RESPONSE PATTERNS FOLLOWING MANIPULANDUM CHANGE

HARLEY M. HANSON

MERCK INSTITUTE FOR THERAPEUTIC RESEARCH

Our early attempts to train squirrel monkeys on an avoidance schedule (RS 40, SS 4) required numerous lengthy periods of training and at best were only moderately successful. The rough grain and oscillating rates in the cumulative records of the performance, even after prolonged exposure to the schedule, suggested that some unidentified behavioral controls were being neglected and were contributing to our difficulties.

Foringer & Co., Inc., rat lever-pressing chambers equipped with telegraphic key levers (purchased 1956-57) were used. The keys were adjusted for 15-g pressure and 0.25-in. excursion. Feedback for switch closures was supplied by a flash from a 7-watt AC light, operating from the common AC-DC ground supplied by the pulse-forming circuit of the control equipment. Two readily apparent features of the telegraphic-key manipulandum are: the unmistakable "stop" in the "travel" of the lever at the moment of switch closure, and the possibility of spuriously high response rates resulting from minimal excursions of the lever. Minute movements of the closed lever will produce bursts of responses. Although these manipulanda proved quite successful with rats on a variety of schedules, they could be expected to lead to variability in response rates because of their inherent lack of definition of a response. In hope of improving control over the studied behavior, I exchanged the telegraph-key manipulanda for micro-switch-type levers (Lehigh Valley Electronics LVE 1352) adjusted to approximately the same pressure and excursion, but kept all other aspects of the apparatus and schedule constant. This substitution changed the physical dimensions of the part of the lever actually projecting into the chamber from a supported tubular form 0.5 by 2 in. to a rectangular form 1 by 0.375 in. In contrast to the telegraph keys, the microswitch lever did not have a stop in the travel of the manipulandum at

the moment of switch closure, and minimal excursion responses were impossible because of the built-in snap action of the switch. The microswitch also supplies a faint click upon operating, which, in this case, added an auditory dimension to the visual feedback already programmed.

Figure 1 shows the effects of this change on the behavior recorded. The cumulative records are from two monkeys, each having more than 150 hr prior exposure to the schedule; seven other monkeys receiving the same treatment showed similar effects. Each sample

Fig. 1. Twelve-minute samples of cumulative-response records of squirrel monkey avoidance behavior, before and after the change from a telegraphic-type to a microswitch-type manipulandum. The change was made just preceding Sessions 85 and 46.

selected was 12 min of the behavior occurring at the expiration of 90 and 180 min of the 240-min sessions, both before and after the manipulandum change. The change was completed just preceding Sessions 85 and 46. In the before condition, the frequency of

"breaks" and "runs" (*a* and *b* in Fig 1) was of special interest. For Monkey 5, the run of responses *b* was the first stage in the transition from a relatively low rate of responding to a much higher rate. Monkey 15's responding was more or less typified by bursts of responses with fairly constant length pauses. In the sessions following the change of manipulanda (Sessions 95 and 56), such local changes in rate were essentially eliminated. In Session 56, Monkey 15 still tended to respond in three-to-four-response bursts, but long pauses and runs of responses were essentially eliminated. However, more important than local rate changes were the long-term changes in response rates which produced objectionable day-to-day variability. This effect is best demonstrated by the response-rate oscillation in Session 83 for Monkey 5. Alternate periods of high and low responding, followed by periods

of acceleration, were typical. These effects were eliminated by the manipulandum change. As the figure shows, the over-all response rates were decreased by 50% or more in the 10 sessions following the change. The grain of the records of the stabilized behavior is finer and is more similar to that usually produced by avoidance schedules. The fact that acquisition time in experimentally naive monkeys was considerably shortened suggests that this factor was related to the observed disturbances in response rates.

In studies using operant-conditioning techniques, the manipulandum is routinely conceded to be of primary importance. The correctness of this assumption was emphasized in the present report by the demonstrated dependence of stability and reproducibility of the recorded behavior on manipulandum type.