How-To-Do-It

High Rise Learning: The Vertical Maze

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Equipment for the instruction of animal behavior in secondary schools is difficult to acquire when science department budgets fail to keep up with inflation. A practical alternative would be to design and build apparatus to meet the needs of the course. These don't have to be expensive or difficult to produce if the school's metal and wood shops will cooperate.

At Montclair High School, some of the more interesting and useful constructions evolved from the project requirement aspect of the course (Marchioni 1978). One particular problem was to test two different methods of learning, operant (Skinnerian) conditioning and classical (Pavlovian) conditioning, by an animal within the same experimental apparatus.

Mazes are traditionally used to test the learning capabilities of animals. They are usually constructed to challenge an animal to negotiate the most direct route through a series of passages, many terminating in dead ends, eventually reaching a food source, which is used as the reinforcement. A learning curve is formed from data collected and graphed on the time it takes the animal to achieve the goal over a number of trials.

The two-dimensional, horizontal maze has a major drawback when used as a demonstration in class. It is difficult for a group of students to view it without crowding around the maze, which interferes with the animal's behavior and, subsequently, with the validity of the experimental results.

The solution we arrived at was to design a portable, vertical maze which could be mounted on the wall or propped up with a base that swivels out perpendicular to the maze. The success of this smaller maze (primarily for mice) led to the construction of a much larger maze permanently mounted on the rear wall of the classroom and used to test rats.

The smaller maze had an additional advantage of testing for classical conditioning (Figure 1). This maze (65 cm × 52 cm × 5.5 cm) was constructed of pine and has three hinged, clear lucite doors for easy access. It has eight "stories" and numerous moveable partitions which could be removed from the rear. Selected partitions were either used in place or removed to condition the animal to a specific route through the maze.

Figure 1. The small vertical maze which has removable partitions to condition small rodents to a specific route.

When an animal was being trained to a particular route, a card of either a + or a ○ was visually displayed on the ground level. This symbol was clearly visible to the test animal as it entered the maze. After obviously learning one route, while always being initially exposed to the + symbol, for example, the alternate symbol was displayed and the partitions were rearranged to produce a new route. When this new one was clearly established, all the partitions were removed and the animal was tested by displaying one of the two symbols. If the conditioning was successful, the displayed symbol would provoke the animal into taking the route with which there was a definite association. Additional challenges to the animal built into the maze were staircases, wire "tightropes" and a clear lucite floor section which produced the effect of a visual cliff (Gibson and Walk 1960). Students could record data from experiments with little or no interference to the animal's behavior (Figure 2).

The larger maze, measuring 240 cm × 120 cm × 20 cm, was constructed without a front lucite panel (Figure 3). As the bottom of the maze was more than a meter above the floor, we reasoned that the animal would not attempt to leap out of it. In all the trials we ran on different animals, we never had one voluntarily leave the maze.

Four planks were fastened to an already existing pegboard on the rear wall of the classroom. The pegboard

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had been securely bolted to the wall so that it supported whatever additional weight we added to it. The planks boxed in the pegboard to form its outside walls. Being a pegboard, we added the 20 cm (8") metal shelf supports in parallel lines across it and placed boards on them to construct the different levels of the maze. With imagination, we added ladders, tunnels, tightropes and teeterboards along the route.

By shaping the rat's behavior through reinforcing its progress in steps through the maze, the students were able to get the animal to accomplish the task within a relatively short time. The moveable components of the maze make the apparatus a versatile tool in the instruction of conditioning.

Learning in animals can be shown to be analagous to learning in humans. The primary daily task of the student becomes the focal point of investigation. The typical student understands very little about the processes by which he or she alters their behavior to environmental cues or reinforcements. These mazes demonstrate the two principal methods of learning and usually elicit questions and further exploration. This is a substantial gain for such a small investment in time and materials.

Figure 2. Students record data of mouse behavior in the small maze.

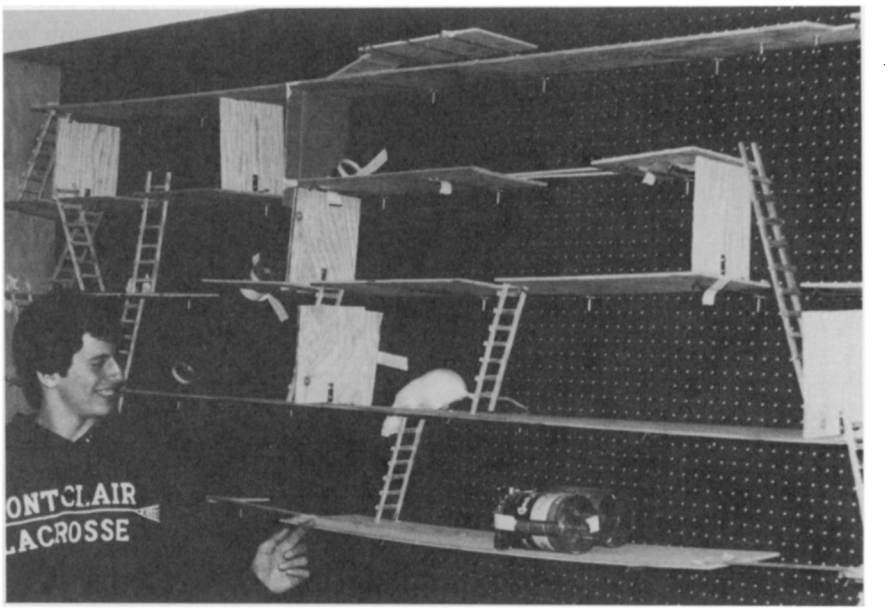

Figure 3. The large maze used to condition rats is put into operation.

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References

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