Partial reinforcement acquisition effects within subject

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Two experiments in a free-operant situation studied the effect of partial and continuous reinforcement schedules on acquisition response rates using a within-S design. Experiment 1 compared 50% and 100% over eight 100-trial sessions using a discriminative stimulus. Experiment 2 compared 20% and 100% over 10 8-min sessions. In Experiment 1, performance during partial reinforcement ultimately surpassed performance during continuous reinforcement. In Experiment 2, this effect was increased.

Amsel, Rashotte & MacKinnon (1966) examine the relation between within- and between-S partial reinforcement effects in a discrete trial situation. The general finding of their studies is that the vigor of response under partial reinforcement (PRF) is greater than the vigor of response under continuous reinforcement (CRF). This is demonstrated in both within- and between-S experiments.

The method they used associates a particular runway color, black or white, with either CRF or PRF. Their intention is to maximize the discriminative function of the color stimuli, and minimize the interaction between the aftereffects of one trial and the next. As they point out, there are several reasons why their findings may not relate to the free operant situation, the major reason being the extent to which the aftereffects of one trial and the next are permitted to interact in the two experimental situations. They suggest that in the free operant situation response chaining may occur and that this may result in a confounding of response patterns from the feedback stimulation from any trial or trials.

Dutch & Quartermain (1967) in a between-S free operant experiment observed a faster response rate in acquisition and greater resistance to extinction for groups receiving higher numbers of nonreinforced trials. They suggested that nonreinforcement increased the speed of responding in acquisition, and that the faster the rate in acquisition, the higher the extinction score. Following Amsel's (1962) hypothesis, which was derived from discrete trial studies, it was concluded that nonreinforcement acted to energize behavior.

It seems, therefore, that in the between-S case PRF has a basic energizing influence on behavior, irrespective of whether the situation involves discrete or continuous trials.

The purpose of the following experiments was to determine whether this energizing influence which Amsel et al (1966) also found in the discrete trial within-S situation also applied in the continuous trial within-S situation.

EXPERIMENT 1

Subjects. The Ss were 10 experimentally naive, male Sprague-Dawley rats from the Massey University colony. Their age ranged from 140 to 150 days at the commencement of the experiment.

Procedure. The apparatus was a Skinner box with appropriate programming equipment using water as reward. Three weeks before the beginning of the experiment, Ss were placed on a 23 h water deprivation schedule. For three days prior to the commencement of acquisition, Ss were magazine trained culminating in each S making 30 reinforced bar presses.

During acquisition, each S was required to make a total of 100 responses on each of eight consecutive days. The 100 responses were composed of 50 responses at 100% and 50 responses at 50% FR reward. The order of presentation of the schedules was randomized daily for each S. Half the Ss always had CRF with the house light on (light) and PRF with the house light off (dark). For the other half this relation was reversed.

Results and Discussion. The mean number of responses per minute overall for the four conditions was: 50%, 9.9; 100% 9.9, Dark, 10.3; Light, 9.6. Considered overall, it is apparent that there was no difference in response rate for either percentage or degree of illumination.

Table 1
Mean Rates of Bar-Pressing under
Different Schedules of Reward

Percentage of Reward	Days							
	1	2	3	4	5	6	7	8
100	6.6	8.4	8.6	11.9	11.9	11.3	10.9	14.2
50	6.3	6.9	12.1	10.6	10.2	10.6	13.8	15.1

Table 1 indicates that there is an effect which may be analogous to the findings of Amsel et al (1966). For the first two days, rate under PRF is depressed; it shows a sudden increase on Day 3, but it is not until Days 7 and 8 that it again surpasses performance under CRF. The initially inferior performance and greater variability under PRF is similar to findings obtained from discrete trial studies using within- and between-S designs (Amsel, 1962; Amsel, Rashotte, & Mackinnon, 1966). The initially inferior performance is also in agreement with findings reported by Jenkins & Stanley (1950) for between-S free responding studies.

From the results of this experiment, it is not possible to say whether the presence or absence of light constituted a discriminative stimulus (S^D). Following Dutch & Quartermain (1967), it seems that in a between-S situation the occurrence of nonreinforcement in itself is sufficient to engender different rates of responding in acquisition; if this applied in the within-S situation it would render the use of S^D superfluous. At the least, the variation in the stimulus (light on or off) would constitute an environmental change with a possibly associated alerting function. This, in turn, could have a masking effect on behavior changes associated with variations in the schedule of reinforcement. As the aim of the present study is an evaluation of the influence of nonreinforcement per se, it seems desirable to minimize the intrusion of stimuli which may mask the effect of nonreinforcement. For these reasons S^D was not used in Experiment 2.

EXPERIMENT 2

Subjects. The Ss were 10 experimentally naive, male Sprague-Dawley rats from the Massey University colony. Their age ranged from 140 to 150 days at the commencement of the experiment.

Procedure. Apparatus, adaptation and preliminary training were as for Experiment 1.

The experiment was spread over 10 days, each S having a total of 8 min per day in the apparatus. The 8 min were divided into four blocks of 2 min; there was no time interval between the blocks. During any 2-min block S was reinforced either continuously or on a 20% FR schedule. The assignment of schedules to blocks was randomized for each S over the 10 days with the restriction that each S receive a total of 4 min of each schedule each day.

Results and Discussion. The mean number of responses per minute overall for the two conditions was: 20% 11.7, 100% 9.6. It is apparent from the overall means and from Table 2 that rate of responding varies according to the schedule in operation. Even without the use of S^D response rate is higher under 20% than under 100%. An unexpected feature is the early superiority

Table 2
Mean Rates of Bar-Pressing under
Different Schedules of Reward

Percentage of Reward	Days									
	1	2	3	4	5	6	7	8	9	10
100	4.5	5.5	5.7	6.7	9.2	10.9	11.6	14.7	13.3	14.2
20	4.5	5.8	7.3	8.1	10.2	14.2	14.4	17.4	17.6	17.5

of the PRF condition, and an absence of initial variability under PRF.

Although Experiment 1 and Experiment 2 are not strictly comparable because of the variation in procedure, it is interesting to note the close correspondence in terms of rate between CRF conditions in the terminal phases of the experiments. On the other hand, increasing the nonreward component in the PRF conditions has resulted in a higher terminal rate for the 20% condition as compared with the 50% condition.

On the basis of these results, particularly Experiment 2, it seems that the energizing influence of nonreinforcement occurs in both between- and within-S situations, regardless

of whether or not these situations involve discrete or continuous trials.

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