A FORTY-THREE DAY AVOIDANCE SESSION¹

ROGER E. ULRICH, GARY R. BRIERTON, JOHN H. MABRY,
AND THOMAS J. STACHNIK

ILLINOIS WESLEYAN UNIVERSITY

A single Sprague-Dawley rat was subjected to an extended discriminated avoidance session in effect continuously for over 1000 hr (43 days). The longest possible shock-free interval that the subject could obtain without responding was 5 min. Since the subject did not sleep through shock, all resting or sleeping was interrupted at least once every 5 min by either a response or a shock. Neither the experimental (avoidance) animal nor a second animal which received all shocks not avoided by the first, gave any appearance of ill effects from the protracted session.

Studies of the effects of prolonged "stress" sessions, where the session is of considerable length (Brady, Porter, and Conrad, 1958) have involved substantial time-out periods as long as 6 hr. Sessions of shorter duration have included some minimum daily interruptions for feeding (Boren, 1960; Byck and Hearst, 1962). The present study considers the avoidance behavior of a single avoidance subject and a passive yoked control over an uninterrupted 43-day session.

METHOD

Subjects and Apparatus

Two mature Sprague-Dawley rats were used. The experimental space was divided into two separate chambers, each measuring 1-ft square, housed in a large sound proof chest. Four 10 w bulbs at the top of the chest provided illumination and a speaker produced a white masking noise. The floor of both chambers consisted of parallel steel bars through which foot-shock could be delivered. A scrambling circuit provided a changing pattern of polarity so that any two floor grids would be of opposite polarity during the major part of each shock presentation. Chamber I contained a response manipulandum .5 in. wide and 2 in.

long, located 4 in. above the grid floor, which protruded .5 in. into the experimental space. Chamber II had no bar. A non-aversive buzzer, clearly audible in both chambers, served as a warning stimulus. The stimulus conditions were programmed by electrical apparatus located in another room. A cumulative recorder and counters recorded the responses.

Procedure

The normal sequence of events if no response intervened was as follows: a 270-sec "safe period", followed by a 30-sec warning stimulus, followed by delivery of a 1.0 ma shock of .5-sec duration repeated at 2-sec intervals with the buzzer remaining on. A response at any time would restart the sequence reinstating the beginning of the 270-sec safe period. The subject could avoid the buzzer and the shock by responding with IRTs of less than 270 sec; R's following in the range 270-300 sec (buzzer only) terminate the buzzer and avoided the shock series. Subjects responses of IRTs > 300 sec would also terminate the buzzer, avoid due shocks but not terminate a shock in progress.

The session was initiated by placing the naive animal into the chamber and beginning the cycle in the safe period. Thereafter, all cycles were initiated by responses.

RESULTS

Shock intensity was increased from 1 to 2 ma and finally to 3 ma during the course of the extended session. Figure 1 indicates re-

¹Supported by grants from the National Institute of Mental Health (MH 08233-01 and MH 08841-01), and the Research Fund of the Illinois Department of Mental Health. The assistance of P. C. Wolff and G. G. Baird is gratefully acknowledged. Reprints may be obtained from R. E. Ulrich, Department of Psychology, Illinois Wesleyan University, Bloomington, Illinois.

Fig. 1. Day-by-day analysis of shocks, responses, and responses during warning stimulus, for days 16 through 43 of the prolonged session.

sponse measures and shock delivery rate from days 16 to 43 inclusive. The initial change in shock intensity from 1 to 2 ma did not appreciably affect total responses, but lowered the number of shocks per hour. No additional reduction in shock frequency occurred after the change from 2 to 3 ma (day 35).

Although shocks per hour at both 2 and 3 ma were much more variable than either total responses or responses during the warning stimulus, they consistently remained below the number of shocks recorded at the 1 ma level. It was found that the fewer shocks at the higher intensities (day 20-43) were related to the slight increase in responding during the warning stimulus and not over-all response rate. Comparison of per hour rate with total response rate during the warning indicated that the decrease in shocks at the higher intensities could be attributed to the greater response efficiency immediately preceding shock.

During the first 3 hr, the majority of responses were made after the shock had been delivered. By the end of the first day, however, 80% of the total were avoidance responses (Fig. 2, upper left). By the tenth day there was little change in the responses dur-

ing the warning stimulus and although responses in shock had increased, responses with IRTs between 30 and 270 sec had virtually disappeared (only IRTs of 1% or greater are shown). After the fifteenth day, IRTs had stabilized and remained constant until the end of the experiment (days 20, 30, and 40 are typical). Following the fifteenth day, responding during the warning stimulus accounted for the highest per cent of the total responses and was approximately equal to the per cent of responses in shock. It was noted when considering the total for all days, that the higher per cent of response which occurred during shock period (IRT greater than 300 sec) was due to the sizable variability of the first 15 days.

An analysis of the daily shock pattern showed no order in their occurrence, *i.e.*, a higher percentage of shocks did not consistently occur during a particular segment of the day. The same was true of responses. Visual observation of animal number 1 revealed that although it often slept through the warning stimulus, sleep never continued after shock. Eating and drinking also took place only in the absence of shock. This was also true of animal number 2.

Fig. 2. IRT distribution for single 24-hr periods and average distribution for all days. The percentage of responses in absence of the warning stimulus (buzzer) are shown in black; those during the first 30 sec of the warning stimulus are shaded and those occurring after the delivery of shock are shown in white.

DISCUSSION

These results show that rats can live and effectively respond to avoid aversive stimula-

tion for extended periods of time. The longest possible shock-free interval that subject number 1 could obtain without responding was 5 min. Since it did not sleep through the

shock, this meant that all resting or sleeping was necessarily interrupted at least once every 5 min by either a shock or a response. Subject number 2, on the other hand, benefited from efficient avoidance on the part of subject number 1, which occasionally produced shock-free intervals as long as 1 hr. If any ill effects occurred, they were undetectable in either animal by visual observation.

REFERENCES

- Boren, J. J. Decrement in performance during prolonged avoidance sessions. *J. exp. Anal. Behav.*, 1960, 3, 201-206.
- Brady, J. V., Porter, R. W., Conrad, D. G., and Mason, J. W. Avoidance behavior and the development of gastro-duodenal ulcers. *J. exp. Anal. Behav.*, 1958, 1, 69.
- Byck, R. and Hearst, E. Adjustment of monkeys to five continuous days of work. *Science*, 1962, 138, 43.

Received October 16, 1964