JOURNAL OF THE EXPERIMENTAL ANALYSIS OF BEHAVIOR VOLUME 7, NUMBER 2 MARCH, 1964

# *AN INSTRUMENTAL TECHNIQUE FOR THE TURTLE*[1]

M. E. BITTERMAN

BRYN MAWR COLLEGE

Figure 1 shows the floor plan of an apparatus developed for the study of instrumental learning in the turtle, *Chrysemys picta picta*. The animal's chamber (*C*), 7 in. wide (at the base) and 6 in. high, is made of 1/4-in. black Plexiglas and equipped with a cover. The chamber must be water-tight, because during experimental sessions it contains about 1 in. of water to facilitate the ingestion of food by the turtle. The response of the animal is to push against a target (*T*) of thin Plexiglas which bears against a sensitive microswitch. The Lehigh Valley Electronics pigeon key is ideal for this purpose. The circular openings in the walls of the chamber, which give access to the targets, are about 1 1/4 in. in diameter. These openings must, of course, be above the level of the water. A distance of 1/2 in. (1.5 in. above the floor) is sufficient to prevent spillage and appropriate to the height of the animal. Colored lights may be projected on the targets with Christmas-tree lamps (*S*), or colored lights and patterns with In-Line projectors. (The apparatus shown was developed primarily for choice-experiments of the discrete-trials variety. It therefore is equipped with two targets, but one of them may be covered by a Plexiglas plate for simple instrumental experiments of either the discrete-trials or the free-operant variety.)

The feeder (*F*) consists of a disk of 1/8-in. aluminum mounted on the shaft of a rotary solenoid. Pellets of lean hamburger (*P*), pressed against the edge of the disk at certain fixed positions, are rotated into the chamber through a slit in the apical walls 1.5 in. above the floor (and 1/2 in. above the water-level). The animal takes the pellet from the tray, lowers it into the water, and ingests it. The solenoid is activated twice during each reinforcement-cycle—once at the start, which brings a pellet into the chamber, and once at the finish, which advances the disk to an inter-reinforcement position. A magazine-light (*M*) is turned on (and the target-lights turned off) during the reinforcement-cycle.

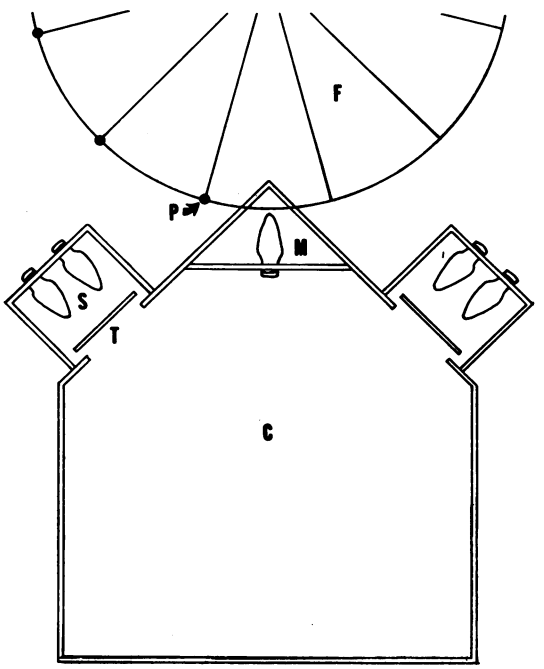


Fig. 1. Floor-plan of a choice-situation with two targets, one of which may be covered for experiments on simple instrumental behavior; *C*, animal's compartment; *T*, target of translucent Plexiglas nosed by the animal; *S*, Christmas-tree lamps for projecting colored light on the target; *M*, magazine-lamp turned on during the reinforcement-cycle; *F*, feeder; *P*, pellet of hamburger rotated into the compartment at the beginning of the reinforcement-cycle and out again at the end.

It will not do simply to drop a bit of food into the water of the chamber, because the animal cannot find it readily; one advantage of the disk-feeder is that the food is introduced at a fixed and easily perceived point. Another

[1]This work was supported by Contract Nonr 2829(01) with the Office of Naval Research.

advantage is that the animal may be reinforced on the limited-access principle (which is incorporated also in the pigeon's grain-magazine as contrasted with the rat's pellet-dispenser). With the rotation of the disk at the end of each reinforcement-cycle, a pellet of beef which has not been taken during the cycle becomes unavailable. Although no formal tests have been made, there is a strong impression that the limited-access principle encourages prompt food-taking in the turtle.

In magazine-training, a film-timer schedules 60-sec reinforcement-cycles on a VI-2 min schedule. The length of the reinforcement-cycle gradually is reduced to 10 sec as the animal takes the food with increasing readiness. After magazine-training, the instrumental response is developed by a combination of baiting and shaping techniques; with a bit of food smeared on the target, very little shaping is necessary in a properly magazine-trained animal. It is essential that the animals be well tamed before work is begun. The procedure in this laboratory is to keep them for several months in large group tanks during which time they have a good deal of exposure to people. Then they are brought to the experimental room, where they are kept in individual 10-gal tanks. One half of each tank contains about 2 in. of water, which is just enough to cover the animal. The other half contains a flat rock, its surface just above the water-level, on which the animal can bask completely dry. A torque-clock schedules 2 hr of artificial sunlight each day.

Figure 2 shows some samples of the performance of a turtle maintained under these conditions for more than six months while it was trained on a ratio schedule of about 20:1. There were six sessions per week, and in each session the animal earned 10 reinforcements totaling 1 g of hamburger, the only food it was given. The six segments of record shown were taken at random from the data of the six-month period. The animal, which was about 3 in. wide and 200 g in weight, remained in excellent health during the entire period. Other animals have worked consistently over long periods for 20 reinforcements (2 g) per session without showing any within-sessions decline in hunger. More must be known, of course, about the control of hunger in the turtle before the technique described can be fully exploited, but the technique itself makes it possible to obtain that information.

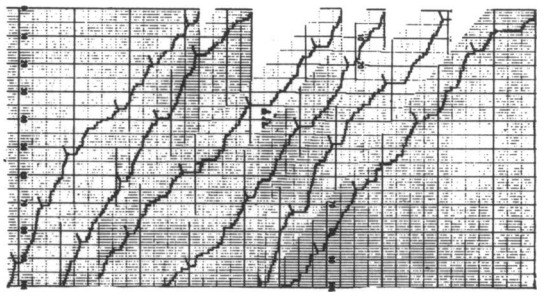

Fig. 2. Six sections of record selected at random from the data for a single turtle trained for more than six months on a ratio schedule of approximately 20:1. There were six sessions each week, during each of which the animal earned 10 reinforcements. The typical rate is about 10 responses per minute. (The heavy horizontal lines are about 10 responses apart and the heavy verticals about 2 min apart. The diagonal upward pips indicate reinforcements.)