Spontaneous recovery and partial reinforcement effects in the runway¹

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Following four days of 100% or 50% reinforced acquisition training on a runway with secondary reinforcement minimized, rats were given two successive days of extinction training. The results revealed both superior resistance to extinction and greater spontaneous recovery by the 100% group. It was suggested that the reversal of the partial reinforcement effect might be attributed to the differential amount of spontaneous recovery, reduction in secondary reinforcement, or both.

At the present time very little is known about the effect of partial reinforcement on spontaneous recovery. The few studies available have reported divergent results (e.g., Froese & Grant, 1961; Hartman & Grant, 1960, 1962; Lauer & Estes, 1955; Lewis, 1956; Notterman, Schoenfeld, & Bersh, 1952; Perkins & Cacioppo, 1950). This experiment was designed to secure additional data regarding this problem in a runway where the number of acquisition and extinction trials were held constant for the two conditions of reinforcement.

Method

Ss were 20 naive male albino rats of Holtzman strain, 87 to 117 days old. The apparatus was a Hunter Animal Runway with the following modifications: the walls of the alley were lined with unpainted Masonite, a larger (12 in. wide, 9 in. high, and 16 in. long) black starting box, and a longer (12-1/2 in.) black goal box were substituted for the standard starting and goal boxes. The starting box was separated from the alley by two Plexiglas guillotine doors, the first translucent and the second transparent. A measure of starting time from the opening of the second door until the breaking of a light beam located 6 in. down the alley was obtained from a Hunter Silent Klockounter activated by a silent relay photo cell. In an effort to minimize secondary reinforcement, a separate food compartment (a 4 in. extension of the goal box) was located 1/8 in. beyond an unpainted Masonite guillotine door at the end of the goal box. This door was closed at the beginning of each trial and raised on all reinforced trials after Ss entered the goal box. The food compartment was all white and contained a white coaster from which S obtained one 45 mg. Noyes Lab Pellet through an opening 1-1/2 in. in diameter located 3/4 in. from the floor in the center of the white wall between the goal box and the food compartment.

Procedure

Ss were put on a 22 hr. maintenance schedule of 9 gm Purina Lab Chow for five days prior to their first session and handled 3 min. daily. On the fourth day each

S was fed 10 pellets in a neutral box before receiving his daily ration; on the fifth day each S was placed in an unpainted training alley for 10 min. and then removed to the neutral box and fed 10 pellets before being returned to his home cage for the daily ration. Ss were fed Purina Lab Chow for 1 hr. in individual home cages 30 min. after each experimental session. Water was available in the home cages at all times.

During each of the first four daily experimental sessions Ss were given 16 acquisition trials with 10 Ss receiving reinforcement on each trial and 10 Ss receiving reinforcement on half of the trials according to a restricted random pattern. Retracing was prevented by lowering the transparent Plexiglas goal box door when S had entered the goal box. On each trial S was allowed to remain in the goal box 10 sec. and was then placed for 20 sec. in a neutral box. On the fifth day of experimental training each S was given 30 extinction trials with the same intertrial procedure, except that Ss failing to enter the goal box in 2 min. were removed to the neutral box for 20 sec. before being placed in the starting box for the next trial. On the following day, extinction trials were continued to a criterion of failure to leave the starting box in 2 min., or for 30 trials.

Results and Discussion

All time measures were converted to speed scores by a reciprocal transformation and the median of each block of five trials was determined. This data was transformed to provide a measure of the relative rate of extinction with unity and zero based upon the reciprocals of the medians of each individual S's last five acquisition trials and the last five extinction trials, respectively (see Logan, Beier, & Kincaid, 1956; Anderson, 1963).

During the first three days of acquisition the 100% group displayed superior performance, but by the fourth day there was no difference between the two groups (median of median starting speed for the last five trials was 1.25 for the 50% group and 1.21 for the 100% group). The 50% group showed superior performance during the first half of Day 1 extinction but the 100% group performed at a higher level during the later stages of extinction. An analysis of the total trials required to reach the extinction criterion on Day 2 indicated a decided superiority in resistance to extinction by the 100% group ($z = 3.32$, $p < .001$). All Ss in the 50% group reached the criterion of extinction while only them of the 10 Ss in the 100% group reached the criterion.

Two indices of spontaneous recovery were employed. The median relative starting speed on the last five

trials of Day 1 extinction of each S was subtracted from (a) the median relative starting speed on the first five trials of Day 2 extinction and from (b) the relative starting speed of Trial 1 on Day 2 extinction. Both measures indicated more spontaneous recovery for the 100% reinforced group and the following values were obtained for the two respective measures using a rank test for two independent samples: $z=1.98$, $p<.05$; $z=2.72$, $p<.01$.

While it may be concluded that the reduction in secondary reinforcement in the end box for the 50% reinforced group led to a reversal of the PRE, the differential amount of spontaneous recovery may well have contributed to this reversal. The results of this study also indicate that the introduction of partial reinforcement results in a reduction of spontaneous recovery, which suggests that studies on the PRE may be confounded when extinction trials are not completed in one session.

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Note

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