Effects of sensory deprivation and hydroxyzine on rats' bar pressing[1]

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Female albino rats (N = 20) were used in this experiment designed to study the effects of hydroxyzine on operant behavior following 24 h of sensory deprivation (SD). A significant drug effect was demonstrated, but no significant degree of inhibition upon the number of bar presses, nor any of the interaction effects resulted from SD. The inconsistency of these results with earlier studies was discussed.

Long periods of SD have been shown to suppress learning in rats and increase their emotionality. This increase in emotionality has been hypothesized as the cause of this suppression (Pishkin & Shurley, 1966). The present experiment was designed to test the effects of SD on operant behavior. Hydroxyzine-hydrochloride was administered to the Ss since it was shown to reduce anxiety involved in human learning situations (Pishkin, Shurley, & Wolfgang, 1967).

Subjects

The Ss were twenty albino female rats of the Holtzman strain, each caged with another albino female rat which was not used in the experiment. All the rats were approximately 51 days old when shaping began, and their mean body weight at the time of injection was 250 g.

Apparatus

For conditioning, a Stoelting Skinner Box (Cat. No. 31292) was used with a lever and a water reward dipper (capacity, .02 cc) and was illuminated with a 15 W bulb. An automatic counter registered the cumulative number of bar presses.

An Animal Acoustical Chamber, Model AC-1 Industrial Acoustics Co. (sound coefficient of .99 at 1000 cps) was used to effect SD. The chamber was 27 in. high, 25 in. wide, 25 in. deep and weighed 250 lbs. It was equipped with a quiet ventilation fan and four insulator pads at the base to prevent vibration. The temperature was kept constant at 72°F. The chamber was completely dark. An ordinary metal cage (10 x 8 x 7 in.) was placed inside the chamber. The rat was confined in this cage inside the chamber during SD, alone, without food or water, for the 24 h period. For the "normal but solitary" environment, rats were placed in an ordinary metal cage (10 x 8 x 7 in.) outside the chamber, alone, without food or water, for the 24 h.

Procedure

During the training period, the rats were conditioned to press a lever for a water reward in 2 h sessions following 46 h of water deprivation. The criterion for S's inclusion in the experiment was a minimum of 200 presses in the 2 h period by the second shaping trial. Five shaping trials, 2 h each, were given before the experimental treatment began. The shaping trials were distributed in the following manner: there was a 30 day interval between the first, the second, and the third trial and a 15 day interval between the third, the fourth, and the fifth shaping run. Seventy hours after the last training session the rats were randomly divided into four groups and subjected to the experimental conditions. The number of bar presses was recorded cumulatively at 10 min intervals.

The four experimental conditions were (1) no SD and saline injection, (2) no SD and hydroxyzine injection, (3) SD and saline, and (4) SD and hydroxyzine. The experimental run began with 22 h of water deprivation, followed by 24 h of SD or a "normal but solitary" environment with continued water deprivation. At the end of 46 h the S was injected with hydroxyzine (50 mg/kg of body weight) or an equivalent volume of saline subcutaneously between the scapula on the dorsal side. The S was then immediately placed in the Skinner box for the 2 h period.

Results and Discussion

An analysis of variance showed no significant differences in the shaping trials of the four experimental groups ($F = .555$, $p > .05$). On the experimental run, a significant drug effect was shown ($F = 7.26$, $p < .05$), indicating that hydroxyzine significantly inhibited bar pressing rate, but no effect by SD ($F = .50$, $p > .05$), nor a significant interaction ($F = .25$, $p > .05$) was found. Pre- and post- comparisons (the fifth shaping trial vs the experimental run) using a t test again showed that the drug significantly reduced operant rate. Significant differences between the last shaping period and the experimental run were found between the drug-SD ($t = 2.64$, $p < .05$) and drug-no SD ($t = 4.24$, $p < .01$) conditions. The suppressing effect of the drug on the conditioned response can be seen in Fig. 1, where virtually no responses were made after 30 min in the box.

It is evident that hydroxyzine suppressed the response rate, rather than maintained it as was expected. This probably resulted from the dosage level (50 mg/kg) as Levis, Preat, Beersaerts, Dauby, Beelen, & Baugniet (1957) reported suppression of an "all-or-none" avoidance response at the subcutaneous dosage of 60 mg/kg. Hughes & Kopmann's (1960) study also suggests that a dosage of 10 mg/kg of hydroxyzine would be more effective for tranquilization. Measuring suppression by the effect on a continuous type behavior appears to be superior to the all-or-none technique.

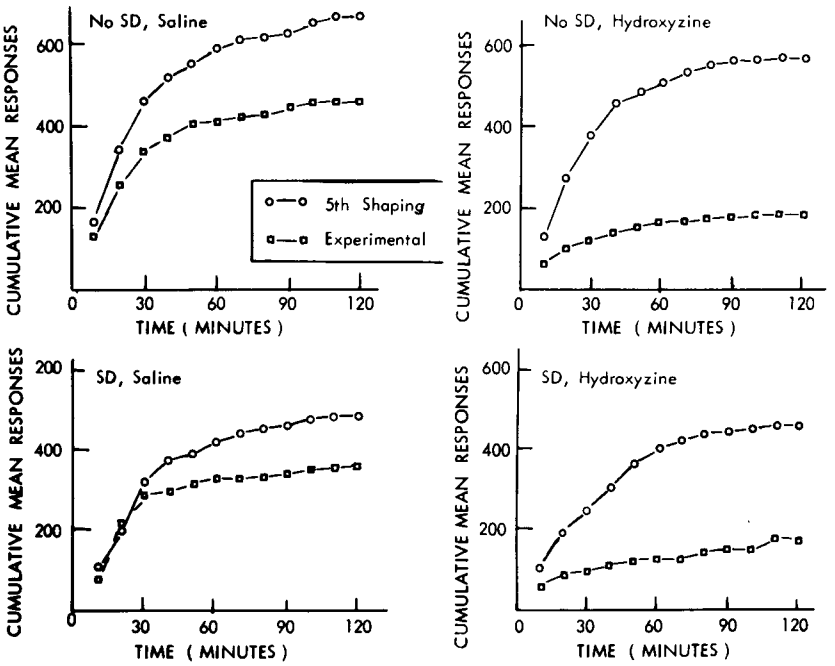

Fig. 1. Cumulative responses on the fifth shaping and experimental trials by the four groups.

The former measure provides information on the relative degree of suppression while showing suppression as a graded effect over time. In the all-or-none technique, the effective dosage is dependent on the specific task being utilized.

Obviously, the 24 h period of SD did not negatively influence subsequent bar pressing. This is probably due to the countereffect of the five previous shaping trials, which would strongly strengthen the conditioned behavior. Contrasting this result with those of Pishkin & Shurley (1966), the difference in results may be related to the type of behavior being suppressed: learning, or performing a task that has already been learned. Figure 1 shows a slight trend toward strengthening the response rate under SD conditions. This trend was suggested by Wendt, Lindsley, Adey, & Fox (1963) who explained their significant results with monkeys as "stimulus hunger."

Standard deviations were computed on Ss' response on each shaping trial, but no significance or trends were demonstrated. This result suggests that individual differences contribute a large degree of variability to comparative group results. In analyzing the shaping trials then, it should be more advantageous to use each S as his own control.

The difference of each S's response on sequential shaping trials was tested for homogeneity of variance. None of the F ratios were significant. Although nonsignificant, there was a progressive decrease in the difference in the number of bar presses between the first and all of the subsequent shaping trials. It is noteworthy that SD had no inhibiting effects on bar pressing, as contrasted to the earlier findings (Pishkin & Shurley, 1966) and is probably due to 10 h of shaping before the experimental run. This finding suggests that SD may have inhibiting effects upon initial stages of operant behavior, but not in cases where the response is already well established.

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