Training, punishment and avoidance'

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Eighty albino rats learned active avoidance responses; 40 in a straight alley and 40 in a Skinner box. Then each group was separated into subgroups of 20 each and tested under these conditions: (a) 20 Ss in each apparatus underwent regular extinction, and (b) 20 Ss in each apparatus were given experimenter-produced punishment with Ss responses producing only CS termination. Condition (a) Ss responded at reduced levels on succeeding trials, and served as control Ss. Condition (b) continued responding at the maximal level throughout the testing phase despite the continuation of the US after the CR.

Mowrer (1960) pointed out that fear often leads to long-lasting and maladaptive kinds of behavior, e.g., Kamin (1957) found that animals would learn an "avoidance" response simply to terminate a fear arousing conditioned stimulus, even though the response did not terminate the painful US. Church (1963) points out that there is evidence that in many instances extinction occurs very rapidly when the conditioned response produces punishment.

The present experiments were designed to answer the question: "If an organism had previously learned to respond to a CS in order to avoid a noxious stimuli, i.e., has gone through a previous avoidance conditioning phase, at what level will the animal perform if it is placed in a situation in which both the CS and the noxious stimulus are presented and his response terminates only the CS but not the noxious stimulus?"

Apparatus 1

Subjects. Forty 90-100 day old female albino rats of the Sprague-Dawley strain were used as Ss.

Apparatus. A straight alley with one foot at each end separated by a guillotine door to provide a start box and goal box was used. The first response measure (start time) was taken from the opening of the start door until the first photo cell, 1 ft. away, was activated. The second measure (run time) was the time taken by the S to run from the first to a second photo cell (2 ft.). A 60 dB 110 V ac buzzer and a .50-mA constant current dc shock served as CS and US.

Training. The 40 Ss were trained to avoid the shock to a criterion level of seven avoidances in 10 trials. The CS-US interval was 5 sec.; entry into the goal box turned the CS off and terminated the shock if the time was greater than 5 sec., and a time of less than 5 sec. resulted in an avoidance of shock. Each S was run five trials a day with a mean intertrial interval of 4 min. within any day.

Testing. The 40 Ss were randomly divided into two groups of 20 each. The shock group (S) was given 30 trials with the CS and US presented simul-

taneously where goal entry terminated only the CS. The US remained on for 8 sec. after the response. Then S was removed and placed in the home cage for a mean intertrial interval of 4 min. The no-shock group (NS) was given 30 trials with only the CS present. Goal entry terminated the CS after which S remained in the box for 8 sec.

Although it appears that the latencies of the no-shock Ss are much longer than those of the shocked Ss, none of the variables used with the start measure produced significant effects. The overall group means were not different ($F=2.91$, $df=1/38$); the mean latencies across trials did not differ ($F=1.61$, $df=5/190$); and the groups by trials interaction was not significant ($F=1.54$, $df=5/190$). The "punishment" neither inhibited the start response nor enhanced it.

The running speed data show that shock had the effect of producing faster running ($F=21.01$, $df=1/38$); but there was no significant change over trials ($F=1.81$, $df=5/190$); and there was no significant groups by trials interaction ($F=1.81$, $df=5/190$). The "no-shock" group ran quickly enough to enter the goal box in fewer than 5 sec. on the average. The "shock" group ran very fast and showed no indication of trying to adopt a different response, such as standing on one leg, to escape the shock. Ss continued to run through the shock and into the goal box where shock continued for 8 sec.

Apparatus 2

Subjects. Forty 90-100 day old female albino rats of the Sprague-Dawley strain were used as Ss.

Apparatus. A 12 in.³ Skinner type box that had a bar manipulandum and grid floor was used. A 60 dB 110 V ac buzzer was attached to a shock scrambler

Fig. 1. Mean start and run latencies across trials for the shock and no shock groups.

Fig. 2. Mean times and mean bar presses across trials for the shock and no shock groups.

10 in. from the box. A .50-mA constant current shock was provided through the scrambler.

Training. The 40 Ss were trained to avoid the shock to a criterion level of seven avoidances in 10 trials. The CS-US interval was 5 sec. The Ss learned to press the bar which terminated the CS and US if the latency was greater than 5 sec., or precluded the US presentation if the latency was less than 5 sec.

Testing. The 40 Ss were randomly divided into two groups of 20 each. One group (S) was given 30 trials with the CS and US presented simultaneously where a bar press response terminated only the CS. The US remained on for 8 sec. after the response. The other group (NS) was given 30 trials with only the CS. A bar press terminated the CS after which S remained in the box for 8 sec.

Results

The shocked rats pressed the bar at a much higher level than did the non-shocked rats. The number of bar presses decreased over trials for both groups. A mixed design analysis of variance showed that the overall group means were significantly different ($F=47.87$, $df=1/38$); the number of responses was different over trials ($F=11.38$, $df=5/190$); but the groups by trials interaction was not significant ($F=1.12$, $df=5/190$). Although the number of bar presses decreased over trials for both groups, the Ss were still responding after the 30 trials.

The latency data are consistent with the bar press data. The shock group Ss maintained a low latency throughout while the non-shock Ss gradually increased the time taken for the first bar press. The analysis of variance showed that the overall group means

differed ($F=10.44$, $df=1/38$); performance changed over trials ($F=7.31$, $df=5/190$); and the performance changes over trials differed for the two groups, i.e., the groups by trials interaction was significant ($F=7.14$, $df=5/190$).

Even though the mean number of bar presses made by the Ss in the two groups differed on the first trial block, the latency of the first bar press was nearly the same. Judging from the relatively constant first-response latency and the decrease in number of bar presses over trials, the later responses (those nearest the reinforcement in time) were the first to drop out. The no-shock group on the other hand showed a steady increase in the latency of the first bar press, but continued to press the bar throughout the 30 trials.²

Discussion

The alley start times and the bar press latencies look somewhat similar in that the shock groups respond quickly and maintain a quick response across trials. The no-shock groups gradually increase their latencies across trials. After an avoidance response has been learned, it continues for a long time.

The behavior of the shock groups is more complex. The Ss experience the CS and shock simultaneously; the well-learned avoidance behavior operates and the response is made—quickly. However, the response, which had previously led to CS and US termination, now terminates only the CS—the shock continues for 8 sec. The reinforcement situation is complex—CS termination provides immediate secondary reinforcement (fear reduction), and the US termination, after 8 sec., provides delayed primary reinforcement (pain reduction). The delay is quite long, the Ss exhibit a great deal of overt signs of agitation and excitement (fear arousal after the original fear reduction contingent on CS termination). However, the latency data show that no response inhibition occurs, but rather, Ss maintain a low latency of responding.

References

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Notes

1. Supported in part by Grant MH-10020-01 from National Institutes of Health.
2. Essentially the same results were reported by Bruning, Becker and Tucker (1965) where a five part response chain was conditioned and later extinguished.