AN INTEGRATOR WITH PUNCHED FILM FOR INTERLOCKING SCHEDULES

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The diagonal line in Fig. 1 depicts an interlocking schedule of reinforcement (Ferster and Skinner, 1957, p. 728) on coordinates of cumulated responses and time. Reinforcement is delivered for the first response after the cumulative record of the animal's responding crosses the diagonal line. Thus, if the animal responds rapidly, a larger number of responses is required for reinforcement than if it responds slowly. When the locus of reinforcement is a straight line, as in Fig. 1, the schedule is defined by the intercepts with the time and number axes (t and n in Fig. 1).

The potential of this schedule in studies of response-output has not been exploited, probably because a relay circuit would be either inaccurate or clumsy. Berryman and Nevin (1962) have devised a mechanical apparatus consisting of two concentric shafts, driven in opposite directions—one by a motor and the other by the animal's responding.

Fig. 1. Diagram for an interlocking schedule of reinforcement. Reinforcement occurs with the first response after the cumulative record crosses the diagonal line.

Their device appears to be satisfactory, but may be somewhat limited in flexibility.

Figure 2 is a schematic representation of another apparatus for the programming of interlocking schedules. The output of the programmer consists of the familiar arrangement of sprocket, 16-mm film with spaced holes, and microswitch (see a, b, and c, respectively, in Fig. 2) that is used for interval and ratio schedules. The driving mechanism comprises two rotary stepping mechanisms linked to a spur gear differential. One stepper (d) meshes, through a chain of gears (e, f, g), with one input to the differential (h). The second stepper (i) meshes, through a parallel chain of gears (j, k, l), with the other input to the differential (m). The angular movements of the inputs to the differential are integrated and their sum is carried by the output gear (n), which, in turn, meshes with the final gear in the system (o) to rotate the sprocket (a).

The steppers are components of Automatic Electric, Type 44 relays, which revolve once

Fig. 2. The integrator and punched film for an interlocking schedule of reinforcement. Explanation in text.

for every 33 operations. The various gears in the system are standard stock items and have numbers of teeth (indicated in Fig. 2) that result in .5 mm of linear travel of the film for every input pulse. The over-all dimensions of the box that houses the gear trains and differential are 4 by 5 by 7 in.

The integrator shown in Fig. 2 sums two inputs: for an interlocking schedule, one input is from the animal's responding and the other from a recycling timer. In terms of Fig. 1, the time intercept is changed by changes in the recycling timer; the number intercept, by changes in both the average distance between holes in the film and the recycling timer, and the two intercepts together, by changes in the average distance between holes in the film. In

principle, it is possible to build integrators with any number of inputs merely by adding additional differentials and linking them in tandem.

The two-input integrator is commercially available from Ralph Gerbrands Company, 8 Beck Road, Arlington 74, Massachusetts, for approximately \$200.

REFERENCES

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