

# Conditioned inhibition of exploration in young rats

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*The inhibition of exploratory behavior, and responses to the CS were used as measures of conditioned fear in young rats. Comparisons with control groups indicate that any experience with shock produces equal amounts of fear retention in the early and middle stages of extinction. The differential effects produced by the various procedures became apparent only later in extinction when the group that had experienced CS-US pairings in acquisition exhibited significantly more residual fear than the controls on both response measures.*

The great majority of the studies on the conditioned emotional response (CER) have used a decrement in the rate of responding for food or water as a measure of the fear elicited by the CS. In the interest of extending the generality of the effects of conditioned emotionality, the present authors have employed another response, exploration. This allows the examination of the effects of fear on the animal's basic response repertoire without the alterations in response thresholds produced by the deprivation regimens necessary to generate other behaviors (Campbell & Sheffield, 1953). In addition, this behavior may be articulated into several meaningful components for a finer overall resolution of behavior.

## METHOD

### Subjects and Apparatus

The Ss were 30, male Sprague-Dawley rats, 23 days old at the start of the experiment. All Ss were housed one to a cage on ad lib food and water.

The apparatus was a Grason-Stadler test chamber using a model E104-GS shock generator-scrambler. The continuous observation data were recorded on cumulative clocks actuated by push-buttons mounted on a small panel in front of the test chamber. The buttons were labeled from left to right, grooming, rearing, locomoting, and inactive.

The CS was a 60 cps buzzer with an intensity of 75-77 dB against a background noise level of 69-71 dB as measured by a General Radio sound meter set on standard frequency-response curve "C."  
Procedure

Six Ss were randomly assigned to each of the five treatment groups. In acquisition, each S in Group 1 was placed in the test chamber where it received 18 1 sec simultaneous buzzer-shock (1 mA) pairings, spaced at 10 sec intervals. Group 2 was treated similarly except for the buzzer occurring for 1 sec in the middle of each intershock interval. Group 3 received only the shock every 10 sec. Group 4 experienced only the buzzer every 10 sec, and Group 5 was merely placed in the test chamber for an identical length of time receiving neither shock nor buzzer.

The extinction sessions, each consisting of 18 CS-only presentations at 10 sec intervals were identical for all groups. Immediate responses to the buzzer were recorded by an observer in the manner of Kimble (1955) and Atrens (1967). Another observer made a continuous record of the behavior between CS presentations by depressing the appropriate button for the duration of each unit of behavior. Atrens (1967) has demonstrated that this technique is highly reliable, yielding interobserver reliability coefficients of 0.91 and higher. The extinction sessions were conducted 16, 20, and 22 days after acquisition.

## RESULTS

An index of suppression is provided by the inactivity scores which are the compliment of the sum of the other three behavioral categories. An analysis of variance on the inactivity data, which are presented in Fig. 1, yielded significant ( $p < .001$ ) effects of treatment and days. In addition there was a significant ( $p < .05$ ) interaction between these two variables.

Separate Duncan's range tests conducted on each day's data

indicated no significant differences among the three shock groups for the first two test days. However, by extinction Day 3, all groups had merged to the level of the nonshocked controls except for Group 1 which still evidenced significantly ( $p < .05$ ) more residual suppression. The buzzer-only group showed less inhibition of exploration on test Day 1 than the no-stimulus group. This difference vanished in subsequent test sessions. However, for the first two days both of these nonshocked groups showed much less suppression than the three groups that had experienced shock.

The data on the immediate responses to the buzzer were analyzed in terms of the mean number of buzzer presentations in extinction to the first trial when the buzzer elicited no disruption of ongoing behavior. These data, which are presented in Fig. 2, generally reflect the same process that is seen in the continuous observation data. Here the same F ratios were significant (all at  $p < .01$ ). The Duncan's range tests, here revealed more clearly ( $p < .01$ ) the higher residual suppression in Group 1 on the last day of extinction.

## DISCUSSION

Perhaps the most striking implication of these data is that initially, equal amounts of conditioned emotional disruption of exploratory behavior are produced by simultaneous conditioning, 4.5 sec trace-conditioning (this can also be called backward conditioning) and sensitization. Initially, these groups spend an average of only 13% of their time engaged in any form of active behavior vs an average of approximately 43% in the two nonshocked control groups. A comparison between the latter two groups on Day 1 affirms the mild aversiveness of the buzzer itself.

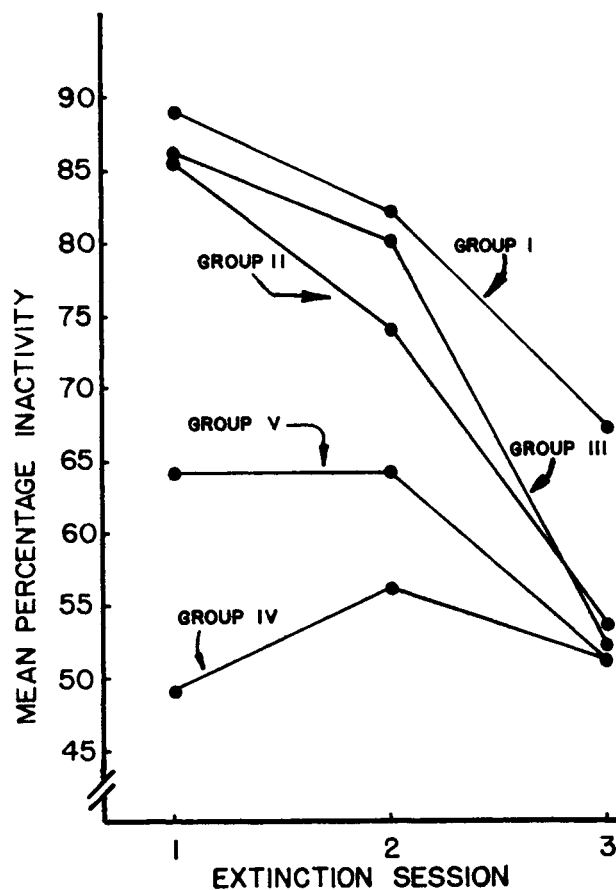


Fig. 1. Mean percentage of inactivity over the three test sessions.

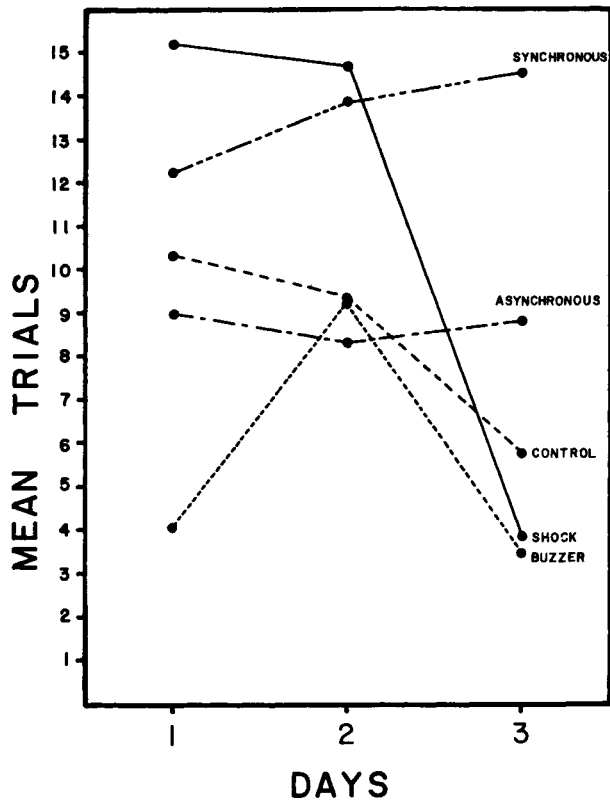


Fig. 2. Mean number of trials till the first non-disruption of ongoing behavior response to the buzzer.

That the simultaneous conditioning procedure ultimately leads to the retention of more fear than the other procedures does not become apparent until the third extinction session. By this time the other groups are spending 50% more of their time exploring. In addition, the immediate disruptive effects of the buzzer had diminished to where it now took an average of 5.5 CS presentations before the other groups showed a no-disruption response. On the other hand, Group 1 had not changed significantly from the first test day, still averaging 14.5 CS presentations to the same criterion.

Note that the groups that responded to the CS most vigorously and for the longest time also showed the most inhibition of exploration. Atrens (1967) has also demonstrated that the vigor of response to a US is positively related to the amount of overall suppression of activity. Taken together, these two studies indicate a basic continuity between the behavior elicited by both conditioned and unconditioned aversive stimuli. In either paradigm the strength of the reaction to the aversive stimulus is negatively correlated with the amount of activity that is emitted between stimulus presentations.

#### REFERENCES

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