Escape conditioning in snakes employing vibratory stimulation¹

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Eight rat snakes were given 50 paired presentations of light and vibratory stimulation. Ss were tested in a two compartment chamber with a 12 hr. interval between each trial. Moving from one compartment to the other terminated and permitted escape from the vibratory stimulus. Data from two Ss was discarded because of inadequate responsiveness. Except for the terminal block of trials Ss demonstrated a progressive decline in escape time. Individual Ss, however, were highly variable in their performance.

Previous investigations of escape conditioning in snakes have used temperature as the aversive stimulus. Kellogg & Pomeroy (1936) placed water snakes in a water maze containing cold water. A correct response permitted escape into a warm goal compartment. The resultant learning curves showed a high degree of intra- and inter-S variability but did demonstrate a gradual drop in overall response time.

Instead of using heat as a reinforcing condition, Wolfle & Brown (1940) attempted to use it as an aversive stimulus. Essentially no learning was demonstrated when snakes were run, in a multiple T-maze having a dry surface with a high temperature, to a shaded pan of cool water. Wolfle and Brown also attempted using shock as an aversive stimulus. They found it unsatisfactory in that the snakes either did not respond or else responded so strongly as to make learning impossible. Preliminary attempts from this laboratory using varying current and voltage ratings provided by constant current and constant voltage AC and DC sources confirmed this finding. An alternative possibility for an aversive stimulus is vibration. The present report describes an attempt to obtain escape conditioning in snakes using vibration as an aversive stimulus.

Method

Ss were eight rat snakes, six of which were yellow rat snakes, *Elaphe obsoleta quadrivittata*, and two were the similar Everglades or "orange" rat snake, *Elaphe obsoleta rossalleni*. The length of the snakes varied from 88.9 to 132.1 cm at the beginning of the experiment. They were housed in individual aquariums located in a room maintained at an approximate temperature of 25.5° C. Ss had ad lib access to water. All Ss but one were fed young rats once weekly. The largest S, a yellow rat snake, refused to eat and was force fed two eggs weekly.

The apparatus was a rectangular chamber 61.0 x 30.5 x 40.6 cm in length, width and height, respectively. The chamber was divided into two compartments of equal size by a partition which had a 5 cm gap across the floor. The gap permitted passage of a snake from one com-

partment to the other. The floors of both compartments were separate and isolated, being independently suspended from the entire apparatus by foam rubber pads. Except for the floors and the side facing the experimenter, which was a sheet of clear plastic, the entire apparatus was made of plywood sections fitted to an aluminum frame. The start compartment, located on the experimenter's right, was unpainted on the interior. The remainder of the apparatus was painted flat black. The tops of the start and escape compartments were separately hinged, and the top of the start compartment had a light fixture containing a 15-w 120 VAC lamp located in the center. A 6 VAC buzzer was mounted on the underside, and in the center of the floor of the start compartment. The entire apparatus was placed upon blocks of acoustical insulation to further control extraneous vibration. A control box containing switches, a transformer, relays, etc., was used to present the vibratory and visual stimuli, and to operate a chronometer.

Two trials a day were given to each S with a 12-hr. interval between trials. Ss were not run during ecdysis so that there was on occasion more than a 12-hr. lapse between two trials for a particular S. On each trial the experimenter released the head and body of S within the start compartment in as much the same manner on each trial as possible. The lid of the start compartment was then closed and the control apparatus was operated within approximately 5 sec. Closing a switch turned on the overhead light and started the chronometer. After 5-sec. light duration a time delay relay turned on the buzzer until an escape response was made. An escape response was defined as one in which the head and body, i.e., all of the snake except from the vent caudally, were in the escape compartment. If S had not escaped within 25 sec. from onset of the buzzer the trial was considered terminated and S was removed from the apparatus. The weekly feeding was always given immediately after an evening trial so as to produce minimum interference with performance.

Results and Discussion

The performance of one yellow rat snake, no. 5, was irregular and inadequate. Another yellow rat snake, no. 6, responded to the vibratory stimulus as though it were positively reinforcing. On all trials but two this S coiled herself in the center of the start compartment directly over the buzzer. The data for the remainder of Ss are presented in Fig. 1. It can be seen that there is a progressive decline in escape time except for the last block of trials. The increase in the last block of trials was produced by what appeared to

Fig. 1. Mean escape time (sec.) for six snakes.

be adaptation to the vibratory stimulus. Individual behavior of Ss was highly variable from trial to trial although the standard error of the mean for the blocks of trials, shown in Fig. 1 by the vertical bars through each point, in every case was 1.2 sec. when rounded

to the nearest 1/10 sec. It should be pointed out that the curve for eight Ss is almost identical to that for six Ss except for greater variability measures for the larger number of Ss.

Although it must be concluded that the Ss demonstrated a meaningful drop in response time the intensity of vibratory stimulation was not optimal. The failure to observe any avoidance responses and the terminal adaptation to the vibration would seem to confirm this opinion. The present study would probably have been improved by using smaller compartments in the test apparatus and by using a one-way screen instead of a transparent front.

References

- Kellogg, W. N., & Pomeroy, W. B. Maze learning in water snakes. *J. comp. Psychol.*, 1936, 3, 275-298.
 Wolfle, D. L., & Brown, C. S. A learning experiment with snakes. *Copeia*, 1940, 134.

Note

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