The effects of novelty on laboratory rat digging behavior

DONALD SCHULTZ

The University of New England, Armidale, N.S.W., Australia

Laboratory rats were allowed to burrow for the first time in an earthen-floored open field. The results indicated that the tendency to dig was related to the degree of novelty of the field; those Ss which were given the opportunity to become familiar with the digging area prior to their burrowing experience dug significantly less than those Ss which were not. The data suggested that in this case the digging may have been elicited by the rat's aversion to the novel stimuli.

Although bred under laboratory conditions for many generations, inexperienced rats appear to be accomplished diggers almost immediately after being given the opportunity to do so (Barnett, 1959; Deutsch, 1960). While this observation implies that the rat may have an independent burrowing "drive," a more parsimonious explanation can also be postulated. Specifically, when Barnett (1959) and Deutsch (1960) tested their Ss, they placed them in a novel digging box; thus, it is possible that the novel stimuli played a major role in the elicitation of the digging. Since it has been shown (Johnston, 1964) that rats will exhibit escape behavior in novel open fields, the burrowing could have been escape behavior elicited by the aversive novel stimuli of the digging box.

Because the strength of escape behavior in rats is positively related to the degree of novelty of the surrounding environment, and if novelty is a factor in eliciting rat burrowing, it follows that the more novel the digging box stimuli, the greater should be the S's tendency to escape and, concomitantly, the stronger should be its tendency to dig. Therefore, the purpose of this experiment was to test the hypothesis that the tendency to dig, i.e., the latency to begin burrowing and the amount of time spent burrowing, in the naive laboratory rat is positively related to the degree of novelty of the digging box.

SUBJECTS AND APPARATUS

The Ss (N = 20) were 140-day-old male albino Simonsen strain rats maintained on an ad lib food and water schedule.

The open fields were 90 x 90 x 85 cm boxes constructed of brown 2-cm-thick cardboard with an 8-cm-diam peephole at the top corner. Following Deutsch's (1960) design, moist clean earth was placed in each field so that there was a slope (approximately 30 deg) on one side; maximum depth was 18 cm. In

addition, in every corner of the box, there was an 18 x 18 x 5 cm projection which was buried in the dirt. The temperature in the open field was $23^{\circ} \pm .5^{\circ}\text{C}$.

PROCEDURE

For 10 consecutive days, the Ss were individually placed in a 25 x 25 x 25 cm transparent or white translucent Plexiglas container for a 20-min period. Each container was situated in the middle of a digging box. The Group A Ss (N = 10) were placed in the transparent containers and could clearly see the surrounding digging area. On the other hand, the Group B Ss (N = 10) were placed in the translucent containers and could not see the digging area, only diffuse white light. At no time during these 10 days was any S allowed to come in contact with the soil.

On the 11th day, the containers were removed and each S was placed directly into the digging box for a 60-min period. The E observed the S through the peephole, and the latency of the first burrowing response and the amount of time spent digging were recorded. If no digging was seen, a latency of 60 min was given. The results were statistically analyzed using the Mann-Whitney U test (Siegel, 1956).

Table 1
Summary of the Digging Latencies and the Percentage of Time Burrowing Once Digging was Initiated*

Group	N	Median Digging Latency (Min)	Median Percentage of Time Burrowing Once Digging Was Initiated (Percent)
A	10	3.6 (1.1-8.5)	30 (12-43)
B	10	9.4 (5.3-20.5)	16.5 (8-20)

*Semi-quartile ranges are in the parentheses below the median scores.

RESULTS AND DISCUSSION

A summary of the results is shown in Table 1. The Group A Ss had significantly ($U = 18$, $p < .02$, two-tailed) longer digging latencies and spent a significantly ($U = 12$, $p < .02$, two-tailed) smaller percentage of their time digging once burrowing was initiated than did Group B Ss. Therefore, the experimental hypothesis was supported; those rats which were given the opportunity to become familiar with the digging area prior to their first burrowing experience exhibited less burrowing than those which were not.

The results of this study indicate that digging in the laboratory rat can be affected by such exogenous factors as novel stimuli. Since the strength of escape behavior in rats is positively related to the degree of novelty of the surrounding environment (Johnston, 1964), it will be suggested that the Ss in this study and in Deutsch's (1960) and Barnett's (1959) experiments were motivated to dig because of their aversion to the digging box stimuli. Once motivated to escape these stimuli, the burrowing behavior was reinforced when through this action the S was able to move away from and, when the burrow was completed, to escape the stimuli.

While more precise studies must be completed before an adequate comparative analysis can be made, it is possible that this interpretation can also be applied to other rodent species. For example, it has been found that the amount of sand-digging in an apparatus is not closely related to the utilization of burrowing under natural conditions in deer mice (King & Weisman, 1964) and in multimammate mice (Veenstra, 1958). Perhaps the amount of digging was related to the S's reaction to the apparatus; for those mice that exhibited the greatest amount of digging, the apparatus stimuli were the most aversive.

Since the burrow gives the animal more protection than the surface, digging in the presence of aversive stimuli may have an adaptive significance. However, it should be emphasized that only certain types of aversive stimuli may elicit burrowing. For instance, an electric shock may not promote digging, but freezing instead. Thus, further research must be completed before there can be an adequate understanding of this complex and interesting behavior.

REFERENCES

- BARNETT, S. A. *The rat: A study of behavior*. Chicago: Aldine, 1959.
- DEUTSCH, J. A. *The structural basis of behavior*. Chicago: University of Chicago Press, 1960.
- FANTINO, A., & COLE, M. Sand-digging in mice: Functional autonomy?

- Psychonomic Science, 1968, 10, 29-30.
- HINDE, R. A. Unitary drives. *Animal Behaviour*, 1959, 13, 130-141.
- JOHNSTON, W. A. Trends in escape and exploration. *Journal of Comparative & Physiological Psychology*, 1964, 58, 431-435.
- KING, J. A. & WEISMAN, R. C. Sand-digging contingent upon bar pressing in deer mice (*Peromyscus*). *Animal Behaviour*, 1964, 12, 446-450.
- SIEGEL, S. *Nonparametric statistics for the behavioral sciences*. New York: McGraw-Hill, 1956.
- VEENSTRA, A. J. The behaviour of the multimammate mouse, *Mastomys natalensis*. *Animal Behaviour*, 1958, 6, 195-206.