reinforcer (Group S) groups (N = 5).

Because a previous pilot study had indicated that Ss receiving one-pellet reinforcers on CRF emitted approximately four times as many barpresses per unit time as did Ss receiving four-pellet reinforcers, we attempted to equate the groups for total number of responses and reinforcers during training by varying the lengths of the daily training sessions. Specifically, Ss in Group L received 20-min training sessions, while Ss in Group S received 5-min training sessions on Days 1-8 and 4-min sessions thereafter. Both groups received 15 days of training. During each training session, the two reinforcement schedules, CRF and VR 3, and the two compound stimulus conditions, A and B (see above), were alternated every 30 sec. Three Ss in each group had Stimulus Compound A paired with CRF and Stimulus

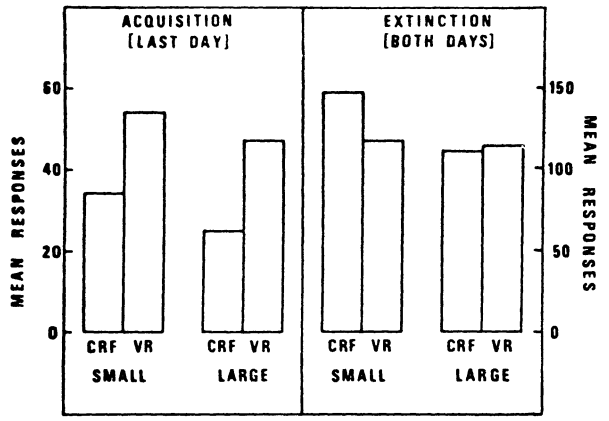

Fig. 1. Mean responses emitted under CRF or VR 3 schedules by small- or large-reinforcer groups during the final acquisition session and over both days of extinction.

Compound B paired with VR 3; the opposite correlation of cue with schedule obtained for the remaining two Ss in each group.

Extinction training was given on Days 16 and 17. Each extinction session was 10 min in length, and no reinforcers were delivered. The compound stimuli alternated every 30 sec, as in training. Half the extinction sessions began with the cue associated with CRF, and half with the cue associated with VR 3.

RESULTS

One S from Group L died during training, and his data were eliminated from all analyses. Figure 1 presents the mean barpresses for both groups in both the CRF and VR 3 conditions. The left panel indicates means for the last day of training (Day 15), and the right panel indicates means for total responses during extinction (Days 16 and 17).

As indicated in the left panel of Fig. 1, Group S Ss emitted numerically more responses than did Group L Ss during training in both schedules. However, analysis of total responses during training reveals that, while the main effect of schedule was highly significant ($F = 44.7$; $df = 1,7$; $p < .001$), with both groups emitting more VR 3 than CRF responses, neither the reinforcer magnitude effect ($F = 2.38$; $df = 1,7$; $p > .10$) nor the interaction of Magnitude by Schedules ($F < 1.0$) was significant.

Analysis of the total responses emitted in the presence of CRF or VR 3 cues during the two 10-min extinction sessions yielded a significant Magnitude by Schedules interaction effect ($F = 8.14$, $df = 1,7$; $p < .025$). Inspection of the right panel of Fig. 1 reveals clearly the basis of this interaction. While Group S emitted more extinction responses in the CRF condition ($\bar{X} = 148.2$) than in the VR 3 condition ($\bar{X} = 117.0$), a reversed PRE, Group L emitted essentially the same number of responses in the CRF ($\bar{X} = 111.8$) and VR 3 ($\bar{X} = 113.8$) conditions. Analysis by repeated measures t tests indicates that the schedule difference was significant in Group S ($t = 5.05$, $df = 4$; $p < .01$) but not in Group L ($t = 0.19$). Viewed orthogonally, the interaction also reflects the fact that, while extinction responding of Group S in the CRF condition was appreciably greater than that of Group L, no such difference between the groups occurred in the VR 3 condition. Ignoring schedules, while Group S emitted more total extinction responses ($\bar{X} = 265.2$) than did Group L ($\bar{X} = 225.5$), this difference was not significant ($F < 1.0$).

Finally, note should be made of the facts that (a) all five Ss in Group S emitted more extinction responses in the CRF condition than in the VR 3 condition, while two of the four Ss in Group L yielded differences in each direction, and (b) the particular combinations of compound stimulus conditions with the two reinforcement schedules yielded no discernible effects.

DISCUSSION

The results of the present experiment are in agreement with the initiating hypothesis. While the reversed PRE obtained previously (Pavlik & Carlton, 1965) is replicable when small reinforcers are used, the effect of increasing reinforcer magnitude within this particular experimental paradigm is to eliminate or attenuate the reversed PRE.

The fact that the hypothesis was derived from results occurring in strictly between-Ss, discrete-trials experiments (Hulse, 1958; Wagner, 1961) suggests that–whatever the mechanisms or mechanism responsible for the reversed PRE with small reinforcers–extinction responding in within-Ss PRE paradigms is affected by some incentive variables in a manner congruent with effects seen in more traditional paradigms. The results of the present experiment also suggest that the frequent failure to detect schedule effects in within-Ss studies of extinction may stem, at least in part, from unfortunate choices of reinforcer magnitude. Given the schedule-dependent, asymmetrical effects of reinforcer magnitude on extinction performance, almost any outcome is possible.

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