Visual vs physical social deprivation and affiliation in rats*

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Rats were housed in pairs and allowed full contact, in pairs separated by a wire mesh screen, or alone for 1 week before being tested for social attraction. Completely deprived animals were significantly more gregarious than animals given complete social contact over the 18-day test period. Animals allowed only visual contact were initially indistinguishable from rats housed alone, indicating the importance of physical contact. Differences gradually emerged, suggesting an additional effect of lack of visual contact, especially as deprivation became longer.

Among the many variables which affect one rat's attraction to another, one of the most potent is their immediate level of social deprivation or satiation. Typically, animals housed in social isolation, away from visual or physical contact with other members of their species and deprived of the opportunity for social interaction, spend substantially more time in social contact when given the opportunity than do rats allowed continuous access to cagemates (see Latané, Cappell, & Joy, 1970, for review). For example, Cappell & Latané (1969) found that rats housed in pairs spent only 33% time in contact, while single-housed rats averaged 61% time in contact when allowed to interact freely in pairs in a large open field. Another experiment reports socially isolated animals averaging 55% time in contact, while socially satiated animals averaged only 39% (Latané, Nesbitt, Eckman, & Rodin, 1971).

Latané, Cappell, & Joy (1970) compared single-housed rats with animals housed in groups ranging from two animals to six animals per cage. They found that single-housed animals were more gregarious than multiple-housed rats and that there was little difference among the various group sizes other than one. This suggests that housing differences do not result from animals' developing animosities as a result of crowding, since increased crowding did not decrease gregariousness, but rather that they are due to social deprivation.

It is unclear, however, what constitutes social deprivation. In these experiments, single-housed animals could hear and smell other rats but could not see them, touch them, or interact with them. It is possible, then, that social deprivation could be

explained in terms of visual deprivation, touch deprivation, interaction deprivation, or any combination of these.

Latané (1969) found that rats are not very much attracted to a rat enclosed in a wire mesh cage—a rat which could be seen but not touched or interacted with. Latané & Glass (1968) found that rats are not very much attracted to an anesthetized rat—a rat which could be seen and touched but not interacted with. If the opportunity for interaction is a more important source of social attraction than vision or touch, then it may also be that the deprivation of interaction is more important than the deprivation of vision or touch.

Although it would be obviously difficult to conduct a conclusive experiment on this issue, the present experiment was designed to provide some partial answers. In it, the gregariousness of rats housed such that they could see but not touch or interact with another rat was compared to that of rats housed either with complete freedom of contact or in relative isolation.

One complication in studying the effects of housing conditions is that they seem to be affected by a rat's familiarity with the testing situation. Typically, on the first few days of testing, when rats are unfamiliar with the testing environment, differences among conditions are minimal. With increasing exposure, single-housed rats typically become more gregarious, presumably as competing exploratory responses drop out (Eckman, Meltzer, & Latané, 1969) and differences among conditions emerge. This pattern of results has led to significant Housing by Day of Testing interactions in the experiments by Cappell & Latané (1969), Latané, Cappell, & Joy (1970), and Sloan, Poor, & Latané (1971). For this reason, rats in the present experiment were tested over a number of sessions.

SUBJECTS

Sixty male experimentally naive 30-day-old albino rats (Sprague-Dawley strain) were housed for 7 days prior to testing on an ad lib schedule of food and water which was continued throughout the experiment.

CONDITIONS

The Ss were assigned randomly to three experimental conditions of 10 pairs each. In the single-housing condition, each member of the pair was housed in a single cage measuring 8 x 10 x 7 in. with a wire mesh bottom and front. Animal pairs in the wire mesh condition were housed in a standard double cage (17 x 10 x 7 in.) with a wire front and bottom, but with a ¼-in. wire mesh screen dividing the cage and thus physically separating the two animals. Each rat's living area was thus roughly the same size and shape as a single cage. The remaining 10 pairs were housed in standard double cages, one pair to a double cage. Thus, the double-housed animals had the same floor area per rat, but more room to move.

APPARATUS

The open field was 4 ft in diam, with sides 18 in. high. The floor, painted flat white, was marked off into approximately equal areas. A more complete description can be found in Latané (1969). The field was illuminated by a 40-W bulb in a conical shield suspended approximately 40 in. above the field so that the light fell only in the field.

PROCEDURE

Each pair was tested together once each day for a 5-min session in the open field. After the first 6-day period (the time span used by previous studies), rats were run for another 6-day period with the same partners and for a final 6-day period with new partners randomly assigned within conditions. During the first 12 days, rats in the double and wire mesh housing conditions were run with their cagemates.

Measures were taken of time in contact, immobility, and boluses. Time in contact is the total proportion of time the animals were in direct physical contact over the 5-min period. Contact was timed whenever one rat touched the other, including vibrissae, but excluding exclusively tail-to-tail contact. Inter-O reliability on this measure is typically in the high .80s or .90s. Animals may come in contact for many reasons, to fight as well as to play. A time in contact measure will not differentiate these motivations. Although we believe it reasonable to speak of attraction in either case, there was little sign of aggressive motivation in the present experiment and no instance of overt fighting.

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Fig. 1. Effect of housing condition on time in contact, Days 1-6.

The immobility measure was calculated from the locations of each member of the pair at 10-sec intervals and is the proportion of consecutive 10-sec intervals in which an animal remained in the same location. At the end of the 5-min period, the number of fecal boluses was counted.

After the 5-min test period, animals were returned to their cages and the field cleaned of boluses. It was then mopped with a damp sponge soaked in a solution of soapy water and vinegar to remove any olfactory stimuli remaining from the previous session. The next pair was placed in the field, and the procedure was repeated until all 30 pairs had been run. The randomized running order was the same each day.

RESULTS

Single Vs Double Housing

Since the single- vs double-housing conditions replicate previous experiments, let us look at these data first. Single-housed rats were significantly more gregarious than double-housed rats ($F = 7.48$, $df = 1,27$, $p < .02$), spending 51% of their time in contact over the first 6 days as compared to 40% for double-housed rats. As expected, these housing conditions interacted with days ($F = 3.70$, $df = 2,54$, $p < .05$). This interaction is due to the fact that single-housed rats showed a significant increase in contact over days ($F = 9.72$, $df = 1,27$, $p < .005$), while double-housed rats did not ($F = 0.05$, $df = 1,27$, n.s.). This pattern of results is the same as that found by Cappell & Latané (1969) and Latané, Cappell, & Joy (1970).

Wire Mesh

Rats in the wire mesh condition

spent 47% of their time in contact over the first 6 days, which was not different from rats in single housing but approached significance in comparison to double-housed pairs ($F = 3.14$, $df = 1,27$, $p < .10$). Wire mesh rats were also similar to isolated rats in that they showed a significant increase in attraction over days ($F = 10.67$, $df = 1,27$, $p < .005$).

As overall analyses of variance showed, there were significant effects due to housing ($F = 3.85$, $df = 2,54$, $p < .05$), days ($F = 12.65$, $df = 2,54$, $p < .001$), and to the Housing by Days interaction ($F = 2.60$, $df = 4,54$, $p < .05$). This interaction is due to the fact that housing conditions did not affect gregariousness on the first days of testing, but had large effects by the last days (Fig. 1).

Continued Testing

Differences among housing conditions continued over the last 12 days of the experiment, although there were no further interactions with day of testing. During both periods, single-housed rats were significantly more gregarious than double-housed rats ($F = 34.7$, 11.1 , $df = 1,26$, $p < .001$, .005, Table 1).

Unlike the first 6 days, rats in the wire mesh condition displayed a level of gregariousness intermediate between the other two conditions. On Days 7-12, they were different from both the double- and single-housed animals ($F = 8.41$, 9.45 , $df = 1,26$, $p < .01$, .005). On Days 13-18, they were significantly different from single-housed rats ($F = 5.10$, $df = 1,26$, $p < .05$) but not from the double-housed condition ($F = 1.29$).

Rats were assigned randomly to new testing partners on Day 13. This had little impact on social attraction, except for a nonsignificant increase in attraction for double-housed rats no longer tested with their cagemates. This result is consistent with the findings by Latané, Schneider, Waring, & Zweigenhaft (1971) that rats in this situation do not develop attachments to specific partners.

Boluses and Immobility

Although there were no significant differences in defecation across housing conditions, there was a significant decrease over days ($F = 3.43$, $df = 2,54$, $p < .05$). Housing conditions did affect immobility ($F = 3.53$, $df = 2,27$, $p < .05$), with

double-housed rats being most immobile and single-housed being least.

DISCUSSION

Animals housed in the wire mesh condition had the opportunity to see, smell, and hear another rat for 7 days prior to testing and then for an additional 18 days throughout the testing period. They were denied only the opportunity for direct physical contact and interaction. Yet this deprivation was strong enough to result in contact scores which, over the first 6 days, were only slightly lower than those of single-housed animals and, overall, were a good deal greater than contact scores of together-housed animals. This suggests that differences in gregariousness between alone and double-housed animals are in large part determined by the lack of physical contact and interaction suffered by socially isolated animals.

Over a long period of time, visual deprivation was also important. The differences between alone and wire mesh conditions, however, unlike the differences between mesh and double conditions, did not emerge until after 1 week of testing and 2 weeks of differential housing. This suggests that contact deprivation has quicker effects than visual deprivation.

This experiment did not test the importance of olfactory or auditory social deprivation, since animals in all three conditions were housed in the same cage rack and could thus hear and smell each other. It is possible that these kinds of deprivation would lead to additional increases in social attraction.

Rats in the present study were relatively young, 37-49 days old during testing. The effects of social deprivation are not restricted to young animals, however, since differences comparable to those obtained between single- and double-housed rats have been found with 240-day-old Ss (Latané & Walton, 1971) and even with 450-day-old rats (Latané, Nesbitt, Eckman, & Rodin, 1971).

The effects also probably do not represent long-term changes in rats' predispositions to approach other animals, but rather short-term increases in motivation due to deprivation. Experiments in which rats are switched from one housing condition to another (Latané, Cappell

Table 1
Effects of Housing Conditions on Time in Contact

Days	Housing Conditions			p Values of Difference		
	Single	Wire	Double	S vs D	S vs W	W vs D
1-6	51%	47%	40%	.025	n.s.	.10
7-12	68%	56%	43%	.001	.005	.01
13-18	68%	56%	50%	.005	.05	n.s.

& Joy, 1970; Latané, Nesbitt, Eckman, & Rodin, 1971) show that the immediate level of social deprivation is more important than prior social experience in determining affiliation.

In conclusion, the results indicate that the denial of the opportunity for direct physical contact plays an important role in the increased gregariousness exhibited by socially deprived rats. It appears as though lack of visual contact may also have an effect, especially as deprivation becomes longer.

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NOTE

1. ANOVAs reported are made on measures summed over 2-day intervals.

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