Effect of maze experience on dominance hierarchies¹

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Submissive rat Ss, defined in terms of the dominance tube, were taught various mazes independent of the more dominant Ss of their groups. After being run in the mazes with the naive Ss, the groups were retested in the dominance tube. The results indicated a significant change from test to retest in the groups subjected to the learning tasks, while two control groups remained stable.

The present study attempted to determine whether modification of the dominance order for groups of rat Ss occurred after additional maze experience on the part of submissive Ss. The interaction between an experienced S and a naive S has been measured in previous studies. Holder (1958) investigated the effect that the association of a stimulus rat with reward or with nonreward exerted upon naive Ss. She concluded that the rate of response for her naive Ss was dependent upon whether these Ss were associated with stimulus rats of reward or nonreward. Simmel & McGee (1966) exposed rat Ss to a novel maze situation. They noted significantly more responses with experienced Ss paired with naive Ss than with the two groups of animals with equal maze experience.

Group interaction in infrahuman Ss has been reported by Miller, Murphy, & Mirsky (1955), who defined a dominance order in terms of the number of encounters won by each of a group of 10 monkeys. Then, they associated members of the group who were low on the hierarchy with shock, and observed the effect that this artificial manipulation would have on the stability of the hierarchy. They noted that the stimulus monkeys rose significantly in the hierarchy upon retest. The present investigation defined a dominance hierarchy in rats through the use of the dominance tube, as employed by Schumsky & Jones (1966) and also by the author in a previous study (Brennan, 1969). The purpose of this study was to observe the effect that maze experience, on the part of submissive Ss, would have on the stability of established group dominance hierarchies.

METHOD

Subjects were 32 male albino rats purchased from a professional supplier and housed singly. Ss were randomly assigned to eight groups, and their tails were color-coded for purposes of identification. Except for deprivation periods, food was available, and water was always available.

Apparatus consisted of a dominance tube

(38 x 2 x 2½ in.), which permitted room for only one S to pass through at a time. At each end, separated from the tube by guillotine doors, were located goal-start boxes (6 x 4 x 3½ in.). One side of the tube was made of Plexiglas, permitting the filming of Ss while in the tube. A clock, measuring in seconds, and a scale divided into nine equal parts, lying parallel to the tube, were within camera range. Filming of each encounter was accomplished by an Ampex videotape recorder, Model VR-7000, with a Vikoa transistorized closed-circuit TV camera, Model ST-903. Three mazes were used, varying in complexity and all made of wood. The first was a simple Y-maze with an entrance chamber and two alleys, 36 in. in length. The second maze was a multiple T-maze requiring four correct choice points, with a total correct path length of 48 in. The third maze was also a multiple T-maze requiring five correct choice points, with a total correct path length of 72 in.

The procedure for the initial testing of the Ss in the dominance tube has been described elsewhere (Brennan, 1969). The most dominant S was defined as the animal that won the most encounters in a paired-comparisons procedure; and likewise, the least dominant, or submissive, S was defined as the animal winning the fewest encounters. After the hierarchies were established, the eight groups were assigned to four conditions: two groups each to a control and three maze-learning situations, which varied in the complexity of the tasks. In the maze-learning situations, the submissive S from each group was taught to run the respective mazes alone to a criterion of five errorless runs. The conditions were: Groups A and B, control (no intervening tasks between test and retest in the dominance tube); Groups C and D, one learning task (Y-maze) between test and retest in the dominance tube; Groups E and F, two learning tasks (Y-maze and simple multiple T-maze) between test and retest; Groups G and H, three learning tasks (Y-maze, simple multiple T-maze, and complex multiple T-maze) between test and retest.

When the submissive Ss had satisfactorily learned the mazes, they were rejoined by the other, "more dominant" members of their respective groups, which were naive to the mazes, and submitted to one group run. During the periods when the submissive Ss were being trained in the mazes, the naive members of each group were handled daily. All Ss were on a 24-h deprivation schedule prior to each group maze run. Upon completion of the intervening conditions, all groups were retested in the dominance tube

using the same procedure as the initial testing. The control group was idle for 1 week (except for daily handling) and was then retested.

RESULTS AND DISCUSSION

The ranks of the dominant and submissive Ss from both control groups remained the same from test to retest in the dominance tube. In one of the control groups, two of the Ss which were initially ranked 2 and 3 in the group (the number 1 assigned to the most dominant S) did show a change in the retest insofar as they switched ranks upon retest. However, this was the only difference in the control groups between test and retest in the dominance tube. The sum of rank change for the dominant and submissive animals from each group indicated that the greatest change occurred between the control condition and the first intervening maze-learning condition. A similar change also occurred between the groups whose submissive member learned one intervening maze and the groups subjected to two intervening maze tasks. However, there was little difference in rank change (.5) between the two intervening maze tasks and the three intervening maze tasks. A Friedman two-way analysis of variance by ranks was used to test the significance of rank change on the part of the dominant and submissive Ss for each group from test to retest. This procedure yielded $\chi^2 = 7.38$ ($p = .053$).

Both the significant rank change and the direction of this change seemed to indicate that the intervening learning tasks affected the stability of the hierarchies of the groups involved in the learning conditions. This change in ranks appeared to have occurred as a result of intervening learning tasks which manipulated the submissive Ss in such a way that these Ss had the advantage of maze experience over their naive counterparts. This process produced a facilitation in performance upon retest in the dominance tube on the part of the submissive Ss.

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NOTE

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