Individual recognition by natural concentrations of olfactory cues in mice¹

MARTIN E. HAHN, Jr. and EDWARD C. SIMMEL, Miami University, Oxford, Ohio 45056

Male *Mus Musculus* were able to discriminate between littermates in a situation with natural concentrations of olfactory and other stimuli. The adaptive value of this ability is discussed with reference to mouse social relationships.

In a very interesting and highly controlled study, Bowers & Alexander (1967) have shown that mice are able to discriminate between individual mice of the same sex and strain, between individuals of two different species, and between sexes, all on the basis of olfactory cues. In the study on which the above article was based, Bowers (1967) forced air through boxes containing a week's buildup of waste materials from one or more stimulus animals. This air was then pumped into a Y maze where it served together with an equal amount of air from other stimulus animals as the stimulus for discrimination.

The present study is designed to examine the extent to which individual discriminations between mice could occur in a more complex (i.e., more natural) sensory environment, allowing for the availability of other cues normally present in the environment. It was felt that this paradigm would give a more naturalistic indication of the role of individual recognition in the relationships of mice.

SUBJECTS

Eight C57 BL/10 male mice, descendants of animals obtained from the Jackson Laboratory, were bred and raised in the Miami Psychology Laboratory. The Ss were housed in two litter groups from weaning and tested from 80-140 days of age.

APPARATUS AND PROCEDURE

The apparatus used (Fig. 1) was a simple two choice discrimination box with a centrally located starting compartment and stimulus objects placed at both ends. Small cages with wire mesh tops and fronts were used to hold the stimulus animals during the discrimination trials. The wire mesh front made olfactory, visual, limited tactual and auditory cues available to the experimental animal during learning. There was no buildup of waste materials in the stimulus cages as they were cleaned thoroughly after each block of trials.

The Ss were acquainted with the apparatus by being housed there for 24 h, and then removed to their home cages and placed

Fig. 1. Discrimination apparatus.

on a 22 h water deprivation schedule. Ss, in sequence, received 10 trials per day with water reinforcement. Trials were continued on each discrimination until the group of Ss reached a mean criterion of 15/20 on two successive days (significant at the .05 level on the binomial distribution). A modified Gellerman series (1933) was employed to control for alternation or position habits.

A series of four discriminations were utilized to test the Ss' ability to distinguish between (1) a mouse of his species and one of another species (*peromyscus maniculatus*); (2) a mouse of his strain and one of a different strain (C3H); (3) two of his littermates; (4) and finally a control with no discriminanda present. The control ensured that the Ss were not responding to some cue in the apparatus other than the stimulus animals.

RESULTS

The results (Fig. 2) indicate that in all discriminations except control, the Ss reached criterion. In the control task, the Ss consistently responded at the chance level, demonstrating that no cues other than the stimulus animals were utilized.

DISCUSSION

In one sense, the present results replicate the general findings of Bowers & Alexander (1967), in that the Ss were able to learn a series of inter-individual discriminations. However, in the present study, a far greater number of trials was required in each case. It is felt that this was due primarily to the relative weakness of the olfactory stimuli in the present study, Bowers having used the

Fig. 2. Performance on discriminations, inter-species discrimination (I), inter-strain discrimination (II), inter-litter discrimination (III), control (IV).

accumulation of urine and feces over a 1-week period as his discriminanda.

Ropartz (1968) hypothesized that olfactory stimuli serve as releasers for aggressive behavior in mice, having found that bulbectomized animals exhibited no aggressive responses. This may indicate that olfactory cues serve as adaptive function in the social structure of specions.

In view of Ropartz's findings, the present results lend credence to the role of individual recognition in maintaining group structure. This is emphasized by the fact that the Ss of this study were able to learn inter-individual discriminations (albeit somewhat slowly) on the basis of a natural concentration of olfactory stimuli, in addition to the presence of other stimuli which may have played some role.

REFERENCES

- BOWERS, J. M. Individual recognition by olfactory cues in mice. Unpublished M.A. thesis. Miami University, 1967.
- BOWERS, J. M., & ALEXANDER, B. K. Mice: Individual recognition by olfactory cues. *Science*, 1967, 158, 1208.
- GELLERMAN, L. W. Chance orders of alternating stimuli in visual discrimination experiments. *Journal of Genetic Psychology*, 1933, 42, 206-207.
- ROPARTZ, P. The relation between olfactory stimulation and aggressive behavior in mice. *Animal Behaviour*, 1968, 16, 97-98.

NOTE

1. This study represents a portion of the M.A. thesis of the first author, under the supervision of the second author at Miami University. It was read at the Ohio Academy of Science, Bowling Green, 1968.