The effects of N-R transitions under extended training conditions on resistance to extinction¹

T. N. TOMBAUGH,² Carleton University, Ottawa 1, Canada

Two sequences of reinforced (R) and nonreinforced (N) trials were employed with extended acquisition training using rats as Ss. One sequence contained one N-R transition, while the other contained two N-R transitions. No differences were obtained in acquisition. In extinction, the sequence containing two N-R transitions produced greater resistance to extinction than did the pattern that contained only a single N-R transition. The results were discussed in relation to Capaldi's modified aftereffects theory.

Capaldi (1966) concluded, in his review of the partial reinforcement literature, that acquisition and extinction performance are influenced by the pattern or sequence of reinforced (R) and nonreinforced (N) trials that occurs during acquisition. One sequential variable that has been shown to be important is the number of times a nonreinforced trial precedes a reinforced trial. This variable is usually referred to as the number of N-R transitions. Resistance to extinction (Rn) has been demonstrated to be an increasing function of the number of N-R transitions when relatively few (35 or less) acquisition trials are used (Capaldi & Hart, 1962; Capaldi, Hart, & Stanley, 1963; Capaldi & Spivey, 1963; Capaldi &

Wargo, 1963; Spivey, 1967; Spivey & Hess, 1968; Spivey, Hess, & Black, 1968).

However, only two studies have been able to show that the number of N-R transitions is an important variable in determining Rn when an extended number of acquisition trials are employed. Koteskey & Stettner (1968) and Spivey, Hess, & Klemic (1968) have demonstrated that Rn is directly related to the number of N-R transitions. Since both studies employed similar training conditions (one and zero N-R transitions), it is possible that the reported relationship may be restricted to the specific instance where one of the treatment conditions must contain zero N-R transitions. Thus, one purpose of the present study was to determine if similar results could be obtained when the fewest number of N-R transitions that occurred within a sequence was greater than zero. The present design incorporated two different partial sequences that contained either one (RNRRRN) or two (RNRRRNRR) N-R transitions.

A second purpose was to examine the influence of the number of N-R transitions on extinction performance when an extended number of extinction trials were used. Since both of the previous studies presented data over only a relatively few number of extinction trials, the permanency of the effect is, as yet, undetermined. Such a determination was

considered important since Gonzalez & Bitterman (1964) have demonstrated that different partial reinforcement effects may occur during early and late extinction trials.

SUBJECTS

The Ss were 16 female albino rats of the Sprague-Dawley strain. They were purchased from the Holtzman Company, Madison, Wisconsin, and they were approximately 90 days old at the beginning of the experiment.

APPARATUS

Eight experimental chambers were used. Each chamber was equipped with a retractable bar calibrated for a 10-g force requirement. A liquid reinforcing magazine was placed under the test cage and directly below the bar.

PROCEDURE

Upon receipt from the supplier, 16 Ss were maintained on ad lib food and water for 10 days. Six days prior to the beginning of the experiment, all Ss were placed on 23-h food deprivation. On each of the 2 days prior to the beginning of the experiment, 1 ml of 32% sucrose concentration was injected into a food cup that was placed in the home cage. This procedure was used to habituate Ss to the sucrose concentration that was used as reinforcement throughout the experiment. During 2 days of magazine training, eight reinforcements per day were presented with the magazine cycling every 45 sec. Reinforcement consisted of .12 ml of 32% sucrose. During bar-press training, the bar was introduced into the experimental cage for a maximum time of 45 sec. If the bar was pressed within this time, it retracted and the appropriate reinforcement condition occurred. If the bar was not pressed, it automatically retracted at the end of the 45 sec interval without any reinforcement occurring. In either case, whether retracted by a bar press or automatically, the bar remained retracted for another 45 sec. Each time the bar was presented, a new trial began. Eight trials per day were given for 27 days. The Ss were divided into two groups, each of which received a different sequence of reinforced and nonreinforced trials. Group 1 received the sequence RNRRRN, which contained one N-R transition, while Group 2 received the sequence RNRRRNRR, which contained two N-R transitions. The magazine did not cycle on nonreinforced trials. The trial sequence advanced each time the bar was presented. On the day following the last day of bar-press training, extinction began.

Fig. 1. Mean log latency in extinction for groups receiving one or two N-R transitions.

All Ss were given 100 extinction trials in a single experimental session. Conditions were the same as in bar-press training except that the magazine did not cycle at any time during extinction. Latency to the first bar press (bar-press latency) was recorded throughout the experiment. If S failed to bar-press, a maximum score of 45 sec was recorded. One S in Group 1 failed to acquire the bar-press response in 7 days and was dropped from the experiment.

RESULTS

All latency scores were transformed to logarithms of the scores + 1. An unweighted-means analysis of variance that was appropriate to a randomized group design with repeated measures was performed on the acquisition data averaged in 24-trial (3-day) blocks. Only the trial-block effect was reliable ($F = 56.33$, $df = 8/104$, $p < .01$). An analysis performed on the last trial block indicated that no differences existed between the groups at the end of training ($F = 1.16$, $df = 1/13$, $p > .2$). The mean log latency for each of the eight daily trials was computed for all 27 days of acquisition. Analyses of variance performed over these results failed to yield any reliable differences between the two groups on any of the daily trials ($p > .2$). Figure 1 shows the extinction results averaged in 10-trial blocks. A repeated-measures analysis of variance indicated that the superior performance of Group 2 was highly reliable ($F = 31.39$, $df = 1/13$, $p < .01$). A reliable Groups by Trial-Block effect ($F = 3.69$, $df = 9/117$, $p < .01$) was due to the fact that the performance of Group 1 rapidly deteriorated during the first 20 trials in comparison to Group 2, whose performance was relatively unchanged during the early part of extinction and which then gradually decreased. An analysis performed over the first 20 trials demonstrated that the differences observed between the groups were reliable ($F = 14.38$, $df = 1/13$, $p < .01$).

DISCUSSION

The results clearly demonstrate that Rn was greater for those Ss that received two

daily N-R transitions as compared with those Ss that experienced a single N-R transition. This relationship was evident early in extinction and remained relatively unchanged throughout the course of the prolonged extinction session. These results seriously question Capaldi & Lynch's (1968) statement that Rn is directly related to the number of N-R transitions only when a limited number of acquisition trials are used. The present findings show that Rn also increases as the number of N-R transitions increase when extended training conditions are employed. The similarity of results obtained in the present study, which used two and one N-R transitions, and those reported by Koteskey & Stettner (1968) and Spivey, Hess, & Klemic (1968), which compared one and zero N-R transitions, demonstrate that the effect is not contingent upon using zero N-R transitions as one of the treatment conditions. The precise conditions under which the number of N-R transitions will influence Rn cannot be determined from the present study but must await future research. However, on the basis of previous evidence, it might be expected that, in the case of extended training, the number of N-R transitions will influence Rn only when a limited number of transitions are used within a daily experimental session and/or when a relatively long N-length (number of nonreinforced trials immediately preceding a reinforcement) occurs. This latter variable has been shown to be a particularly powerful variable in determining Rn with extended training (Capaldi, 1964, 1966) and probably was one of the major variables influencing the results of the present study.

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NOTES

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2. Requests for reprints should be sent to Tom N. Tombaugh, Department of Psychology, Carleton University, Ottawa, Ont., Canada.