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The Narrow-Path Elevated Maze for Studying Rats.

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Students of animal behavior concern themselves much with the problem of "learning," and the influence that various factors may have upon it. The devices commonly employed in working this field are problem boxes and mazes.

A very unique maze was employed by Vincent¹ in a study on the use made of the vibrissae by the rat. The runways in this case were raised 2 feet above the laboratory floor, the paths were 4 inches wide and the walls which should have enclosed the runways were hinged at the lower edges so that they dropped below. This system of raised paths (not alleys) covered an area 54x54 inches and the open space separating adjoining parallel runways was 6 inches. The food box except where it connected with the maze was surrounded with 4 inch walls. Vincent reports that fewer errors were made on the "sideless maze" than when it was converted into an alley maze by turning up the hinged sides and hooking them together. The use of nose, vibrissae, feet and apparently eyes was easily noted with this elevated maze, but Vincent's study probably has not been widely or carefully read, otherwise many would have been prompted to try this type of device.

The narrow-path elevated maze illustrated in Fig. 1 differs in several respects from the Vincent "sideless maze". It is an assembly of straight units which are stood up adjoining each other, and hence may be placed in many different combinations. There are 19 of these units in the pattern illustrated. The rat is started at S and in the illustration (see below the arrow at F) is shown eating at the "food-box". This latter is an inverted bottle cap fastened in a notch at one end of a maze unit so that the food is not observable above the surface of the paths. A similar food cup is shown on the isolated support O in the figure.

Each hurdle-like frame (made of redwood) provides a horizontal path 1 inch wide and 36 inches long. The horizontal strip, $\frac{3}{4}$ inch thick, is supported 30 inches, table height, above the floor by two uprights suitably braced together. Each upright has a 4x6 inch base block. At each end the horizontal bar projects 3 inches beyond the support. These units lend themselves particularly to T-type patterns. The one shown employs 19 maze frames, presents the animal

with 14 T-choices and 1 L-choice, 15 culs-de-sac each 18 inches long and a true path 32 feet in length. The open space between adjoining parallel paths is 18 inches. Most of the runways between turns are 18 inches, but some are 3 feet and two are 4½ feet long.

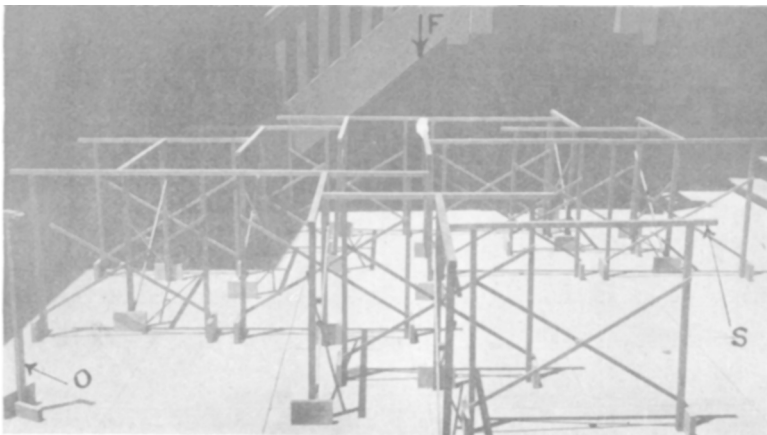
Such a set of narrow elevated paths makes what might be termed a *skeleton maze*, the form of which is readily modifiable. Cross-sectional area has been reduced to the least practical minimum, the situation is simplified for the animal, he is free to use vision along with other sensory cues, and every move may be readily observed. Such a maze stacks compactly when not in use. The parts, with the exception of the frame that holds the tiny food cup, are differently placed each time, thus pure pattern is emphasized. Excrements are not so bothersome a factor as in alley mazes.

The research in progress with this maze will be reported later. At present some general points concerning the behavior of the rats may be mentioned.

1. A 1-inch elevated path is wide enough for large adult rats to run with ease at least after the first trial or so. They can turn around without special difficulty at the end of a "jump-off" as elsewhere. Two 400 gram males can even pass each other; one burrows under. Younger rats could doubtless use a slightly narrower width, but the 1 inch path is practical.

2. From several months experience accidental falls are found to be very rare,* and the animals practically never attempt to climb down. The sections are not tipped over. The slight vibration of a frame may cause an animal to stop momentarily.

FIG. 1.



Elevated narrow-path maze for rats.

3. After preliminary feelings on two adjoined units animals commonly explore rapidly. Quickly exhausting the area at any one location they go on. Rats well used to this kind of maze run the pattern in Figure 1 without mistake on as early as the 4th to 6th trial, and some well used to the pattern have covered it in as short as 10 sec. Corners may be cut.

4. Tracking does not seem to play a very important rôle. Each maze unit may be quickly turned end for end. All the culs-de-sac will thus be placed in the true path. This seldom seems to make any difference in the next run.

5. Vision is often used in general orientation as may be shown by the promptness with which many animals notice a maze unit that is set in somewhere out of contact with the general pattern. They will reach and often cross the 5 inch gap to this isolated unit (which may be new or old), explore it and then return.

6. Balance at rapid turns or at the time of a mis-step is obviously aided by movements of the tail. Not infrequently the animal may stand high up on its hind legs. This was noted by Vincent.

7. The introduction of short cuts, alternate paths, gaps and other obstructions produce easily observable changes in behavior, which may be recorded by motion pictures apparently without distraction to the rat. This is a preliminary report.

¹ Vincent, S. B., *Behavior Mono.*, 1912, i, 1-81.

* Vincent reported that falls happened from the ends, turns and "frequently from sides midway." Our experience does not agree. Possibly her animals were too well used to the same floor pattern in the alley form, *i. e.*, with the sides turned up.

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Observations On Hearing-Acuity For Bone-Transmitted Sound.

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The writers have demonstrated that bone-transmitted sound follows at least part of the pathway to the labyrinth taken by air-transmitted sound. It has also been determined that the acuity for air-transmitted sound is not necessarily a criterion for the bone-sensitivity, or *vice versa*. The writers have reported elsewhere¹ the quantitative findings in two cases of deafened individuals who