The effect of electroconvulsive shock on a socially motivated instrumental response¹

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Four groups of Ss were trained to cross a hurdle in a straight runway. Two groups were reinforced by being able to come in contact with another rat. Two groups received no reinforcement. One reinforcement group and one no-reinforcement group received ECS. ECS interfered with the socially motivated instrumental response. The results of this study are consistent with the competing response or fear hypothesis of ECS.

Numerous studies have indicated that electroconvulsive shock (ECS) has a strong attenuating effect on a conditioned emotional response while leaving the conditioned instrumental response relatively intact (Heistad, 1955; Hunt & Brady, 1951; Poschel, 1957; and Williams, 1961). In the study by Poschel (1957) an approach-avoidance conflict was established to the goal end of a runway. After a series of 10 ECSs it was found that the avoidance portion of the conflict had been reduced and the Ss now performed the approach response.

Lewis & Maher (1965) introduced the concept of "Conditioned Inhibition" to explain the effect of ECS. They stated that ECS produces relaxation which competes with an avoidance response such as freezing which is mediated by a high level of arousal (fear). In contrast, the instrumental response, which is mediated by a low level of arousal (hunger or thirst), is unaffected by the ECS and reappears once the avoidance response has been disrupted.

The "Conditioned Inhibition" theory would be untenable where avoidance responses mediated by a high level of arousal (fear) are not involved. Little work, however, has been done on the effect of ECS on responses not mediated by fear.

Angermeir (1960) demonstrated that rats will learn to bar press for a reinforcement consisting of physical contact with another rat. This mode of reinforcement depends on neither fear nor deprivation and according to Lewis & Maher's (1965) description should represent a relatively low level of arousal.

The present investigation sought to demonstrate that ECS would interfere with an instrumental approach response which was mediated by a low level of arousal and which depended upon a non-homeostatic social reinforcement rather than fear or deprivation.

Method

The Ss were 50 male albino rats of the Holtzman strain all approximately 100 days old at the start of the experiment. Throughout the experiment the Ss lived in treatment group cages.

The ECS source was similar to the one described by Hayes (1948). A current of 43 mA was administered through Alligator clips attached to S's ears for .5 sec.

The apparatus consisted of a gray runway 6 in. high x 5 in. wide x 38 in. long. The runway was divided into two 19 in. sections by a 2 in. high hurdle and a guillotine door which rested on top of the hurdle. This guillotine door will be called the Center Door. One

side of the runway was used as the start box. The other side of the runway had a second guillotine door 8 in. from the end. This 8 in. end section was the goal box and the guillotine door just in front of it will be called the Goal Door. The floor and ceiling of the runway were made from chicken wire and the runway was well lighted.

The Ss were randomly divided into four groups of 12 Ss each. The two remaining Ss were used randomly as the reinforcement and were housed separately.

One S was placed into the start box for 15 sec. The Center Door was then raised and remained up until S crossed the hurdle after which the Center Door was lowered and the Goal Door was simultaneously raised. Response latency was measured in seconds from the opening to the closing of the Center Door. For the reinforcement groups, one reinforcement animal was placed into the goal box. For the no-reinforcement groups, the goal box was empty. Fifteen sec after the Center Door was lowered and the Goal Door was raised, S was removed from the runway. Ss from the ECS groups received one ECS within 10 to 15 min after being removed from the runway. During the waiting period, they were individually housed in separate wire cages in the laboratory. Ss from the No-ECS groups were returned to their group cages after being removed from the runway.

A summary of the four groups is shown in Table 1. Each S received one trial per day for 10 continuous days. Five Ss were lost due to ECS and seven were randomly discarded to equalize groups.

Results and Discussion

The latency data were analyzed by an analysis of variance. The interaction between ECS conditions and Reinforcement conditions was not significant ($F = 2.53$, $df = 1/32$, $p > .05$). The effect of the ECS conditions was significant ($F = 17.31$, $df = 1/32$, $p < .01$) and the effect of the Reinforcement conditions was significant ($F = 5.42$, $df = 1/32$, $p < .05$).

Mean latency data are shown in Table 1. Comparisons between group means (t tests) demonstrated that the differences between Groups 1 and 3 ($t = 3.78$, $df = 16$), Groups 2 and 4 ($t = 3.06$, $df = 16$), and Groups 3 and 4 ($t = 4.30$, $df = 16$) were all significant ($p < .01$). The difference between Groups 1 and 4 ($t = 2.65$, $df = 16$) was also significant ($p < .02$). The difference between Groups 1 and 2 ($t = 1.97$, $df = 16$) approached significance ($p = .07$).

The statistical results demonstrate that the procedure used to condition an approach response using physical contact with another animal as the reinforcement was successful. The difference between the two No-ECS groups was highly significant.

The data also confirmed that ECS interfered with the approach response (Group 1 was significantly slower than Group 3).

The interpretation suggested by Lewis & Maher (1965) is based on the finding that ECS acted to inhibit strong emotional responses while leaving the instrumental responses relatively intact. Thus they suggest that the effect of ECS is selective to strong emotional (fear) responses. However, the results of the present study suggest that another mechanism is operating. The interference theory (Adams & Lewis, 1962; Yarnell & Adams, 1964; and Coons & Miller, 1960) parsimoniously explains the present results. Viewed in terms of interference theory, ECS produces a crouching and freezing response or fear which competes with the instrumental response of running. The response decrement after ECS would then be due to this interference.

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Table 1
Summary of Conditions, Respective Mean Latencies,
and Significance Levels of t s

Group	Conditions	Mean latency in seconds
Group 1	Reinforcement, ECS	113.51
Group 2	No-Reinforcement, ECS	224.90
Group 3	Reinforcement, No-ECS	40.45
Group 4	No-Reinforcement, No-ECS	61.42

Groups: 1,3; 2,4; 3,4 $p < .01$

Groups: 1,4 $p < .02$

Groups: 1,2 $p = .07$

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NOTES

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