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EFFECTS OF SPATIAL AND SOCIAL DENSITY ON AROUSAL, MOOD AND SOCIAL ORIENTATION

by
Susan Camille Saegert

A dissertation submitted in partial fulfillment
of the requirements for the degree of
Doctor of Philosophy
(Psychology)
in The University of Michigan
1974

Doctoral Committee:

Professor Robert B. Zajonc, Chairman
Professor Dorwin Cartwright
Professor Stephen Kaplan
Associate Professor Andre Modigliani

ABSTRACT

EFFECTS OF SPATIAL AND SOCIAL DENSITY ON

AROUSAL, MOOD AND SOCIAL ORIENTATION

by

Susan Camille Saegert

Chairman: Robert B. Zajonc

A review of studies of the effects of high densities on animals indicates that serious negative psychological, behavioral and social consequences are associated with such conditions.

Studies of human inhabitants of high density environments, reviewed in this paper, have provided rather ambiguous evidence for a similar relationship between density and pathology for man. Laboratory studies of human subjects in high density environments have indicated that density tends to affect mood and social behavior, but the results of different studies are contradictory.

The two major purposes of this study were to explore the effects of density on a range of measures associated with physiological and behavioral arousal, affect and social orientation. Further, two components of density were independently manipulated: (1) spatial density (amount of space per person) and (2) social density (number of people in an area). It was tentatively hypothesized that these components would have independent and perhaps different effects on the various measures.

The experimental situation involved strangers in a task-oriented situation in which all had individual goals. Resources were adequate for the task so that objective competition for resources would not be

necessary. Spatial density, social density and sex comprised the independent variables. The two spatial density conditions allowed the subjects either 6 square feet per person (high spatial density) or 24 square feet (low spatial density). The social density conditions ranged from one person alone, to two people, four people or twelve people together. Subjects were run in same-sex groups.

The results indicate that in this study, increased spatial and social density increase arousing stimulation from the environment, that increased social density tends to increase drive as indicated by number of word associates given to a stimulus word, that both components of density are associated with perceptions of interference and desire for more space, and that they interact to affect competitiveness among participants. Low correlations and divergent findings for measures expected to be associated with arousal cast doubt on the utility of the unitary arousal concept in understanding the effects of density.

These findings are discussed in relation to studies of social facilitation and of group size. Possible implications of this study for understanding other high density situations are considered.

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TABLE OF CONTENTS

ACKNOWLEDGMENTS ii

LIST OF TABLES iv

LIST OF FIGURES v

LIST OF APPENDICES vi

INTRODUCTION 1

Animal Populations
Human Populations
Rationale for This Study

METHODS 21

Research Design
Subjects
Experimental Session Schedule
Description of Tasks
Procedure
Summary of Dependent Measures

RESULTS 35

Arousal-Related Measures
Measures of Personal Orientation
Measures of Social Orientation
Summary of Results

DISCUSSION 54

Implications

APPENDIX A 74

APPENDIX B 105

REFERENCES 129

LIST OF TABLES

Table 1	Research Design with Number of Subjects in Each Cell	24
Table 2	Lists of Dependent Measures	34
Table 3	Mean Baseline Palmar Sweat Indices in All Conditions	39
Table 4	Desire for More Space During the Card Task as a Function of Social Density	44
Table 5	Desire for More Space During the Card Task as a Function of Spatial Density, Social Density and Sex	45
Table 6	Mean Rating of Subjects' Own Competitiveness During the Card Task as a Function of Spatial and Social Density	50
Table 7	Mean Rating by Subjects of Other's Competitiveness During the Card Task as a Function of Spatial and Social Density	50
Table 8	Mean Preference for Working with Others During the Card Task and the Word Association Task as a Function of Social Density	53
Table 9	Mean Preference for Working with Others During the Card Task as a Function of Spatial and Social Density	54
Table 10	Mean Ratings of Liking for the Experiment as a Function of Spatial Density and Sex	56

LIST OF FIGURES

Figure 1	Mean Palmar Sweat Indices for Spatial Density conditions at Time 2 and Time 3	37
Figure 2	Mean Palmar Sweat Indices for Social Density Conditions at Time 2 and Time 3	38

LIST OF APPENDICES

Appendix A	Dependent Measures	74
Appendix B	Analyses of Variance and Covariance Tables	105

Introduction

In the past decade, population growth, increasing urbanization, and increasing ecological awareness has brought the controversal issue of the psychological and social effects of crowding into prominence. J. B. Calhoun's article, "Population density and social pathology" (1962), has given rise to extrapolations from the serious negative consequences for rats of high density living to predictions of similar outcomes for humans (e.g., Holford, 1970; Leyhausen, 1965; Wolfe, 1970). Defenders of urban life have attempted to counter these dire predictions with accounts of the benefits, or at least lack of negative effects, associated with high density experiences (e.g., Freedman, 1971; Jacobs, 1961).

Animal Populations

Certainly, the effects of high population density on animals are dramatic. Since the 1930's, many observational studies of animals in their natural habitats have revealed the existence of a population-limiting mechanism in a variety of species. Rapid declines in unusually large populations have been noted for hares (Green & Evans, 1940; Green & Larson, 1938), voles (Chitty, 1952), lemmings (Christian, 1970), and sika deer (Christian, Flyger, & Davis, 1960), to list but a few. In all cases the researchers ascrtained that shortage of food or even of nesting space was not the cause of the downturn. Nor can increases in number of predators be blamed. Detailed studies of natural, captive and experimental animal populations have suggested that a crowding

syndrome may be responsible for the sudden drops in number (Christian, 1970; Lack, 1954; Stott, 1963; Wynne-Edwards, 1962). This syndrome includes physiological stress reactions, abnormal social behaviors, and, in some cases, complete breakdown of social structure. The behavioral aspects of this syndrome include increased territorial defense by high ranking animals, loss of territory by lower ranking animals, increased aggression, withdrawal from social interation, homosexuality, hypersexuality, ineffective maternal behavior, and, eventually for some animals, total withdrawal from sexual activity and most other interactions (Calhoun, 1962; Morris, 1952; Myers, Hale, Hykylowycz & Hughes, 1971; Susiyama, 1967; Southwick, 1967). Physiologically, animal populations subject to high density living show endrocrine changes characteristic of stress reactions (Selye, 1956): increased secretion of adrenocorticotropin and increased activity of the adrenal cortex. Most physiological studies of animals in high density situations have indicated that the animals were in one of the two earlier stages of the General Adaptation Syndrome as Selye described it, that is, the stages of arousal and resistance (c.f., Myers et al., 1971). However, Christian and his colleagues (1960) suggested that the animals in their investigation may have died as a result of exhaustion of their adaptive potential. In most studies of animals, some early mortality increase is observed. The most common effects of the hormonal changes range from lowered body weight and decreased resistance to disease to slower maturation, lowered fertility, incompleted and false pregnancies, and increased mortality, especially among the young (Christian, 1963; Davis, 1971;

Myers et al., 1971; Thiessen, 1964; Thiessen & Rogers, 1961).

These physiological effects seem to have adverse affects on the offspring of crowded animals (Delong, 1967; Stott, 1963), even when the offspring are separated from the mother at birth and raised by substitute mothers who have not been crowded (Keeley, 1962). Delong reported much higher mortality rates for house mice born during high density periods than for those born during lower density times. Stott has reviewed a range of effects of high densities on the young which he has summarized by labeling "lack of forthcomingness;" this refers to the timid, withdrawn way such offspring behave. The chief postnatal effects Keeley has reported are ones he has interpreted as lowered receptivity to stimulation; the manifestation of this lowered responsiveness involves longer latency in leaving the home cage, less activity and less defecation in a novel environment.

Less emotionality, higher adrenal weights, and lower body weights were observed in rats raised in higher density groups. Interestingly, rats raised in crowded conditions showed increased emotionality when other rats were introduced into an open field, whereas rats raised in crowded conditions showed decreased emotionality in the presence of other rats (Morrison & Thatcher, 1969).

Several studies, all using mice or rats as subjects, have found number of animals per group to be the critical factor in creating crowding effects (Bailey, 1966; Christian, 1961; Thiessen, 1964). However, one study of a population of captive rabbits indicated that amount of space available more significantly affected the well-

being of this population (Myers, et al., 1971). The authors of this last study concluded that rabbits seem to be able to accomodate increased numbers but react negatively to decreased territory. Unlike rats and mice who tend to huddle together (Davis, 1971), rabbits use what space is available to them.

McClelland (1973) convincingly argues that the behavioral and physiological effects of crowding in animals are a joint function of number and quality of social interactions. Aggressiveness of population (Christian, 1963), introduction of aliens into the population (Davis & Christian, 1956; Southwick, 1964), availability of resources and size of original populations (Calhoun, 1971), all factors shown to significantly affect the crowding syndromw, are considered determinants of the quality of social interactions.

Human Populations

The careful and extensive investigations of high density animal populations do not have equal counterparts in the studies of human populations. The psychological and social effects of high densities on human subjects have been studied in two ways: (a) by examining correlations of indices of social and individual pathologies and survey data with measures of dwelling unit and area density; (b) by observing the effects of short-range manipulations of immediate density in an experimental situation.

Correlational studies These studies have been concerned largely with the possible relationship between high densities and the frequency of psychopathology, ill-health and anti-social behavior. At least three problems occur in many of these studies: (1) confounding of social class and density in the populations studied

to a perhaps irresolvable extent, (2) possibly misleading definitions of high and low density, social class, and other variables, (3) absence or abuse of statistical procedures for controlling variance in dependent measures that is related to factors other than high density. Nonetheless, the results of these studies, in light of the animal work, are at least suggestive.

Loring (1956) found that socially disorganized families tended to have less space in their dwelling units and to live in more crowded areas than the control families who were roughly matched on cultural and economic variables.

Martin (1967) reviewed a number of findings showing a correlation between poor health and overcrowding. Specifically, adult and infant mortality and incidence of bronchitis and pneumonia were found to correlate with overcrowded housing. These correlations were significant when income was controlled in studies done in the 1930's, with the exception of the correlation between adult mortality and overcrowding. In later studies, these correlations tended not to be significant.

Schmitt (1966) in his study of the Honolulu Standard Metropolitan Statistical Area, discovered a correlation of .56 between density and his measures of pathology and disorganization, even when income and educational levels were controlled by partial correlation. His measures of pathology included average annual civilian resident deaths, infant mortality, suicides, average annual new cases of tuberculosis, average annual cases of venereal disease, average annual first admission to the territorial hospital

for mental disorders, illegitimate births per 1000 live births, families with juvenile offenders per 1000 families and average annual admission to Oahu Prison per 1000 adults. He reported highest partial correlations of density with venereal disease rates, mental hospital admission rates and tuberculosis rates, and lowest with suicide and infant mortality. These relationships held only for density per acre, not for density within dwelling units. Many of Schmitt's measures were so grossly defined as to leave open the possibility that different relationships might have emerged if finer units of measurement had been employed. For example, one of Schmitt's categories for assessing dwelling density was "dwelling units with 1.01 or more persons per room as a percent of all occupied rooms." Lack of differentiation above this arbitrary cut-off point may have obscured the potential relationship between dwelling unit density and his dependent measures. Freedman, Klevansky & Ehrlich (1971) made similar criticisms of Schmitt's two-category system of measuring income and educational level. In both measures, a person was either high or low, but no gradations in the middle were taken into account.

Mitchell (1971) reports an interview study conducted in Hong Kong which showed that within-dwelling unit density was related to less supervision of children and less frequent entertainment of friends. Level of superficial strain correlated positively with density only for low income respondents. The effects of density in Mitchell's study seemed to become serious only for persons living on higher floors where density correlated positively with emotional

illness and hostility. Education and income were controlled.

Since serious criticisms can be directed at the measures of pathology and social disorganization and at the correlational techniques used in many studies, a number of investigators have concluded that no relationship has been demonstrated (deGroot, Carroll, & Whitman, 1970; Mitchell, 1970; Wilner & Baer, 1970). Winsborough (1966) attributed the apparent correlations to failure to control for social class and income. His argument was based on the lack of significant correlations between density and measures of pathology when twelve demographic variables were controlled. However, in his analysis of this data from seventy-five Chicago area communities, he controlled, through partial correlations, so many variables, including percent households with more than 1.5 people per room, that the meaning of his results are unclear.

In a study of neighborhoods, another investigator has reported that respondents maintained an optimal number of friends regardless of neighborhood density (Lee, 1968); however, the validity of such self-reports may be questioned. The much-studied West End of Boston indicates that social structure rather than density per se mediates social orientation and satisfaction (Fried & Gleicher, 1961; Gans, 1962). Although density in this area was very high, residents expressed much satisfaction with the area, their lives there and their social ties in the neighborhood. Familiarity with the neighborhood and its residents and high rates of social interaction seem to have more than compensated for the negative qualities of slum housing. The high density may have even contributed to the high and satisfying interpersonal involvement among residents.

After studying a black, Detroit neighborhood, Wolfe & LeBoux (1967) pointed out that usable space may be internal or external to the dwelling unit. These findings suggest that measures of census tract density and persons per room in a dwelling unit may not measure experienced density very accurately.

Schmitt's study of Hong Kong (1963) suggests that social structure, traditions and expectations play a critical role in moderating the effects of density. Comparative statistics showed fewer occurrences of pathology and social disorganization in highly populated Hong Kong than in less dense American cities. Of course, the measure of pathology may not be comparable. Definitions of pathology as well as record keeping practices may be different in Hong Kong than in U.S. cities. Mitchell's study of Hong Kong (1971) indicates that, even in this milieu, density has some effects, although they are quite complex.

At present, one must conclude that a relationship between pathology and density is plausible but unproven. In a recent study, Galle, Gore, & McPherson (1972) examined the correlations between indices of pathology, density, and socioeconomic status for Chicago and concluded that a model in which density plays a causal role is tenable. That is, the density-pathology relationship was not unambiguously spurious and clearly due to socioeconomic status alone, as Winsborough had suggested. Nevertheless, the authors end on a cautious note: "At the moment, we may speculate about how overcrowding relates to various pathologies, but specific knowledge about causal links, if there are any, is lacking" (p.29).

Other studies suggest that the links may be quite subtle. For example, Dohrenwend & Dohrenwend (1966) found that later-born offspring of disadvantaged ethnic groups dwelling in crowded areas were less emotionally healthy than either their older siblings or offspring of more advantaged groups.

Although it is not presently possible to infer any clear relationship between density and stress or behavioral patterns, many of the findings reviewed in this section are somewhat analogous to those for animal studies. Signs of stress and anti-social behavior appear to be more prevalent in high density populations under certain conditions.

The stronger negative effects observed for members of lower social standing and for younger siblings echo the importance of age and social rank demonstrated in animal studies. However, as one might expect, people are quite resourceful in adapting to high density living conditions. For example, the work of Schmitt, Mitchell, and Wolf and Leboux indicates the critical nature of all accessible spaces and of social milieu.

Experimental studies As McClelland has pointed out in her review (1973), whereas most animal studies have addressed the question of the causes of crowding effects, most experimental studies of human subjects have concerned simply whether there are effects of crowding and, if so, what they might be. This difference is quite explainable when one considers that the evidence concerning psychological and social effects of high density experiences on humans is ambiguous and sometimes contradictory. The brief span of such

experimental situations and the subjects' knowledge that the situation is experimental no doubt contribute to the difficulty of studying human crowding. Although the scope of the dependent measures and the density situations in these studies are not wide, the number and breadth of experimental studies of the psychological effects of high densities have increased markedly in the last several years. The ways in which these studies support and contradict each other are important to consider.

A study by Smith and Haythorne (1972) varied space and number independently but within extremely narrow ranges. The groups were composed of either two or three men who lived for 21 days in either crowded or uncrowded conditions. The space available in the two crowding conditions was either approximately 70 cubic feet per person or approximately 200 cubic feet. Two major findings related to these variable emerged: (1) three-man groups were less stressed, less annoyed and better adapted (a main effect for group size on these dependent measures), (2) group size interacted with crowding in such a way that crowded, three-man groups were the most stressed and worst adapted of all two- and three-man groups. The main effects for group size were created by the outstanding lack of stress and annoyance and the superior adaptation of the three-man, uncrowded groups despite the strong opposite tendency in the crowded group. A main effect for crowding emerged in which lower scores on a hostility-to-partners scale occurred in the more crowded groups.

In all, three men living together with an adequate amount of space available per person seemed to be an easier situation for these

subjects than when only two lived together. Self-reports of stress and annoyance were less in the three-man groups and all groups survived the 21 day confinement. Perhaps these results indicate more flexibility and less constraint in relationships when more than two people are involved. However, whatever the advantage achieved by a three-man as compared to a two-man group, it was erased when the groups lived in crowded conditions. Quite possibly, the need to coordinate activities in a small space is more unmanageable when three rather than two people must be taken into account. The crowding main effect on the hostility scale is inconsistant with other findings; it may mean that the crowded subjects attained greater harmony at a higher cost of personal stress and annoyance or that stronger norms against expressing hostility existed in the more crowded groups.

A study of interpersonal attraction, affect, and crowding was carried out by Griffitt and Veitch (1971). Using the Byrne paradigm (1969), similarity of attitudes was manipulated by giving the subjects a questionnaire supposedly containing attitude ratings of some unknown, same-sex person. The attitudes were matched with the subjects' own answers to the questionnaire so that the proportion of similar attitudes was either high or low. Generally, Byrne and his colleagues have found rated liking for the stranger to vary positively with percent of attitude similarity.

Subjects' liking ratings in crowded conditions showed significantly less attraction toward both similar and dissimilar others. Crowded subjects also reported more negative personal affect and less positive responses to the experiment and the room. In this

study, crowding was manipulated by holding space constant and increasing the number of subjects in the groups. A second independent variable, hot or normal room temperature, provided a similar pattern of results, but there was no interaction; this may suggest that the physical discomfort arising from extreme density was responsible for the finding.

Freedman, Klevansky and Ehrlich (1971) based their experiment on the social facilitation research (Zajonc, 1965) indicating "that density may function as an aversive stimulus to arouse drive." Drive, then, should facilitate performance on simple or well-learned tasks and debilitate performance on complex or novel tasks by energizing dominant responses. Number of subjects and space per subject were manipulated although conditions emerging were not completely comparable in terms of square feet per person. The two sized groups contained either five or nine people in rooms of 35, 80, or 160 square feet. A series of group and individual tasks varying somewhat in complexity were performed during each experimental session. In these experiments, no differences between conditions were obtained for crowding, task type, or an interaction of the two. The authors concluded that density per se must not be aversive or drive-arousing when physical comfort is not impaired.

These studies can not really be taken as a test of an extension of the social facilitation findings. First of all, the tasks used were not ones that had been shown in other contexts to be drive-sensitive. They are not clearly simple or complex nor well-learned or novel. Secondly, a great deal of social interaction was allowed

including group task performance, in the Freedman et al. study, whereas none usually has occurred in social facilitation studies.

Freedman, Levy, Buchanan, and Price (1972) arranged two experiments to investigate the relationship between high density and human aggressiveness. Space per person but not group size was varied. Subjects were run in all-male, all-female and mixed-sex groups in either a prisoner's dilemma game situation or a jury situation. All-male groups proved to be more competitive and gave more severe sentences in smaller rooms; all-female groups were more cooperative and gave less severe sentences in smaller rooms. Neither males nor females seemed to be affected by room size in mixed-sex groups.

The other studies of aggressiveness and crowding have been conducted with children as subjects. Hutt and Vaizey (1966) observed normal and brain-damaged children during free play in groups numbering less than six, seven to eleven, and over twelve. The same 27 by 17.5 feet playroom was always used. Normal and brain-damaged children became more aggressive and less sociable in larger groups while autistics became more withdrawn, spending more time near the boundary of the room.

In another study, this time varying space per person rather than group size, children were observed playing in either a small or a large room (Loo, 1972). The results from this study contradict findings on the relationship between density and aggression reported in other investigations. Subjects behaved less aggressively in the higher density situation; males especially were less aggress in these conditions. The Hutt and Vaizey finding that children engage

in less social interaction in higher density play situations was replicated. Inter-rater reliability was rather low in the Loo study and was not reported by Hutt and Vaizey. As Maccoby (1970) has documented, observer biases in such studies may easily determine the outcome if caution is not exercised.

Three studies have attempted to examine variables, other than spatial density and group size, that influence perception of crowding and crowding stress. Following Christian's work, Desor (1971) hypothesized that amount of social stimulation is a critical determinant of these effects. His subjects were asked to fill model rooms differing in shape, size, number of doors, and internal divisions with clothespin figures that were supposed to represent people until the rooms seemed crowded. The type of activity subjects were asked to imagine occurring in the model rooms also affected the average number of figures required for the rooms to seem crowded. Smaller rooms were shown to hold higher densities than larger ones, indicating that group size, independent of space per person, contributes to perceptions of crowding.

Stokols, Rall, Pinner, and Schopler (1973) manipulated both room size and task set. Each of these two variables increased perceived crowding although size was a more significant determinant than task set. Further, negative feelings tended to be associated with physical crowding chiefly in the competitive task set condition.

In a study manipulating both number of people and distance between people, Kutner (1973) explored the hypothesis that visual exposure creates stress in a crowded situation. He ran groups of

two or four subjects sitting either close or somewhat farther away from each other, and either facing each other or with backs turned. A factor analysis of the results of his study indicated that his dependent measures fell into four groups: measures of interpersonal attraction, questionnaire measures of anxiety, measures of unpleasant competition, and measures of nervousness about being around others. In his study, subjects actually liked each other more when they were visually exposed to each other. At the same time they manifested signs of body protection and conformity which Kutner interpreted as reactions to loss of privacy. His naming this factor "nervousness about loss of privacy" involves a fairly tenuous inference; further support for this interpretation is needed for it to be really convincing. Subjects in the four person groups reported more feelings of unpleasant competitiveness than did subjects in the two person group. The self-reported anxiety measures were not affected by any of the experimental variables. Thus, he concluded that nervousness manifested by conformity and body protection occurred because of visual exposure to others. However, negative feelings about competitiveness seem to be primarily related to group size.

Taken together, these studies indicate that perceived crowding and negative psychological states associated with crowding reflect not simply spatial density, that is amount of space per person, or social density, defined as the number of people occupying a visually exposed area, but also the amount and quality of social interactions. This conclusion seems applicable to the correlational as well as the experimental studies of human subjects. Still, the more specific

questions concerning the relationships among the variables of spatial and social density, various social and task definitions and the feelings, task performances, and social behavior of people in high density situations is anything but clear.

Rationale For This Study

The various investigations of the effects of high densities on animals and humans point to several clusters of dependent measures that seem important for study. These areas include (a) indices of physiological and behavioral arousal, (b) positive versus negative affect, and (c) pro-social versus anti-social behaviors and emotions. Appropriate dependent measures should take these separable effects into account. The time span of the study would, of course, further define suitable measures since a distinction between the probable long and short range physiological, psychological, and social consequences of high density experiences must be made.

Sharper and more systematic definition of the independent variables also seems important since several studies have indicated that the effects of spatial and social density are not identical. A high physical density situation may be achieved by decreasing amount of space per person or by holding space per person constant and increasing the number of people in the situation. The work of Desor, Kutner, and Smith and Haythorne suggests that these two different manipulations bring about dissimilar results, yet no studies of human subjects have systematically varied both space per person and group size across any considerable range. Desor's finding that several small rooms are judged to hold more people than one large room of equal floor space without becoming crowded is particularly suggestive.

Clearly, the situation of the subject is different when number of people increases than when amount of space decreases with number

remaining constant. More people provide more sources of stimulation. The subject's uncertainty about the environment at any particular time probably tends to be increased because each person may change his behavior. To the extent that any movement or interaction occurs, the subject has to accomodate more possible relationships; even among strangers, partners in eye contact, accidental touching, negotiation during movements etc., would be increased. At least the potential for social stimulation, to use Christian's term, becomes greater. Of course, factors such as social norms, types of activities being performed, and the quality of the relationships among people in the situation could prevent this potential for social stimulation from becoming actual or, conversely, heighten such stimulation.

After reviewing the research on the effects of group size on organized groups, Thomas and Fink (1963) concluded the following: (a) members of larger groups are less satisfied than members of smaller groups, apparently because size limits communication within the group, (b) small groups perform tasks more rapidly, (c) large groups perform better on tasks in which success is not dependent on speed, and (d) cliques and factions tend to develop in large groups. Increased group size tends to be accompanied by increased number and heterogeneity of demands being made and of resources available within the group. This greater number and heterogeneity tend to strain the ability of members to organize exchanges of demands and resources optimally while also increasing the possible range of performances and satisfactions attainable by and within the group. The formation of cliques and factions in large groups suggests that

people have difficulty maintaining such complex situations, as does the finding that the overwhelming majority of natural groups are dyads (James, 1951).

Since the experimental studies of crowding lack any systematic investigation of the independent role of group size in determining crowding effects, no clear continuity between the research on group size and on crowding can be demonstrated, although the Smith and Haythorne findings seem compatible with Thomas and Fink's conclusions. However, the increased complexity of a highly peopled environment may very well have different implications for the participants than a situation in which the number of people is constant but the space available to them is decreased.

Physical constraint and increased salience of other people might be expected to characterize high spatial density more than the increased complexity of high social density. Stokols et al. did find that room size strongly affected their subjects' feelings of constraint and desire for more space. Freedman et al. (1972) tentatively proposed that whatever the feelings of expectations people have concerning others in a particular situation, these will be strengthened when spatial density is higher. Several still unpublished studies conducted by Freedman and his colleagues have tended to support this interpretation.

These speculations together with the results of research on group size and crowding seem to provide a basis for systematically differentiating the components of high density situations. They do not, however, suggest any simple relationship between either

spatial or social density and arousal, mood, or anti-social behavior and feelings. The nature of the activities engaged in by the subjects, the social expectations and norms in the situation, and the availability of resources must also be taken into account. Situations in which increased complexity and stimulation as well as increased salience of others are experienced as positive can easily be imagined as can situations in which physical constraint is irrelevant and social interaction facilitated by physical proximity. One might expect, however, that increased complexity and stimulation would tend, in most cases, to increase arousal, regardless of the positivity or negativity of one's feeling in a situation.

This study is designed to explore the relationship between the manipulated variables of spatial and social density, and measures of arousal, mood, and social orientation.

Methods

Research Design

The main independent variables in this study are spatial density, or space per person, and social density, or number of subjects in a room. Two levels of spatial density were employed: subjects were allowed either 6 square feet or 24 square feet per person. The high spatial density condition allowed the subjects enough room to stand and move around as the task required but clearly constrained such movement. The low spatial density condition provided ample room for moving and walking but was still on a small scale. In the high spatial density condition subjects had about as much room as one has in a portable shower stall, whereas the lower spatial density condition gave each subject an amount of space comparable to a modest entry hall or a student's office. Perhaps most importantly, this amount of space allowed per person in the low spatial density condition was about the same as subjects are usually alotted in experiments in this laboratory, but the amount of space in the high density condition was drastically less.

Social density varied across four levels: subjects were either alone in the experimental room, with one other person, with three other people, or with ten or eleven other people. These levels were chosen to represent the widest variation possible given the amount of laboratory space and the number of subjects that could feasibly be employed. The one-person condition seemed particularly interesting in that it would allow examination of the effects of spatial density, if any, when no social interaction was occurring. One

might expect that the other social density conditions would be noticeably different from each other as social experiences also.

In summary, the amount of space per person was either 6 or 24 square feet; the number of subjects in an experimental room was either 1, 2, 4, or 12. Thus, the experimental rooms employed in the high spatial density condition measured 6 square feet, 12 square feet, 36 square feet, and 72 square feet. In the low spatial density condition the rooms were 24 square feet, 48 square feet, 96 square feet and 288 square feet.

Special care was taken in choosing a task and an experimental induction to give the size of the rooms a sort of face validity. The rooms were presented to the subjects as display rooms for the cards used in the first task. The walls of the rooms were either constructed of wall board or covered with that material. The cards for the task were then arrayed on the walls giving the effect of bulletin boards. It was hoped that the clearly temporary construction and in some cases the relatively tiny size of the rooms would seem justified by this use.

The two smallest rooms were each free standing inside a separate cubicle, flush to the door so that the remainder of the cubicle was not visible. The rooms were four inches lower than the 8 feet high ceilings to allow for ventilation. Two rooms contained moveable rear walls so that these rooms could be made into two different sizes. One room with a moveable wall was used for the 36 and 48 square feet rooms; the other room with such a wall could serve as either the 72 square feet room or the 96 square feet room. The remaining rooms

were constructed by covering the walls of existing rooms with wall board.

In other aspects the rooms were the same. Air conditioning equipment kept the rooms relatively comfortable and constant. All rooms were carpeted and had ceilings 8 feet high. All were located in the Group Dynamics Laboratory at the University of Michigan. The experimental rooms were surrounding the same central waiting room.

A third independent variable included in the design is sex of subject. Several studies have indicated that males and females may react differently to high density situations; therefore, the inclusion of both sexes seemed important. Females and males were run separately in the social conditions because Freedman and his colleagues (1972) have reported that high density has the strongest effect on same-sexed groups. The already large number of subjects required by the design made the inclusion of mixed-sex groups impractical even though this would have been desirable.

Subjects

Ninety-one females and 126 males participated in this study. Because group size varied, unequal numbers of subjects were run in the different conditions. A compromise was decided upon so that a reasonably large number of subjects would be run in the one-person and two-person groups and an acceptable number of groups would be run in the four- and twelve-person conditions.

Groups of two and four were run only when all subjects were present. Twelve person groups were run if at least 11 subjects had arrived. In one all-female, twelve-person, high spatial-density group, one

subject left shortly after the study began. She excused herself by saying that she got claustrophobic and upset in crowds. The final number of subjects in each cell is shown in Table 1.

Table 1

Research Design with Number of Subjects in Each Cell*

ROOM SIZE	SEX	GROUP SIZE 1 Person	2 People	4 People	12 People
6 Sq. ft.	Male	5 (5)	10 (5)	12 (3)	36 (3)
	Female	5 (5)	10 (5)	8 (2)	21 (2)
24 Sq. ft.	Male	5 (5)	10 (5)	12 (3)	36 (3)
	Female	5 (5)	10 (5)	8 (2)	23 (2)

*Figures in parentheses indicate number of groups in each condition.

Subjects were drawn from three sources: (1) those who answered an advertisement in the student newspaper, The Michigan Daily, (2) undergraduates enrolled in an introductory psychology course at the University of Michigan who fulfilled a class requirement by participating in the experiment, and (3) students registered in a paid subject pool organized by the Human Performance Research Center at the University of Michigan. Subjects from these three sources

were randomly scheduled in all conditions. Paid subjects were not identified until after the experiment was completed; at that time, they received three dollars for their participation.

Experimental Session Schedule

The duration of an experimental session was approximately one hour and fifteen minutes. Debriefing occupied an additional 10 to 15 minutes. Four sessions were scheduled on Mondays through Thursdays. Three sessions were scheduled on Fridays, two on Saturdays and Sundays. Subjects' schedules had to be taken into account, but sessions never began before 10 a.m. nor lasted later than 9:30 p.m. Despite frequent subject cancellations, every spatial and social density was run equally in the morning, afternoon, and evening. All space and number conditions were run on each week-end day also.

Subjects were scheduled by telephone. Each name was selected from a master list previously constructed. The subjects were then asked to participate in a study of cognitive task performance. The subject was told that the study would involve performance of a number of different kinds of tasks that would be explained during the experimental session. The time, duration, and location of the study were given and the subject's assent obtained. The assistant who called subjects did not know the nature of the study nor the space condition to which the subjects were being assigned. The number of subjects required for a session was, of course, obvious.

Description of Tasks

Card task The first task for the subjects to do was called the card task. In this task, each subject was to collect two hundred cards of specific types. The task was designed to remove an objective

justification for competition. All cards were displayed on the walls of the experimental rooms. To this end, 20% more cards of each type that each subject was to acquire were displayed. The subject was asked to collect 60 of one type of card, 20 of another and 12 sets of 10 of a kind. The particular type cards and the number of each type that the subject was to acquire were specified on a goal list each subject received. The cards were identified by two letters or a geometric form and a letter. These characteristics were only two of the four characteristics that distinguished each card. The cards all bore two letters, one geometric form and a border. To make the discrimination aspect of the task more difficult, the same letters, forms, and borders were used on various cards but in different combinations. For example, one type card would have A●P printed on it and another would have P▲O. The subject looking for a card bearing the letter OP would then have to discriminate between these two cards as well as among others.

Pretesting of this task indicated that it required about forty minutes. During this experiment, subjects were given 28 minutes to complete it.

The major purpose of this task was to serve as a filler activity rather than as a performance measure. It is a task that can be performed by an isolated actor or by coactors; competition was possible but not necessary. There was no shortage of resources nor did any special reward exist for finishing first or getting the most cards.

The number of cards to be acquired and the over-lapping characteristics of the cards were designed to make the task relatively

difficult and time-consuming. As a filler activity, the task had to last long enough for subjects to be exposed to their experimental environment for a reasonable length of time. The fact that the task required movement and visual scanning was also intended to increase subjects' exposure to the experimental environment.

The individualistic quality of the task was expected to minimize the role of social organization in this study. Subjects were strangers to each other, were allowed no time for organizing themselves, and had individual goals to pursue. Of all subjects run, only one group of subjects, a female dyad in the high spatial-density condition, reported having organized as a group. In all groups, including that one, little conversation occurred.

Finally, the card task was designed to be involving and to justify the use of temporarily constructed rooms. When high spatial-density appears to have been inflicted on subjects gratuitously, any stress or anti-social effects observed may be attributable to the subjects' feelings of being unfairly treated rather than to the experimental manipulation.

Word association task The second task was mainly intended as a dependent measure. But, since it required 34 minutes during which subjects were exposed to their experimental environments, it also was a significant part of the manipulation. Subjects were given booklets of 17 stimulus words. Each word was listed 50 times, in two columns, with one stimulus word to a page. The words, in order of their appearance were Pelt, Tackle, Bath, Wrench, Carpet, Storm, Ocean, Mean, Joy, Religion, Stem, Hit, Thief, Cottage, and Cuff. Subjects

were asked to read each word as it was listed down the page; the word was to be read, then an associate given, then the next printing of the word was to be read and another associate given, and so on down the page until the time was up. A signal to turn the page was given by the experimenter knocking on the door every two minutes.

This task was selected because it is supposedly affected by drive. Allport (1924) and Matlin and Zajonc (1968) both report increased number and commonality of associates when subjects are in a coaction situation rather than alone. Zajonc (1965) had interpreted the various findings of performance changes as a function of the presence of another as being reflective of increased drive. The study by Matlin and Zajonc was interpreted as confirming this explanation. One virtue of this task as an indicator of drive is that it seems less likely to be affected by evaluation apprehension or a subtle competitive orientation on the part of subjects than other, more goal-directed tasks that might also be sensitive to the effects of drive. As mentioned in the introduction, Freedman, Klevansky and Ehrlich (1970) expected to find drive effects as a function of density, but they were not obtained. Two aspects of the experimental situation make this non-finding uninterpretable: (1) the tasks employed had not been shown to be drive sensitive and had not been used in other research on social facilitation even though the researchers claimed to be working with a social facilitation paradigm, (2) the nature of the tasks and the room arrangement minimized exposure to social stimulation and spatial constraint as well as providing a task-oriented, cooperative social structure when social interaction did occur.

To avoid these problems, subjects were exposed to the card task first, before the relatively isolating word associate task. Secondly, the word associate task was chosen on the basis of its use in earlier research.

The choice of stimulus words had two purposes. First, eight of the words chosen had been found in other research to have approximately similar probabilities associated with the primary response and the secondary responses; that is, the most common response was not so overwhelmingly probable that experimental intervention was unlikely to affect commonality of associates (Innes, 1972). These stimulus words were Bath, Carpet, Cottage, Joy, Ocean, Religion, Stem, and Thief.

The remaining nine words were obtained from a study by Simpson and Craig (1967). In this study, subjects with aggressive personalities were found to give more aggressive associates to words with a double meaning, one of these meanings being aggressive. The double meaning words employed were Cuff, Hit, Mad, Mean, Pelt, Storm, Tackle, and Wrench.

Commonality and uniqueness were both scored on the basis of norms in this population rather than relying on previous norms such as the Palermo and Jenkins (1964) norms. Coding of aggressive associates was done chiefly by the author but a stratified random sample of twenty percent of the responses, drawn proportionally from each condition, was scored by another judge. The correlation of percent aggressive associates scored by the two judges was .86.[1]

[1]Thanks go to Emilie O'Mara for acting as the second judge.

Procedure

As the subjects arrived, they waited in the waiting room until the entire number scheduled for that session was present. Although no special precautions were taken to prevent subjects from talking, very little conversation occurred since the subjects were strangers to each other and the waiting period did not exceed 15 minutes, usually lasting less than 10 minutes.

The experimenter began the experimental session with the following remarks:

> The study today concerns the performance of various cognitive tasks. Each task will be explained as we get to it. One factor of interest in the study is the relationship between physiological states and task performance. For that reason, I will be collecting a special kind of fingerprint from you at intervals throughout the study. In a moment I will take the first print.
>
> I can explain more about the various tasks and measures after the experiment is completed. For the time being, I would appreciate your listening to instructions carefully and cooperating. Please save your questions that are not directly concerned with perfoming the various tasks until after the study. Thank you.
>
> Now will you come with me so that I can take the first fingerprint?

The subjects were then led to a table in a corridor near the experimental rooms that held the equipment for obtaining a palmar sweat index (PSI) by the method described by Johnson and Dabbs (1967). The time required for obtaining the prints varied from about one or two minutes for one person to at most eight or ten minutes for twelve people. At the time of the first PSI print, subjects were assigned identification numbers. In the twelve-person groups, three subjects at a time were fingerprinted in order to hasten the procedure.

Next, the card task was explained as follows:

The first task is a discrimination task. It requires that you find and collect specific cards from the wall display. A room has been specially prepared so that all the cards for the task are thumbtacked to the walls.

Here is a goal list. (Each subject was handed a list containing the number of cards and the identifying features of these cards that the subject was to acquire.) The goal card you have lists the different cards you are to collect. The cards are identified by two symbols, for example, X and B or W and A. (A sample goal list was displayed.) You should look for cards having both of these characteristics, for example, X and B. The card may have other symbols and letters on it, but it must have the two you are looking for. For example a card bearing an X and B may also have a D or a dark diamond . These other symbols may vary.

The number listed with each set of two symbols indicates how many cards with that characteristic you must acquire, If your list has 60 X P printed on it, then you are to collect 60 cards bearing both X and P. On your goal list the first number indicating the number of cards of that type you should collect is 60. You must collect all 60 of these cards before going on to the rest of the list. After you get the first 60 cards, then you may gather the remaining cards in whatever order you want. Please look at your goal lists and ask me any questions you may have.

The task will be timed. When I close the door of the display room, I want you to begin working. Continue until I come in and tell you that your time is up.

Here is a cup for the thumbtacks holding the cards to the walls and an envelope for the cards. Please follow me to the display room.

(The experimenter then led the subject or subjects to the experimental room.)

Okay, now please begin.

As soon as the door was closed, the experimenter started a stop watch. Twenty-eight minutes were allowed for the task. At the end of that time the experimenter returned to the room and collected the envelopes holding the cards gathered by each subject.

At this point, subjects and experimenter left the experimental room and returned to the table in the corridor. Another palmar sweat print was taken from each subject, then the next task was explained.

Before explaining the word association task, the experimenter handed out clipboards with a booklet of stimulus words and a pencil. Subjects were then given the following instructions:

> The second task is a word association task. I have given you a list of words. The same word is repeated down the page. I will want you to start at the top and look at the word, then write down the first word that comes into your mind. Next, look at the printed word again and write down whatever comes to your mind. Continue this on down the page until I tell you to turn the page. Do not turn the page until I tell you to do so. I must stress this: it is important that you continue to work on the same page until I ask you to turn the page by knocking on the door and saying "Turn". When you hear the knock and my instruction, go on to the next page.

The subjects then returned to the experimental room, the same room that had been used for the card task. Once they were in the room, they were asked to begin the word association task. The experimenter closed the door, began timing the two minute intervals and signalled a page turn at the end of each interval. Thus, 34 minutes were allotted for the completion of the 17 stimulus word booklet. If subjects were heard talking, the experimenter asked them not to converse.

After this period, the booklets were collected and the subjects again left the experimental room for the third and final fingerprinting. The subjects, having kept their clipboards, then received the Knowlis Mood Adjective Check List (MACL) with printed instructions for its use. The experimenter gave the following explanation:

> The main part of the experiment is now over. There is just one more thing that I would like for you to do. Sometimes the way a person is feeling, his mood at the moment, may influence his performance on tasks like the ones you have done. As a check on this possibility, I would like for you to fill out this questionnaire concerning your

mood at this time. Please be completely honest and report your feelings as you experienced them.

I want you to return to the display room to complete this questionnaire. The instructions appear on the first page. The whole thing should not take more than a few minutes. When you have completed the questionnaire, please come out into the waiting room so that we can discuss the study.

Subjects returned to the experimental room, completed the MACL in that room, then, when this was completed, returned to the waiting room. At this time, the MACL was collected and a post-experimental questionnaire was distributed. When all subjects had finished the post-experimental questionnaire, a written description of the purpose of the study and of the various measures was distributed. Subjects were asked if they had any questions or comments. The experiment was discussed until subjects no longer had any questions. Then paid subjects received their money.

Summary of Dependent Measures

The more important measures taken in this study fall into three categories: measures related to arousal, measures of personal feelings or orientation; and measures of social feelings or orientation. This division is not meant to imply that there is no relationship among these categories but simply that they represent somewhat different aspects of a subject's psychological state. Lists of these measures by category appear in Table 2.

Table 2

Lists of Dependent Measures

Arousal Related Measures	Measures of Personal Orientation	Measures of Social Orientation
Number of Word Associates Commonality of Word Associates Number of Unique Associates Palmar Sweat Index Scales from MACL: Concentration Fatigue Vigor	Scales from MACL: Anxiety Surgency Elation Sadness Egotism Post-experimental Questionnaire: How free did you feel to write down the first thing that came into your mind in the word association task? Would you have liked more space during the card task? Would you have liked more space during the word association task?	Percent aggressive word associates Scales from MACL: Aggression Social Affection Skepticism Post-experimental Questionnaire: Did you feel that other people interfered with you during the card task? Did you find the other subjects' distracting during the card task? Did you feel competitive with the others during the card task? Were the other subjects competitive toward you? If you were to do the card task again, would you prefer to do it alone or with others present? If you were to do the word associate task again, would you prefer to do it alone or with others present? Overall, how did you feel about the experiment? How did you feel about the experimenter?

Results

The reader will recall that the main purpose of this study was to explore the effects of high densities on several sets of dependent variables. Research on animals and people in high density situations has suggested that arousal, positive or negative affect, and social orientation and behavior might be influenced by density. Most studies of people have not included a range of such measures. Therefore, as an exploratory study, one of the purposes of this experiment was to assess the effects of a short-term, density experience on these different dependent variables.

Secondly, definitions of density in studies involving human subjects have not distinguished between spatial density (amount of space available per person) and social density (number of people present). This study involved independent manipulations of these two factors so that main effects for each and interactions could be assessed.

The results of this study indicate that not all of the three types of dependent measures were affected by density and that spatial and social density affect the measures somewhat differently. The finding for each set of measures will be reported separately.

Arousal-Related Measures

The effects of density on arousal-related measures tend to support the expectation that spatial density would increase the amount of stimulation a subject felt. Also, as expected, social density related positively to level of arousal. The main effect for spatial

density appeared on the direct measure of arousal, the palmar sweat index, whereas social density affected both the palmar sweat index and the number of word associates.

The palmar sweat indices (PSI) were analyzed using a three-factor, multivariate analysis of covariance with one covariate; the three factors were spatial density, social density and sex. The baseline PSI from each subject served as the covariate, as suggested in such cases (Wiener, 1962, pp. 578-579). A multivariate F was obtained for the PSI taken after the card task (T_2) and after the word associate task (T_3). Univariate F ratios for T_2 and T_3 were also calculated using the same three factor analysis of covariance.

The multivariate analysis revealed significant main effects on all three factors. Subjects in the high spatial-density condition had higher PSI's than subjects in the low spatial-density condition ($F = 4.62$; $df = 2/199$; $p < .01$). The univariate F ratios for T_2 and T_3 were also significant ($F = 4.76$ and 8.10; $df = 1/200$; $p < .05$). Figure 1 shows the differences between the two spatial density conditions at T_2 and T_3.

Social density also proved to be a significant determinant of PSIs. Figure 2 indicates the average level of the PSI for each social density condition at T_2 and T_3.

The multivariate F ratio for this factor was 2.09 ($df = 3/199$; $p < .10$). The T_2 univariate F ratio was clearly significant ($F = 3.06$; $df = 3/200$; $p < .05$); however, the effect for social density at T_3 indicated only a non-significant trend ($F = 2.44$; $df = 3/200$).

Generally, in this population, females tended to have higher PSIs than did males. At T_2, the females' mean PSI was 102.43, whereas

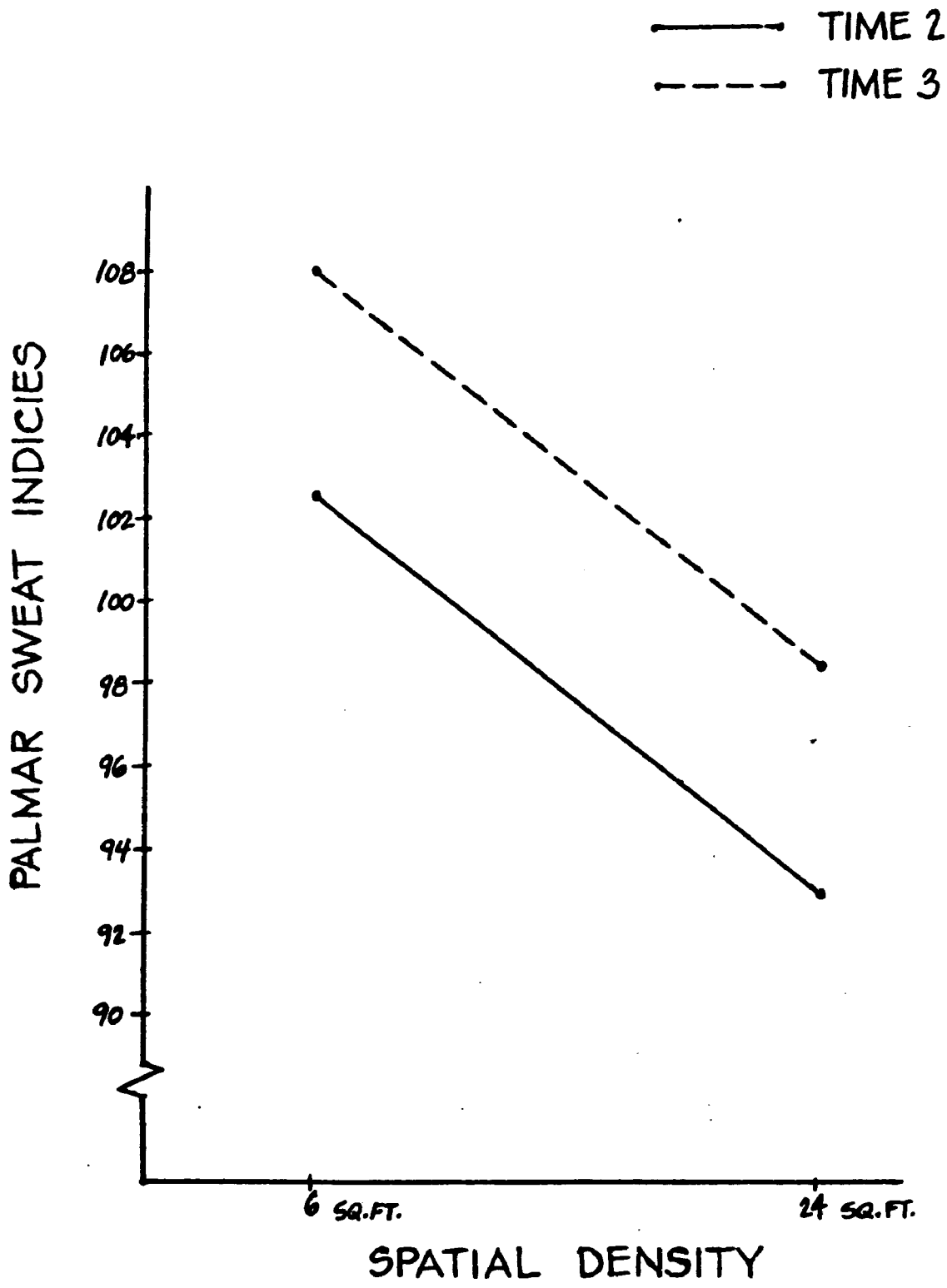


Figure 1 Mean Palmar Sweat Indicies for Spatial Density Conditions at Time 2 and Time 3

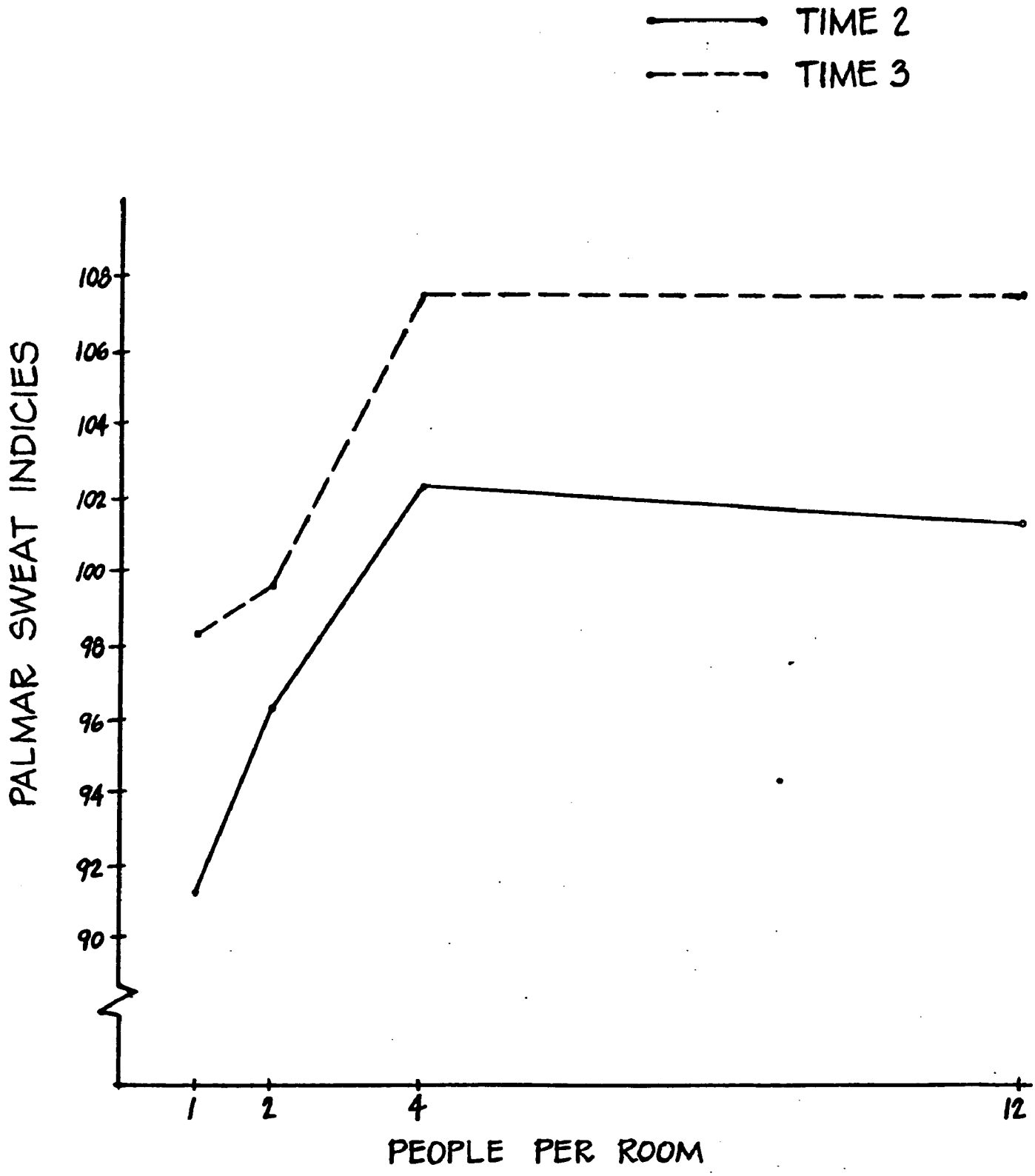


Figure 2 Mean Palmar Sweat Indicies for Social Density Conditions at Time 2 and Time 3

the mean for males was only 92.63 (F = 2.91; df = 1/200; $p < .10$). The same pattern occurred at T_3 when the mean PSI for females was 108.67 and for males it was 97.71 (F = 8.98; df = 1/200; $p < .01$). The multivariate F ratio for sex was significant (F = 4.59; df = 2/199; $p < .01$).

Inspection of the means for the baseline PSI revealed fairly large differences among groups. The baseline PSI means for subjects in each cell of the design are reported in Table 3.

TABLE 3

Mean Baseline Palmar Sweat Indices In All Conditions

SPACE	SEX	PEOPLE PER ROOM			
		1 Person	2 People	4 People	12 People
6 Sq. ft.	Female	88.40	94.20	107.37	101.43
	Male	89.20	89.90	98.25	88.83
24 Sq. ft.	Female	92.40	89.00	93.62	92.78
	Male	88.00	75.20	80.92	85.08

On the bases of these differences and on the expectation that baseline level of arousal would have influenced subjects' responses on other measures, two analyses of all remaining measures were undertaken. First a three-factor, between-subjects analysis of

variance was performed on all the measures. Then an analyses of covariance with the baseline PSI serving as the covariate was performed also. This use of the analysis of covariance seems to be justified by the different pattern of findings resulting from the two analyses. These differences would seem to indicate that the baseline level of arousal as measured by the PSI, introduced significant variation into the findings that was not related to the experimental manipulations. Thus, effects occurring only in the analysis of variance but not in the analysis of covariance could quite possibly be attributable to initial differences among subjects. Whereas the effects found significant in an analysis of covariance would be those that resulted from the experimental manipulations but had been previously masked by variation in baseline arousal level among the subjects.

The three arousal-related measures obtained from the word associate task included the total number of word associates, the average commonality of associates and the total number of unique associates given by each subject. Only one of them varied significantly along one of the two main experimental variables in both analyses. The total number of word associates given by each subject was significantly higher for subjects in the higher social density conditions. The means are as follows: one-person condition, $\bar{X}$ = 248.30; two-person condition, $\bar{X}$ = 236.90; four-person condition, $\bar{X}$ = 289.05; twelve-person condition, $\bar{X}$ = 332.04. Also, females gave more word associates ($\bar{X}$ = 289.50) than did males ($\bar{X}$ = 263.64). The analysis of variance did not yield a significant main effect for sex; however,

in the analysis of covariance this effect was highly signifcant. The analyses of variance and of covariance are presented in Table I in Appendix B.

Because the card task always occurred before the word association task, it seemed plausible that performance on the first task would affect performance on the second. In that case, the increased number of word associates given in the larger groups could indicate either general increased arousal occurring as a consequence of decreased task success in the larger groups. The analysis of variance of the number of cards acquired by each subject did reveal that social density significantly affected number of cards acquired. The mean number of cards acquired in the various social density conditions are as follows: one-person condition, $\bar{X}$ = 197.75; two-person condition, $\bar{X}$ = 176.52; four-person condition, $\bar{X}$ = 169.75; twelve-person condition, $\bar{X}$ = 129.09. The analysis of variance and covariance appear as Table II in Appendix B.

In order to assess the effect of social density on the word associate task as an index of arousal, another analysis of covariance was performed. In addition to the baseline PSI, number of cards acquired also served as a covariate. The result of this analysis, presented in Table III, Appendix B, supports the interpretation that number of people in the room contributed to increasing the number of word associates, apart from the covariation of task success and number of word associates. The main effect for social density was highly significant as was the main effect for sex when both number of cards acquired and PSI were covaried.

The results of the first analysis of the remaining indicators of drive in the word associate task, commonality of associates and uniqueness, yielded two rather odd interactions. A social density X sex interaction occurred for the commonality measure. Also, a spatial density X social density X sex interaction resulted for the commonality measure and for the unique associate measure. The analysis of covariance reduced all these interactions to less than statistically significant effects, as shown in Tables IV and V in Appendix B.

Two of the three MACL scales (concentration, fatigue, vigor) that might be expected to be associated with arousal appeared to be significantly affected by the experimental manipulation on the analysis of variance. But these apparent main effects disappeared when the covariance analysis was performed. The main effect for social density on the concentration scale was significant in the analysis of variance but not in the analysis of covariance as reported in Table VI in Appendix B.

Similarly, the main effect for spatial density on the fatigue scale, shown in Table VII, became insignificant in the analysis of covariance reported in the same table.

No other main effects or interactions were significant in the analyses of the concentration and fatigue scales. Also, there were no significant effects on the vigor scale.

Because the different measures thought to reflect arousal may not necessarily all be related to the same phenomenon, correlations among them were performed. The resulting correlations were

quite low, indicating that the original intention of including various measures of arousal may not have been realized. Instead, it would appear, several different phenomena were reflected separately in the different measures. PSI at T_2 correlated .01 with total number of word associates given; at T_3, the correlation was -.03. The correlation of PSI at T_2 with commonality of word associates was .05; at T_3, it was -.01. Similarly, number of unique associates and PSI at T_2 correlated .09, and at T_3, -.01. The correlation of number of word associates with commonality was -.03; with unique associates, it was .04. Commonality and number of unique associates, of course, correlated significantly ($r = -.33$; $p < .01$, one-tailed).

The meaning of this lack of correlation among the measures intended to indicate arousal is not clear. Lacey (1967) has previously pointed out that in situations less extreme than electrical shock, measures of arousal often fail to correlate, thus casting doubt on the utility of a simple, unitary arousal construct.

Measures of Personal Orientation

Generally, the measures in this group were not much affected by the experimental manipulations. The only spatial and social density effects to be significant in both the analyses of variance and covariance were on two post-experimental questions, and these might be regarded, in part, as manipulation checks.

Spatial density strongly affected subjects' desire, expressed on a seven-point scale, for more space during the card task (6 sq. ft. $\bar{X} = 4.66$; 24 sq. ft. $\bar{X} = 3.13$). There was also a tendency for subjects in the higher social density groups to want more space than subjects

in the lower social density conditions. This effect in the analysis of variance was significant; however, it was only a non-significant trend in the covariance analysis, as shown in Table VIII, Appendix B.

The covariance analysis also revealed a trend toward a spatial density X social density X sex interaction, which might suggest that social density affected males' and females' desire for space somewhat differently in the high spatial-density condition while their reactions were more similar in the lower spatial-density condition. The means for these two borderline effects are presented in Tables 4 and 5.

TABLE 4

Desire for More Space During the Card Task as a Function of Social Density*

People per Room			
1 Person	2 People	4 People	12 People
3.05	4.00	4.32	4.22

*Higher numbers indicate greater desire for more space.

TABLE 5

Desire for More Space During the Card Task as a Function of Spatial Density, Social Density and Sex*

Space per Person	Sex	People per Room 1	2	4	12
6 Sq. ft.	Female	2.20	4.60	5.25	5.57
	Male	4.20	5.10	5.83	4.55
24 Sq. ft.	Female	2.80	3.20	3.37	3.09
	Male	3.00	3.10	2.83	3.69

*Higher numbers indicate greater desire for more space.

This trend toward a three-way interaction appeared only after the covariate was added; the analysis of variance showed no such trend.

The Scheffé method of post-hoc analysis was used in comparing all social density conditions within females and males and within the two levels of spatial density. These tests indicate that one comparison was significantly different. The female subjects in the high spatial-density condition wanted more space in the twelve-person condition than in the one-person condition ($F' = 49.38$; $df = 15/216$; $p < .01$). This same comparison of social density conditons for males in the

high spatial-density condition was not significant ($F' = 0.14$). Comparisons of males and females separately did not reveal any significant differences between spatial density conditons at any of the levels of social density.

Spatial density significantly affected subjects' desire for space during the word association task. Subjects alotted 6 square feet per person reported an average scale rating of 3.91, whereas subjects in the 24 square feet per person condition had an average score of 2.12. Also males expressed a stronger desire for more space during the word association task ($\bar{X} = 3.44$) than did females ($\bar{X} = 2.59$). The F ratios for the analyses are reported in Table IX, Appendix B.

Two main effects for experimental variables were significant on the mood scales. Both of these were not significant when the baseline PSI covariate was included in the analysis. In the first analysis of variance, the main effect for spatial density on egotism was significant but in the analysis of covariance this effect became very small. Similarly, the F ratio for the spatial X social density interaction on the egotism scale dropped from being highly significant in the analysis of variance to being clearly insignificant in the analysis of covariance, as shown in Table X.

Social density seemed to be a significant determinant of subjects' ratings of sadness in the first analysis as indicated in Table XI of Appendix B. However, the covariance analysis, reported in the same table, failed to show such an effect.

The interaction between spatial density and sex was significant on the anxiety scale in the first analysis. This interaction also

was no longer significant when baseline differences on the PSI were covaried as can be seen in Table XII.

The analysis of variance revealed that three of the mood scales relevant to personal orientation were significantly affected by sex of the subject. Females were more anxious ($\bar{X}$ = 5.04) than males ($\bar{X}$ = 4.41). Males were more egotistical and surgent ($\bar{X}$s = 4.95, 6.90) than females ($\bar{X}$s = 4.10, 5.19). The F ratios for these effects are presented in Tables XII and XIII in Appendix B.

To the extent that sex differences produce baseline population differences on the PSI as well on the mood measure, they may both by thought of as traits subjects brought into the study. Because sex is not an experimental variable, interpretation of results is not particularly aided by the analysis of covariance. Nonetheless, the covaried analysis of variance for these scales will be presented also. The F ratio for the sex main effect for anxiety declined greatly when the PSI covariate was included; however, the sex main effect is significant for surgency. The analyses of variance and covariance for these scales appear in the tables already mentioned.

One other measure from the post-experimental questionnaire showed a main effect for sex in the first analysis. Males felt less free to give whatever word association came into their minds ($\bar{X}$ = 2.66) than did females ($\bar{X}$ = 2.16). When the covariance analysis was performed, this effect was reduced to a non-significant trend. These two analyses are presented in Table XIV.

In summary, the only measures of personal orientation affected by density factors, in both analyses, were questions about desire

for space. Not suprisingly, subjects in the high spatial-density condition expressed a stronger desire for more space than did subjects in the lower spatial-density condition. Also, there was a tendency for subjects in the higher social-density condition to desire more space.

Measures of Social Orientation

Spatial and social density did affect a number of measures of social orientation. Subjects' feelings and perceptions of interference and competition as well as their preferences for working with others and their liking for the experiment were all affected in some way by the experimental manipulations. The mood scales and the percent of aggressive word associates were not affected by spatial or social density, although there were significant sex differences.

The first three measures to be discussed in this section are subjects' perceptions of interference from others on the card task, subjects' own feelings of competitiveness, and subjects' perceptions of others' competitiveness. It did not seem reasonable to ask subjects who had been alone throughout the experiment if other subjects had interfered with them, or if they had felt competitive with others, or if others had seemed competitive. Therefore, these questions were included in the post-experimental questionnaire only for subjects in the two-, four-, and twelve-person conditions. Thus the analyses to be reported for these measures involve three rather than four levels of social density.

Subjects reported more interference from others during the card

task when they were in the high spatial density condition ($\bar{X}$ = 2.70) than in the lower ($\bar{X}$ = 2.04). The main effect for social density was also significant. The mean rating of interference given by subjects in the two-person condition was 1.97; in the four- and twelve-person groups this rating was identical ($\bar{X}$ = 2.56). Comparisons between conditions using the Scheffé method indicate that only the two- and twelve-person conditions even approach being significantly different (F' = 8.70; df = 2/193; $p<.10$). The analyses of variance and covariance are reported in Table XV, Appendix B.

Answers to the question about distraction during the card task were affected by spatial density in the analysis of variance. Covarying the baseline PSI reduced this effect to a less than significant one. The difference in results of the two analyses can be seen in Table XVI.

The question about competition provided some of the most interesting findings in this study. The interaction of spatial and social density was highly significant on both the measure of how competitive the subjects felt and how competitive they thought other subjects were. The F ratios for the spatial X social density interaction for scores on the question "Did you feel competitive with others on the card task?" were significant in both analyses. When subjects were asked if the others were competitive, the interaction was also significant in both analyses. Tables 6 and 7 present the means for these interactions.

Table 6

Mean Ratings of Subjects' Own Competitiveness During the Card Task as a Function of Spatial and Social Density*

Space per Person	People per Room			
	2 People	4 People	12 People	Overall Means
6 Sq. ft.	3.45	4.60	3.57	3.41
24 Sq. ft.	2.80	3.02	4.30	3.27
Overall Means	3.12	3.81	3.94	3.34

*Higher scores indicate more competitiveness

Table 7

Mean Ratings by Subjects of Other's Competitiveness During the Card Task as a Function of Spatial and Social Density*

Space per Person	People per Room		
	2 People	4 People	12 People
6 Sq. ft.	3.5	3.73	2.98
24 Sq. ft.	2.4	3.21	3.90

*Higher scores indicate more competitiveness

Overall, the analysis of covariance, presented in Table XVI of Appendix B, suggests that subjects felt they were somewhat more competitive in the higher social density conditions, but this trend did not reach the .05 level of significance. The average ratings in the two-, four, and twelve-person conditions were 3.12, 3.81, and 3.94. This trend had not been of even borderline significance before the covariate was included in the analysis. The first analysis is also reported in Table XVI.

Table XVII shows the analyses of variance and covariance for subjects' ratings of others' competitiveness.

Scheffé post-hoc comparisons revealed that, for both the self and other measures of competition, the difference between the two- and twelve-person conditions was significant in the low spatial-density condition($F' = 12.50, 15.00$; $df = 5/190$; $p < .05$ and $.025$). These differences were not significant in the high spatial-density condition. The differences between two- and four-person groups and between four- and twelve-person groups were not significant in either spatial-density condition for either question. Interestingly, in the twelve-person condition, the mean score of subjects in the high spatial-density condition tended to be lower than the average for subjects in the lower spatial-density groups ($\underline{F}' = 9.44$; $\underline{p} < .10$) on the question of others' competitiveness.

The spatial-density effect for interference and the spatial-X social-density interaction for competition are particularly interesting since neither a spatial-density main effect nor a spatial-X social-density interaction occurred for card task success, as measured by number of cards acquired. That is, subjects in the higher spatial-

density condition did not, in fact, significantly prevent each other from acquiring cards although they perceived greater interference and competition. The correlation between number of cards acquired and perceived interference is -.05. The correlations between estimates of the subjects' own competitiveness and that of other subjects with number of cards acquired were .01 and -.04. Obviously, task success did not mediate the subjects' perceptions of interference and competition. Perceived interference correlated .22 with subjects' ratings of their own competitiveness ($p<.05$, two-tailed) and .34 with subjects' ratings of others' competitiveness ($p<.01$, two-tailed). The two competitiveness ratings correlated .56 ($p<.01$, two-tailed). These findings are revealing because they suggest that in this situation, subjects' perceptions of interference and competition arise from some other quality of the interaction than simple frustration of a goal.

The fact that perception of interference and competition tended to be lower in the high spatial-density, twelve-person condition than in the low spatial-density, twelve-person condition indicates that competition for space or mere physical interference with others does not explain these findings; one would expect both factors to be greatest in the highest spatial- and social-density condition. Possible explanations for these findings will be discussed later in the light of the total configuration of results.

Subjects preferred to work with others rather than alone somewhat more when they had experienced working with others during the experiment. The means for the social-density conditions are presented in Table 8.

TABLE 8

Mean Preference for Working with Others
During the Card Task and the Word Association Task
as a Function of Social Density*

	People per Room			
	1 Person	2 People	4 People	12 People
Card Task	2.25	4.07	4.67	4.30

	1 Person	2 People	4 People	12 People
Word Association Task	2.20	3.77	4.16	3.81

*Higher scores indicate greater preference for working with others.

The main effect for social density was significant for preference for working with others during both the card task and the word association task, as can be seen in Tables XVIII and XIX.

Post-hoc analysis of the differences between preference ratings in the various social-density conditions indicate that for both the card task and the word associate task, the only significant differences were between subjects in the one-person condition and subjects in all other conditions. For the card task, the one-person condition differed from the two-person condition with an F' of 15.77 ($df = 3/200$; $p < .01$); the difference between the one- and four-person condition yielded an F' of 27.89 ($p < .01$); between the one- and twelve-person

conditions, the F' was 24.72 ($p < .01$). The comparable F's for the word associate task were 17.60 ($p < .01$), 29.55 ($p < .01$), and 23.56 ($p < .01$).

There was also a tendency toward an interaction between spatial and social density on the preference-for-working-with-others-during-the-card-task measure. Although this trend is not statistically significant ($p < .10$), inspection of the means presented in Table 9 indicates why it is of particular interest: the mean preference for working with others, while mainly increasing with number of subjects in a condition, drops off in the twelve-person, high spatial-density condition.

TABLE 9

Mean Preference for Working with Others
During the Card Task
as a Function of Spatial and Social Density*

Space per Person	People per Room			
	1 Person	2 People	4 People	12 People
6 Sq. ft.	2.90	4.25	4.50	3.97
24 Sq. ft.	1.60	3.9	4.85	4.64

*High scores indicate greater preference for working with others.

Again, a series of Scheffé comparisons was performed. None of the

differences between social-density conditions were found to be significant in the high spatial-density condition. However, in the low spatial-density condition, the one-person condition was significantly different from the two-person condition (F' = 25.19; df = 7/200; $p < .01$), the four-person condition (F' = 70.42; $p < .01$), and the twelve-person condition (F' = 84.01; $p < .01$). Comparisons also were made between the two levels of spatial density at every level of social density; none of these comparisons revealed significant differences.

A tendency for males and females to diverge in their ratings of liking for the experiment in the low spatial-density condition was suggested by the data. The analysis of variance showed a nearly significant ($p < .10$) interaction between spatial density and sex. The tendency for females and males to respond similarly in the high spatial-density condition is of interest chiefly because the direction of the difference is counter to findings in other studies. Females liked the experiment somewhat more in the low spatial-density condition, whereas males liked it somewhat less. The means are presented in Table 10.

The analyses of variance and covariance table, Table XX, Appendix B, indicates that the trend did not appear until the covariate was included, and then it only reached a significance level of .10.

The experimental conditions did not affect the percent of aggressive word associates given by subjects. However, males gave a significantly greater percent of aggressive associates

TABLE 10

Mean Ratings of Liking for the Experiment by Spatial Density and Sex*

	Sex	
Space per Person	Female	Male
6 Sq. ft.	4.62	4.58
24 Sq. ft.	4.85	4.45

* Higher scores indicate greater liking

($\bar{X}$ = 6.96%) than did females ($\bar{X}$ = 5.60%). The analyses of the percent scores are shown in Table XXI.

Similarly, none of the mood scales relevant to social orirntation were affected by spatial or social density, but one did reveal a sex difference. Males were more socially affectionate ($\bar{X}$ = 7.52) than were females ($\bar{X}$ = 6.40). The F ratios for this effect can be seen in Table XXII.

Thus, the findings of particular interest on the measures of social orientation are those indicating that both spatial and social density influence perceptions of interference from others and that spatial and social density interact to affect perceptions of competition. The finding that subjects who had been with others expressed a stronger preference for being with others may indicate that being with others increases one's desire to continue being with people. However, this finding might simply indicate that subjects feel it would be impolite or reflect negatively on their characters to prefer to be alone when they are in a situation with other people. Because of this possibility, the utility of the measure for comparison across social-density conditions is limited. The nonsignificant trends are suggestive but must be considered with reservation because of their statistical weakness.

Summary of Results

The findings of this study, then, indicate that short-term, high density situations do affect subjects' responses on the different sets of dependent measures. Spatial and social density influenced number of word associates. This discrepancy may have implications either for the concept of arousal, its measurement or both, as they are used in such studies, since correlations among these indices were low.

Although spatial density influenced subjects' ratings of desire for more space, for the most part neither spatial nor social density affected measures of personal orientation. Thus, subjects did not seem to feel generally better or worse as a consequence of density.

The main effects for spatial and social density on perception of interference and the interaction effects on measures of competition suggest that social orientation is affected by density. Again, while these effects do seem to be associated with density, they do not support the simple interpretation that higher densities increase anti-social orientation.

The findings concerning all three types of measures indicate that the components of density can be usefully distinguished. Spatial and social density affected the different dependent variables in distinct ways. Further, the measures of competition revealed significant interaction effects. Any adequate understanding of the effects of density must thus consider both the influence of space available, or spatial density, and of the number of people co-present, or social density.

The main effects for sex, while no doubt deserving of study on their own account, will not be considered further. In this design, sex was included as a factor for two reasons, to reduce the variance due to population differences and to test for interactions of sex with the two density factors.

In the discussion to follow only those results that were significant in the analyses of covariance will be considered. This is a conservative approach since findings that appear only in the analysis of variance quite probably could be attributed to population differences rather than to the experimental manipulations. Since this is an exploratory study not based on strong hypotheses about probable effects, a conservative strategy in interpreting the results seems advisable.

Discussion

This study indicates that, at least under these experimental circumstances, social and spatial density do have effects on human subjects. Further, these two density factors have somewhat different effects.

The circumstances of the study were designed so as to bring together strangers in a task-oriented situation in which visual exploration of the environment and movement were required. Resources were adequate for each individual to accomplish the task. An effort was made neither to preclude nor to encourage competition. Individuals had their own goals and worked as co-actors but no social organization was suggested nor, apparently, did any arise. The situation was temporary but confining. Although subjects could leave, they were certainly not encouraged to do so. Quite probably, the subjects did not feel that their participation was entirely voluntary once they had committed themselves to be in the study.

In this situation, increased social density produced increased palmar sweating and increased number of word associates, both originally intended to be taken as indicators of arousal. In view of the lack of correlation between the two measures, they would probably be better interpreted as measures of somewhat different phenomena.

The PSI is a very labile measure. The correlation between T_1 and T_2 was -.23 ($p < .05$, two-tailed), and between T_1 and T_3 it was -.16 (n.s.) The T_2 and T_3 measures correlated .15 (n.s.). Johnson and Dabbs (1967) have proposed that the PSI be taken as an

indicator of the extent to which a person is being subjected to or is attending to environmental stimuli; increases are seen as relating to environmental awareness and decreases as indicating concentration on internal stimuli. Thus it appears that subjects become more aroused in this restricted sense of the term when more people were present. This increased arousal should not be cavalierly interpreted as increased stress, however. In fact, there is some evidence that over a period of continuing stress, descreased palmar sweating has been observed (Johnson and Dabbs, 1967).

The word associate measure has been used as an indicator of drive or arousal, without a distinction being made between these two concepts (Matlin and Zajonc, 1968). In this study, the increased number of word associates might then be taken as an indication that drive or arousal increased with increased social density. In that case, not only would the relatively transitory form of arousal reflected in the PSI be affected by social density, but another form of activation or drive would seem also to be affected.

However, the increased number of word associates given by subjects in the larger groups might indicate something else. With more subjects in a room, perhaps there was a higher probability that at least one of them would give a fairly great number of word associates. If the others in the group then modeled this behavior, the outcome would be a larger number of word associates given by subjects in the higher social density conditions.

In any case, these two findings suggest that responses often taken to indicate arousal in subjects are affected by social density

in this study. The lack of correlation between measures would seem to imply that various supposed measures of arousal or the effects of arousal may, in fact, relate to different processes in the subject.

The absence of social density effects on any of the scale measures that would reflect a negative affective experience further indicates that the increased arousal as a function of number of people in the room should not be interpreted as stress. Although subjects' expressed desire to be with other people drops off somewhat in the twelve-person condition, a series of post-hoc comparisons indicate that the only statistically significant differences between groups are between subjects in the one-person condition and subjects in each of the social conditions.

The only evidence that would support an interpretation of these effects as also stressful comes from the post-experimental questionnaire. Subjects perceived others as interfering with them more in the higher density conditions. Although the main effect was significant and the means for the twelve- and four-person conditions were the same, only the difference between the two- and the twelve-person conditions was of borderline significance. That more subjects in a room present greater coordination problems in a task involving movement is not suprising. However, while it is not an unexpected finding, it should be taken into account in efforts to understand and predict the effects of crowding. Depending on the activities carried out and the social organization, the sheer interference aspect of large numbers of coacters in natural settings quite plausibly may cause stress and negative feelings if experienced often or for long

periods of time.

Subjects expressed a greater desire for more space in the larger groups and were also more competitive. These two social-density effects, of only borderline significance, indicate that subjects may be somewhat more personally protective in larger groups. Kutner (1973) has reported a similar relationship between feelings of unpleasant competition and group size.

The results of this study show fewer effects of spatial density than of social density. While Freedman and his colleagues (1971) have suggested that social density is a more significant determinant of crowding effects and, indeed, most studies of crowding have tended to support this view, caution in drawing this conclusion is warranted. The costliness of this kind of research usually induces researchers to employ only two levels of spatial density, as was true in this study. Many of the main effects for number may well have occurred because the range of levels sampled was more extensive; conversely, the somewhat fewer spatial-density effects may be due to the restricted range of conditions represented.

Palmar sweat indices were significantly higher in the high than low spatial-density condition. Subjects in the high spatial-density condition wanted more space during both tasks than subjects in the lower spatial-density condition. Finally, subjects felt others interfered more in the high than low spatial-density groups. A number of correlations among these measures were significant. The T_2 and T_3 PSI's correlated .16 and .19 ($p < .10$ and .05, two-tailed) with desire for more space during the card task although

the correlations were not significant for the word associate task (r = .13 and .12). The desire for more space during the card task also correlated .26 ($p < .01$, two-tailed) with perceptions of interference.

The finding that subjects wanted more space when they had less might seem completely uninteresting. Certainly other studies have shown that amount of space available affects subjects' desire for more space (Mitchell, 1970) and perceptions of crowding (Desor, 1971; Stokols et al., 1973). However, at least it should be noted that the comparable question with respect to social density did not show that the more people around a subject, the fewer he would prefer.

The combination of measures that were affected by spatial density would seem to indicate that subjects in high spatial-density situations are made more aware of their environments and exhibit increased arousal as measured by the PSI. High density in this study involved increased necessity to coordinate movements with others and awareness of physical limitations on movement. Under these circumstances of stimulation and constraint, subjects would prefer more space. Implications of this finding might be that when the environment is unpleasant, high spatial-density would make it particularly intolerable, but if it were pleasant, the effect would be the opposite.

Subjects' competitiveness and perceptions of others competitiveness were affected in this study by both spatial and social density in interaction. This finding reflects a tendency for subjects in the two- and four-person groups to experience more competition in

the high spatial-density condition; subjects in the twelve-person, high spatial-density condition experience less competitiveness than those in the lower spatial-density condition. The drop-off in the twelve-person condition is significant only for the question concerning others competitiveness but it occurs in the question about the subjects' own competitiveness and preference for working with others on the card task.

A possible explanation for these two trends may be found in seeing both competitiveness and, eventually, loss of personal involvement with others as two types of defensive social reactions. When the complexity of the situation is not too great, a more aggressive, active strategy of defense, competition, may be useful. When the number of people in the situation reaches a certain point, active defending may be replaced by psychological withdrawal from the situation. While in this study, competitiveness seems to have been the most available active defensive strategy, the ongoing activities and norms in a situation could provide different defensive strategies. For example, Kutner found that conformity related to nervousness about being with others in his study. Freedman and his colleagues have reported that women became more socially positive in interactive, spatially dense conditions, but men became more anti-social. Both Kutner (1973) and Freedman et al. (1971) placed their subjects in small groups of either two or four. All of Kutner's subjects were quite close to each other; his two distance conditions differed by only 21 inches. Thus his findings that unpleasant competition increased with number and that nervous self-protectiveness occurred

when subjects were facing each other may both reflect defense strategies employed in relatively small, spatially dense groups. Freedman et al. ran only groups of four but varied space available more dramatically than did Kutner; the resulting sex X spatial density interactions may be indications of increased social protectiveness also.

None of these three studies involved any sort of material resource shortage, unless one views space available as such a resource. Certainly situations in which high density produces objective competition for scarce material resources would be expected to increase competition among participants. Whether certain values or psychological resources were in short supply as a consequence of increased social or spatial density is a question that requires further study.

Other density studies could be interpreted as relevant to the hypothesis that personal defense strategies are employed in higher density situations when there is no overt resource shortage. The two studies of children's play behavior in high density situations (Hutt & Vaizey, 1966; Loo, 1972) employed larger groups of subjects and found that reduced social interaction occurred in the higher density conditions. Neither study varied space and number independently; Hutt and Vaizey kept space constant and increased number, whereas Loo kept number constant and decreased space.

The one study with adults employing larger groups is somewhat difficult to interpret. Griffitt and Veitch (1971) ran subjects in groups of three to five or of twelve to sixteen, keeping space constant. Subjects in the larger groups reported less urgency, less vigor, more fatigue, less liking for the room, and less liking for the experiment.

High density subjects also rated a description of an unknown person less favorably. Subjects were not asked any questions about their responses to others actually encountered. The present study fails to replicate the mood findings Griffitt and Veitch have reported, perhaps because in the Giffitt and Veitch study subjects' reactions were more attributable to the unexplained discomfort of the experiment than to density itself. In addition, these effects might not have occurred in this study because the tasks were fairly absorbing which may have kept subjects' affect relatively neutral. The rejection of the described stranger by subjects in the high density situation tends to support the idea that subjects are more socially defensive in such conditions.

Females and males did not react differently to the spatial- and social-density conditions in this study. Two of the borderline interactions that did occur tend to contradict the implications of Freedman and his colleagues (1972) findings to a certain extent. Females were somewhat more positive and males somewhat more negative to the experiment in the low spatial density condition, whereas liking ratings for the experiment in the high spatial-density condition were very similar. Further, in a spatial-density X social-density X sex interaction for subjects' rated desire for more space during the card task, females in the high spatial-density condition increased their desire for space the most of all groups as a function of social density. Males in the high spatial-density condition had the highest mean rating in the four-person group of any condition in the experiment, but the males' ratings were lower in the twelve-person, high spatial-density

condition. Perhaps this latter finding indicates that males were beginning to tune out others present in the high spatial- and social-density situation, while females remained more aware of them.

Both these two findings and the general lack of significant sex X density interactions can probably be attributed to the nature of the social situation. Freedman and his colleagues (1972) and Loo (1972) have reported sex by density interactions in situations with relatively high social involvement. This study and that of Griffitt and Veitch more closely approximated an aggregation of coacting strangers and no sex differences were found. These contradictory findings may indicate that when sex differences do occur, they represent differentially available modes of coping with a desire to protect oneself. Males may tend to take a negativistic, aggressive stance and females, a prosocial, ingratiating one. When social interaction is minimal, both protective strategies and emotional reactions to others may become more similar.

Implications

The effects of increased numbers of coactors found in this study are consistent with findings in other relevant areas of research. The finding that drive, indicated by its effect on number of word associates, increases with number of others present may be seen as an extension of the findings concerning social facilitation (e.g., Zajonc, 1965; Matlin & Zajonc, 1968). Not only does the presence of one other person seem to increase drive, but more people seem to produce an even greater increase. This measure of drive might also reflect other processes. For example, in this study it might be an

indicator of modeling or perhaps more people suggest more associates. However, the convergence of various performance effects associated with drive support its use as such a measure. Some caution must be employed in drawing a parallel between this study and the work on social facilitation; although both involve coaction situations, the first task in this study, preceding the word associate measure, is of a more interactive nature than the experimental situations found in most social facilitation studies. To a certain extent, the continuity of findings is more striking because of these differences in experimental situations.

Some of the effects of social density in this study are also congruent with the effects of group size reported in a review by Thomas and Fink (1963), despite the fact that these authors focused on organized groups whereas this study involved coacting strangers. The card task in this study was a task in which speed was essential for success; as in larger organized groups, subjects in higher social-density situations performed less well. Further, the tendency for perceptions of interference and competition to increase somewhat with group size may be relevant to the findings that members of larger groups are less satisfied. The tendency for subjects who had been in the twelve-person groups to express somewhat less desire to work with others than those in the four-person group may also be an indication of at least mild dissatisfaction.

Because investigators concerned with the effects of group size have been interested in extending their findings to naturally occurring organizations, they have not examined possible arousal effects occurring simply because of the presence of others. Perhaps such effects

should be taken into account, especially in interpreting the results of laboratory studies. It might be useful also in investigations of group size effects in naturally occurring groups to distinguish between groups formally composed of so many members but not actually occupying the same space and groups in which members are physically exposed to each other. The spatial by social density interactions on the measures of competition suggest that in assessing the quality of relationships in groups as a function of size the amount of space available during interactions among members should be taken into account.

Speculations abound that reactions to high spatial-density relate to territoriality and interpersonal distance norms. The increased perceptions of interference and desire for more space as a function of spatial-density are consistent with research on invasion of personal space. Felipe and Summer (1966) reported that when people were approached more closely than the norm, they tended to flee. Desiring more space may reflect a similar tendency. Other findings concerning the effects of personal characteristics, race and sex on spacing behavior also hay have implications for further research on spatial density (Leibman, 1970; Little, 1968; LIttle, Ulehla and Henderson, 1968).

Perhaps the most important implications this study has for understanding the effects of density on people are that it indicates that spatial and social density both affect participants, at least under some circumstances, that these effects are not identical, and that these two variables also have interactive effects. Therefore,

conclusions about the effects of density drawn from various studies should be considered in the light of the particular group sizes employed as well as in terms of the amount of space available. The possibility that the level of spatial density employed is significant should also be investigated. Both spatial and social density are continuous variables; research treating them as such rather than as dichotomous categories should reveal much more about their effects.

The finding that spatial and social density have separable and also interactive effects has practical as well as theoretical implications. In planning and designing spaces for various activities, even when the total amount of space available is fixed, the decisions about dividing the space as well as amount of space per person allocated for that function.

The lack of correlation between the palmar sweat index and the word associate measure of arousal again point out that in less than extreme situations the use of the arousal construct may not be justified. Lacey (1966) has reviewed at least some of the evidence that somatic and behavioral arousal are dissociated under some circumstances. In assessing the physiological impact of high densities on humans; longer-range, carefully monitored studies are critical. Although the palmar sweat index should not be taken as a measure of stress, it could quite possibly represent the first stage of such a reaction. Selye (1956) has pointed out that the General Adaptation

Syndrome begins with arousal, then proceed to a stage of resistance which, if insufficient, is followed by exhaustion. The sort of environmental stimulation indicated by the PSI could have further physiological consequences if the highly stimulating situation were to continue over a longer period of time without being mitigated. Of course, quite possibly, behavioral adaptations such as withdrawal from social interaction could occur that would reduce the stimulation to a point where it was no longer arousing. Long-range studies of both physiological states and social interaction patterns of human subjects in high density situations are clearly needed.

In extending the implications of this study into other situations, several variables that were kept constant should be examined. First, the type of activities engaged in by participants in a high density situation have been shown to influence perceptions of crowding (Desor, 1971). Secondly, norms for social interaction also determine the participants' reactions to such conditions; for example, Stokols and his colleagues found differences among subjects; reactions in cooperative and competitive interactions. Other factors such as familiarity of participants with each other and the amount of interaction required by the situation probably affect subjects' reactions. Different lengths of exposure to and frequency of occurrence of high density situations would also be likely to have different effects. Finally, investigations of real situations as well as laboratory ones are crucial in understanding the effects of density. To the extend that high densities might be stressful, natural or realistic settings become very important; subjects may be able to discount most of the

stressfulness of an experience if they know that an experimenter is responsible and that the end of the study is in sight.

On the other hand, in naturally occurring high density situations cultural norms and situational factors may exist that allow participants to experience little stress, little need for self-protectiveness and low arousal. For example, a recently studied tribe in Africa, the ! Kung bushmen apparently do not exhibit physiological stress symptoms such as high blood pressure or high levels of serum cholesterol even though their dwelling units are so closely spaced that inhabitants are practically in physical contact with each other most of the time when they are in the encampment (Draper, 1973). The living situation of the !Kung differs dramatically from that of city-dwellers in that their encampments are entirely barren and are scattered relatively sparsely throughout a wilderness area. Further, the activity patterns and differentiation of activities are cooperative and are probably quite a bit less complex than those of modern city-dwellers. Also, unlike the inhabitants of modern cities, all the members of the village are familiar with each other. Should relationships in the village become strained or should economic considerations make it advisable, the !Kung can easily move to another village inhabited by other familiar tribesmen. All these factors would be expected to mitigate stimulus or information overload and feelings of constraint or competition that might be associated with such high densities under some other circumstances.

The present study could be expected to generalize most probably to other situations involving aggregations of strangers, especially

of persons involved in individual tasks. Situations in which no clear social organization or norm structure is apparent and temporary situations from which escape is not very accessible would be somewhat similar to the experimental conditions achieved in this study.

In summary, this study suggests that increased spatial and social density heighten stimulation from the environment, that increased social density tends to increase drive, that both factors relate to perceptions of interference and desire for more space, and that, in interaction, they influence competitiveness among participants, at least in the type of situation represented by this experimental procedure. Physiological and behavioral indices and indicators of social orientation were more influenced by density than were measures of general affective tone. That is subjects' reported liking for the situation and their positive or negative feelings were not significantly affected by the density manipulations despite other effects of such manipulations.

In the past year or so, enough research has accumulated to allow us to ge beyond asking whether there are psychological and social effects of density to asking what particular aspects of various density situations produce the various specific effects. This study clearly indicates that spatial and social density should be distinguished in future research and suggests some of the ways in which these two variables create different reactions.

Appendix A

Dependent Measures

Stimulus Words

for Word Association Task

pelt pelt

pelt pelt

pelt pelt

tackle tackle

tackle tackle

tackle tackle

tackle tackle

tackle tackle

tackle tackle

tackle tackle

tackle tackle

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Mood Adjective Check List

Each of the following words describes feelings or mood. Please use the list to describe your feelings at the moment you read each word. If the word definitely describes how you feel at the moment you read it, circle the double check (vv) to the right of the word. For example, if the word is relaxed and you are definitely feeling relaxed at the moment, circle the vv as follows:

relaxed vv v ? no. (This means you definitely feel relaxed at the moment.)

If the word only slightly applies to your feelings at the moment, circle the single check v as follows:

relaxed vv v ? no. (This means you feel slightly relaxed at the moment.)

If the word is not clear to you or you cannot decide whether or not it applies to your feelings at the moment, circle the question mark as follows:

relaxed vv v ? no. (This means you cannot decide whether you are relaxed or not.)

If you definitely decide the word does not apply to your feelings at the moment, circle the no as follows:

relaxed vv v ? no. (This means you are definitely not relaxed at the moment.)

Work rapidly. Your first reaction is best. Work down the first column, then go to the next. Please mark all words. This should take only a few minutes. Please turn the page and begin.

I feel...

angry vv v ? no.

uptight vv v ? no.

carefree vv v ? no.

elated vv v ? no.

concentrating vv v ? no.

drowsy vv v ? no.

affectionate vv v ? no.

regretful vv v ? no.

dubious vv v ? no.

boastful vv v ? no.

active vv v ? no.

defiant vv v ? no.

fearful vv v ? no.

playful vv v ? no.

overjoyed vv v ? no.

engaged in thought vv v ? no.

sluggish vv v ? no.

kindly vv v ? no.

sad vv v ? no.

skeptical vv v ? no.

egotistic vv v ? no.

energetic vv v ? no.

rebellious vv v ? no.

jittery vv v ? no.

witty vv v ? no.

pleased vv v ? no.

intent vv v ? no.

warmhearted vv v ? no.

sorry vv v ? no.

suspicious vv v ? no.

self-centered vv v ? no.

vigorous vv v ? no.

tired vv v ? no.

Post-Experimental Questionnaire

Background Information

Name:

Sex:

Subject Number:

Address:

Number of older brothers and sisters:

Number of younger brothers and sisters:

POST-EXPERIMENTAL QUESTIONNAIRE

Because I will be conducting more studies in the future and because I want to find out as much as possible about how you reacted to this experimental situation, I would like for you to answer the following questions. Please be completely honest in your answers. I am interested in your real thoughts and feelings in this situation.

1. Did you use a strategy in performing the card task; that is, did you have any particular plan for gathering your cards:

   If so, please describe what you did.

2. Would you use a strategy now if you were to do the card task again?

   If so, what would it be?

3. How free did you feel to write down the first things that came into your mind in the word association task?

completely free not at all free

1 2 3 4 5 6 7

3. Did you feel that other people interfered with you during the card task?

not at all very much

1 2 3 4 5 6 7

4. Did you find the other subject(s) distracting during the card task?

not at all very much

1 2 3 4 5 6 7

5. Did you find others distracting during the word association task?

not at all very much

1 2 3 4 5 6 7

6. Did you feel competitive with the others during the card task?

not at all very much

1 2 3 4 5 6 7

7. Were the other subjects competitive toward you?

not at all very much

1 2 3 4 5 6 7

8. If you were to do the card task again would you rather do it alone or with other people?

much prefer alone much prefer with others

1 2 3 4 5 6 7

9. If you were to do the free associate task again, would you prefer to do it alone or with others present?

much prefer alone much prefer with others

1 2 3 4 5 6 7

10. Would you have liked to work in a bigger space during the card task?

had more than enough space would have liked much more space

1 2 3 4 5 6 7

11. Would you have liked more space during the word association task?

had more than enough space would have liked much more space

1 2 3 4 5 6 7

12. Overall, how did you feel about the experiment?

disliked it very much liked it very much

1 2 3 4 5 6 7

13. How did you feel about the experimenter:

disliked her very much liked her very much

1 2 3 4 5 6 7

4. If you were to do the card task again would you rather do it alone or with other people?

much prefer alone much prefer with others

1 2 3 4 5 6 7

5. If you were to do the free associate task again, would you prefer to do it alone or with others present?

much prefer alone much prefer with others

1 2 3 4 5 6 7

6. Would you have liked to work in a bigger space during the card task?

had more than enough space would have liked much more space

1 2 3 4 5 6 7

7. Would you have liked more space during the word association task?

had more than enough space would have liked much more space

1 2 3 4 5 6 7

8. Overall, how did you feel about the experiment?

disliked it very much liked it very much

1 2 3 4 5 6 7

9. How did you feel about the experimenter?

disliked her very much liked her very much

1 2 3 4 5 6 7

How well do you think you did on the card task?

very badly very well

1 2 3 4 5 6 7

TO THE SUBJECT:

The experiment in which you have just participated was designed to explore the effects of crowding on psychological states. Crowding has been shown to have strong disorganizing effects on populations of animals (Calhoun, 1962), but its effect on humans remains unclear. It seems probable that whatever the effects of crowding on humans, they will be more complex than they are for animals (for a review of this topic see Stokols, 1972). What strategies the person uses in performing tasks, what she or he attends to and what aspects of the situation are remembered may be influenced by crowding. Physiological state, feelings and attraction or hostility to others may be affected also.

In order to compare crowded and uncrowded conditions, two variables were manipulated: amount of space per person and number of persons in the room. Subjects had either 6 sq. ft. per person or 24 sq. ft. per person; the number of people in the room was one, two, four, or twelve. Thus the one-person, crowded condition involves one person in a tiny room only 6 sq. ft. and the twelve-person, uncrowded condition involves twelve people in a 288 sq. ft. room. All other groups are in intermediate sized spaces proportional to the number of people in the group.

The purpose of the card task is to make you aware of the physical environment and, in the social conditions, to make you aware of the other subject(s). Your performance is an index of ability to concentrate and work in the situation. My main interest in this task is to discover whether spatial restriction or group size influences ability to concentrate and/or feelings of competitiveness.

The finger printing technique is designed to give me information about your physiological level of arousal by allowing me to count the open sweat glands in the tips of your fingers. Number of word associates is also an index of arousal since previous work has shown that people who are more aroused give more associates.

The aggressive content of the associations given will be analyzed also. Studies of crowding in animals and children have found increased aggressive behavior in more crowded situations. The mood scale will add further information about your emotional state.

This study is being undertaken as the basis for my dissertation. It is very important to me that each subject come into the experiment without knowing what the exact purpose of the study is. The subject who provides the most information is the subject who responds to the experiment in terms of his or her own experience in the study rather than in terms of pre-conceived ideas of what should be done. So PLEASE DO NOT TELL ANYONE ABOUT THE PURPOSE OF THIS STUDY UNTIL AFTER OCTOBER 15, 1972.

Please feel free to ask any further questions you have about the study. After October 6, you may write me at 560 Riverside Dr., 4-D, New York, N.Y. 10027.

Thank you very much for your cooperation.

Sincerely,

Susan Saegert

References:

Calhoun, J.B. Population density and social pathology. Scientific American, 1962, 206, 139-248.

Stokols, D. A social-psychological model of human crowding phenomena. Journal of the American Institute of Planners, 1972, 38, 72-83.

Appendix B

Analyses of Variance and Covariance Tables

Table I

Analyses of Variance and Covariance

for Total Number of Word Associates

Source	df	MS	F	df	MS	F
Spatial Density (A)	1	5724.60	0.623	1	3231.87	0.327
Social Density (B)	3	7247.19	7.890***	3	111184.61	11.259****
Sex (C)	1	17627.47	1.920	1	58670.44	5.941**
A X B	3	1805.8	0.197	3	2830.40	0.286
A X C	1	2805.80	0.306	1	3237.36	0.327
B X C	3	14150.89	1.541	3	16312.13	1.651
A X B X C	3	9116.38	0.993	3	8318.32	0.842
Regression				1	17247.17	1.746
Error	200	9179.92		199	9874.87	

** $p < .025$

*** $p < .01$

**** $p < .001$

Table II

Analyses of Variance and Covariance

for Number of Cards Acquired

Source	df	MS	F	df	MS	F
Spatial Density (A)	1	2219.02	1.880	1	1580.48	1.330
Social Density (B)	3	34870.43	29.484****	3	57608.93	48.737****
Sex (C)	1	333.61	0.282	1	1765.78	1.485
A X B	3	947.20	0.824	3	1289.51	1.085
A X C	1	267.38	0.226	1	221.30	0.186
B X C	3	264.17	0.223	3	372.78	0.313
A X B X C	3	14.68	0.012	3	15.15	0.012
Regression				1	33.23	0.027
Error	200	1182.69		199	1188.46	

**** $p < .001$

Table III

Analysis of Covariance with Two Corariates,

T1 PSI and Total Number of Cards Acquired,

for Total Number of Word Associates

Source	df	MS	F
Spatial Density (A)	1	2232.19	0.226
Social Density (B)	3	92003.98	9.333****
Sex (C)	1	53534.45	5.430**
A X B	3	3201.93	0.324
A X C	1	3648.52	0.370
B X C	3	16349.37	1.658
A X B X C	3	8314.27	0.843
Regression	2	15296.86	1.551
Error	198	9857.33	

** $p < .025$

**** $p < .001$

Table IV

Analyses of Variance and Covariance

for Average Commonality of Word Associates

Source	df	MS	F	df	MS	F
Spatial Density (A)	1	241963.87	0.260	1	1253406.75	1.122
Social Density (B)	3	465618.06	0.500	3	1171214.00	1.048
Sex (C)	1	98311.81	0.105	1	2190854.50	1.962
A X B	3	252978.03	0.272	3	383837.94	0.343
A X C	1	24326.73	0.026	1	8579.63	0.007
B X C	3	3135335.51	3.366**	3	2669189.50	2.390
A X B X C	3	2795241.51	3.001**	3	2059480.25	1.844
Regression				1	497895.50	0.445
Error	200	931527.25		199	1116599.25	

** $p < .025$

Table V

Analyses of Variance and Covariance

for Number of Unique Word Associates

Source	df	MS	F	df	MS	F
Spatial Density (A)	1	7.29	1.539	1	3.91	0.470
Social Density (B)	3	6.48	1.368	3	4.44	0.534
Sex (C)	1	13.83	2.920	1	0.08	0.009
A X B	3	8.35	1.763	3	18.46	2.220
A X C	1	0.05	0.011	1	0.17	0.021
B X C	3	12.26	2.588	3	14.47	1.740
A X B X C	3	21.71	4.584****	3	19.88	2.390
Regression				1	0.36	0.043
Error	200	4.74		199	8.31	

**** $p < .001$

Table VI

Analyses of Variance and Covariance

for the Concentration Scale

Source	df	MS	F	df	MS	F
Spatial Density (A)	1	1.36	0.242	1	8.56	0.455
Social Density (B)	3	22.39	3.998***	3	15.99	0.851
Sex (C)	1	1.31	0.234	1	0.76	0.040
A X B	3	5.70	1.234	3	10.85	0.577
A X C	1	0.51	0.092	3	0.23	0.012
B X C	3	2.43	0.433	1	30.16	1.605
A X B X C	3	6.23	1.112	3	10.90	0.580
Regression				1	30.70	1.634
Error	200	5.60		199	18.78	

*** $p < .01$

Table VII

Analyses of Variance and Covariance

for the Fatigue Scale

Source	df	MS	F	df	MS	F
Spatial Density (A)	1	47.39	5.309***	1	12.17	0.288
Social Density (B)	3	6.79	0.761	3	23.92	0.566
Sex (C)	1	1.00	0.113	1	67.30	1.593
A X B	3	12.73	1.427	3	23.72	0.561
A X C	1	1.40	0.156	1	1.32	0.031
B X C	3	3.70	0.415	3	20.44	0.484
A X B X C	3	1.71	0.192	3	1.65	0.039
Regression				1	143.61	3.401
Error	200	8.93		199	42.22	

*** $p < .01$

Table VIII

Analyses of Variance and of Covariance

for Subjects' Rated Desire for Space During the Card Task

Source	df	MS	F	df	MS	F
Spatial Density (A)	1	85.47	24.005****	1	137.41	38.582****
Social Density (B)	3	12.43	3.492***	3	8.50	2.414
Sex (C)	1	2.97	0.834	1	0.01	0.000
A X B	3	7.24	2.034	3	6.46	1.815
A X C	1	2.17	0.610	1	1.62	0.723
B X C	3	2.89	0.810	3	2.58	0.455
A X B X C	3	4.81	1.352	3	8.42	2.364
Regression				1	1.65	0.463
Error	200	3.56		199	3.56	

*** $p < .01$

**** $p < .001$

Table IX

Analyses of Variance and Covariance

for Subjects' Rated Desire for Space During Word Association Task

Source	df	MS	F	df	MS	F
Spatial Density (A)	1	116.08	29.535****	1	156.72	39.545****
Social Density (B)	3	0.24	0.060	3	0.68	0.172
Sex (C)	1	25.49	6.474**	1	20.16	5.087**
A X B	3	1.06	0.270	3	1.33	0.336
A X C	1	3.43	0.873	1	0.00	0.00
B X C	3	3.71	0.943	3	3.54	0.894
A X B X C	3	3.21	0.816	3	6.14	1.550
Regression				1	1.85	0.467
Error	200	3.93		199	3.96	

** $p < .025$

**** $p < .001$

Table X

Analyses of Variance and Covariance

for the Egotism Scale

Source	df	MS	F	df	MS	F
Spatial Density (A)	1	12.97	3.948*	1	0.66	0.049
Social Density (B)	3	4.03	1.227	3	1.72	0.129
Sex (C)	1	17.27	5.258**	1	62.78	4.719*
A X B	3	17.42	5.303***	3	20.29	1.525
A X C	1	3.85	1.173	1	0.19	0.014
B X C	3	2.46	0.750	3	4.51	0.339
A X B X C	3	3.64	1.109	3	7.95	0.597
Regression				1	15.93	1.197
Error	200	3.28		199	13.30	

* $p < .05$

** $p < .025$

*** $p < .01$

Table XI

Analyses of Variance and Covariance

for the Sadness Scale

Source	df	MS	F	df	MS	F
Spatial Density (A)	1	5.62	1.554	1	0.05	0.001
Social Density (B)	3	12.25	3.388**	3	30.85	1.256
Sex (C)	1	0.28	0.078	1	14.99	0.610
A X B	3	3.07	0.849	3	4.47	0.182
A X C	1	0.61	0.169	1	18.91	0.770
B X C	3	2.69	0.743	3	3.22	0.131
A X B X C	3	4.93	1.364	3	12.61	0.513
Regression				1	9.88	0.402
Error	200	3.62		199	24.55	

** $p < .025$

Table XII

Analyses of Variance and Covariance

for the Anxiety Scale

Source	df	MS	F	df	MS	F
Spatial Density (A)	1	1.75	0.466	1	5.62	0.306
Social Density (B)	3	7.74	2.064	3	15.63	0.853
Sex (C)	1	14.41	3.844*	1	1.21	0.066
A X B	3	4.82	1.285	3	8.85	0.483
A X C	1	17.71	4.724*	1	0.00	0.000
B X C	3	1.24	0.330	3	4.07	0.222
A X B X C	3	2.96	0.791	3	17.36	0.947
Regression				1	56.62	3.091
Error	200	3.75		199	18.32	

* $p < .05$

Table XIII

Analyses of Variance and Covariance

for the Surgency Scale

Source	df	MS	F	df	MS	F
Spatial Density (A)	1	9.61	1.835	1	0.53	0.028
Social Density (B)	3	4.55	0.869	3	10.67	0.567
Sex (C)	1	82.77	15.803***	1	205.35	10.921****
A X B	3	2.94	0.562	3	19.93	1.059
A X C	1	8.12	1.550	1	10.88	0.578
B X C	3	11.65	2.225	3	11.98	0.637
A X B X C	3	13.21	2.522	3	8.70	0.462
Regression				1	46.41	2.467
Error	200	5.24		199	18.80	

*** $p < .01$

**** $p < .001$

Table XIV

Analyses of Variance and Covariance

for Ratings of Freedom in the Word Associate Task

Source	df	MS	F	df	MS	F
Spatial Density (A)	1	1.01	0.553	1	0.32	0.178
Social Density (B)	3	2.19	1.201	3	1.88	1.034
Sex (C)	1	9.11	5.001*	1	5.31	2.914
A X B	3	0.11	0.062	3	0.19	0.106
A X C	1	0.07	0.037	1	0.01	0.003
B X C	3	0.84	0.460	3	1.36	0.745
A X B X C	3	0.30	0.165	3	0.27	0.149
Regression				1	0.10	0.056
Error	200	1.82		199	1.82	

* $p < .05$

Table XV

Analyses of Variance and Covariance

for Ratings of Interference During the Card Task

Source	df	MS	F	df	MS	F
Spatial Density (A)	1	27.96	14.780****	1	20.85	11.084****
Social Density (B)	2	4.93	2.607	2	6.17	3.282*
Sex (C)	1	0.97	0.510	1	0.07	0.039
A X B	2	3.78	1.998	2	3.24	1.721
A X C	1	1.62	0.856	1	0.00	0.00
B X C	2	2.33	1.233	2	2.69	1.43
A X B X C	2	1.16	0.611	2	1.76	0.93
Regression				1	0.73	0.39
Error	184	1.892		183	1.88	

* $p < .05$

**** $p < .001$

Table XVI

Analyses of Variance and Covariance

for Ratings of Distraction During the Card Task

Source	df	MS	F	df	MS	F
Spatial Density (A)	1	8.56	4.972**	1	3.88	2.232
Social Density (B)	2	1.85	1.073	2	1.74	0.999
Sex (C)	1	3.13	1.819	1	4.99	2.869
A X B	2	0.90	0.520	2	3.58	2.057
A X C	1	0.51	0.294	1	0.03	0.018
B X C	2	3.59	2.086	2	3.58	2.057
A X B X C	2	0.43	0.249	2	0.52	0.300
Regression				1	0.07	0.043
Error	184	1.72		183	1.74	

** $p < .025$

Table XVII

Analyses of Variance and Covariance

for Ratings of Own Competitiveness

Source	df	MS	F	df	MS	F
Spatial Density (A)	1	16.65	4.296*	1	0.28	0.074
Social Density (B)	2	8.50	2.193	2	9.47	2.462
Sex (C)	1	3.76	0.969	1	6.69	1.738
A X B	2	15.02	3.875*	2	16.69	4.338**
A X C	1	7.08	1.828	1	0.46	0.119
B X C	2	1.28	0.331	2	1.04	0.271
A X B X C	2	3.65	0.941	2	6.35	1.649
Regression				1	9.00	2.340
Error	184	3.87		183	3.85	

* $p < .05$

** $p < .025$

Table XVIII

Analyses of Variance and Covariance

for Ratings of Others' Competitiveness

Source	df	MS	F	df	MS	F
Spatial Density (A)	1	3.39	1.242	1	1.49	0.548
Social Density (B)	2	3.70	1.352	2	4.46	1.637
Sex (C)	1	3.54	1.293	1	2.66	0.977
A X B	2	12.27	4.488*	2	15.91	5.847***
A X C	1	0.07	0.027	1	0.59	0.215
B X C	2	1.74	0.635	2	1.56	0.573
A X B X C	2	2.73	1.000	2	3.15	1.156
Regression				1	0.01	0.000
Error	184	2.73		183	2.72	

* $p < .05$

*** $p < .01$

Table XIX

Analyses of Variance and Covariance

for Ratings of Preference for Working with Others

During the Card Task

Source	df	MS	F	df	MS	F
Spatial Density (A)	1	0.99	0.303	1	6.44	1.960
Social Density (B)	3	42.60	13.021****	3	26.70	8.131****
Sex (C)	1	1.34	0.411	1	0.98	0.299
A X B	3	6.75	2.063	3	7.35	2.238
A X C	1	0.09	0.026	1	0.00	0.000
B X C	3	0.18	0.055	3	0.28	0.086
A X B X C	3	6.08	1.858	3	5.25	1.599
Regression				1	9.35	2.848
Error	200	3.27		199	3.28	

**** $p < .001$

Table XX

Analyses of Variance and Covariance

for Ratings of Preference for Working with Others

During the Word Association Task

Source	df	MS	F	df	MS	F
Spatial Density (A)	1	4.02	1.762	1	4.64	2.022
Social Density (B)	3	27.71	12.140****	3	17.81	7.763****
Sex (C)	1	3.68	1.612	1	6.77	2.950
A X B	3	1.25	0.546	3	1.36	0.591
A X C	1	0.51	0.223	1	1.02	0.443
B X C	3	0.83	0.365	3	1.04	0.455
A X B X C	3	0.13	0.057	3	0.12	0.051
Regression				1	0.03	0.014
Error	200	2.28		199	2.29	

**** $p < .001$

Table XXI

Analyses of Variance and Covariance

for Ratings of Liking for the Experiment

Source	df	MS	F	df	MS	F
Spatial Density (A)	1	0.06	0.033	1	1.11	0.644
Social Density (B)	3	4.01	2.324	3	3.42	1.975
Sex (C)	1	1.71	0.993	1	2.24	1.295
A X B	3	2.43	1.410	3	2.28	1.377
A X C	1	1.25	0.723	1	0.88	0.508
B X C	3	3.58	2.073	3	3.71	2.141
A X B X C	3	0.54	0.314	3	0.60	0.347
Regression				1	0.69	0.398
Error	200	1.73		199	1.73	

Table XXII

Analyses of Variance and Covariance

for Percent Aggressive Word Associates

Source	df	MS	F	df	MS	F
Spatial Density (A)	1	1.07	0.138	1	2.19	0.052
Social Density (B)	3	7.14	0.922	3	32.44	0.775
Sex (C)	1	48.12	6.214**	1	179.26	4.284*
A X B	3	4.14	0.534	3	7.61	0.181
A X C	1	0.37	0.048	1	3.47	0.082
B X C	3	15.11	1.951	3	9.50	0.227
A X B X C	3	2.28	0.295	3	6.97	0.166
Regression				1	158.16	3.780
Error	200	7.74		199	41.84	

* $p < .05$

** $p < .025$

Table XXIII

Analyses of Variance and Covariance

for the Social Affection Scale

Source	df	MS	F	df	MS	F
Spatial Density (A)	1	21.03	3.490*	1	6.32	0.998
Social Density (B)	3	0.89	0.148	3	0.78	0.123
Sex (C)	1	48.07	7.980***	1	25.08	3.965*
A X B	3	5.61	0.931	3	8.40	1.328
A X C	1	17.50	2.906	1	8.21	1.298
B X C	3	12.73	2.113	3	9.22	1.457
A X B X C	3	5.30	0.880	3	7.80	1.232
Regression				1	0.01	0.001
Error	200	6.02		199	6.32	

* $p < .05$

*** $p < .01$

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