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ABSTRACT

Overcrowded residence halls at Rutgers University form the basis for this research study on the effects of overcrowding. Subjects were the occupants of 31 rooms (7 triple male rooms, 7 triple female rooms, 7 double male rooms, and 10 double female rooms). Two sets of measures were used to determine whether crowding caused arousal and stress. The first set involved the measurement of unbound cortisol obtained from urine samples. The second set of measures involved cognitive performance. Results indicate that crowding causes more negative effects on women than on men. (Author/HMV)

FIELD EXPERIMENTAL RESEARCH ON HUMAN CROWDING*

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Recently there has been a growing interest in the experimental study of the effects of human crowding. Two major issues have been central in the research effort to date. First there has been the general question of whether crowding is arousing. The well-known study of Freedman, Klevansky and Ehrlich (1971) seemed to indicate that crowding did not cause arousal and could not be conceptualized as a stressor in the traditional sense. A subsequent study by Heft and Adams (1974) seemed to support this position. They found that crowding has no effect on errors on a proofreading task and there were no reliable changes in performance over time. The first suggestion to the contrary in the human experimental literature appeared in the study by Stokols, Rall, Pinner, and Schopler (1973). They found that crowded subjects laughed more than those who were not crowded - a behavior which they interpreted as "a coping response to perceived crowding stress" (p.105).

A program of research initiated by one of the present authors (Yakov Epstein) supports the latter position. Epstein and Karlin (1974) found that crowded subjects showed significantly better performance on a simple cognitive task than did noncrowded ones. Since arousal should increase performance on simple cognitive tasks and impair performance on complex ones, these data are to some extent consistent with the hypothesis that crowding is arousing. We then proceeded to measure arousal more directly using skin conductance level as our dependent measure. The results were rather unequivocal: crowded subjects, both male and female, had higher conductance scores than did their noncrowded counterparts (Aiello, Epstein and Karlin, 1975). In addition, two studies recently completed in our laboratory give further support to this notion. A replication of the skin conductance study has just been finished and the pattern of higher skin conductance among crowded Ss was clear (Epstein and Aiello, in preparation). Further, we had hypothesized that the lack of arousal effects in laboratory settings might well be the product of insufficient proxemic interaction in earlier studies (cf. Epstein and Karlin, 1974). A second study by two of our students supports this notion. When visibility is prevented, crowded males become significantly less aroused on skin conductance measures than do crowded males who can see each other (Kim and Mangus, in preparation).

However, the fact that it is possible to create a laboratory setting in which crowding causes arousal does not necessarily imply that crowded living conditions would be similarly arousing. The question remains as to whether crowded urban environments can be conceived of as stressors. Clearly, theorists concerned with urban conditions have conceptualized crowding in this light and our recent findings in the laboratory are in no way inconsistent with this position, but the empirical question is still unresolved. One aspect of the present study was an attempt to provide an answer to this question.

A second issue which has been central to experimental research on crowding concerns a sex by crowding interaction. The experimental literature has consistently shown that males and females react differentially to crowding. For example, Freedman, Levy, Buchanan and Price (1972) found that crowded women were less negative and crowded men more negative than their noncrowded counterparts. Further, crowded women gave more lenient sentences and crowded men gave more severe sentences in a mock jury situation when crowded. Stokols, Rall, Pinner and Schopler (1973) found that compared with noncrowded subjects, crowded men rated themselves as more aggressive and crowded women rated themselves as less aggressive. Epstein and Karlin (1974) found that women were more cohesive and cooperative and men more fragmented and competitive when crowded than when in a noncrowded situation. Further, crowded women saw themselves as more similar to each other and evaluated each other more positively than females who were not crowded. Crowded males, on the other hand, felt less similar to one another and did not differ from their noncrowded counterparts with respect to their evaluation of fellow group members. In an attempt to conceptualize these differential reaction patterns, it was suggested that in the face of stress, different group processes occur for men and women. For example, one stress reducing behavior is the sharing of distress with others. There are societal norms which allow women to share their distress, but prohibit men from doing so (cf. Kagan, 1964). To the extent that individuals share their distress with one another, they perceive that they are similar to one another and that they share a common fate - i. e. that they are in the same boat with respect to the need to cope with a stressful situation. If they do not share their distress, then each individual feels that he is alone in his discomfort and a social unit, a cohesive group does not form.

In following this conceptualization, it becomes clear that one salient factor in crowding is that crowding is a group phenomenon. Social behaviors in groups are at least parially controlled by the individual's relationship with his group. Epstein and Karlin further suggested that this is not a sex specific phenomenon: were the norms to be reversed, the outcomes would be reversed. In a study which we have recently completed (Karlin, Epstein, Aiello and McFarland, in preparation) we manipulated the norms for crowded women. In one condition we intensified interdependence by creating a norm of "sharing distress". In a second condition, interdependence was minimized via norms encouraging "hiding of distress", whereas a third condition did not manipulate the norms. On a variety of self report measues, a linear trend was apparant: subjects in the "sharing condition" were most positive, whereas subjects in the "hiding" condition were most negative. One serendipitous finding, however, was that it was at times rather difficult to manipulate the norms in the situation. Pilot testing indicated that it is not easy to get crowded women to hide their feelings when crowded. It is even more difficult, however, to get crowded men to share their feelings. This led us to the belief that these effects might be more important than we had previously imagined. We had been interested in sex effects because they were a clear demonstration of how group process influenced reactions to crowding. This is in line with the position which we have taken elsewhere (Aiello, Epstein and Karlin, 1975) that the use of laboratory lies not in simulating the urban experience, but inccontrolled testing of ideas derived from observations of the city. As a result of the Karlin et. al. study, we began to believe that sex effects would be important in understanding what occurs in long term mono-sex living situations. It seemed possible that an extension over time of the kind of group specific sex effects that we had observed in the laboratory would in fact take place in the real world. That is, women when crowded should manifest more positive effects than crowded men. A second aspect of the present study, then, is an attempt to investigate this sex by crowding interaction in long term crowded living conditions.

Overview of the experiment.

The questions noted above essentially call for a field experiment. Fortunately, we have recently had a chance to conduct such an experiment.

For several years, Rutgers University has been experiencing a shortage of student housing. With the addition of new colleges, enrollments have increased rapidly. The shortage of state budgeted funds has meant that the University has been unable to construct new housing facilities. The poor housing conditions in the New Brunswick area, the high cost of such housing, and the generally high crime rate in the area have combined to create a great demand for on-campus housing. All these factors have contributed to the crowded conditions in the dormitories. Different undergraduate colleges at Rutgers have evolved differing solutions to this problem. At one of the undergraduate colleges, for example, a practice of "staging" students has been used. This means that 18-20 students are placed in barrack-like lounges. The only facilities available to these students are beds. Little privacy is available. In this situation, students wait until rooms become vacant - either because other students never show up at the beginning of the semester, or because they move out of rooms or drop out of school. The staging arrangement usually does not last for more than several weeks. At another undergraduate college, however, a different procedure is being used. Rather than staging some students in a large room and allowing all other students to live two to a room, this college has decided to triple up students in rooms that were intended for two person use. Since there are fewer students than would be required to triple up all the rooms, some rooms are tripled and some are not. The procedure for deciding who will be tripled is left to a chance lottery. This situation has created the conditions for an ideal "natural experiment". We have available to us a population of males who have been tripled, females who have been tripled, and their counterparts of both sexes who are living two to a room. All these people come from relatively homogeneous backgrounds with respect to socioeconomic status. They have equal education backgrounds (all are college freshmen), are about equally healthy when they arrive at college, and have all been randomly assigned to living conditions. This has afforded us an opportunity to study the effects of crowding from a longitudinal perspective in a manner uncontaminated by socioeconomic class and health factors which have usually differentiated persons who live in crowded urban conditions from those who do not. At the same time, it provides us with some of the strengths of the experimental method and an opportunity to examine the processes by which people cope with conditions of crowded living.

Method

Subjects

A sample of 31 rooms (7 tripled male rooms; 7 tripled female rooms; 7 double male rooms; and 10 doubled female rooms) was randomly selected from the available population. Potential subjects were offered an incentive of $25 each to contribute about 15 hours of their time during the course of the fall semester to the research project. All but one person so approached agreed readily to participate in the study. They were told that the study would investigate patterns of adjustment of college freshmen to dormitory and college life.

Dependent measures

Our research has been greatly influenced by Irwin Altman's (1975) model of the process of contact regulation that governs responses to crowded situations and ones in which there is a lack of privacy. Basically, the model posits that individuals strive to reduce discrepancies between the desired amounts of contact and obtaining levels of contact. Many factors influence both the desired and the obtaining levels of contact. Where there is a discrepancy between desired and obtaining levels, individuals engage in discrepancy reducing processes. If they succeed at reducing the discrepancies, they avoid a series of costs. However, if they are unsuccessful, they incur psychological, physiological, and social costs. This is a very abbreviated version of the model and does not due justice to the many important details specified in Altman's writing.

The Altman model, then, provided a guiding framework for our choice of dependent variables. Since the model is comprehensive, dealing with a wide range of variables which might be important to consider in trying to understand the effects of crowding, we attempted to collect information on as many of them as possible. The present study will consider only those measures which directly relate to arousal or are clearly pertinent to the extension of laboratory findings of sex differences in response to crowding. A complete list of the measures obtained in this investigation can be found in Table 1. A more detailed description of these measures and their relation to Altman's model can be found in Epstein, Karlin and Aiello (1975). It should be noted that the present paper is merely a preliminary rather than a comprehensive report.

Results

Checks on the manipulation

While it is clear that the dormitory rooms were built to house only two people, it could not be assumed that three people occupying these rooms would consider themselves crowded. It might just as well be the case that the small size of these rooms causes even two people to feel crowded and the addition of the third person may make no difference. Alternately, it is possible that even three people in the room may not feel particularly crowded - clearly, they have more space than do subjects in laboratory studies of crowding. Two questions were therefore asked tapping perceived crowding and satisfaction with living conditions. Subjects in tripled rooms perceived themselves as significantly more crowded than did persons living in double rooms ($F=67.91$, $df=1, 58$, $p<.001$). Interestingly, while both men and women in tripled rooms differed significantly from their less crowded counterparts, the effect is stronger for women than it is for men ($F=61.25$, $df=1, 58$, $p<.02$). The same pattern emerges when we look at satisfaction with living conditions. Tripled subjects were significantly less satisfied than were doubled Ss ($F=61.25$, $df=1, 58$, $p<.001$). The effect is stronger for crowded women than it is for crowded men ($F=5.93$, $df=1, 58$, $p<.025$).

Tables 2 & 3 about here

Arousal

Two sets of measures were used to study arousal; cortisol levels and cognitive task performance. Cortisol levels did not show significant differences. However, tripled Ss showed an increase in cortisol levels and doubled Ss showed a decrease in cortisol levels over time. Large individual differences in cortisol level as well as the small size of our sample prevented these differences from being clearer. Cognitive task performance, on the other hand, revealed clear indications of arousal over time. Subjects in double rooms showed improved performance over time on both the simple and the complex tasks ($\chi^2=0.57$, $df=1$, n.s.). Tripled subjects, however, showed the expected pattern of arousal - ie. improved

performance on a simple task and impaired performance on a complex task ($X^2=12.02$, df=1, $p<.001$).

Tables 4 & 5 about here

Health and room stability

Laboratory findings have generally demonstrated that the major detrimental effects of crowding occur for male groups. The two measures to be reported below reveal that in this instance, the major detrimental effects occurred for crowded women. The Cornell Medical Index revealed that crowded women had more physical and psychological problems than did the other three groups. Male tripled subjects did not differ from males in doubled rooms ($F=7.22$, df=1, 58, $p<.01$). Looking at the relative stability of the various living conditions the same pattern emerges. Tripled rooms were significantly more unstable than doubled rooms ($X^2=9.38$, df=1, $p<.01$). However, this effect was almost entirely caused by the dissolution of tripled female rooms. In all seven cases at least one of the tripled females had left the room for an althernate living arrangement by the end of the semester. This was the case for only two of the tripled male rooms. Thus, tripled females rooms were significantly less stable living arrangements than were tripled male rooms ($p<.01$, Fischer exact test). Anecdotally, it is interesting to note that one of the two tripled male rooms which dissolved invited a new third person to join them.

Tables 5, 7, and 8 about here

Discussion

These results would seem to indicate that there are a number of differences in the effects of the environment on students living in tripled rather than in doubled room arrangements. Tripled as opposed to doubled subjects saw themselves as more crowded and were less satisfied than doubled students. They seemed to be more aroused. However, when considering the effects of crowding on health and the stability of living arrangements, it is the crowded women who are most negatively affected. It should be noted that the same pattern emerged on the manipulation checks where the effects were stronger for women. While the data on arousal are consistent with results obtained in the laboratory, it would seem that on the face of it the sex effects have been reversed.

Looking first at arousal we now have evidence from both laboratory and field that crowding is stressful. Contrary to the position taken by Freedman, Klevansky and Ehrlich (1971) it is clear that crowding can and should be concieved of as a stressor in the traditional sense. Cognitive task performance post laboratory crowding (Epstein and Karlin, 1975) skind conductance measures taken during crowding (Aiello, Epstein, and Karlin, 1975, and Epstein and Aiello, in preparation), and cognitive task performance over time in crowded dormitories all reveal consistently significant differences in arousal for crowded and noncrowded subjects. During the last several years the status of crowding as a stressor has been unclear. The animal literature and data from sociological surveys have suggested that crowding is a stressor. The program of research undertaken by the present authors brings the findings of the human experimental literature into line with the findings of these other approaches.

Turning now to the sex by crowding interaction, we have found what seems to be a reveral of the laboratory findings on both measures of health and stability of living arrangements. It is the crowded women who show clear evidence of the detrimental effects of prolonged crowded living conditions. Even on our manipulation checks, the sex by crowding interaction emerges. Tripled women perceive themselves as more crowded and less satisfied than crowded men. At this point we do not understand why

the effects of crowding seem to be reversed in short and long term situation.

In general then, what we have found is that our field study, in one instance provides a clear extension of effects we have observed in the laboratory, and in the other case constitutes a reversal of laboratory findings. In previous papers we have noted that the investigation of crowding necessitates a consideration of at least five levels of analysis. One implication of this position is that several methods must be employed in order to understand the complex nature of the effects of crowding. Crowding is a complex phenomenon. The popular literature has long assumed that people know what the effects of crowding are. In recent years we have become more and more aware that the impact of a crowded environment varies as a function of a multitude of factors.

TABLE 6

Physical and psychological problems reported on the Cornell Medical Index by male and female doubles and triples

	Doubles	Triples
Female	1.93	1.89
Male	1.93	1.95

TABLE 7

Stability of double and triple rooms

	Doubles	Triples
Broke up	1	9
Stayed Together	16	5

TABLE 8

Stability of female and male triples

	Female	Male
Broke up	7	2
Stayed Together	0	5

NOTES:

Table 2 1=not crowded; 7=very crowded
Table 3 Lower scores are associated with greater satisfaction
Table 6 The lower the score, the greater the reported problems.

TABLE 2

Feeling of room crowdedness by male & female doubles & triples

	Doubles	Triples
Female	2.5	6.1
Male	3.2	5.1

TABLE 3

Satisfaction of doubled & tripled males & females

	Doubles	Triples
Female	2.0	5.0
Male	2.3	4.0

TABLE 4

Cortisol levels of doubled & tripled students

	Time 1	Time 2
2 person	41.8	34.7
3 person	44.5	47.6

TABLE 5

Cognitive performance of doubled & tripled students

Triples

Number who:	Simple	Complex
Increase	22	8
Decrease	7	19

Doubles

Number who:	Simple	Complex
Increase	16	13
Decrease	6	8

TABLE 1

Measures used in the investigation

1. Privacy Preference Scale
2. Room Use Inventory
3. Background Questionnaire
4. Noise Evaluation Questionnaire
5. Dormitory Environment Assessment Inventory
6. Self-disclosure Questionnaire
7. Roommate Rating Questionnaire
8. Woodbury Residence Inventory

9. Rutgers Health Survey
10. Cornell Medical Index
11. Symptom Checl List-90

12. Rotter's I-E Scale
13. Jackson Personality Research Form
14. FIRO-B Scale

15. Biochemical (Cortisol) Analysis
16. Finding As task (Simple Performance)
17. Nonsense Syllogisms Task (Complex Performance)
18. Frustration Tolerance Task

19. Picture Sorting Task
20. Picture Identification Task
21. Picutre Knowledte Rating Task
22. Academic Log
23. Room Use Log
24. Interview Reports

25. Roommate Discussion (Proxemic Observation)
26. Ethological Observations in Dorm
27. Model Rooms Task
28. Drom Room Mapping Task
29. Personal Space Measure I (Approach Task)
30. Personal Space Measure II (Felt Board Placement)

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