Post-reinforcement delay in extinction: A failure to replicate¹

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Three groups of rats were run in a straight runway to sucrose reinforcement. Group 10 received 10 sec. of immediate reinforcement; Group 10D received 10 sec. of reinforcement followed by 20 sec. delay in the goalbox; Group D10 received 10 sec. reinforcement after a 20 sec. delay in the goalbox. Unlike an earlier study, which the present investigation attempted to replicate, Groups D10 and 10D were less resistant to extinction than Group 10 when start and run times were considered.

Fehrer (1956) reported two studies using post-reinforcement delay as one of the major variables. In Experiment I, she found no differences during acquisition between a 40 sec. reinforcement group (Group 40), a 10 sec. reinforcement group (Group 10), and a 10 sec. reinforcement group with a 20 sec. delay following reinforcement. During extinction she noted that Group 10D was reliably slower to extinguish than either Group 40 or Group 10.

Experiment II included groups similar to those in Experiment I with the addition of a pre-reinforcement delay group (Group D10). She found Group D10 to be running reliably slower during acquisition. Since there is some question as to the efficacy of Fehrer's procedures, a replication seemed in order.

In the present study, three groups of albino rats were run in a straight alley runway to sucrose reinforcement. Group 10 received 10 sec. of immediate reinforcement; Group D10 received 10 sec. of reinforcement following a 20 sec. delay in the goalbox; Group 10D received 10 sec. of reinforcement followed by 20 sec. confinement in the goalbox.

Method

Subjects. The Ss were 24 female albino rats, approximately 90-110 days old at the start of the experiment, purchased from the Holtzman Company.

Apparatus. The apparatus consisted of a straight alley runway 7 ft. long, 5 in. high, and 4 in. wide. Photocells were placed 12 in. outside the 16 in. startbox and 12 in. inside the 16 in. goalbox. Reinforcement was delivered automatically in a 50 cc burette through a hole in the side of the goalbox 1-1/2 in. high and 3/4 in. wide, located 2 in. above the runway floor, 4 in. from the terminus of the runway.

Procedure. All Ss were put on a 23-hr. deprivation schedule for five days prior to the start of the experiment. The E handled Ss for 15 min. in groups of three each on each of these days at approximately the time they were to be run. Following handling, Ss were re-

turned to their home cage and fed dry mash for one hour. On day 6, each S was allowed 5 min. of exploration in the runway with all sliding doors open.

Prior to the beginning of acquisition the Ss were randomly assigned to one of three experimental groups. Group 10 received 10 sec. of immediate reinforcement with 16% sucrose solution in water; Group 10D received 10 sec. of reinforcement after which the tube was automatically withdrawn and Ss were confined in the empty goalbox for an additional 20 sec.; Group D10 received 10 sec. reinforcement following a 20-sec. delay in the goalbox.

Starting on day 7, each S was run 10 trials per day for seven days in the following manner. E brought S into the experimental room from the home cage and placed S in the intertrial interval cage (ITI) for 60 sec. S was then removed from the ITI cage and placed in the start box facing the exit door. The startbox door was opened and S was allowed to proceed to the goalbox, at which time the retrace door was closed behind S. Following completion of the trial, S was returned to the ITI cage to await the next trial. Upon completion of the tenth trial, S was returned to its home cage. The ITI was 20 sec. for Group 10D and D10 and 40 sec. for Group 10. Start and run times were measured automatically through the use of photocells and standard electric timers. Ss were staggered to facilitate massed extinction procedures.

During extinction, trials were identical to acquisition trials except for the omission of reinforcement. The same ITIs were maintained. A massed extinction procedure was used, each S being run until it met a criterion of two consecutive 60-sec. trials without entering the goalbox, or for a maximum of 50 trials. All Ss were run for a minimum of 30 trials during extinction. Ss in Group 10 were confined in the goalbox for 10 sec.; Ss in Groups 10D and D10 were confined for 30 sec. Start times, run times, and number of trials to criterion were recorded and analyzed.

Results

Start and run times were transformed to reciprocals and the data is shown graphically in Figs. 1 and 2. An overall analysis of variance was performed on the start and run speeds during acquisition. Reliable delay ($F = 88.06$; $df = 2/21$; $p < .01$) and delay by trials interaction effects ($F = 2.10$; $df = 12/126$; $p < .05$) were found for start speeds. Similar results were obtained in the analysis of run speeds. Multiple comparisons among groups, using the Newman-Keuls procedure, showed Group D10 start-

Fig. 1. MEAN MEDIAN START SPEEDS, IN BLOCKS OF TEN TRIALS.

Fig. 2. MEAN MEDIAN RUN SPEEDS, IN BLOCKS OF TEN TRIALS.

ing and running reliably slower than either Groups 10 or 10D ($p < .01$ in all cases). This can be seen clearly in the left hand portions of the graphs.

A similar analysis of the start speed data during extinction yielded a reliable delay effect ($F = 8.02$; $df = 2/21$; $p < .01$). Multiple comparisons indicated that Group 10 was starting faster than either Group 10D or D10 ($p < .01$ in both cases).

Analysis of the run speed data during extinction yielded a reliable delay effect ($F = 3.54$; $df = 2/21$; $p < .05$) and a reliable delay by trials interaction ($F = 4.70$; $df = 8/84$; $p < .01$). Multiple comparisons indicated that Group 10 was running faster than either Group 10D or D10 ($p < .05$ for Group 10D vs. Group 10; $p < .07$ for Group D10 vs. Group 10). This can be seen in the right hand portions of the graphs.

A reliable difference between groups was obtained when trials to criterion were analyzed ($F = 8.33$; $df = 2/21$; $p < .01$). Multiple comparisons indicated that Group 10D had reliably fewer trials to criterion than either Group 10 or D10 ($p < .01$ in both cases). The fact that Groups 10D and D10 differed in trials to criterion but not in start or run speeds during extinction may

indicate that the two measures are not really comparable.

Discussion

The present study replicates the major acquisition results of the Fehrer study. Post-reinforcement delay has no differential effects on acquisition, when compared to immediate reinforcement, while pre-reinforcement delay substantially retards running speeds during acquisition. The results found during extinction, however, do not agree with Fehrer's. The results of the present study indicate a substantial decrease in resistance to extinction for the delay groups.

An aftereffects position (Capaldi, 1958) would of necessity predict increased resistance to extinction for both delay groups since they both have the after-effects of non-reinforcement present on all acquisition trials. The discrimination hypothesis would make a similar prediction since both delay groups have experiences during acquisition which are more similar to extinction conditions than the immediate (Group 10) group.

There seems to be support for a secondary reinforcement position (Denny, 1946). The post-reinforcement delay may provide an opportunity for the extinction of the positive secondary reinforcement cues found in the goalbox, as might the pre-reinforcement delay. Because there may be no frustration occurring during the post-reinforcement delay period since reinforcement has occurred, the Amsel (1958) frustration hypothesis could also handle these data adequately.

References

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Notes

1. This work was completed during the author's tenure on an NIH predoctoral fellowship. A fuller version was read at the annual meeting of the Midwestern Psychological Association, Chicago, 1966.
2. Presently at Texas Technological College.