testing. This generalization-decrement notion could also be a reason for Group PR not being significantly more resistant to punishment than Group C. Third, contrary to the findings of Miller (1960), performance of Group PP Ss was not appreciably slowed down by the end of operant-box training. Also, Brown & Wagner (1964) delivered shock 1.0 sec after S made contact with the food, while in the present study, Ss were shocked simultaneously with the opening of the goal-cup lid. Thus, it is possible that Group PP Ss did not learn to resist punishment to such an extent that they could generalize this learned resistance to punishment to a new "stress" (i.e., nonreinforcement) in a new situation.

REFERENCES

- AMSEL, A. The role of frustrative nonreward in noncontinuous reward situations. *Psychological Bulletin*, 1958, 55, 102-119.
- AMSEL, A. Frustrative nonreward in partial reinforcement and discrimination learning: Some recent history and a theoretical extension. *Psychological Review*, 1962, 69, 306-328.
- BANKS, R. K. Persistence to continuous punishment following intermittent punishment training. *Journal of Experimental Psychology*, 1966a, 71, 373-377.
- BANKS, R. K. Persistence to continuous punishment and nonreward following training with intermittent punishment and nonreward. *Psychonomic Science*, 1966b, 5, 105-106.
- BANKS, R. K. Intermittent punishment effect

- (IPE) sustained through changed stimulus conditions and through blocks of nonpunished trials. *Journal of Experimental Psychology*, 1967, 73, 456-460.
- BROWN, R. T., & WAGNER, A. R. Resistance to punishment and extinction following training with shock and nonreinforcement. *Journal of Experimental Psychology*, 1964, 68, 503-507.
- MILLER, N. E. Learning resistance to pain and fear. Effects of overlearning, exposure, and rewarded exposure in context. *Journal of Experimental Psychology*, 1960, 60, 137-145.
- ROSS, R. Positive and negative partial-reinforcement extinction effects carried through continuous reinforcement, changed motivation, and changed response. *Journal of Experimental Psychology*, 1964, 68, 492-502.
- TERRIS, W., GERMAN, D., & ENZIE, R. Transituational resistance to the effects of aversive stimulation. *Journal of Comparative & Physiological Psychology*, 1969, 67, 264-268.
- TERRIS, W., & WECHKIN, S. Learning to resist the effects of punishment. *Psychonomic Science*, 1967, 7, 169-170.
- THEIOS, J., & MCGINNIS, R. W. Partial reinforcement before and after continuous reinforcement. *Journal of Experimental Psychology*, 1967, 73, 479-481.

NOTES

1. This research was based on a thesis submitted to the Graduate School of the University of Oklahoma in partial fulfillment of the requirements for the MS degree. The author wishes to thank Dr. William Terris for advice and assistance during the course of this research and for presenting these data at the Midwestern Psychological Association Convention in Chicago, 1968.

2. Now at the University of Oklahoma Medical School, Oklahoma City.

Effects of current deprivation and deprivation experience on exploration¹

DAVID LESTER, *Suicide Prevention & Crisis Service, 312 Lafayette Building, Buffalo, N. Y. 14203*

Rats with experience of deprivation emerged from their home cages sooner than rats without deprivation experiences. Current deprivation had little effect on the exploratory behavior of rats. These results were seen as contradicting previously published data.

Hughes (1968) found that current deprivation decreased locomotor activity for deprivationally experienced rats but had no effect on deprivationally inexperienced rats. The latency for approach to novel stimuli was, however, affected by current deprivation. Previous studies (Lester, 1967a) have found that deprivation

facilitates exploratory behavior in male rats and inhibits exploratory behavior in female rats. These data conflict and the present study was designed to clarify the phenomenon. In the present study, the variable of handling experience was also introduced.

METHOD

The Ss were 48 male and 48 female rats from the Charles River Breeding Laboratories, Strain CD, aged 65 days.

The rats were housed singly in Walmann cages, 9½ x 7 x 7 in. They were tested in a Y maze with wood walls, 6 in. deep, 6 in. wide, and 18 in. long. The floor of the maze was of paper and changed for males and females. The maze was covered with wire mesh.

On Day 1, the rats were caged singly and given ad lib food and water. On Days 4-8

and 11-15, half of the rats were handled. Handling consisted in removing the rat from its cage, weighing it, and returning it to its cage. On Days 3, 5, 7, 10, 12, and 14, half of the rats were deprived of water for 24 h. All rats were fed via receptacles placed on the outside of the cages. Thus, the cages of nonhandled rats were not opened or moved during Days 1-17.²

On Day 18, each rat was tested for exit from the home cage. The cage of each rat was pulled open about 4 in. and the time taken for the rat's nose to rise above the top of the cage was timed with a stopwatch to the nearest 0.1 sec. Also, the time taken for the rat to place one paw on the rim of the cage was noted. Half of the rats were tested under 0 h and half under 24 h of water deprivation.

On Day 20, each rat was placed for 3 min into the Y maze and the sequence of arms entered was noted. An entry was defined as made when all four paws of the rat had entered into the arm. Half of the rats were tested under 0 h and half under 24 h of water deprivation. Each rat was tested under the alternate deprivation to that tested under on Day 18.

The experiment was, therefore, a 2 by 2 by 2 by 2 factorial design with six rats in each group. The variables were sex (S), current deprivation (D), deprivation experience (E), and handling experience (H).

RESULTS

The only significant effects in the four-way analysis of variance carried out on the number of arm entries of each rat were: (1) females entered more arms than males (11.2 and 9.0 arms, respectively) ($F = 14.8$, $df = 1/80$, $p < 0.01$); (2) the H by D interaction was significant ($F = 7.6$, $df = 1/80$, $p < 0.01$), with handled rats entering more arms when satiated than when deprived, whereas unhandled rats entered more arms when deprived than when satiated; and (3) the S by E by D interaction was significant ($F = 9.8$, $df = 1/80$, $p < 0.01$) which arose from the fact that the effect of deprivation reported by Lester (1967b) was found in deprivationally inexperienced rats but not in deprivationally experienced rats.

The analysis of variance on the orderliness measure of the Y-maze exploration [measured as did Montgomery (1955)] produced no significant F ratio.

The analysis of variance on the nose-exit latencies (subjected to a logarithmic transformation to achieve homogeneity of variance) produced two significant effects: (1) rats with deprivational experience exited faster than those with no deprivational experience (0.95 log sec and 1.19 log sec, respectively) ($F = 8.91$, $df = 1/80$, $p < 0.01$); and (2) the S by H by E

interaction was significant ($F = 7.91$, $df = 1/80$, $p < 0.01$) since, for male rats, deprivation experience decreased latencies for unhandled rats compared to handled rats, and lack of deprivation experience increased latencies for unhandled rats compared to handled rats, whereas for female rats, the opposite was true.

The analysis of variance on the paw-exit latencies (subjected to a logarithmic transformation to achieve homogeneity of variance) produced only one significant effect: handling decreased latencies for male rats but increased latencies for female rats ($F = 4.80$, $df = 1/80$, $p < 0.05$).

DISCUSSION

The present experiment failed to replicate the results of Hughes's experiment (Hughes, 1968). Hughes found that current deprivation decreased activity for deprivationally experienced rats but had no effect on deprivationally inexperienced rats. The present study found no significant interaction and, in fact, the data were in a direction opposite to that reported by Hughes.

None of the variables appeared to affect the orderliness of the exploratory behavior of rats. This makes sense since the variables of handling and deprivation possibly affect the fear levels of rats (Lester, 1967a) and Lester (1967c) found that fear had no effect

upon the orderliness of the exploratory behavior of rats.

The latency measure of exploration of exit from home cage appears to be an unreliable measure. No term in the analyses of variance was significant both for nose-exits and paw-exits. The correlation between the two measures over all 96 rats was 0.42 ($p < 0.01$), and Lester³ has reported product-moment correlations in other experiments between different exit measures and repeated exit measures ranging from 0.37 to 0.67. Thus, these correlations leave a large amount of the variance unaccounted for.

Lester (1967b) found that male rats explore more when deprived than when satiated, whereas the opposite was true for female rats. Lester,⁴ in subsequent studies, has failed to replicate this result. The present study presents a possible explanation for this inconsistency. The sex difference in exploration reported by Lester (1967b) was found for arm entries here only for deprivationally inexperienced rats. This factor was not systematically varied in previous experiments, and its uncharted influence may have led to the inconsistencies. It is also possible that other independent variables that affect the fear level of the rats may influence the appearance of the sex difference in exploration.

Finally, it should be noted that this experiment used water deprivation rather than food deprivation (which is usually used in these experiments). This was to ensure that deprived rats did not receive minimal experience of some of the components of handling (such as cage movements) when being deprived. This factor has not been controlled for in previous experiments.

REFERENCES

- HUGHES, R. N. Effects of food deprivation, deprivation experience, and sex on exploration in rats. *British Journal of Psychology*, 1968, 59, 47-53.
- LESTER, D. Sex differences in exploration: Toward a theory of exploration. *Psychological Record*, 1967a, 17, 55-62.
- LESTER, D. Sex differences in exploration of a familiar locale. *Psychological Record*, 1967b, 17, 63-64.
- LESTER, D. Effects of fear on exploratory behavior. *Psychonomic Science*, 1967c, 9, 117-118.
- MONTGOMERY, K. C. The relation between fear induced by novel stimulation and exploratory drive. *Journal of Comparative Psychology*, 1955, 48, 254-260.

NOTES

1. This research was supported by Research Grant MH 14404-01 from NIMH.
2. This has not been possible in experiments using food deprivation.
3. Lester, D. The reliability of exploratory measures: 1 & 2. Unpublished manuscript.
4. Lester, D. Effects of sex and deprivation on exit latencies of rats. Unpublished manuscript.