Intertrial reinforcement: A test of several hypotheses¹

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A rewarded goalbox placement, when given following nonrewarded trials which precede rewarded trials, has been found to eliminate or at least reduce the partial reinforcement effect. While this finding has been taken to support the sequential hypothesis, two similar but independent nonsequential hypotheses have been suggested to explain the placement effect. The rewarded placements were given here so as to provide a test of the sequential vs nonsequential interpretations. The nonsequential view was not supported. It was suggested that on placement trials the S makes an instrumental response. On the basis of this assumption, it was possible to explain a variety of placement findings in sequential terms.

The partial reinforcement effect (PRE) can be reduced, and in some cases entirely eliminated, simply by placing S in the baited goalbox following nonrewarded (N) trials which precede rewarded (R) trials. Such placements have been called intertrial reinforcements (ITR). The ITR findings have been considered as support for an approach to partial reward in terms of the sequence or order in which N and R trials occur, a sequential approach (Capaldi, 1967).

Two similar but independent "nonsequential" interpretations of ITR have recently been suggested (Lobb & Runcie, 1967; Surridge & Amsel, 1966). At the extreme, according to these views, if all N trials were followed by ITR, a schedule of partial reward would become one of consistent reward. The two views, which differ in detail, agree that ITR reduces or eliminates the PRE because it reduces or eliminates the frustration which occurred on the N trial the ITR follows. Surridge and Amsel also suggested that when ITR follows an R trial, it increases the reward magnitude of that R trial. These conversions are achieved, however, only when ITR follows R or N trials by a short temporal interval. The nonsequential interpretation of ITR was tested here.

METHOD

Each of the four groups contained 13 Holtzman male rats about 100 days old when supplied. The initial portion of the gray alley was an 8 in. treadle which, when depressed by the rat whose front paws were always placed on its forward edge, started the first clock (.01 sec). When S interrupted a photobeam 2 in. beyond the treadle, Clock 1 stopped and Clock 2 started. Clock 2 stopped and Clock 3 started when S broke a photobeam 52 in. from the first. The last photobeam was 15¼ in. beyond the second and 2¾ in. in front of a brass 2 x 4 x 1½ in. food cup covered by a sliding metal lid which opened automatically when the last photobeam was broken. There were two identical food cups, one for reinforced trials (wet mash), one for nonreinforced trials. A manually-lowered guillotine door, 14 in. from the rear of the goal compartment was lowered when S broke the last photobeam. Confinement in the goalbox was always 15 sec. Except when ITR was given, the entire ITI of 30 sec was spent in a neutral wait box. When ITR was given, S spent only 15 sec in the wait box, the subsequent 15 sec being spent in the goalbox where S's nose was placed directly over the foodcup by E. The S was then brought forward to the start section of the alley to begin the next trial.

Ten days after being supplied, the Ss were removed to individual cages and deprived of food (12 g daily ration). On Days 1-7 of deprivation the Ss were handled. On Days 8-9 Ss were fed outside the home cage for about 5 min. On Day 10 each S was placed in the goalbox and allowed to eat for 30 sec.

Table 1
Reinforcement Schedules and Intertrial Reinforcements of the Partial Reward Groups

Groups	Trial				
	1	2	3	4	5
Group ONR	R	N ₁	N ₂	N ₃	* R
Group 1NR	R	N ₁	* N ₂	R	
Group 2NR	R	N ₁	* N ₂	N ₃	R

Table 1 shows the reward schedules received by each of the partial groups, the asterisk (*) indicating where ITR was given. The groups are designated on the basis of the number of N trials which follow ITR. The daily ITR received by each group always followed an N trial, never an R trial. Thus, according to the frustration views of ITR already considered, each group had the same number of N trials converted into R trials, and no rewarded trial had its reward magnitude increased by ITR. According to these views, while Group 1NR received only one "legitimate" N or frustration trial daily (N₂), Group ONR received two (N₁ and N₂) as did Group 2NR (N₂ and N₃). The partial groups received the schedules shown in Table 1 on Days 3-7 of experimental training, an extra R trial being added to the beginning or end of the sequence on Day 5 and on Day 6. On Day 1 and on Day 2 of experimental training all Ss received four rewarded runway trials. The consistently rewarded group (Group C) was given five trials on Days 3, 4, and 7 and six such trials on Days 5 and 6, and no ITRs. The Ss were run individually and no more than two Ss from the same group were run consecutively. There were two days of extinction at seven trials each day. The Ss were fed the daily ration in the home cage 10 min following the last daily trial. The data for an S from Group ONR who died were discarded.

RESULTS

The major result in acquisition was that Group C was faster than the partial groups which did not differ among themselves. Since on Day 7 the goal speeds differed reliably ($F = 3.05$, $p < .05$, $df = 3/47$), rate measures (Anderson, 1963) were employed. The mean speed on the trials of Day 7 provided the estimate of acquisition asymptote, the reciprocal of 60 sec (forcing time in alley) the estimate of extinction asymptote. The rate measures for the trials of Day 1 and Day 2 of extinction in the run section of the alley are shown in Fig. 1. The rate measures exceeded 1.00 in some cases because, under massed trials, the speeds on the early trials of a day tend to exceed those of the mean of all trials of the day, and the acquisition asymptote was based on the mean speed on Day 7.

Fig. 1

Differences in the rate measure were significant ($p < .01$) in all sections ($df = 3/47$ in all cases) on Day 1 of extinction (start: $F = 7.19$, run: $F = 42.51$, and goal: $F = 50.31$), and Day 2 of extinction (start: $F = 7.27$, run: $F = 22.33$, and goal: $F = 22.52$). A Duncan's range test for unequal N s indicated that on Day 2 all groups differed at the .05 level or better, while on Day 1 only the difference between Groups 2NR and 1NR was not significant. The run section gave similar results with one exception; on Day 2 the difference between Group 1NR and 0NR was not significant. In the start section only the more extreme differences were significant.

DISCUSSION

The hypotheses suggested by Lobb and Runcie and by Surridge and Amsel would expect that Groups 0NR and 2NR, which received the same number of frustrative or nonrewarded experiences, would be equally resistant to extinction and more resistant to extinction than Group 1NR which received a fewer number of such experiences. But whether or not converted N trials are considered (i.e., converted by ITR), resistance to extinction was unrelated to number of N trials, e.g., Group 0NR was least resistant to extinction yet received the same number of N trials as Group 2NR and a greater number of N trials than Group 1NR. It should be added that the present results are not consistent with the dissonance hypothesis (Lawrence & Festinger, 1962) which relates resistance to extinction to number of N trials.

In this study resistance to extinction was related to the number of N trials which followed ITR, two (Group 2NR, most resistant), one (Group 1NR, intermediate resistance), or none (Group 0NR, least resistant). The present results suggest, then, the importance of sequence of N trials rather than total number of N trials in extinction. According to the sequential hypothesis, ITR as employed here determined a variable called N -length, the number of N trials which precede the R trial (Capaldi, 1967). The present results are consistent with the assumption that resistance to extinction increases as N -length increases.

The PRE was reduced, but not totally eliminated, in Group 0NR. To deal with this finding it is suggested that on ITR trials a short terminal instrumental response occurs (R_T), e.g., S hunches forward over the foodcup. Whatever stimuli are present on the ITR trial will be conditioned to R_T . Through generalization, R_T will support the longer instrumental reaction. According to this view, nonrewarded stimuli supplied by the immediately previous N trial(s), e.g., S_N , are conditioned to R_T . To the extent that R_T supports the instrumental reaction, the PRE will not be eliminated by ITR but rather will only be reduced. Thus ITR is increasingly less successful in reducing the PRE as number of partial reward

training trials increase (Spence, Platt, & Matsumoto, 1965) because as ITR is increasingly employed, R_T becomes increasingly stronger and thus increasingly capable of supporting a PRE in the longer instrumental reaction. The R_T hypothesis is consistent with the results of Capaldi & Olivier (1967) which suggest that when number of acquisition trials and the repeated use of ITR are separated, the PRE is greatly reduced, almost as much, perhaps, as only when limited acquisition is employed.

Lobb and Runcie, in support of their frustration hypothesis, showed that ITR was more successful in eliminating the PRE when given 15 sec after the N trial rather than 1 h later. Extinction occurred at one trial per day. Capaldi & Minkoff (1966) showed that when the extinction intertrial interval (ITI) was either longer or shorter than the acquisition ITI between N and R trials, extinction was more rapid than when the two ITIs were identical. In the Lobb and Runcie study the extinction ITI (24 h) was more similar to the N - R interval of the 1-h group than of the 15-sec group. This view assumes, as was explained above, that ITR functions in respects similar to an R trial. If this is so, the Lobb and Runcie results are similar to those supplied by Capaldi and Minkoff and can be explained in the same general terms (see Capaldi & Minkoff, 1966).

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NOTE

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