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ABSTRACT

This report describes two studies in which 48 male college students and 144 male high school students, respectively, were assigned to high or low spatial density conditions and instructed to construct, as a team, an erector set model within a 40-minute period. High school students were assigned to high, middle, and low attraction groups on the basis of their ratings of their fellow classmates. The results indicated that subjects in both studies did not find those crowded conditions to be aversive or stressful or to influence their affective ratings of their fellow subjects. In the second study, while density had no main effects on task performance, under middle attraction conditions performance was impaired as a function of density. These findings suggest that while crowding did not necessarily result in a stressful experience, both social and spatial elements were important in obtaining group productivity. Overall, negative, and neutral verbal behavior increased as a function of density. Neutral verbal behavior increased in high and middle attraction groups while it slightly decreased in low attraction groups as a function of density. There were no efforts of density and attraction on positive verbal behavior. (Author)

THE EFFECTS OF CROWDING AND INTERPERSONAL ATTRACTION ON AFFECTIVE RESPONSES, TASK PERFORMANCE, AND VERBAL BEHAVIOR[1]

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SUMMARY

This report describes two studies in which 48 male college students, and 144 male high school students, respectively, were assigned to high or low spatial density conditions and instructed to construct, as a team, an erector set model within a 40-minute period. High school students were assigned to high, middle, and low attraction groups on the basis of their ratings of their fellow classmates. The results indicated that subjects in both studies did not find those crowded conditions to be aversive or stressful or to influence their affective ratings of their fellow subjects. In the second study, while density had no main effects on task performance, under middle attraction conditions performance was impaired as a function of density. These findings suggest that while crowding did not necessarily result in a stressful experience, both social and spatial elements were important in obtaining optimal group productivity. Overall, negative, and neutral verbal behavior increased as a function of density. Neutral verbal behavior increased in high and middle attraction groups while it slightly decreased in low attraction groups as a function of density. There were

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no effects of density and attraction on positive verbal behavior. It appears that crowding intensified social interaction in a negative manner, supporting the contention that crowding can have detrimental effects on human behavior. Crowding should be dealt with as a multidimensional concept that interacts with different settings, individuals, and activities.

A. INTRODUCTION

In recent years there has been growing concern over the effects of overpopulation and crowding on human behavior (9). Zlutnick and Altman (31), in a ten year review of the Reader's Guide to Periodic Literature, outlined many of the popular speculations on the effects of crowding, and they concluded that these speculations have received little solid research support.

Research examining the effects of crowding on lower animals (5, 6, 23) has indicated serious physiological and social breakdowns resulting from prolonged crowding. Generalizing from these studies, Dubos (8) stated, "the readiness with which man adapts to potentially dangerous situations makes it unwise to apply directly to human life the results of experiments designed to test the effects of crowding on animals" (p. 207).

In evaluating the effects of crowding on human beings, correlational invesitgations (14, 28, 30) have found a general tendency for death rate, infant mortality rate, public assistance rate, crime rate, disease rate, and rate of admissions to mental hospitals to increase as a function of density. However, many of these significant relationships vanished when such variables as social class, ethnicity, education, and migration were controlled for. Different measures of population density as well as dif-

ferent methods of partialling out confounding variables have produced an inconsistent picture of the relationship between density and pathology.

Being crowded is generally regarded as a negative experience, involving the perception of spatial restriction, as well as the experience of physiological and psychological stress (29). Experimental investigations with human subjects (13, 15, 27) have generally found that reports of affective experience were more negative in crowded than in uncrowded conditions. However, these results do not necessarily indicate the crowding functions as a stressor.

Freedman, Klevansky and Ehrlich (12) conducted a series of studies designed to assess more directly the notion that the effects of density on humans can be explained as reactions to stress. They theorized that high density functions as an aversive stimulus capable of raising drive level and interfering with performance on complex or not well learned tasks. To test this hypothesis, they placed groups of subjects in different sized rooms and had them perform a series of motor and cognitive tasks. They found no effects or trends attributable to density, and they concluded that density does not function as an aversive stimulus like electric shock or loud noise. The two studies presented below attempted to further clarify the effects of crowding on task performance and affective responses. The first experiment examined the effects of crowding on affective responses and task performance.

B. METHOD FOR BOTH EXPERIMENTS

Subjects were run in groups of four in the same eight by ten feet room. The only furnishings were a work table and four chairs. Subjects in low

spatial density conditions were provided twenty square feet per person, while in high spatial density conditions, they were provided six square feet per person. In low density condition, the table provided total work area of three square feet per person; while in high density condition, the table allowed a total work area of 1.5 square feet per person. While the constriction of total space contributes to crowding, the use of different sized tables was designed to maximize the probability that subjects would violate each other's personal space in coordinating task operations.

One erector set (Erector Mark 40 by Gilbert) was provided for each group with four sets of tools and instructions for the construction of a ladder truck model. This task was selected as it was highly complicated and required a high amount of verbal and physical interaction in coordinating task construction. Task performance was defined by the total number of correctly positioned pieces.

Subjects were instructed to construct the model, as a team, within a 40-minute period. They were told to proceed along any lines they all decided upon as long as they all actively participated in the construction of the model.

Following completion of the experimental task, subjects were given the Subjective Stress Scale (19) and nine-point rating scales designed to assess the degree of pleasantness of the experience and the degree to which they liked working with their peers. Items were included to ascertain whether or not subjects were aware of the spatial restriction and felt crowded.

C. EXPERIMENT 1: CROWDING AS A STRESSOR

1. Method

a. Subjects. Subjects were 48 male undergraduate students in introductory psychology at a midwestern university.

b. Procedure. Subjects were told that the purpose of the research project was to examine team coordination of task behavior. Each subject was randomly assigned to high or low spatial density conditions.

2. Results

High density subjects rated the adequacy of the working space significantly more negative ($t = 8.43$, $df = 46$, $p < .001$) and themselves as being signficiantly more crowded ($t = 4.07$, $df = 46$, $p < .001$) than did low density subjects. Ratings of the adequacy of space were more negative than were the "crowdedness" ratings ($t = 3.50$, $df = 23$, $p < .01$). No significant differences were obtained in ratings of subjects' affective reactions to the experience or of their fellow subjects or in terms of task performance.

3. Discussion

In much of the literature in this area, there seems to be some confusion in discussing crowding as a physical or psychological phenomenon. In this study, the terms "high density" and "crowded" have been used interchangeably. Stokols (29) distinguished between these two concepts and conceptualized density as involving a limitation of space, while crowding is seen as an experiential state in which the individual perceives a spatial restriction and experiences stress. Accordingly, some high density conditions (e.g., a cocktail party) may not lead to the experience of being crowded. In the present study, the focus has been on the effects that a high density situation has on the individuals who are experiencing it. It appears that subjects discriminated between their assessment of the physical and the psychological dimensions of the experiment. This observation supports the contention that physical parameters of an environment account for only a portion of the variance contributing to the subjective experience

of crowding, and that social factors are probably involved. It is most interesting to note that even when this subjective state of crowding was experienced, it was not necessarily perceived as aversive nor did it necessarily negatively affect attraction responses to others. These results support Freedman's et al. (12) contention that crowding, in and of itself, does not function as a stressor capable of raising drive level and impairing task performance. Freedman suggested that if crowding does affect behavior, it does so as a highly complicated social stimulus.

D. EXPERIMENT 2: CROWDING AS A SOCIAL STIMULUS

A number of experimental investigations have examined the effects of crowding on children's social behavior. Hutt and Vaizey (18) and McGrew (24) found a trend toward more aggressive behavior and less social contact in high density conditions. Hutt and McGrew (17) found that social interaction among children and with adults, and aggressive behavior, increased as spatial density increased. Price (25) observed that crowding yielded an increase in noninteractive behavior and a decrease in social interaction, but had no effect on aggression. Loo (20) found significantly less aggression in high density conditions only among boys. Subjects in her experiment also spent more time in solitary play in high density conditions. These studies indicate that while the effects of density on aggressive behavior are unclear, there is a general tendency for social interaction to decrease.

Griffit and Veitch (15) found that college students' attraction responses to an agreeing or disagreeing stranger were more negative in crowded experimental conditions. Several authors (13, 27) found that college males

responded more negatively to crowded conditions, while females responded more positively to crowded conditions. These studies indicate that in certain situations, crowding can adversely effect social behavior and subjects' perceptions of each other and that crowding affected male groups more negatively than female groups.

Freedman (10) suggested that crowding has no effect of its own, rather it intensifies the ongoing social situation. To test this hypothesis, female college students were asked to present extemporaneous speeches to groups of fellow students under conditions of high or low density and under positive or negative speaker performance evaluation by the group. He found that while density had no main effects on subjects' ratings, pleasant conditions were rated as more pleasant and unpleasant conditions were rated more unpleasant as a function of spatial restriction.

Similarly, the characteristics of individuals with whom one interacts could also be expected to affect one's responses to crowded situations. Altman and Haythorn (1) obtained significant interaction effects between amount of social withdrawal and incompatibility on certain personality traits among pairs of sailors socially isolated in a small room. MacDonald and Oden (22) compared the performance and interpersonal behavior of married couples subjects to crowded or spacious living conditions and found no significant differences.

These studies suggest that certain settings, activities, and individuals can affect the experience of spatial restriction in such a way as to negate unpleasant aspects of a crowded situation, and, in some instances, intensify positive elements. The purpose of the second experiment was to examine the effects of spatial density and interpersonal attraction on task performance, affective responses, and verbal behavior.

1. Method

a. Subjects. Subjects were 144 male sophomore students from a high school in Chicago. The student body was predominantly Caucasian, Catholic and middle class.

b. Procedure. Subjects were told that the purpose of the study was to examine the effects of team composition on group task performance. Subjects were informed that they would be given various personality inventories, an attitude survey, a background questionnaire, and forms for rating their fellow students, and that, on the basis of this information, they would be assigned to groups of four students to construct a model.

Subjects were assigned to high, middle, or low attraction groups on the basis of responses to the nine-point rating scales of their fellow classmates. High attraction groups were composed of students whose attraction ratings were within the top third of the scale ($\bar{X}$ = 1.72). Middle attraction groups were composed of students whose attraction ratings were within the middle third ($\bar{X}$ = 4.46). Low attraction groups were composed of students whose attraction ratings were within the bottom third ($\bar{X}$ = 6.95). Student t tests obtained significant rating differences between these groups at the .001 level. These groups were randomly assigned to conditions of high or low spatial restriction.

Credibility was added to the attraction manipulation by offering bogus information to the subjects based on the personality tests, attitude survey, and background questionnaire. Byrne (4) describes a number of studies in which such bogus information about assumed similarity between subjects influences interpersonal attraction. He found that, in general, as assumed similarity of personality, attitude and background increases, so does the

degree of interpersonal attraction. In this study, manipulations similar to those used by Back (2) were used to establish the desired expectations in the high, middle, and low attraction groups.

All sessions were tape recorded and rated independently by two raters. The rating procedure and the method of training raters were modifications of the procedures described by Bales (3). Raters scored each tape for three variables: the frequency of positive, negative, and neutral verbal behavior. Average rater reliability across these variables was .96.

2. Results

High density subjects rated the adequacy of the working space significantly more negative ($F = 67.65$, $df = 1/138$, $p < .001$), and themselves as being significantly more crowded ($F = 40.31$, $df = 1/138$, $p < .001$), than did low density subjects. Ratings of the adequacy of space were more negative than ratings of the degree to which one felt crowded ($t = 2.10$, $df = 71$, $p < .05$). Density had no significant effects on the pleasantness ratings, the degree to which subjects liked working together, and the Subjective Stress Scale ratings. There were no significant density by attraction interaction effects on any of these measures.

Density had no main effects on task performance, but there was a significant density by attraction interaction ($F = 3.68$, $df = 2/30$, $p < .05$). Post hoc Dunn's Test yielded significant differences only between middle attraction groups ($t = 2.57$, $df = 6/30$, $p < .05$) indicating more impairment as a function of density.

The effects of density and attraction on the frequency of total, positive, neutral, and negative verbal behavior were analyzed by means of four separate two-way analyses of variance. This statistical treatment was used

as opposed to a more economical method because the nature of the verbal behavior categories resulted in a biased distribution of scores favoring neutral verbal behavior and violated the analysis of variance assumption of homogeneity of variance.

Total verbal behavior increased as a function of density ($F = 7.23$, $df = 1/30$, $p < .01$), as did both neutral ($F = 13.89$, $df = 1/30$, $p < .01$), and negative, verbal behavior ($F = 9.57$, $df = 1/30$, $p < .01$). Density had no effect on positive verbal behavior, and there were no significant density by attraction interactions except in the case of neutral verbal behavior ($F = 4.87$, $df = 2/30$, $p < .05$). Post hoc comparisons of cell means yielded significant differences between high attraction groups ($t = 3.90$, $df = 3/30$, $p < .05$) and middle attraction groups ($t = 2.87$, $df = 3.30$, $p < .05$) indicating an increase in verbal behavior in these groups as a function of density. This pattern was reversed in low attraction groups in which verbal behavior slightly decreased as a function of density. The general pattern was similar in terms of total verbal behavior except the interaction effects were not significant.

3. Discussion

Loo (21) stated that how the experimenter structures the activity and architecture of the setting will greatly determine "(1) whether a feeling of crowding is experienced and if so, (2) how crowding affects the people involved (p. 4)." The most noticeable difference between the present study and others (12, 15, 27) was the nature of the experimental task. This experiment involved a well defined construction task that required much physical and verbal interaction in assembling a complicated model. Subjects in crowded conditions were aware of the spatial restriction and rated them-

selves more crowded than subjects in uncrowded conditions. In spite of this they, again, did not perceive this crowding as aversive or stressful nor did it negatively affect attraction responses to others. It is possible that subjects were able to submerge themselves in the physical activity of model construction and "tune out" potentially negative aspects of this situation.

The fact that crowding did not affect task performance except in middle attraction groups raises the question as to whether crowding was selectively functioning as a stressor in middle attraction groups but not in high or low attraction groups. The conceptualization of the impairment of task performance in middle attraction groups as a function of density as a stressor is suspect in this study for several reasons. First, subjects' ratings of perceived stress did not correspond to the observed patterns of task performance among the groups. Second, task performance in middle attraction, high density groups did not differ significantly from task performance in high and low attraction groups, regardless of density. Only middle attraction, low density groups signficantly departed from this pattern. These facts suggest that several other factors, both social and spatial rather than stress, were operating to maximize productivity in middle attraction, low density groups.

First, in middle attraction groups, there were little or no potentially interfering or distracting social elements that one might expect of high or low attraction groups as subjects in middle attraction groups were basically neutral in regard to each other. Second, the distinguishing feature in accounting for differences between middle attraction, high and low density groups was the fact that the adequacy of the working space was relatively

optimal in coordinating task operations in low density conditions. If this were not so, one would expect a rise in task performance in middle attraction, high density groups, that paralleled the rise in the middle attraction, low density group. Instead, task performance in middle attraction, high density groups was lower than performance of the other groups.

Several authors (21, 29) have suggested that one of the reasons that Freedman et al. (12) failed to obtain any effects of density was due to the fact that the individual nature of the experimental tasks minimized interaction with others and thereby reduced the probability that members would violate each others' personal space. They further suggested that the probability that task performance would be impaired and that individuals would perceive the crowded conditions as stressful would be increased in situations requiring the coordination of one's own activities with that of others. In view of the fact that a task designed to maximize group interaction was used in the present study, the failure to achieve significant overall decrements of task performance as a function of density supports Freedman's et al. (12) contention that crowding does not function as an ordinary aversive stimulus capable of impairing complex task performance.

The present study was the first investigation to examine the effects of crowding on verbal behavior of adolescents. The fact that some of the findings of this study ran counter to some of the findings of studies examining the effects of crowding on social behavior of children is not surprising since these studies differed greatly in terms of both the activity and architecture of the experimental setting and the ages of the subjects. Studies of children have used highly unstructured free play situations with portable toys and little or no furniture. The present study was relatively

structured in that group activities were determined by the experimenter, and that the setting was equipped with furniture. Although the method by which the groups were to construct the model was left unstructured, it is possible that the presence of the table and individual chairs helped to establish personal boundaries and provided an individual territory for each subject. Loo (21) stated that if "territories are equal and determined beforehand, ambiguity and anxiety over one's personal territory and possessions are eliminated (pp. 4-5)." She suggests that this type of arrangement may reduce the probability that a state of crowdedness would be experienced and/or result in different behavioral effects than more unstructured situations.

In any case, crowding does appear to have had major effects on social interaction. In the present study, these effects were seen as an intensification of the process of social interaction as indicated by the increase in verbal behavior as a function of density. This increase in social interaction may reflect a higher level of arousal in crowded conditions. Furthermore, the effects of crowding on verbal behavior appears to have interacted with the nature of group members' attraction toward each other. Crowding seems to have differentially affected verbal behavior in low attraction groups by decreasing social interaction, which may have been an adaptive strategy if one considers the fact that one does not usually seek to interact with those whom one dislikes.

If one concludes that crowding can intensify social interaction, then what is the nature of this process? Freedman (11) suggested that density, per se, should not necessarily be viewed as a social evil, and that density can intensify positive as well as negative aspects of social situations. The

results of this investigation do not support the idea that crowding can intensify positive elements of a situation. Negative verbal behavior increased as a function of density, but there was no corresponding increase in positive verbal behavior. This finding supports the contention that crowding has indirect detrimental effects on human social behavior.

E. GENERAL DISCUSSION

Generalizations based on the results of these studies must be made with caution as there are obvious limitations inherent in a laboratory analogue. First, subjects in the high density conditions were aware of the fact that they would be exposed to the situation for only 40 minutes; this brief exposure to a very high density may result in entirely different effects than would longer exposures to lower densities. For example, living in a crowded ghetto dwelling is undoubtedly pheonomenologically quite different from a short wait in a packed elevator.

Second, the focus of this present study was on the effects of spatial rather than social density on group behavior. Spatial density research compares the behavior of groups of the same number in space of different sizes; while social density research compares the behavior of groups of different numbers in the same size space (21). It is possible that in high spatial density conditions, individuals are primarily affected by violation of previous expectations of personal distances (16) and/or by an awareness that the demand for space exceeds the available supply, resulting in a constriction of freedom of choice and behavior in the setting (26). On the other hand, in high social density conditions, individuals may be more affected by the awareness that one is receiving excessive social stimulation (7),

that one's central nervous system is unable to process this overload of information (10), and/or that one is unable to pace and manage interaction with others on both psychological and interpersonal levels (31). Accordingly, these two variations of crowded conditions may lead to different phenomenological experiences as well as different behavioral effects.

Third, one must be cautious in applying the results of studies with American subjects to different cultures as cross-cultural responses to crowding may be quire variable (16). This consideration is particularly relevant in that it is generally felt that the effects of crowding are more pronounced in underdeveloped countries such as numerous African and South American nations (9).

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