"Conditioned anticipation" with an extinction base-line: The need for a disinhibition control group

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A stimulus was presented to rats lever-pressing on VI extinction and was found to produce increases in response rate regardless of whether the stimulus was neutral or had been previously paired with food in a Pavlovian conditioning paradigm. This facilitative effect of a neutral stimulus (operant disinhibition) suggests a possible artifact in experiments by Estes and demonstrates the need for a disinhibition control group in such studies.

Estes (1943, 1948) found that when an originally neutral stimulus was repeatedly paired with the presentation of food in a Pavlovian conditioning paradigm, the stimulus (CS) would exert discriminative control over an operant response. Specifically, rats trained to lever-press for food and then placed on extinction were found to press more often in the presence of the CS than in its absence, although the response had never been associated with the CS. This finding, taken to indicate a state of "conditioned anticipation" in the organism, is logically parallel to the phenomenon obtained with the more familiar CER technique (Estes & Skinner, 1941), in which a stimulus paired with shock decreases the rate of responding in a food-reinforcement operant situation.

Although the Estes experiments claim to demonstrate the conditioned anticipation phenomenon, there is an important control group lacking which makes this interpretation questionable. Brimer (1963; Brimer & Kamin, 1963) has found that the mere presentation of a stimulus will increase the rate of a food-reinforced operant, if the rate has been previously reduced through extinction or other means. Brimer has termed this phenomenon "operant disinhibition." Because Estes presented the CS during extinction, the resulting increase in response rate may have been due to disinhibition of this kind rather than to conditioned anticipation. The present study evaluates this possibility.

Subjects and Apparatus

The Ss were 20 male hooded rats, experimentally naive and 150-250 days old at the start of the study. They were maintained on a 23-hr. food deprivation schedule and at 80-85% of their ad lib body weights throughout the experiment.

The apparatus consisted of four modified Skinner boxes equipped with retractable levers and housed in sound-attenuating chambers. Two of the boxes delivered solid reinforcement (45 mg sucrose pel-

lets) and two liquid (.04 ml of a 50% solution of condensed milk). The magnitudes of these two kinds of reinforcement had previously been adjusted to produce approximately the same rate of lever-pressing. In each of the two experimental groups, half of the Ss always received solid reinforcement, and half liquid. A 50-W light mounted in the outer chamber surrounding each box served as the CS in Pavlovian conditioning.

Procedure

Stage 1-VI training. On Day 1, S was placed in the Skinner box with continuous reinforcement in force until 100 responses were accumulated. From Day 2 through Day 9, each S received a daily 1-1/2 hr. session during which a VI-2.5 schedule was in effect. Except for Days 1 and 2 (when a 5-W house light was on), Ss were trained in complete darkness. Day 8 of VI training served as the pre-test day; during this session the CS was presented alone to observe the unconditioned effects of the CS on reinforced lever-pressing. For Day 1 through Day 9, the levers extended into each box.

Stage 2-Pavlovian conditioning. On Days 10 through 12, the levers were retracted from the boxes and each S in Group I (N=12) received a total of 30 Pavlovian conditioning trials, 12 on Day 10, and nine each on Days 11 and 12. On each of these trials, CS was presented for 30 sec. and terminated with the delivery of food to the magazine. The trials on each day were distributed over a 1-1/2 hr. session. Ss in Group II (N=8) constituted the random control group. They received the same treatment as the Ss in Group I with one exception: only a random correlation obtained between the 30 presentations of the CS and the 30 deliveries of food to the magazine. Rescorla (1966) has argued that such a random group is a more appropriate control for non-associative effects (e.g., sensitization) in Pavlovian conditioning paradigms than the more commonly used backward-conditioning group. In the random sequence employed here for Group II, food presentation followed CS termination by an average of 3-1/2 min. (with a range of 20-640 sec.).

Stage 3-Testing. On Day 13, the levers were returned to the boxes and all Ss received an additional session of VI training. On Day 14, all Ss were placed on VI extinction for the first time. Over the course of the 1-1/2 hr. extinction session, the CS was pre-

sented alone four times at 15 min. intervals. Each such presentation lasted for 2 min. Print-out counters recorded the number of responses during each CS presentation and during the 2 min. immediately preceding it.

Results

Of the 12 Ss in Group I, 11 made more responses during the 8 min. spent in the presence of the CS than they made during the 8 min. preceding CS presentation. The mean "enhancement" ratio (responses during CS/responses during + responses preceding CS) was .75. This ratio is significantly greater than .5 ($t=4.35$, $df=11$, $p<.01$), indicating that the rate of responding was indeed enhanced by CS presentation. A similar trend was obtained for Group II, the random control group. Of the eight Ss in Group II, seven showed a similar enhancement of rate during the "CS." The mean enhancement ratio for this group was .63, again significantly greater than .5 ($t=2.37$, $df=7$, $p<.05$). The difference between the two mean ratios was not significant ($t=1.46$, $df=18$, $p>.10$). All the above statistical comparisons are two-tailed.

The effect of the CS presented on the extinction baseline was opposite to that found on the pre-test day, when the light CS presented alone on the reinforced VI baseline was found to decrease responding for all Ss in both groups.

Discussion

The results indicate that the rate of an operant during extinction can be increased by the presentation of a neutral stimulus thus confirming previous results (e.g., Horns & Heron, 1940; Brimer, 1963).

We could not find evidence for conditioned anticipation; while the difference in the mean enhancement ratios of our two groups was in the right direction, it fell quite short of significance. Of course, this hardly proves that conditioned anticipation could not occur under these conditions. It does indicate, however, that there is a possible artifact in studies that test for this effect using an operant baseline undergoing extinction (e.g., Estes, 1943, 1948). If such a baseline is utilized an operant disinhibition control group is indispensable.

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