

Short Communication

A Discrimination Learning Procedure with a Y-Maze for Experimental Studies on Brain Malformations

(discrimination learning/brain malformations)

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The authors proposed the use of a discrimination learning method with a modified form of Y-maze to research the brain malformations in rats.

In addition to morphological studies on the ultrastructures in the brain, there is a need for the utilization of some psychological methods, for careful judgment is required in diagnosing cases displaying a congenital dysmature brain, minimal brain damage or both, as the brain shows very delicate alterations.

The authors proposed the use of a modified form of a simple psychological method, that is, visual discrimination learning (1, 2, 3) rats on a black and white maze, to research the postnatal evolution in the brain.

Apparatus: A two limb maze shaped like the letter Y was used, and the limbs, i. e. the rat courses, were distinguished by their black and white coloring (Figs. 1 and 2). The reward for the rats was 20% sucrose solution only.

Procedure: The 14 experimentals and the controls were evenly divided into respective black groups whose 20% sucrose solution reward was in the black goal box at the distal end of the black limb in the Y-maze and white groups whose reward was in the white goal box at the distal end of the white limb.

Orientation of the animals: The daily one hr feeding schedule of the rats took effect 10 days before the beginning of the experiment and continued throughout the experimental period.

A daily 5 min handling of the rats was carried out carefully during the 5 days preceding the beginning of the experiment. Then, to habituate the rats to the apparatus, each rat was placed in the spare box for 10 min daily during the last 3 days before the beginning of the experiment and was given a reward (20% sucrose solution, 1 ml) which was put into a spoon the way it would be during the experiment. Finally, the last two days before the experiment, each animal was put into the Y-maze, with all doors open but

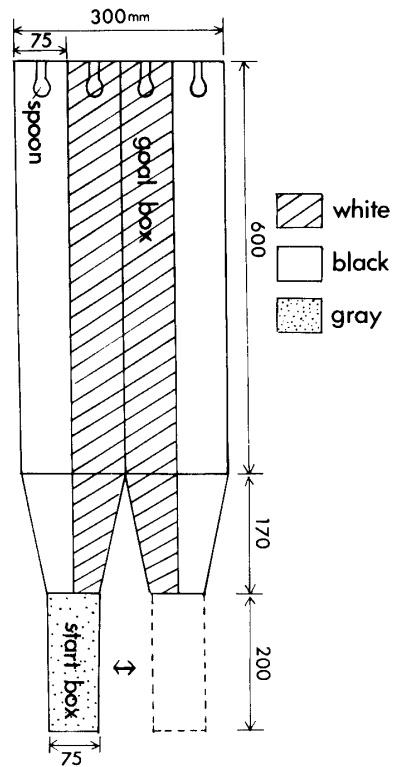


Fig. 1. The plan of discrimination learning apparatus (modified form of Y-maze).

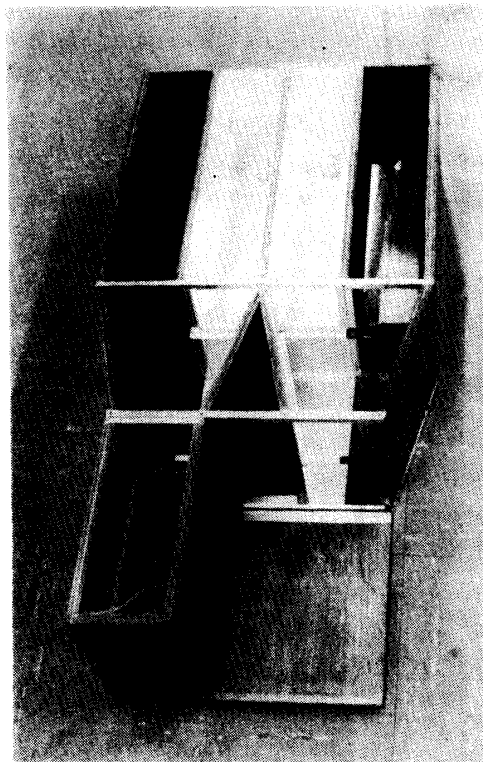


Fig. 2. The apparatus of discrimination learning (modified form of Y-maze).

without the food-spoons, to explore the apparatus for the running for 5 min daily.

Experiment : When a rat was facing a guillotine door in the Y-maze, the door would be opened 10 sec after the animal had been put in the start box.

First, two free trials were carried out, e. g. one rat of the group having its reward in the black goal box, would make its first discrimination learning trial on a Y-maze whose black limb was on the right and white limb was on the left. The same rat would make its second trial on an apparatus whose white limb was on the right and whose black limb was on the left.

Second, two forced trials were made, i. e. the same rat was forced to run forwards in the colored limb where it did not choose to go.

Third, the free trials were resumed following on ABBA order pattern. The schedule of trials was once daily from the 1st to the 4th day, twice daily on the 5th and 6th days, and four times daily on and after the 7th day.

The standard of discontinuance was for a rat to achieve hundred percent choice in reaching reward, that is, when its responses were all positive in 10 trials.

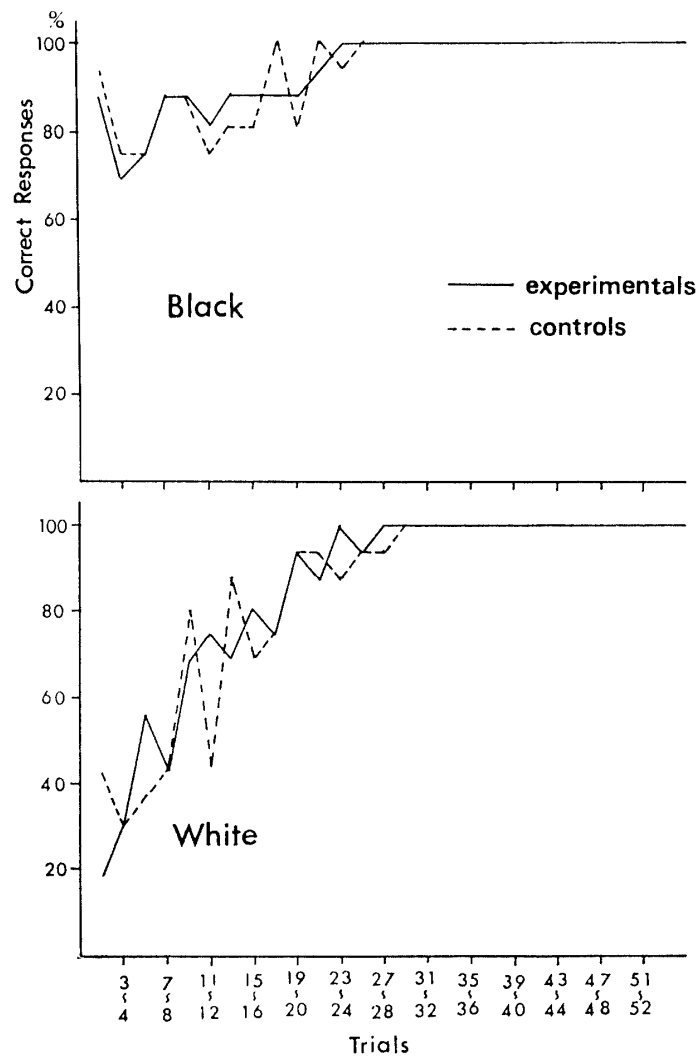


Fig. 3. Learning curves in black and white goal groups.

Additional experiment : The above procedure was applied to an experiment on the litters born from mother rats who had been pretreated with L-DOPA.

The mother rats were administered 800 mg of L-DOPA per 100 g of body weight every day from the 8th to 12th pregnant day, and the experiment started when the litters had grown up towards weighing 100 g.

The comparisons between the experiment and control groups yielded the data shown in Fig. 3. It can be seen in this figure that the x-axis shows the number of their trials and the y-axis shows the percentage of correct responses.

The lines of the experiment group parallel those of the control group in both white and black goals signifying that the results of the two groups are approximately equal with no significant difference to be found at the 5% level.

In this procedure, all the young rats lost some body weight, but there was no difference between the experimentals and the controls. However, it was impossible to begin experiment until the litters had grown up to weighing fully 100 g, as the young rats had already long exhausted their strength by the preparatory procedure.

REFERENCES

- 1) Munn, N. L. (1950) Handbook of psychological research on the rat: an introduction to animal psychology. pp. 103–154, Houghton Mifflin, Boston
- 2) Nakamura, K., Morita, C., Saeki, S. and Moridera, K. (1969) Callosal section: its effect on discrimination learning by Y-maze. *Med. Biol.* **79**, 17–21 (in Japanese)
- 3) Imada, H. (1977) Behavioral techniques to measure individual psychological functions in rats. *Teratology* **16**, 95 (abstract)