

Resistance to extinction as a function of reinforcement schedule and amount of reinforcement

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Twenty male albino rats were trained to run a straight runway on a partial reinforcement schedule. On reinforced trials a lever was introduced into the goalbox, and the subject leverpressed for sucrose on either a continuous reinforcement schedule (CRF) or on a partial reinforcement schedule (PR). On nonreinforced runway trials, the lever in the goalbox remained retracted. Upon completion of acquisition, subjects were extinguished in the runway. Results showed that subjects that received CRF on the lever were significantly more resistant to extinction than were subjects that received PR on the lever.

The partial reinforcement effect (PRE), increased resistance to extinction following intermittent reinforcement training (PR) as compared to continuous reinforcement training (CRF), is a well established phenomenon (Lewis, 1960).

A number of experiments using a within-subjects design have shown that PR training under one set of external stimulus conditions and CRF training of the same response under a different set of external stimulus conditions results in increased resistance to extinction when subjects are extinguished under either set of external stimulus conditions (Brown & Logan, 1965; Rashotte & Amsel, 1968; Young & Costelloe, 1974). For example, in the Young and Costelloe study, rats were trained to leverpress with the houselight ON (or OFF) as the differential external stimulus condition. The subjects received either CRF (ON)/PR (OFF) or CRF (OFF)/PR (ON) training schedules followed by extinction either with the houselight ON or the light OFF. Results showed that the PRE did not become differentially associated with either external stimulus condition.

These studies are in agreement that, after training as described above, subjects show what has been called the generalized partial reinforcement effect (GPRE). That is, PR training increases resistance to extinction under either set of external stimulus conditions, even though one set of stimuli has been associated with PR and the other set of stimuli has been associated with CRF.

These studies suggest that the PRE may be "response specific," which is to say that whatever causes the PRE becomes attached in some way (perhaps through classical conditioning) to the stimuli produced by the instrumental response. This hypothesis is similar to, if not identical with, that of Mowrer (1960), and would predict that, in the experiments cited above, since the

same (leverpress) response was made under both external stimulus conditions and since the PRE was attached to the response-produced stimuli, all groups should show the GPRE, which was the result obtained.

Additional support for this hypothesis was shown in a study (Young, Favret, & Keyes, 1975) in which rats were trained to run a straight runway on either a CRF or PR schedule and to leverpress in the goalbox on either a CRF or PR schedule. Half of the subjects were then extinguished in the runway and the other half were extinguished on the lever. Results showed that extinction on the lever was independent of runway reinforcement schedule, and the extinction in the runway for CRF runway-trained subjects was independent of leverpress reinforcement schedule. An odd finding of that study, however, was that extinction in the runway for PR runway-trained subjects was not independent of leverpress reinforcement schedule. In fact, for subjects that received PR runway training, those that were CRF trained on the lever were significantly more resistant to extinction in the runway than were those subjects that received PR leverpress training.

In that experiment the number of leverpresses was equated on reinforced runway trials and, since the PR schedule was a VR 2, those subjects on a PR leverpress schedule received only half the amount of reinforcement on each reinforced runway trial that did those subjects on a CRF leverpress schedule. This difference in reinforcement magnitude is of interest because previous studies (i.e., Hulse, 1958) have shown that the effects of magnitude of reinforcement are schedule dependent.

The present experiment was thus conducted to determine if the same results would be obtained if the magnitude of reinforcement is equated for groups which receive CRF and PR leverpress training.

METHOD

Subjects

The subjects were 20 naive male albino rats, 150-175 g in weight at the start of the experiment.

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Apparatus

The apparatus was a straight Plexiglas runway 60 x 4 x 4 in., including the startbox (6¼ in. long) and goalbox (10 in. long and 5-3/8 in. wide). The runway had a grid floor and guillotine doors separated the start- and goalboxes from the runway. Fitted on the end wall of the goalbox was a retractable lever and liquid dipper which dispensed .01 ml of a 40% sucrose solution. Raising the startbox door started a timer, calibrated in 10ths of a second, which stopped automatically when the subject passed through a photobeam at the entrance to the goalbox.

Procedure

The subjects were randomly selected from the Louisiana State University colony and were placed in individual cages on a food deprivation schedule of 10 g Purina Chow every 24 h. Water was available in the cages at all times, and the subjects were fed approximately 10 min after each experimental session.

From Days 4 to 8, the subjects were handled in pairs for 5 min each day, and on Days 9-12 the subjects were given magazine training on the dipper on a VI 30-sec schedule. Experimental periods consisted of 20 presentations of the dipper.

On Day 13 all subjects were conditioned to leverpress and to make 50 reinforced leverpresses. On Day 14 the subjects were given five CRF runway runs and on each run the subject was allowed to make 10 leverpresses under CRF. A discrete trial procedure was used and the lever, which required 4 sec to retract and extend fully, was inoperative during retraction.

Acquisition training began on the following day. The subjects were randomly divided into two groups, CR and PR. The subjects in the CR group received continuous reinforcement on the lever in the goalbox, while subjects in the PR group received reinforcement for leverpressing in the goalbox on a VR 2 schedule. All subjects received PR runway training on a VR 2 schedule and, on nonreinforced runway runs, the lever was not introduced into the goalbox, but remained retracted.

Acquisition training consisted of 10 runway runs daily, with a 15-sec intertrial interval, and continued for 10 days. To equate amount of reinforcement on reinforced runway runs, the subjects receiving CRF on the lever were allowed to make 10 leverpresses, while the subjects receiving PR on the lever were allowed to make 20 leverpresses.

Upon completion of acquisition, all subjects were extinguished in the runway. Extinction sessions consisted of five runs daily for 5 days, and total latency for the trials on each day was recorded. On any trial, if the subject failed to break the photobeam within 30 sec, the timer was stopped, the subject was removed to the holding cage to await the next trial, and a latency of 30 sec was recorded.

RESULTS AND DISCUSSION

The total latency for each block of five trials in runway extinction was recorded and results showed that Group CR ran faster throughout extinction than did Group PR. The data were converted to reciprocals and subjected to an analysis of variance which showed that both treatment and trials were significant beyond the .05 level. Thus, running speeds were significantly faster

Table 1
Running Speed in Extinction (Feet Per Second)

Group	Blocks					Across Blocks
	1	2	3	4	5	
CR	4.26	3.84	1.63	.97	.80	1.48
PR	1.92	1.06	.61	.48	.37	.64

for Group CR than for Group PR and running speeds decreased across trials. These data are shown in Table 1.

Although running speeds in acquisition were slightly faster for Group CR than for Group PR, the difference was slight and did not approach significance.

These findings are in agreement with those of Young, Favret, and Keyes (1975), even though in the present study the total amount of sucrose on each reinforced trial was equated for the two groups. Although it is clear that there is no transfer of the PRE from one response to another, as a "response-specific" hypothesis would predict, these results are somewhat surprising and probably would not be predicted.

Perhaps it is the case that a nonreinforced runway run produces a greater frustrative reaction when lever reinforcement is under conditions of CRF. If that assumption is made, then these results are explainable either in terms of conditioned frustration (Amsel, 1958) or the differential attachment of frustration to the (running) response-produced stimuli (Mowrer, 1960).

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