

The influence of specific group membership upon individual performance in a "social problem" for rats

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Two experiments were designed to indicate interaction between groups of laboratory rats in a social learning task. First, groups of "worker" and "nonworker" animals were compared with their original performances in the groups in which these "roles" had become established. Second, the performances of "worker" rats were compared in two series of test trials given in "parallel" sessions and in which the rats were members of different groups. Individual performances were found to be influenced by specific membership.

A series of experiments by the present author (Oldfield-Box, 1967a) has extended the earlier work of O. H. Mowrer (1940, 1960) in which he described a number of experimental social organizations, using laboratory rats. One of these situations, in which groups of three rats were run in an operant conditioning task with lever and food tray at opposite ends of an apparatus 21 in. in length, a "social problem" was found to give rise to a persistent "division of labor" in that one animal did most of the lever pressing to produce food, while the other animals spent most of their time eating. The experimental situation was useful in that it allowed manipulation of the organization under a variety of experimental conditions, and raised questions of relevance for the study of experimental social behavior generally. One problem which kept occurring, however, was that whereas on the one hand individual lever-pressing performances to obtain food in a group situation were at least partly determined by a number of variables such as the speed with which rats learned the task, and the degree to which they were deprived of food (Oldfield-Box, 1967b), on the other hand individual performances also appeared to be influenced by the performances of other members of the group. For example as one rat increases its rate of lever pressing, the rates of the other two group members usually decline. Again, if the "worker" rat is removed, then another rat will take over the "worker" role. Briefly, the point is whether these observations represent social interactions. One way of examining this problem more closely is to investigate the performances of individual rats as members of different groups.

EXPERIMENT 1

GROUPS OF "WORKER" RATS AND GROUPS OF "NONWORKER" RATS

Method

Twelve male and 12 female rats aged between four to seven

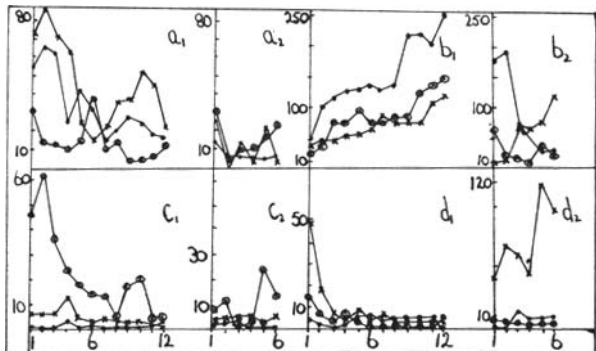


Fig. 1. The performance of "worker" and "nonworker" groups of rats tested in Box A—Experiment 1.

months were accustomed to a 24-h food-deprivation schedule and individually trained in the operant task. They were then given a series of 12 30-min test trials in the "social problem" in order to establish "divisions of labor" within a number of groups. Subsequently, the rats were run in another series of trials as members of "new" groups. Four groups of three "worker" rats and four groups of three "nonworker" rats (those that had obtained the lowest lever-pressing scores in their original groups) were selected from the previous experimental groups. In each case, two of the four groups were male, the others female.

Additionally, half the total number of groups was run in a closed box 24 x 18 x 24 in. with hardboard ends and Plexiglas sides (Box A). The other groups were run in a second operant apparatus which measured 21 x 15 x 12 in. with a wire-mesh floor and single lever and tray attachments placed 3 in. from the floor and at opposite ends of the box (Box B).

All the rats were individually identifiable by aniline dye marks and test trials were run at one trial per day on consecutive days.

Results

The results of the four groups of animals which were run in apparatus (A) are shown in Fig. 1. Graphs a and b show the performances of the male and female "worker" groups, respectively. Graphs c and d show the performances of the male and female "nonworker" groups. The first 12 test trials in each case refer to the individual scores for the rats as members of their original groups (a1, b1, c1, and d1.)

Scores over the second series of six test trials were those obtained when the new groups were run together as groups (a2, b2, c2, and d2). Fig. 2 shows graphs of the performances of the four groups of rats given trials in the apparatus (B). Graphs e and f represent the scores for the male and female "worker" groups and Graphs g and h those of the male and female "nonworker" groups.

Within all four "nonworker" groups, the animal which obtained the highest lever-pressing rate was that which had attained the highest initial score.

Performance in the groups of "worker" rats appeared to be more complex. In three of these four groups there was no correspondence between relative rates of lever pressing during the first series of 12 test trials and subsequent performance in the new groups. For example, in Fig. 1a and Fig. 1b the rats which had previously obtained the lowest lever-pressing scores subsequently ended the new series of trials by obtaining the highest.

Again, in three of the four groups, the overall lever-pressing

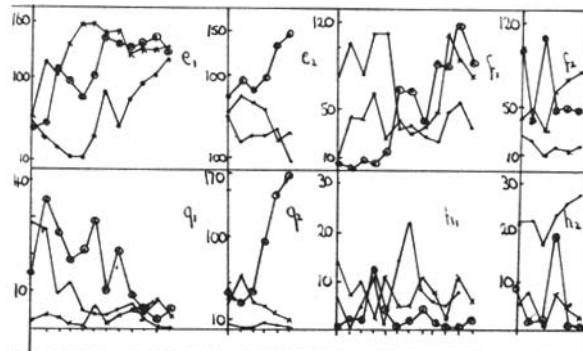


Fig. 2. Lever-pressing performances of the four groups of rats in Box B—Experiment 1.

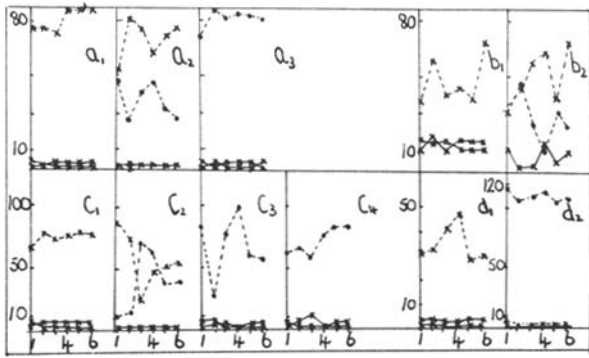


Fig. 3. Individual performance in 11 groups of rats with "workers" as members of different groups—Experiment 2.

rates were generally less than those in the first series of test trials. Observations of more general interactions between animals in all the eight groups of rats suggested much greater activity around the apparatus than during their original test trials. Again, many more instances of competition for food which included fighting were noted.

EXPERIMENT 2

"WORKER" RATS AS MEMBERS OF TWO GROUPS GIVEN TEST TRIALS IN "PARALLEL" SESSIONS

Method

Eight groups of three male and three groups of female rats, which were between six and eight months old, served as Ss. Six of the animals were members of more than one group. Trials were run in Box B (21 x 15 x 12 in.), with lever and food tray arranged at opposite ends.

Groups were trained in groups of six 30-min periods in the "social problem" experiment. Thereafter, six of the groups were given an additional six 15-min test trials. During the same period of six days, the "worker" rat from each of the groups was given a second series of 15-min test trials, in which each replaced one of the "nonworker" rats of a previously "established" group, to form a "new" group.

Results

The performances of the six selected "worker" rats may be compared as members of the different groups (Fig. 3). Taking the three female groups first, Graphs a1 and a3, show the lever-pressing performances of the three members of each of two "established" groups. Graph a2 shows the individual performances of a new group in which the "workers" of the two Groups a1 and a3 were combined with one of the "nonworker" animals from Group a3. Graphs b1 and b2 represent the lever-pressing performances of two male groups.

Graph b1 refers to the six test trials in which the members of the original group remains together. Graph b2 shows the lever-pressing rates for a "new" group in which the "worker" from b1 was combined with the "worker" and "nonworker" of another established group.

Similarly, Graph c1 shows individual performances of an established group; c2 those of a "new" group in which one of the "nonworker" members of another group was replaced by the "worker" animal of Group c1. In Graphs c3 and c4 the performances of the original "worker" rat of an established group from which c2 was made up is shown, first, as a member of another new Group c3, and second, in six more test trials as a member of its original group. Finally, Graphs d1 and d2 show the lever-pressing performances of members of an "original" male group compared with those of a "new" group in which the "worker" rat of d1 had been included in d2 in place of one "nonworker" rat.

These comparisons clearly demonstrated that the performance rates of the "worker" animals were at least partly determined by specific group membership.

DISCUSSION

The behavior of laboratory rats in a number of group experiments has not appeared to be impressively social when compared with the behavior of a number of other species. Moreover, many of the interpretations offered from experiments related to those described here, e.g., Baron & Littman (1961) incline towards the new point which broadly suggests that the determining factors characteristic of social behavior may be reduced to the properties and behavior of individual animals under "solitary conditions," while at the same time emphasizing the lack of contradiction at this stage between hypotheses based upon observations of the interactions of members of a group of animals, and others based upon observations of individual behavior and the conditions of the group test situation. It is now suggested that the experiments of this report may be taken as adding additional perspective and emphasis towards future analyses of the communication processes operating in groups of animals engaged in social learning tasks.

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