A failure to obtain "Hudson's effect" following one-trial discriminated avoidance training

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Rats learned to avoid the illuminated wall of a conditioning box when illumination of the wall by a bar press was followed by foot shock as S retrieved the food pellet. Extending the duration of the illumination beyond shock onset failed to produce greater avoidance, in contrast to the results of Hudson (1950).

Hudson (1950) reported the first one-trial avoidance learning experiment conducted with rats. Food deprived rats were shocked as they ate from a food cup mounted on a black and white striped Bakelite square. The Ss displayed less avoidance of the square if it was removed immediately after shock than if it remained for 4 min after shock. Despite the obvious importance of Hudson's finding for learning theories, his work has received very little attention, quite possibly because of the subjective measures of avoidance used. Confirmation of Hudson's effect would also be of importance to the evaluation of experiments in which presumed amnestic agents, such as electroconvulsive shock (ECS), follow learning. Since in both Hudson's procedure and ECS experiments the stimulus situation is abruptly changed following punishing shock, it may be that ECS interferes with learning rather than memory.

EXPERIMENT 1

The first experiment reports the development of a one-trial discriminated avoidance conditioning procedure. Unlike Hudson's (1950) procedure, the technique provides quantitative and objective measures of avoidance. It is also superior to another one-trial discriminated avoidance procedure developed in our laboratory (Beaumaster & Suboski, 1967) in that the discriminative stimulus is identifiable and controllable and generalized suppression produced by foot shock is extinguished prior to testing.

Method

Subjects. The Ss were 13 male hooded rats, weighing 250-300 g at the beginning of the experiment.

Apparatus. The apparatus consisted of a conditioning box, 9 x 11-1/2 x 8 in., with three sides of unpainted plywood, top of Plexiglas and floor of 1/8 in. steel grids, 1/2 in. on center. The fourth wall, opposite the bar, contained a clear Plexiglas food chamber mounted at the bottom of the 6x6 in. square of clear Plexiglas that formed the major part of the wall. The outside of the wall and food chamber were covered with a light coat of white paint. The light beam of a slide projector was focused on the translucent wall panel from a distance of 2 ft. A Gerbrands pellet feeder mounted on top of the box delivered a .045 g Noyes pellet through a clear plastic delivery tube for each bar press. A timing mechanism rendered the bar inoperative for 9 sec following each bar press.

Procedure. The Ss were first trained to bar press in an ordinary Grason-Stadler conditioning box and then given 10 daily sessions of approximately 25 reinforcements each in the special conditioning box with the wall unilluminated. The Ss were fed for 1 h after each session throughout the experiment. The translucent wall was illuminated by the slide projector beam at the 11th bar press of the following session and a .5 sec, 5 mA scrambled shock delivered through the grid floor to six Ss (Experimental Group) when they put their noses into the food chamber. The other seven Ss (Control Group) received the light stimulus but not shock. After 60 sec further exposure to wall illumination, S was removed. The Ss were reinforced for bar pressing in two additional sessions with the wall unilluminated. On the third posttreatment session, 5 min of bar pressing was followed by a 20 trial Gellermann series with the wall illuminated for 9 sec following half of the bar presses and unilluminated for the other half. Pellets not retrieved within 9 sec were manually dropped out of the bottom of the food chamber.

Results

Figure 1 presents the percentage of pellets not retrieved with 9 sec for the test session. Only one of the seven Ss in the Control Group had a greater percentage of unretrieved pellets on light trials than on dark trials, whereas five of the six Experimental Ss showed such differences. This difference is significant by Fisher's exact test ($p < .05$).

EXPERIMENT 2

Method

Subjects. The Ss were 32 male hooded rats, weighing 250-300 g at the beginning of the experiment.

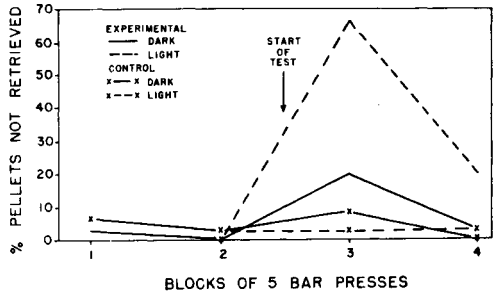

Fig. 1. Percentages of unretrieved pellets in the test session.

Procedure. The apparatus and training procedure were as described in Experiment 1 except that four rather than 10 training sessions were used. For one group of eight Ss (60 D), the treatment session was identical to the Experimental Group of Experiment 1, with the wall remaining illuminated for 60 sec after shock. Two other groups of eight Ss were treated similarly except that for one group (10 D) the light was extinguished 10 sec after shock, and for the other group (OD), the wall remained illuminated only until shock onset. The fourth group (SC) was shocked but not exposed to the wall illumination. Following three sessions of bar pressing with the wall unilluminated, two test sessions were conducted. Each session consisted of 12 bar presses followed by six test trials with the wall illuminated for 9 sec following the bar press. Each test trial was randomly located within a block of three trials in which the wall was not illuminated. Retrieval latency was measured by stop watch and pellets not retrieved within 9 sec were removed.

Results

Figure 2 shows the proportions of the pellets that were not retrieved. The three groups that reveived both light and shock all demonstrated a high and approximately equal level of discrimination, while Group SC avoided the light stimulus only in the first trial block. Analysis of variance of the overall differences between proportions of pellets unretrieved to the light and dark stimuli indicated a significant difference among groups ($F = 5.97$, $df = 3/28$, $p < .01$). Duncan's multiple range test indicated that each of the light-shock groups differed from Group SC ($p < .05$) but did not differ among each other.

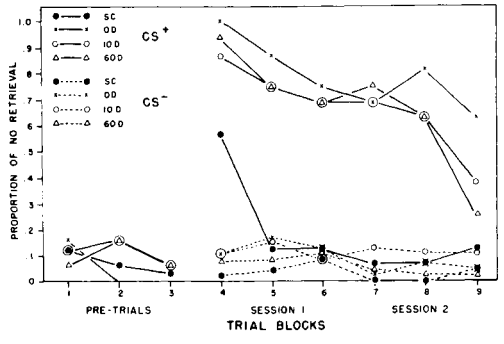

Fig. 2. Proportions of pellets not retrieved in the test sessions. Proportions are for blocks of three light trials and nine dark trials. Pre-trials of the second test session are omitted.

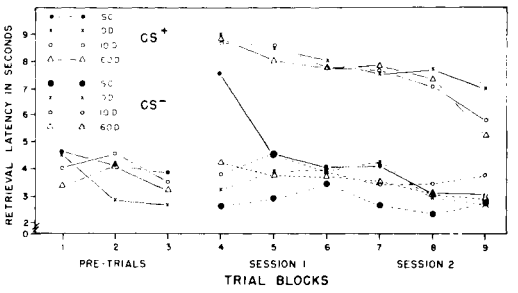

Fig. 3. Mean latency of pellet retrieval in the test sessions.

Figure 3 presents mean retrieval latency. The latency effects were highly similar to the proportions and analysis of variance of retrieval latencies to the light stimulus yielded similar results. The groups differed significantly ($F = 7.46$, $df = 3/28$, $p < .01$), and Duncan's test indicated that only the difference between each of the light-shock groups and Group SC were significant ($p < .05$).

DISCUSSION

The results of these experiments show that rats can learn to avoid a discriminative stimulus in one trial. However, the results do not support Hudson's (1950) finding of greater avoidance of a stimulus present after shock. The slight effects of delaying the offset of the discriminative stimulus were in the opposit direction from Hudson's results but were in the direction that would be expected from backward conditioning or extinction. Our procedure differed considerably from those of Hudson (1950) and our failure to find his effect may lie in these differences. One outstanding difference should be identified. Hudson's Ss were shocked after a long period of exposure to the discriminative stimulus whereas our Ss were shocked very shortly after initial exposure to the discriminative stimulus. However, in later pilot work involving long exposure to the light before shock, we were unable to obtain any discrimination at all.

References

BEAUMASTER, E., & SUBOSKI, M. D. A one-trial discriminated avoidance conditioning technique. Presented at Canadian Psychological Association meeting, Ottawa, May, 1967.

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Note

1. These data were reported at the Canadian Psychological Association meeting, Ottawa, May, 1967. This research was supported by grants from the Medical Research Council of Canada and the Ontario Mental Health Foundation, Grant No. 161.