A DEVICE FOR THE PARTIAL RESTRAINT OF RATS IN OPERANT CONDITIONING STUDIES¹

ROBERT D. HALL, RICHARD J. CLAYTON, AND ROGER G. MARK

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

In studies of operant behavior it is sometimes desirable to place narrow limits on the kinds of possible behavior. This is often the case when excessive movement might interfere with acquisition or interpretation of some physiological measures. A wide variety of restraining devices for the rat have been described;² but only two seem suitable for studies of operant behavior. (Bijou, 1943; Miller and DeBold, 1965; DeBold, Miller, and Jensen, 1965). The device shown in Fig. 1 has been used regularly for more than three years. It is a lever-pressing situation in which only the rat's head and one foreleg are free to move to any appreciable extent. Its advantages include: (1) simple and rigid construction, (2) the ease with which animals may be inserted, (3) its use in the restraint of rats for extended periods of time, (4) the excellent control of operant behavior it allows, and (5) the accessibility of most of the animal's body, especially the head. This last advantage makes the restrainer quite suitable for studies concerned with the electrical activity of the brain or those which employ electrical or chemical intracranial stimulation; cannulae or electrode assemblies and their related leads are completely unobstructed.

The rat is held in the restrainer by a collar worn throughout the experiment. The collar

is made from a Plexiglas rod ($\frac{1}{4}$ -in. diameter) which is first formed into a circular ring and then cut in half so that it can be fitted to the animal. The two halves are held together by a wire strap that fits into a groove cut in the outside edge around the entire ring. After tightening the strap by twisting, the twisted ends are soldered. The two halves are mated properly by fixing pins to the ends of one half which fit into holes drilled in the ends of the other half. Small loops in the wire strap on the sides of the collar make it possible to tie the animal to the restrainer. Plastic cable ties (General Cement Electronics, No. 34-432) are suitable although they must be replaced rather frequently. With a number of collars of various sizes on hand, the fitting is no more than a 10-min task.

The restrainer itself can be made readily from brass and Plexiglas. The exact dimensions will depend upon the size of the animals to be used. The rat rests on a grid which is not clearly visible in Fig. 1. A section of this grid is omitted on one side in the front to allow the animal to reach the lever below with no difficulty. The grid and bars which surround the animal are made from $\frac{1}{8}$ -in. brass rod. The front piece, to which the collar is tied, should be of heavier stock and sufficiently large that it does not unduly impede head movements or come in contact with assemblies that might be attached to the skull. It is convenient to pivot the "back door", with its slot for the tail, so that it can be easily opened to insert an animal and readily locked afterward. The restrainer is supported approximately 2 in. above the floor by two vertical Plexiglas supports.

For aversive conditioning procedures, electric shock can be applied to the tail by means of two electrodes in the small box shown at the rear of the restrainer. The tail is laid on the lower halves of the electrodes, which are made

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²See Ebel and Thompson (1965) for references to restrainers described in studies of classical conditioning. The restraint of rats has also been employed in studies not specifically concerned with operant or respondent behavior during restraint; see, for example, the devices described in Bollman (1948), Frankel (1959), and Umberger (1946).

Fig. 1. Restraining device for rats. The rat is shown with right forepaw on lever and with cable attached to electrode assembly. Food cup appears in lower right-hand corner.

of flat spring wire and shaped to fit the tail. The upper halves, which are mounted on the box lid, clamp the tail when the lid is closed. The tail cannot be pulled away if a piece of adhesive tape is wrapped around the part of the tail between the two electrodes.

If a rat has continuous access to a food cup in this situation, it will spend much of the time chewing the cup. This can be avoided by using a motor-driven cup that accepts a pellet from a dispenser (not shown in Fig. 1), delivers it, and retracts.

The animals must be adapted to the restrainer before training. If food reinforcement is to be used, this can be accomplished in approximately four days by making food available to an animal only while it is restrained for daily periods of 3 to 4 hr.

Rats can be trained to enter the restrainer themselves, but this is seldom practicable. They can be inserted with little difficulty if they are first wrapped in a thin sheet of plastic (for example, $\frac{1}{32}$ -in. Teflon) long enough to

cover the body, but not the head. The plastic wrapper is then slipped out the back of the restrainer when the animal can be held securely in it. Insertion requires only a minute or two, and no anesthetics are necessary.

This restraining device has been used extensively in studies concerned with neuroelec-

Fig. 2. Cumulative record for entire CER session. Bar pressing was maintained on a tandem VI 30 FR 4 schedule of food reinforcement. CS was a 10 db increase in background noise level; UCS was .5-sec, .5-ma shock to tail. First pip in each set of three indicates start of pre-CS control period.

tric correlates of a conditioned emotional response (Estes and Skinner, 1941; Brady and Hunt, 1955). A cumulative record showing representative behavior in the CER situation is shown in Fig. 2 to illustrate the kind of behavioral control that can be achieved.

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