Social dominance and motivational variables in rats¹

SIGMUND HSIAO AND SAMUEL C. SCHREIBER
UNIVERSITY OF ARIZONA

White rats' social dominance patterns were observed in a straight runway dominance apparatus. The results indicate that the dominance pattern is stable only if other conditions are equal. If the motivational level is unequal, the rat with the higher level of motivation dominates in the situation.

Social dominance patterns in rats have been reported to be consistent and stable in some studies (Grant & Chance, 1958) though not in others (Candland & Bloomquist, 1965). Most of the studies in social dominance have been observations of "spontaneous" social encounters (Baenninger, 1966). In this study, a controlled procedure was given to the rat to observe the stability of a social dominance pattern and the effect of motivational variables on social dominance.

Method

Fourteen male albino rats, Sprague-Dawley descendants, about 100 days old, were divided into seven pairs and each pair's dominance-submissive relationship under various motivational conditions was observed in a straight runway dominance apparatus (Schumsky & Jones, 1966; Lindzey, Winston, & Manosevitz, 1961). A similar situation was used also in an underwater dominance test (Uyeno & White, 1967). The apparatus consisted of a 38 in. long and 2-3/4 in. wide and high straight runway with a guillotine door at the center. At both ends of the runway there were goalboxes, 8-3/4 in. long, 7 in. wide and 8 in. high, with guillotine doors at the entrances. The runway was a narrow passage which permitted only one rat at a time to pass through. One side of the runway was made of a Plexiglas panel to allow observation of the rat's position. The Ss were maintained on a restricted diet to reduce their body weight to approximately 75% of their initial body weight. They were then trained to run from one goalbox to the other to be rewarded with a small pellet of food. The central guillotine door was closed but soon after the rat arrived at the door it was raised. A pair of rats was trained in alternate trials and each was given 10 daily runs for a period of five days.

The original dominance test was given after the training period. A pair of rats was alternately given six practice runs and, at the next run, both rats were introduced simultaneously into the starting boxes; as soon as both reached the central door it was raised to permit the two rats to meet, and they invariably forced each other through the runway. The winner was rewarded with a food pellet and the loser was fed after he ran to the opposite goalbox. This was called an "encounter." After the first encounter, the pair had practice runs for two more trials and then given the second encounter.

There were two encounters on a daily session which continued for five days. The data of this test, as well as for each of the subsequent tests, consisted of 10 encounters for each pair of Ss. The winner and loser in a pair was defined in this test. The rat that forced the opponent out of the runway more than 50% of the time in this test was defined as a winner.

In the frustration-of-the-loser test the procedure was the same except that in the runs prior to the encounters there was no food in the goal box for the losers. This withdrawal of reward constituted frustration which was to raise the motivational level (Amsel & Roussel, 1952). In the low and high level prefeeding tests, the winners were given 3 g and 8 g of food, respectively, before the daily session to reduce motivational level. The second dominance test was run in order to detect any lasting effect of the previous encounters and to provide one more control condition with whatever practice or carry-over effect was taken into consideration. In the satiation test the winners were given unlimited amounts of food during

DOMINANCE TESTS ARRANGED IN SEQUENCE CONDUCTED

Fig. 1. Total numbers of winning encounters of the original winners in various dominance tests; original dominance, frustration of loser, low prefeeding level, high prefeeding level, second dominance, and satiation tests. Maximal possible number of winning encounters is 70.

the test period all the time in their home cages.

Results and Discussion

The main results are summarized in Fig. 1. In the original dominance test, seven winners won 57 out of 70 encounters. All other figures indicate the number of wins by the original winners out of 70 encounters in each test. The results were compared by an analysis of variance with repeated measures. The difference between the original and second dominance tests was not statistically significant and test results were combined to form a control. The comparisons between the control and the other motivational conditions were all statistically significant ($p < .01$) except for the comparison between the low level prefeeding. Thus, the rat's dominance pattern, as defined in this runway situation, seems to be stable only if other conditions are equal; if the motivational level is not equal the rat with high level motivation seems to dominate in the situation.

References

- AMSEL, A., & ROUSSEL, J. Motivational properties of frustration: 1. Effect on a running response of the addition of frustration to the motivational complex. *J. exp. Psychol.*, 1952, 43, 363-368.
- BAEGGINGER, L. P. The reliability of dominance orders in rats. *Anim. Behav.*, 1966, 14, 367-371.
- CANDLAND, D. K., & BLOOMQUIST, D. W. Interspecies comparisons of the reliability of dominance orders. *J. comp. physiol. Psychol.*, 1965, 59, 135-137.
- GRANT, E. C., & CHANGE, M. R. Rank order in caged rats. *Anim. Behav.*, 1958, 6, 183-194.
- LINDZEY, G., WINSTON, H. D., & MANOSEVITZ, M. Social dominance in inbred mouse strains, *Nature*, 1961, 191, 474-476.
- SCHUMSKY, D. A., & JONES, P. D. Reliable paired comparison dominance orders in rats. *Psychol. Rec.*, 1966, 4, 473-478.
- UYENO, E. T., & WHITE, M. Social isolation and dominance behavior. *J. comp. physiol. Psychol.*, 1967, 63, 157-159.

Note

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