Recovery following extinction of a locomotor response

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Albino rats were given acquisition training in a runway with either consistent delay or partial delay of reward. Following a subsequent extinction series, delay of reward was reinstated resulting in a performance increase for the animals previously given partial delay training but not for animals given consistent delay training. The results were discussed in terms of a modified aftereffects position.

Recently, a modified version of the stimulus aftereffects position has been employed, interpreting extinction phenomena in terms of generalization decrement without reference to weakening of the original S-R connection. This position has been termed the stimulus specificity hypothesis (Capaldi, 1966), and states that each condition of reward and nonreward produces a distinctive internal stimulus consequence or aftereffect. These aftereffects are assumed to lie on a stimulus continuum as shown in Fig. 1.

Thus, from left to right, the aftereffects shown are those of reward (S^R), of delay of reward (S^D), and of nonreward (S^N).

If an intermixture of delayed and immediately reinforced trials is given during acquisition, each condition is assumed to give rise to specific aftereffects (S^D and S^R , respectively) which persist or are evoked on the following trial and may become conditioned to the locomotor response. Increments of habit strength, accrued to a particular S^R or S^D value in training, may then generalize along the stimulus continuum. In extinction, all trials are nonreinforced, resulting in the aftereffect of nonreward (S^N), and any continued responding is assumed to be governed by generalized habit strength from the training stimuli, S^R and S^D . Nonreinforced trials in extinction, moreover, are assumed to result in S^N values (S^{N1} , S^{N2} , S^{N3}) progressively further out the continuum and eventually out of the zone of generalized habit, resulting in response decrement. It follows from this position that the training stimuli, S^R and S^D , maintain their original habit loadings; thus, if after extinction of the response is complete and the original training stimuli were to be reinstated, immediate recovery of the response should result.

In the present investigation, two conditions were established in acquisition. One group (Group PD) received an intermixture of immediately reinforced and 60 sec delay-of-reinforcement trials such that a delayed trial, resulting in the aftereffect of delay (S^D), was always followed by an immediately reinforced trial. Conditioning of S^D to the locomotor response should

thus occur and, with repeated trials, generalize along the stimulus aftereffects continuum. A second group (Group CD) received 60 sec delay of reinforcement on all trials of acquisition and, although each trial should result in S^D , minimal conditioning, if any, should occur, since the time interval separating the locomotor response and reward is large. Wike & Kintsch (1959) found essentially no acquisition for a consistent 20 sec delayed reward group. Further, Poyner (1965) found no difference between groups given consistent 30 sec delay of reward and consistent nonreward. Thus Group PD should, during acquisition, develop habit strength for S^D , while Group CD should not.

On the basis of the above assumptions, it was predicted that following an extinction series, during which both groups would experience response decrement, reinstatement of the acquisition conditions of 60 sec delay would result in an immediate performance recovery for Group PD, having had S^D previously conditioned, but should not similarly affect Group CD.

Procedure

The Ss were 20 albino rats, 90-100 days old, obtained from the colony maintained by Trinity University. They were randomly assigned to two groups of 10 each. The apparatus was a gray straight-alley runway 60 in. long, 5 in. wide, with 9 in. high sides, covered with hardware cloth. The initial portion of the alley was an 8 in. floor treadle which, when depressed by the weight of the rat, started a clock calibrated to .01 sec. The clock was stopped by the breaking of a photobeam 2 in. from the end of the alley and 1 in. in front of a brass, 1 in. x 1 in. x 3-3/4 in. food cup covered by a sliding lid which opened automatically either immediately upon the breaking of the photobeam or after a 60 sec delayed interval. On all reinforced trials (acquisition and recovery), the reinforcement consisted of six .045 g Noyes pellets. A manually lowered guillotine door 12 in. in front of the goal compartment served to confine S to the goal area.

On Day 1, Ss were placed in individual living cages and 23 h food deprivation began. On Days 4-6 Ss were handled and tamed. Training on Days 7-9 consisted of two immediately reinforced goal box placements for each

Fig. 1. Stimulus aftereffect continuum.

Fig. 2. Mean reciprocal running time for each group on each day of acquisition, extinction, and recovery.

animal. On Day 10 all animals were given one immediately reinforced runway trial.

The 12 days of acquisition training (three trials per day) began on Day 11. Group CD received consistent delay of reinforcement while Group PD received an irregular 67% schedule of immediate reinforcement—two immediately reinforced and one delayed trial per day, such that the delayed trial was always followed by an immediately reinforced one. Following acquisition, eight days of extinction (three trials per day) were given with 60 sec nonreinforced goal box confinement. Following extinction, five days of recovery were given during which both groups received 60 sec delay of reinforcement on all trials.

Results

In Fig. 2 is plotted the mean reciprocal running time for the two groups over the last two trials for each day of acquisition, extinction, and recovery. Trial 1 data was excluded from all analyses since Trial 1 performance should be governed by aftereffect from the previous day and perhaps by other factors. Differences in performance between groups over the last three days of acquisition were significant ($F=104.67$, $df=1/18$, $p<.001$) as were differences over the last two days of extinction ($F=7.58$, $df=1/18$, $p<.05$).

Since terminal extinction differences occurred, comparisons were made between Day 8 of extinction and Day 1 of recovery for each group. The performance of Group PD increased significantly in the recovery phase ($F=9.94$, $df=1/9$, $p<.025$) while that of Group CD did not ($F<1$).

Discussion

The increase in performance for Group PD in the recovery phase is consistent with the stimulus specificity position held by Capaldi, and would appear to indicate that extinction progressively results in a stimulus situation greatly changed from that present

during acquisition. Thus, when stimuli similar to those conditioned in acquisition are reinstated following extinction, response strength is reflected in performance increase. In so far as little or no conditioning of S^D can be assumed in acquisition for Group CD, no performance increase results when S^D is reinstated.

Although running speed on the first trial following reinstatement of delay in the recovery phase provides an adequate test of the hypothesis, 14 additional trials, over five days, were given. Consistent delay, resulting in no habit decrement but with repeated delay trials yielding a progressive stimulus change, S^{D1} , S^{D2} , S^{D3} , etc., along the continuum toward S^N , should result in decrement during the recovery phase for Group PD. The data would appear to support this trend. It should be noted that the recovery phase, with repeated long-delay trials, cannot be considered a reacquisition phase, since no learning took place (as exemplified by Group CD in the acquisition phase). Thus the performance increase seen in Group PD during the recovery phase would seem to indicate that extinction represents a stimulus change with corresponding generalization decrement rather than habit decrement. Reinstatement of acquisition stimuli during the recovery phase call out the locomotor response, but decrement in performance again occurs as delay stimuli in the recovery phase become decreasingly similar to those conditioned in acquisition.

References

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