Dependence on smell of social and overpopulation effects in the white rat

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Sixty-four albino rats were obtained at 30 days of age, and half of them had their olfactorial bulbs aspirated. Two weeks later half of the Ss were housed in groups of 4 per cage and half in groups of 16 per cage. After 6 weeks all Ss were tested both individually and in groups in a counterbalanced manner in an open field where seven indices of emotionality were recorded. The results showed that smell is the dominant, if not sole, cue to group reduction of emotionality in the white rat. It is not, however, responsible for the increased emotionality found in overpopulated rats. The abnormal social behavior in overpopulated rats, however, tends to be eliminated by loss of smelling ability.

Morrison & Hill (1967) found that white rats tested in groups of three in an approach-avoidance conflict were less emotional than white rats tested individually in the same situation. Morrison & Thatcher (1969), in a study which replicated the biological and psychological effects of overpopulation in white rats, found that this group reduction of emotionality did not exist for those animals raised under high densities of 16 or 32 Ss per cage, though it was found for the animals housed 1 or 4 per cage. Ropartz (1968) has shown that the increased adrenal weights usually associated with fighting in mice can be caused solely by the odor of another mouse. Overpopulation in rats also shows increased adrenal weight. The present experiment attempts to find out the effect of smell on the overpopulation effect, the group testing effect, and the Overpopulation by Group Testing interaction.

METHOD

Sixty-four albino rats were obtained at 30 days of age, and half of them had their olfactorial bulbs aspirated. Two weeks later half of the Ss were housed in groups of 4 per cage and half in groups of 16 per cage, with food and water ad lib.

All cages measured 17 x 10 x 7 in. and were constructed of metal with screen on the front and bottom. Auditory and olfactory, but not visual or tactual, interaction was possible between cages. After 6 weeks all Ss were tested both individually and in groups in a counterbalanced manner in an open field where seven indices of emotionality were recorded.

The open field measured 45 x 45 in. and had 21-in. sides. It was painted black and ruled into 9-in. squares.

Recording was done on an Esterline-Angus event recorder, which recorded the occurrence and duration of:

(1) center entry—S is in a square that does not have a wall along its border; (2) corner occupancy—S is in one of the four corner squares; (3) movement—the number of lines S crossed; (4) rearing—either against the wall or free rearing; (5) grooming; (6) freezing—S spends more than 5 sec crouching in an immobile position; (7) defecation. The data were then analyzed, using an analysis of variance with 1/56 df and 5% significance level.

RESULTS

From inspection of the intercorrelations of the behavioral indices, two response patterns emerged. One pattern was characterized by short length of time in corner occupancy, high number of squares entered, high number of times standing, high number of center entry, short length of time freezing, and long length of time grooming. This was operationally defined as low emotionality; this conforms to previous studies and the observation of the E. High emotionality was indicated by the opposite.

Physiological

The physiological changes due to overpopulation were found to replicate the previous findings of Thiessen (1964) and Christian (1961). Animals raised 16 per cage for overpopulation conditions were found to weigh less ($F = 3.96$). Overpopulated Ss also had smaller adrenal weights ($F = 3.19$). However, the body-weight/adrenal-weight ratio showed that overpopulated Ss had a higher adrenal weight per body weight than the animals housed in normal conditions. Olfactorial bulb removal operations had no effect upon the body weight or adrenal weight of the Ss.

Group Reduction of Emotionality

The findings of Morrison & Hill (1967) were also replicated in that the group-tested animals showed less emotionality than did individually tested

animals. Group-tested animals crossed more lines ($F = 11.65$), reared less ($F = 5.18$), and spent less time in the corner ($F = 6.61$) than did individually tested animals.

Density-Testing Interaction

This experiment replicates the Morrison & Thatcher (1970) study in that overpopulated Ss were more emotional when group tested as opposed to the normal-rearing-condition Ss, who were less emotional when group tested. Overpopulated Ss spent more time in the corner when group tested ($F = 14.29$) overpopulated Ss also crossed fewer lines when group tested, as opposed to individually tested.

Effect of Bulbus

Olfactorial Removal

There was no significant main effect of the operation on body weight, adrenal weight, or the ratio of these two. The inability to smell also had no effect on any of the overpopulation effects. Olfactorial bulb removal did, however, effect the Ss social behavior. Ss without the ability to smell behaved in a group exactly like they behaved individually. This is shown by significant Operation by Testing interactions for number of lines crossed ($F = 6.82$) and for amount of time in the corner ($F = 6.71$).

Olfactorial bulb removal also tended to eliminate the abnormal social behavior exhibited by rats housed in high densities (number of lines $F = 5.32$, with other indices of emotionality showing a tendency toward elimination of the Testing by Density effect with operation).

CONCLUSION

Smell is the dominant, if not sole, cue to group reduction of emotionality in the white rat. It is not, however, responsible for the increased emotionality found in overpopulated rats as would be suggested by the work of Ropartz. On the other hand, abnormal social behavior in overpopulated rats tends to be eliminated by loss of smelling ability.

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