Simple and complex learning in rats reared socially or in isolation¹

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Male rats made hyperactive and sexually inept by rearing in isolation showed higher rates of response in a single response task and lower proficiency in a competing response situation than did normal, socially-reared litter-mates. These results and a marked reduction in errors on the competing response task by Ss of both rearing conditions which were more experienced in the conditioning situation confirm Spence's (1958), (1964) drive-anxiety theory.

In addition to being sexually inept, socially isolated rats, guinea pigs, and monkeys (Gerrall, 1963; Valenstein, Riss, & Young, 1955; Mason, 1960) often are hyperactive in a mating situation. While neither etiology nor consequences of this experimentally induced hyperactivity have been fully explored, the possibility of integrating the above findings with one systematic series of hypotheses and laws is presented by Spence's theory of emotionally based drive (1958).

If it is assumed that the hyperactive Ss possess a high generalized drive state, they should, according to Spence (1958), attain higher performance levels sooner than lower drive, socially reared Ss when learning a single response task. When learning involves competing responses, however, acquisition rate should be faster for the lower drive Ss. Any situational variable which affects drive level at the time of acquisition should similarly influence performance. Ss unfamiliar with an experimental situation generally have a higher level of drive relative to sophisticated Ss (Spence, 1964). Since drives are assumed to summate, unsophisticated, socially isolated Ss should have the highest level of generalized drive and sophisticated socially reared Ss the lowest levels. In the present study, the extension of this theory to the performance of socially isolated and socially reared Ss was tested directly in an operant conditioning situation using two tasks involving different degrees of competing responses.

METHOD

Subjects

The six socially isolated Sprague-Dawley male rats serving as Ss were separated from their mothers and litter mates at 14 days of age and placed in individual air cooled styrene plastic 9 by 12 by 12 in. cages. Their first contact with another S occurred at 90 days of age, when each was given the first of nine 10-min. mating tests during a five-week period. Without exception the isolated Ss failed to copulate and exhibited hyperactivity. The six socially reared Ss, which were litter mates of the isolated Ss, were also removed from their mothers at 14 days of age and lived under identical conditions, except that two males and one

female lived together. All of the socially reared Ss mated normally and none was hyperactive. The Ss were between 150-175 days of age at the beginning of the learning phase. Isolated and social housing conditions were maintained, and all Ss were 22 hrs. food deprived throughout the study.

Apparatus

Foringer operant conditioning programming and recording units and a 10 by 9.5 by 11.5 in. environmental box with two manipulanda were used.

Procedure and Design

Three socially reared and three socially isolated Ss made up an experimentally naive group. Following acquisition of the bar pressing response, these Ss were allowed to respond for 150 45-mg food reinforcements on CRF for 10 daily sessions. During this period each S's bar of preference (i.e., the manipulandum pressed most frequently) was determined. From the 11th day on CRF onward, only the bar of preference was reinforced until the S made 10 or fewer responses to the non-reinforced bar while making 100 responses to the bar of preference on each of two consecutive days. The response contingency was reversed the following day, and the new contingency was maintained during daily sessions of responding for 100 reinforcements until the S made 10 or fewer responses to the non-reinforced bar on two consecutive days. This constituted the competing response task.

A sophisticated group formed from the remaining three socially reared and three socially isolated Ss was first allowed five days of responding for 150 45-mg food reinforcements on CRF, and then, 1-hr. periods of responding for five days on FI 12 sec., five days on FI 30 sec., and for 14 days on DRL 30 sec. The Ss were then returned to CRF for two days, and after each S's bar of preference was established, the reinforcement-of-bar-of-preference and competing response tasks were presented.

RESULTS

The time required to obtain 150 reinforcements during each group's first four days of training is shown in Fig. 1. Analysis of variance revealed that neither the interaction between groups and trials, nor the main effect of trials was statistically significant. The difference between socially isolated and socially reared Ss was statistically significant beyond the 5% level of confidence, the level used in rejecting the null hypothesis in this study. Thus, the isolated Ss required less time than the presumed lower drive, socially reared Ss to reach the performance criterion.

Fig. 1. Mean time required by social and isolated Ss to obtain 150 rewards on a crf schedule involving no competing responses.

The total number of errors made by the Ss before obtaining 100 pellets in the competing response task is shown in Fig. 2. The socially isolated Ss made significantly more errors before reaching the criterion of 100 reinforcements than did the socially reared Ss. Since the cumulative records indicate that the isolated Ss responded at a higher rate, it might be argued that number of errors on the competing response task is a linear function of response rate. To partial out the rate difference between the groups, analysis of covariance was performed with mean response rate on the first four days of CRF training as the predictor variable. The result was that the difference between the socially isolated Ss was increased rather than decreased.

Ss with the greatest amount of previous experience in the Skinner box switched to the new bar after signifi-

Fig. 2. Mean number of errors made by social and isolated Ss in bar pressing task involving competing response tendencies.

cantly fewer trials than the relatively naive Ss. The interaction between degrees of sophistication and conditions of early rearing was not statistically significant.

DISCUSSION

The results of this study generally confirm the prediction made from Spence's theory of the effect of emotionally based drive on the learning of simple and competing response tasks. Ss reared in social isolation, which were assumed to possess higher drive than socially reared Ss, performed with higher proficiency than social Ss when a single response was required and were poorer on a task involving a competing response. The opposite results were obtained in the lower drive, socially reared Ss.

The variable of degree of previous training might be characterized as overlearning, or degree of sophistication or learning to learn phenomena. However viewed, the predictions generally remain the same: learning of a new task, whether or not it involves reversal, should be facilitated by previous experience. The results of this experiment are in accord with this prediction. While these data do not indicate whether the sophisticated Ss perform well because of increased habit strength or reduced drive, the results are clearly in accordance with Spence's suggestion that the sophisticated Ss will be hindered less by high drive states than inexperienced Ss.

Although relationships between high drive, an accompanying rise in anxiety, and deficit in sexual performance cannot be stated at this time, the data presented encourage further comparisons between the behaviors associated with rearing in isolation and those elicited from high drive or high anxiety Ss.

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Notes

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