

Preexposure to the UCS affects avoidance conditioning

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Four groups of hooded rats received 100 trials of avoidance training per day for 10 days in a four-way shuttlebox. The animals were assigned to experimental groups as follows: Group 1 received 25 escape trials immediately preceding avoidance training on Day 1. Group 2 were placed in the chamber on Day 1 for the equivalent time required for escape pretraining. Group 3 animals were exposed to the 25 escape trials on the day preceding the beginning of avoidance training. Group 4 received avoidance training only. All groups acquired the avoidance response to a similar level in the first two sessions. Significant group effects [$F(3,20) = 14.36, p < .01$] were seen, with the performance of Group 1 decreasing on Day 3 and remaining lower over the 10 days of the experiment. Thus, a delayed long-term interference effect was found when escape pretraining immediately preceded avoidance training.

The effects of preexposure to electrical shock upon avoidance learning are not simple. In previous studies using pretreatments of inescapable or escapable shock, inescapable shock groups have been found unable to develop an escape response. Such "learned helplessness" has been demonstrated in both dogs (Overmier & Seligman, 1967; Seligman & Maier, 1967) and rats (Seligman & Beagley, 1975). The effect has been seen to dissipate after a 48-h period (Overmier & Seligman, 1967), and it is thought to be due to a disruption in central nervous system monoamine activity (Weiss, Glazer, & Pohorecky, 1976).

A second type of interference has been found to persist after 7 days in inescapably shocked animals. This effect is thought to be learned, due to its persistence over time (Glazer & Weiss, 1976a, 1976b).

Studies using escapable shock have reported less consistent effects. Lord, King, and Pfister (1976) proposed that different mechanisms were involved in escape and avoidance behavior in rats given chronic peripheral sympathectomy, since escape, but not avoidance behavior, was affected adversely. Mowrer and Lamoreaux (1946) had found evidence that avoidance responses are more easily learned when they are similar to escape responses than when the two required responses differ. However, Bolles (1969) found the primary requirement for rapid acquisition of an avoidance response to be its similarity to the animal's natural defense reactions. He also found that the avoidance response is not always facilitated when escape and avoidance behaviors are identical.

In the present study, pretraining of an escape response identical to the avoidance response was hypothesized to result in a positive transfer to later avoidance training,

facilitating this response. Also of interest were the long-term effects of this type of pretraining.

METHOD

Subjects

The subjects were 24 Long-Evans-derived rats 100-110 days old at the start of the experiment. These animals were individually housed and received food and water ad lib in their home cage throughout the study. The animals were kept on a 12:12-h light:dark cycle (on 6:00 a.m., off 6:00 p.m.). Half of each group were run in the a.m. (7:30 a.m. till 11:30 a.m.), and half in the p.m. (12:30 p.m. till 5:30 p.m.).

Apparatus

A shuttlebox similar to that first described by Meyer, Isaac, and Maher (1958), measuring 61 × 61 cm, with hurdles 5 cm high dividing the box into four equal quadrants, was used for both escape training and avoidance conditioning. The grid floor and the hurdle tops could be electrified (990 mW). A removable glass top 15 cm above the floor allowed viewing and transfer of the animals.

Continuous background lighting (<5 fc) was provided by a 15-W bulb in a reflective fixture facing the ceiling of the experimental room. The ambient sound level was 60 dB SPL (C scale) at the floor of the chamber. A doorbuzzer (85 dB C scale, at chamber floor) was mounted above the chamber top. A 200-W bulb for the CS was located 20 cm above the floor of the chamber. This additional lamp provided 210 fc at the floor and served as the CS. This apparatus and the following conditioning procedures have been used in our lab for many years (Gavin & Isaac, 1986; Isaac, 1964; Worthington & Isaac, 1967).

Procedure

All animals were given 100 avoidance conditioning trials per day for 10 days. Prior to each conditioning session, each subject was allowed a 5-min exploration period in the chamber. The trials began when the 200-W bulb above the shuttlebox was turned on. After a 4-sec period, the grid was electrified and the buzzer activated if the rat did not move from one quadrant of the box to any other. The CS was terminated if the subject completed the avoidance response in this period. If the response was not completed, both the CS and the UCS continued until the animal crossed a hurdle to a different quadrant. All the animals learned to cross the barrier to escape the compound UCS. The trials were presented on a VI 30-sec schedule with a range of 20 to 40 sec. Each animal was given a rest period of 10 min on completion of each session, before removal to the home cage.

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Four groups of 6 rats each were randomly assigned to different conditions of training, as follows: Group 1 received 25 escape trials on the day avoidance training began, immediately preceding the 100 avoidance conditioning trials. Group 2 spent an equivalent time in the box preceding the avoidance conditioning trials on the day avoidance training began, as did Group 1, but no escape training trials were given. Group 3 received 25 escape training trials on the day preceding the day avoidance training began. Group 4 received no escape training and avoidance conditioning began immediately after the 5-min habituation period. The escape trials were also presented on a VI 30-sec schedule. They were identical to the avoidance trials, in the shock parameters used and the response required for termination. The UCS in escape training also consisted of the combination footshock and doorbuzzer. No CS was presented, however.

RESULTS

The mean numbers of avoidance responses for the four groups of male rats over the 10 avoidance conditioning sessions are presented in Figure 1. As can be seen, all groups acquired the response to a similar level in the first two sessions. An analysis of variance was used to compare the overall performance of groups under the four training procedures. Differences in overall performance were significant [$F(3,20) = 14.36, p < .01$]. The decrement in Group 1 scores began on Day 3, and daily scores remained lower throughout the experiment. Performance difference over days was found to differ significantly [$F(9,180) = 8.13, p < .01$]. It can be seen that all groups except for the one given immediate UCS preexposure (Group 1) remained at a consistent level of avoidance. Tests on mean group scores showed Group 1 to be significantly lower overall compared with the other groups (Duncan's multiple range, $p < .01$).

DISCUSSION

In neither short-term (Overmier & Seligman, 1967; Seligman & Maier, 1967) nor long-term (Glazer & Weiss, 1976a, 1976b) studies using inescapable shock have the conditioning effects been similar to those in the present study, which would indicate a different effect operating here. Seligman and Maier (1967) found no interference with escape/avoidance

conditioning when escapable shock preceded this conditioning by 24 h. This finding is supported by the present study, in which escape pretraining 24 h earlier produced no interference for later avoidance conditioning (Group 3). The present effect was of lesser severity, however, since all the animals presented some avoidance responding throughout the experiment. The present effect also differed in time of onset, for the deficit was not seen in immediately preexposed rats (Group 1) until the third day. Group 1 was then seen to decrease avoidance responses as the sessions continued, stabilizing at a much lower level than the other groups. This effect cannot be seen as an extinction of avoidance behavior, because some level of avoidance was maintained by all the animals.

This UCS preexposure effect with escape pretraining was found to produce enduring effects, with some defining parameters. Immediate escape pretraining (Group 1) produced the effect, whereas a 24-h period between the UCS pretraining and avoidance training did not (Group 3). Thus, the delay in the time between pretraining and subsequent avoidance training prevented the effect. The effect did not result from preexposure to the apparatus immediately before the first avoidance conditioning session (Group 2), because this group performed as well as the animals that received avoidance training only (Group 4). While preexposure to the UCS has been studied primarily with inescapable shock, less attention has been focused on escapable shock; further study of this delayed and long-lasting effect is warranted.

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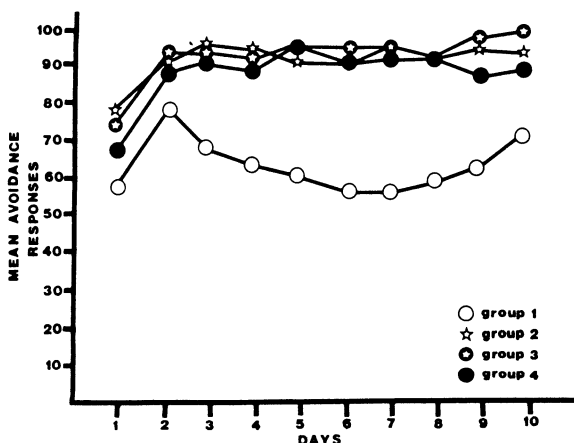


Figure 1. Mean avoidance responses over days.

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