"Motor hypothesis" in rats in relation to the cue value and reward value of home cage proximity to the maze

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In an unsolvable orientation-problem situation in the alley T-maze, with neither place nor response cues operating, rats develop a persistent "motor hypothesis" without any place orientation. However, in certain conditions, the proximity to the home cage and to the other rats in it may exert a subsidiary reinforcing effect, of a social nature, on motor responses of a given laterality, thus giving the false impression that the cage is a place cue in the spatial orientation of rats looking for food in the maze.

In previous work (Blancheteau, 1969), it was found that rats first orient themselves in an alley T-maze by means of a "motor hypothesis" or position habit of a given laterality, equally well in both place and response learning. In the former case, the systematic laterality reduces only when place cues appear to control orientation. We concluded that only the validity of place cues in association with no validity of response cues could reduce the tendency to take a position habit.

To test this assumption, we had to observe whether or not position habits would occur in the absence of such an association; that is to say, with no validity of response cues or of place cues, or in an unsolvable orientation problem. Such a situation is provided for rats by a single alternation learning task with widely distributed trials over time and rather few runs.

EXPERIMENT 1

Apparatus and Method

The Ss were 13 female albino rats from a Wistar CF strain, 10 weeks old at the beginning of training, housed in groups of 4 or 5 in their home cages.

The maze was a +-shaped one, with one entrance arm shut at the choice-point level in order to use it as a T-maze. All four arms were alleys 4 in. wide, 6 in. deep, and 20 in. long, covered with Plexiglas. During the experiment, the home cage of the Ss was always put at the same place near the maze, on the east side of the room for five rats and on the west side for the other eight rats.

After some preliminary training to get the rats familiar with the maze, there were six daily sessions of six orientation trials, spaced 15 to 20 min apart, using the correction method. Food was put in the east or west goalboxes following a single

alternation schedule. The entrance arm was always the same for each rat: seven Ss were introduced from the north side and six from the south side, this condition being counterbalanced with that of the east or west location of the cage mentioned above.

Results

There was no learning, the proportion of errors remaining 1/2. Laterality developed up to the criterion of more than 12 consecutive runs in the same direction: 6 Ss consistently took a right turn, 6 Ss a left one, and only 1 S gave random responses. This finding should confirm the above hypothesis, but a striking observation raises some doubt about its value: laterality was not independent from place cues, because 11 Ss turned towards their home cages. One of them even carried the food to the goalbox near its cage when it had to find it in the opposite one. The 12th S turned at the opposite side; when it was in its cage, it proved to be submissive to other rats and avoided contact with them. The Ss in the maze could not see their cage, but they could hear the many noises made by the companions in it.

Discussion

One can say that the cage provides the rat in the maze with auditory place cues and thus that the behavior of the S is relevant to a place-learning process. However, since response and place cues are correlated because of the use of one and the same entrance orientation for each S, there is no ground to dismiss the role of response cues. To answer the problem, it is necessary to dissociate these cues by using both entrance orientations for each rat and to look for a "motor" or "place (cage)" hypothesis in Ss' orientation.

EXPERIMENT 2

Apparatus and Method

In every respect, the conditions were the same as in Experiment 1, except that there were eight trials a day, using both entrance arms for

every rat, following a double alternation schedule of the NSSN type. Twenty-two Ss were used, the home cage being located to the east side of the maze for 11 of them and to the west side for the 11 others.

Results

Again there was no learning, the proportion of errors remaining at the 50% level. Lateralization also was observed in 21 Ss: 11 took consistently a left turn and 10 a right one. Thus, cage location appears to play no role at all: the orientation of rats was a typical "motor hypothesis," not a "place" one. Moreover, in a 7th session, we reversed the location of the cages, without any effect on orientation.

GENERAL DISCUSSION

Experiment 2 supports our assumption on the role played by the "motor hypothesis" in first orientation behavior; however, the coincidence of chosen laterality and cage location in Experiment 1 needs to be explained.

Auditory stimuli from the cage are not place cues or CS for food US, but we can assume that they possess a social US value, thus acting as subsidiary reinforcers of the motor responses leading the rat to the vicinity of its companions. The motivational value and fear-reducing effect of such a social proximity was recently demonstrated by Davitz & Mason (1955), Latané & Glass (1968), and Baum (1969). In Experiment 1, food reinforcement (Rf) of right or left turns is partial (50% ratio) because of the single alternation design, whereas social Rf is consistent, due to permanence of cage location: a given response can lead consistently to cage vicinity, but not to food, so its Rf becomes of a social nature. Such effects of subsidiary but consistent Rf are assumed by Lawrence & Festinger (1962) to explain rat behavior in partial food Rf experiments. Thus, development of laterality in our Ss depends on the location of its social reinforcer.

In Experiment 2, on the contrary, social Rf is as partial as the food Rf is with regard to a given response and therefore it cannot act as a subsidiary reward for it; thus, the position habit develops free of any place contingency.

To sum up, the proximity of companions can give rise to possible artifacts in orientation experiments, with rats in mazes (Ritchie, 1947) as well as with birds in experimental ethology (Perdeck, 1963), unless this variable is properly controlled.

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