turned off or if it fails. The restart resumes on the existing core content.

In spite of semiconductor memory volatility, manufacturers apparently foresee no serious difficulties and state

that critical data can be written onto a nonvolatile medium with a planned shutdown. Where a need exists to protect main-memory content through an outage, a mixture of core and

semiconductor memory is suggested. Another approach is that used with large control computer systems, i.e. to provide short-term emergency power to capture crucial memory content.

A shuttlebox for use with rats

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An ideal apparatus for the study of negative reinforcement in a discrete trial situation is the shuttlebox. The main problem encountered in the construction of this apparatus is to prevent S from escaping shock in ways other than that specified by E. The most frequent area of difficulty is in the barrier and gate separating the two compartments. The presence of the barrier is desirable since it increases the likelihood that S will make a relatively discrete response. The gate is necessary to prevent retracing and to

assure the discrete trial nature of the situation. The problem lies in the construction of a barrier-gate combination which S cannot use to escape the shock. After numerous successive approximations, we have developed an apparatus which is easily constructed and has functioned well throughout work on several hundred animals. Ss have not learned techniques for using it to escape shock.

A diagram of the entire apparatus is presented in Fig. 1. The box is 66 cm long x 15 cm deep x 89 cm high. The back and ends are of wood, painted brass color; the front is of .63-cm clear Plexiglas. The back and ends of the box are covered with brass sheeting to a height of 23 cm above the grid. This serves to discourage Ss from standing on a single bar and leaning on the wall to escape shock. The grid floor,

composed of .63-cm brass rods spaced 1.9 cm apart, center to center, is located 43 cm from the top of the box.

The box is equally divided into two compartments by a .16-cm stainless steel combination barrier and guillotine gate. A diagram of this unit is shown in Fig. 2.

The barrier-gate unit is constructed by first punching a 7.5 x 15 cm oval-shaped hole in a 15 x 91 cm piece of .16-cm stainless steel so that the

Fig. 1. A diagram of the shuttlebox with the barrier-gate combination in a partially raised position.

Fig. 2. A diagram of the barrier-gate combination.

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bottom of the hole is 10 cm above the bottom edge of the piece. Most sheet metal shops can accomplish this easily by punching two 7.5-cm holes and smoothing the edges. Next, the piece is cut in half from top to bottom, producing two 7.5-cm-wide sections. The two pieces are then bolted (top and bottom) to .63-cm Plexiglas braces with a .63-cm space separating the pieces.

To prevent urine and feces from

collecting on the bottom brace and short circuiting the two halves of the gate, we have used 2.5-cm ceramic spacers to separate the bottom brace from the stainless steel. The two halves of this unit may be wired so that S is shocked if he touches the two pieces simultaneously. Ss are thus unable to sit on the barrier and escape shock.

This entire barrier-gate unit slides into grooves cut into the front and back walls of the box. In the down

position, the hole is entirely below floor level, and shuttling is prevented. In the up position, the hole is above floor level. This provides access to the other side of the box. The gate is operated, by a rope-and-pulley arrangement, by an E located several meters from the box. A curved piece of aluminum is bolted to a 5-cm L bracket attached to the Plexiglas brace at the top of the gate. This unit trips a microswitch screwed to the back of the box when the gate is raised.