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<https://escholarship.org/uc/item/5qn903bc>

Journal

Journal of the American Planning Association, 38(2)

ISSN

0194-4363

Author

Stokols, D

Publication Date

1972

DOI

10.1080/01944367208977409

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A SOCIAL-PSYCHOLOGICAL MODEL OF HUMAN CROWDING PHENOMENA

Daniel Stokols

Previous research on crowding has generally lacked a theoretical perspective. Moreover, there has been a tendency to view crowding in terms of spatial considerations alone and a failure to distinguish between the physical condition (density) and the psychological experience (crowding). In the present discussion, a heuristic model of human crowding phenomena is proposed which permits an integration of various theoretical perspectives and the derivation of experimental hypotheses. Although the limitation of space remains as the essential ingredient of crowding, the proposed model introduces personal and social variables which have a direct bearing on a person's perception of spatial restriction as well as on his attempts to cope with this constraint. The relation between the dimensions of the model is examined in terms of social-psychological theory. Finally, a program for future research is discussed.

Within the past decade, growing concern for the quality of the physical and social environment has prompted scientists from various academic disciplines to concentrate their research efforts upon contemporary ecological problems. A fundamental assumption underlying ecologically oriented research has been that an understanding of the relationship between organisms and their environment, gained through scientific inquiry, will ultimately provide guidelines for social planning and urban design.

Among the ecological phenomena which have attracted the attention of behavioral scientists are

The author completed his undergraduate work at the University of Chicago and is presently a graduate student in the Department of Psychology, University of North Carolina at Chapel Hill. His research interests include crowding, alienation, attributional processes, and the psycho-physiological effects of stress.

those related to spatial limitation and crowding. Problems of spatial restriction represent formidable topics for scientific inquiry due to their high degree of complexity. Like most concomitants of overpopulation and urbanization, such as pollution and scarcity of resources, crowding phenomena are highly interrelated with other societal problems—for example, poverty and racial discrimination. Hence, at the urban level it is difficult to separate the behavioral effects of spatial limitation from those of other variables.

Another source of complexity which hinders a comprehensive understanding of crowding is the variety of levels at which it is manifested throughout society. We can speak of a crowded home, neighborhood, or city. The types of variables which interact with spatial restriction undoubtedly vary from one level to the next. Consequently, the effects of crowding on human behavior are probably different at each level.

Finally, the ambiguity of vocabulary used to describe crowding phenomena has also made it difficult to subject problems of spatial limitation to empirical study. For instance, many writers often use the terms "density" and "crowding" interchangeably rather than distinguishing between the physical condition, density, and the psychological experience, crowding. Such confusion not only impairs the precise specification of independent and dependent variables, but also obstructs the development of a broad theoretical perspective from which to approach crowding phenomena.

In order for crowding to be rendered amenable to scientific inquiry, some of the above-mentioned complexities and ambiguities must be recognized, and an attempt must be made to resolve them. In this article I develop an analysis of human crowding phenomena and propose a conceptual model of crowding situations and their effects on human behavior. First, however, a brief review of previous approaches to the study of crowding is presented. A consideration of the contributions, as well as the inadequacies, of these approaches provides the foundation on which the proposed framework is developed.

Previous Research on Crowding

There have been four basic lines of behavioral research which relate to the issue of crowding: animal studies, correlational surveys utilizing census tract data, experiments on the human use of space, and experimental studies directly concerned with the effects of crowding on human behavior.

The well-known animal studies of Calhoun

(1962, 1966) and his associates (Marsden, 1970) exemplify the first approach. By limiting the amount of space available to a community of Norwegian rats, Calhoun observed a phenomenon known as the "behavioral sink," that is, the simultaneous gathering of several animals at specific points in the community (for example, feeding areas) over long periods of time. Calhoun linked the crowded conditions of the behavioral sink to pathological behaviors exhibited by certain animals in the community: the neglect of maternal duties, hyper- and homosexuality, and the withdrawal of individual animals from social interaction.

An experiment by Christian, Flyger, and Davis (1960) provides further evidence regarding the detrimental effects of crowding upon animal populations. In this study, a herd of deer was confined to a small island and allowed to reproduce. As the number of deer increased, a pronounced decrease in reproductivity was observed.

The correlational studies of Schmitt (1957, 1966), Chombart de Lauwe (1959), Winsborough (1965), and Mitchell (1971), which have relied upon census tract data, are examples of the second type of crowding research. The typical approach of such surveys is to correlate various measures of population density (for example, number of persons per net acre or per dwelling unit) with several indices of social and medical pathology (for example, rates of crime, tuberculosis, and suicide). Usually, the effects of variables, such as income level and education, are controlled through the technique of partial correlation.

The findings of these surveys suggest that population density is generally associated with social disorganization. Winsborough, however, has demonstrated that the positive correlation between density and pathology disappears when certain measures of social status are utilized as control variables. And Schmitt (1963) has observed that in Hong Kong, density per acre is not invariably associated with behavioral anomalies; other factors such as cultural traditions and the nature of residential land use seem to mediate the relationship between population density and human behavior.

The ecological research of Barker (1965, 1968) on behavior settings, and the work of Hall (1959, 1966) and Sommer (1967, 1969) on proxemics (the use of space in everyday behavior) represent the third type of investigation of crowding. Although these studies do not focus directly upon the behavioral effects of crowding, their inquiry

into the perception and use of space is certainly germane to a consideration of problems arising from spatial restriction.

Barker, in his naturalistic studies on "undermanned" versus "overmanned" behavior settings, found that students of small schools generally achieved satisfaction by being competent, accepting challenges, and engaging in group activities, while students of large schools derived satisfaction more frequently out of vicarious, rather than direct, participation in group functions. The main implication of Hall's work on proxemics is that people differ in their habits, attitudes, and values concerning the use of space and interpersonal distance, and that differences along these dimensions are largely culture-bound. Finally, the message of Sommer's research regarding "personal space" is that the perception of spatial relations among objects is significantly influenced by the type of activity which generally occurs in a given area.

Experimental investigations directly concerned with the effects of spatial limitation on human behavior reflect the most recent approach to the study of crowding phenomena. Such studies have generally been of two types, those which define crowding in terms of group size and those which manipulate it in terms of room size. The research of Ittelson, Proshansky, and Rivlin (1970), Hutt and Vaizey (1966), and Griffit and Veitch (1971) represent the first type of investigation, while those of Freedman (1970) and Freedman, Klevansky, and Ehrlich (1971) represent the second. Results from the first set of studies indicate that members of larger groups are more aggressive and asocial than those of smaller ones, regardless of whether the setting is a psychiatric ward, a playground, or a psychological experiment. The second set of experiments, however, demonstrates that when group size is kept constant but room size is varied, the task performance of subjects in the small room is no less efficient than that of subjects in the large room. Freedman did observe, though, in the small room condition, that interpersonal relations within female groups were more intimate and friendly than the affective behaviors manifested in male groups.

From the four categories of research outlined above, a preliminary picture of crowding phenomena begins to emerge. The animal studies portray crowding as a stress situation which develops over time. The physical condition of spatial limitation, which places constraints upon certain social activities (for example, allocation of food and sexual

behavior), represents the necessary condition for crowding phenomena. As population density increases, spatial constraints become more acute until, finally, they eventuate in social disorganization and physiological pathology. Situations of crowding, then, are characterized both by the element of spatial restriction and by the manifestation of its deleterious effects on organisms over time.

The research on human populations, however, indicates that spatial restriction is not inevitably associated with social maladies. The survey studies, for instance, suggest that in Asian societies cultural traditions serve to offset the detrimental effects of high population density. Experiments concerning the human use of space provide further evidence that cultural norms mediate the perception and adjustment of interpersonal space. Such research also suggests that the type of activity performed in a given area largely determines whether the amount of available space is perceived as adequate or too limited. Finally, the laboratory investigations of human crowding demonstrate that when group size is held constant and the physical consequences of spatial restriction (for example, high temperature, stuffiness, limited movement) are controlled, high density exerts virtually no ill effects on human task performance. The research on human subjects, then, considered in light of the animal studies, indicates that spatial restriction serves as a necessary antecedent of, but not always a sufficient condition for, the arousal of crowding stress.

Although previous empirical approaches provide some insights into the nature of human crowding phenomena, interpretation of the findings from each line of inquiry is rendered difficult by methodological or conceptual inadequacies. For example, the applicability of data from animal research to the analysis of human crowding is limited by problems of ecological validity (Brunswick, 1956) which arise whenever one generalizes from communities of rats to societies of men. The findings of survey studies are plagued by the causal ambiguities of correlational research. The results from experiments on personal space, while interesting, do not relate specifically to the experience of human crowding. And the more direct experimental investigations of human crowding have not been guided by any coherent theoretical perspective.

The lack of a conceptual framework concerning crowding has led to a failure in laboratory studies to distinguish between the different types of variables which mediate the experience of crowd-

ing stress, such as spatial, temporal, social, and personal factors. Hence, most investigators have defined crowding in terms of spatial considerations alone. Moreover, there has been little consensus among experimenters regarding the specification of independent and dependent variables. Thus, in some studies the manipulation of density has been accomplished through variations in group size, while in others it has been effected through the use of small and large rooms.

Direct experimental investigation appears to be the most advanced and promising approach to the analysis of human crowding. In order to resolve some of the ambiguities which have previously hindered research, a conceptual framework for the experimental study of human crowding is introduced in the ensuing discussion.

A Conceptual Framework For The Analysis of Human Crowding

An Elementary Definition of Crowding Before the concept of human crowding can be framed as a psychological research topic, some attempt must be made to define, or describe, this concept. As a preliminary definition, we will assume that a state of crowding exists, and is perceived as such by an individual, when the individual's demand for space exceeds the available supply of such space. A similar conceptualization of crowding has been proposed by Kwan (1967) and by Proshansky, Ittelson, and Rivlin (1970).

While the above definition is rudimentary, it enables us to draw a crucial distinction between the concepts of *density* and *crowding*. Density denotes a physical condition involving the limitation of space. Crowding, on the other hand, refers to a situation in which the restrictive aspects of limited space are perceived by the individuals exposed to them. The recognition of spatial inadequacy arouses the experience of psychological and physiological stress. Thus, density is a univariate condition of limited space, without motivational overtones, whereas crowding is a multivariate phenomenon, resulting from the interaction of spatial, social, and personal factors, and characterized by the adverse manifestations of stress.

Some Additional Distinctions In order to delineate, more specifically, the scope of the proposed model, four additional distinctions regarding the conceptualization of crowding are required. First, it is important to differentiate between crowding as a *stressor situation* and the experience of crowding as a *syndrome of stress*. The first concept refers to sources of crowding stress, that is,

those variables whose interaction evokes the experience of being crowded. The second concept connotes the experience of crowding itself and its various levels of impact within the individual or group, that is, the manifestations of physiological and psychological stress, or social disorganization. Each of the above meanings is represented as a separate dimension of the proposed model.

Secondly, we can distinguish between *nonsocial* and *social* crowding. In the first case, a person's supply of useable space is restricted at what he perceives to be an inadequate level by purely physical factors. For example, an astronaut may feel crowded because of the cramped quarters of his space capsule, or a person sitting at a table may feel crowded if his desk is overly cluttered with books, papers, and a typewriter. Among the major types of variables affecting an individual's experience of nonsocial crowding are: spatial factors including the amount and arrangement of space, stressor variables such as noise or glare which heighten the salience of physical constraints, and personal characteristics including idiosyncratic skills and traits.

In situations of social crowding, the individual's awareness of spatial restriction is related directly to the presence of other persons, as well as to his relationship to them. The number of people in a given area largely determines the proportion of space available to each person. While situations of nonsocial crowding involve spatial restriction caused by physical variables alone, conditions of social crowding introduce social constraints on available space and imply competition with other persons for scarce resources (for example, space and material).

An individual may feel crowded in the midst of strangers, but quite comfortable and secure in the presence of an equal number of friends. The factors which determine one's experience of social crowding include the variables already mentioned in relation to nonsocial crowding, as well as social factors such as group structure and activity variables. The ensuing discussion focuses upon social crowding situations because they involve a greater number of component variables than do nonsocial situations and thereby afford a more complete application of the proposed model of crowding.

A third major distinction can be drawn between situations of *crowding* and those of *undercrowding*. The first situation involves an acute restriction of space, while the latter is characterized by an excessive abundance of space (that is, a situation in which an individual's supply of space greatly

exceeds his demand for space; *uncrowded* situations, on the other hand, are those in which there is a balance between an individual's supply of and demand for space). Each type of situation elicits characteristic forms of stress. While crowded persons may feel constrained and infringed upon, undercrowded individuals tend to experience a need for enclosure and affiliation with others. The present discussion is concerned mainly with crowding situations, although the proposed model of crowding can be extended to a consideration of undercrowded conditions.

The fourth and final distinction concerns the levels at which human response to crowding can be considered. Two basic levels of crowding phenomena are distinguishable: the sociological, or *macrocosmic*, level; and the psychological, or *microcosmic*, level. The first represents the level at which most urban designers and environmental behavioral scientists approach crowding. Its main concern is with the effects of large scale urban population density upon societal and cultural integration. The psychological, or microcosmic, level is primarily concerned with the impact of perceived spatial restriction on the individual's behavior. The experience of crowding is viewed as a syndrome of psychological stress, the intensity of which is determined by several independent factors. This article deals primarily with the microcosmic level.

An Equilibrium Model of Human Response to Crowding

Because the individual and the environment are the basic units involved in crowding phenomena, the variables which mediate an individual's perception of and response to crowding can be subsumed under two major categories: qualities of the physical and social environment, and personal attributes of the individual. Qualities of the physical environment include the amount and arrangement of available space, as well as stressors which affect the salience and immediacy of spatial variables (for example, noise, glare, and length of exposure time). Features of the social environment include variables which are introduced by the presence of other persons (for example, status allocation, the division of labor, and group size). Finally, personal attributes of the individual include momentary states of arousal (for example, hunger and sexual arousal), idiosyncratic skills and weaknesses related to effective operation in the environment (for example, intelligence, strength, and agility), and personality characteristics (for example, internal-external locus of control and comparison level).

The present model applies to situations involving spatial restriction in which personality and social factors interact with physical variables to induce psychological or physiological stress in the individual. The experience of such stress provokes behavioral, perceptual, or cognitive responses designed to alleviate physical discomfort or psychological strain. Hence, the model represents a multivariate schema of response to crowding in that it incorporates several distinct sets of input and output variables. Moreover, the relationship between input and output factors is one of equilibrium in the sense that extremes in one type of variable are compensated for through adjustments in other types of variables so as to maintain a state of equilibrium between the individual and the environment.

As illustrated in figure 1, the model consists of four basic dimensions: environmental variables, *E*; personal attributes, *P*; intensity and type of stress, *S*; and adaptive and maladaptive responses to stress, *R*. There are five major phases of crowding phenomena which are inherent in the model. Their numerical ordering denotes a chronological sequence of events: (1) the interaction between *E* and *P* variables which determines their respective salience and immediacy to the individual; (2) the perception of that subset of interactions between *E* and *P* variables which induces crowding stress in the individual (that is, psychological and physiological strain); (3) the provocation of tension-reducing responses in the person (these may include cognitive, perceptual, or behavioral adjustments); (4a) the enactment of specific responses aimed at modifying either environmental qualities or (4b) personal attributes (for example, moving to a less crowded area, or adjusting one's perception of the situation so as to render it more tolerable); and (5a) the adaptive or maladaptive consequences of environmental, as well as (5b) personal, adjustments.

In the present framework, a response is adaptive to the extent that it relieves either environmental or personal sources of strain and breaks the cycle of crowding stress (in figure 1, this is represented by the broken arrows). A response is maladaptive to the degree that it intensifies strain due to environmental and personal factors and thereby perpetuates the cycle of crowding stress (in this case, the arrows of [5a] and [5b] in figure 1 would be solid).

According to the present analysis, all crowding situations involve stress, and the occurrence of this stress cannot be predicted on the basis of spatial

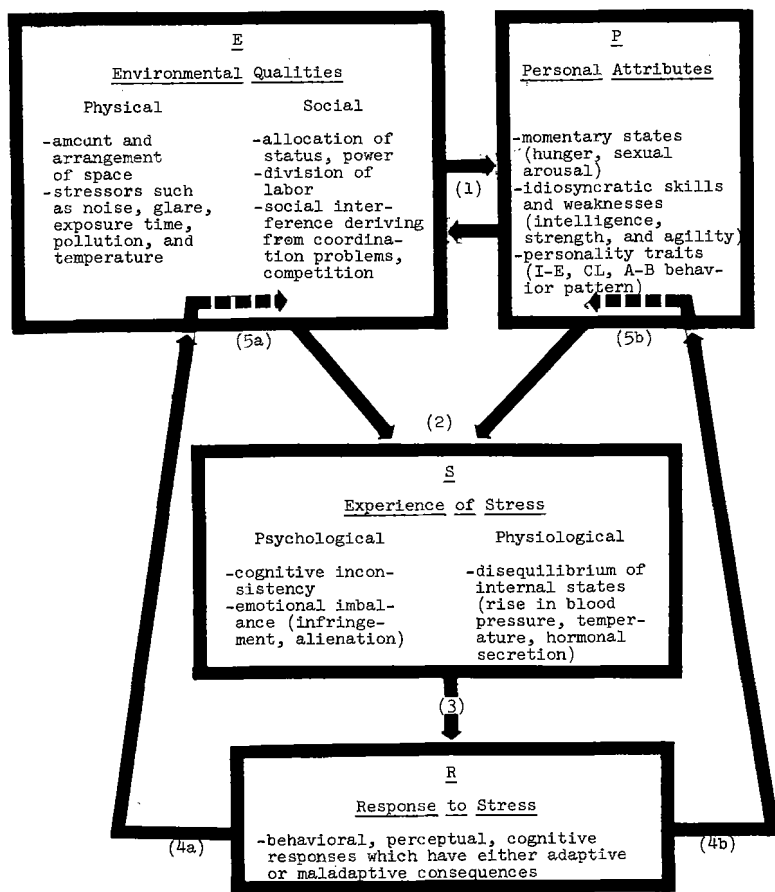


FIGURE 1 *An Equilibrium Model of Human Response to Crowding*

considerations alone. Rather, the experience of crowding must be understood as a phenomenon which develops over time, and whose developmental pattern and intensity are determined through a combination of environmental and personal factors. If several people occupy a small room in which there is a relatively small amount of space per person, yet these people feel completely comfortable and unrestricted, then a situation of crowding does not exist. On the other hand, if fewer persons in a larger room feel restricted and infringed upon by each other, then a state of crowding does exist.

Regardless of the specific environmental and personal factors involved, all situations of crowding seem to involve similar manifestations of stress. The basic forms of crowding stress have already been mentioned, namely, psychological and physiological strain. Psychological stress can be characterized as two types: cognitive inconsistency stemming from the realization that one's demand for space exceeds the available supply of such space, and emotional imbalance resulting from feelings of infringement, alienation, and lack of

privacy. Physiological stress involves a disequilibrium in one's internal response systems (for example, increased blood pressure, temperature, or adrenalin secretion) and can be triggered by purely spatial variables, as evidenced in the discomfort of feeling cramped. It may also arise through the interaction of spatial variables with social and personality factors. A person with high affiliative needs, for example, who finds himself in a small room with several unfriendly strangers, may experience physiological symptoms of anxiety stemming from feelings of alienation and detachment. Thus, physiological stress is often aroused by psychological strain.

In the present model, the experience of crowding stress provokes tension-reducing responses which occur in order to reduce physical or psychological discomfort. The particular form of one's response to crowding will be a function of the relative intensity of environmental and personal factors and of the degree to which they can be modified. When spatial variables can be readily altered, a person who feels crowded will most likely adopt a behavioral mode of response. For example, an individual can increase his amount of personal space by leaving the crowded situation. In cases where overt behavioral adjustments of spatial variables are limited, perceptual and cognitive modes of reducing crowding stress will be more likely to occur. In such situations, a person may modify his standards of spatial adequacy so as to alleviate the sensation of crowding.

Adaptive responses to crowding are those which reduce the stressful effects of perceived spatial restriction. The reduction of stress is accomplished through the effective adjustment of either physical, social, or personal factors. Maladaptive responses, on the other hand, are those which fail to alleviate the experience of crowding stress. For example, a person's decision to remain at a crowded party with several strangers would be adaptive if it eventually led to pleasant interaction and friendship with other persons. The decision to remain, however, would be maladaptive if the person was unable to strike up a conversation with someone at the party and left feeling alienated and depressed.

Derivation of Hypotheses From Social-Psychological Theory

The major features of the proposed model of human crowding have been delineated above; hypotheses regarding the interaction of its various components remain to be specified. In the ensuing discussion, the relationships between the four

dimensions of the model are considered in terms of social-psychological theory. A set of experimental hypotheses is derived by examining examples of situations in which environmental and personal factors engender the experience of crowding.

ENVIRONMENTAL AND PERSONAL SOURCES OF CROWDING STRESS

Some of the environmental and personal factors which yield conditions of crowding are categorized in figure 1. Because these variables are quite numerous, only a representative sample will be discussed. It should be emphasized that the variables included in each box of figure 1 are not intended to comprise an exhaustive inventory of the parameters of crowding. Rather, they reflect the variety of factors, within each of the four dimensions of the model, which may contribute to an individual's experience of crowding. Determination of the relative salience and importance of each factor, across various situations of crowding, is a task for future research.

Physical Variables The amount and arrangement of space are probably the most salient physical dimensions of a crowded situation. The amount of space available to a person represents a crucial determinant of his behavioral freedom. As space becomes scarce, the number of behavioral



alternatives available to an individual decreases. Although the amount of space sets limits on one's range of behavioral freedom, the intensity of spatial restriction can be altered, somewhat, through various arrangements of the available space. For example, a small room may be made to appear larger by surrounding it with mirrored walls or by judiciously arranging furniture. As Michelson (1970) points out, the arrangement of dwelling space in Japan may be one factor which mitigates the adverse effects of high population density there.

In light of the research on crowding, mentioned earlier, spatial limitation appears to be a variable whose latent unpleasant properties are activated only through its interaction with other aspects of the specific situation. The immediacy and salience of reduced space are intensified, for instance, through the operation of physical stress factors such as temperature and noise. Griffit and Veitch (1971) observed that interpersonal affective responses were significantly more negative under conditions of high temperature and high density than under those of comfortable temperature and low density. Also, it is plausible that noise, through its unwelcomed infringement on the individual's personal space, also serves to increase the salience of spatial restriction and thereby intensify the experience of crowding.

Social Factors The presence of other persons introduces several factors which may heighten the individual's sense of spatial restriction. The type of activity engaged in with others will directly affect the salience of limited space. The impact of activity variables on the experience of crowding is evident at a football game, where thousands of people are packed into a giant stadium. While the game is being played, everyone is completely engrossed in the action, and the limitation of space goes unnoticed or is forgotten. As soon as the game ends, however, the restrictions of spatial limitation are immediately felt. Each person becomes concerned with exiting the stadium as quickly as possible. It is at this point that the individual must coordinate his actions with those of other persons. The necessity of behavioral coordination as a means of limiting social interference and insuring the efficient use of space (for example, avoidance of traffic jams) represents one social factor which may intensify the experience of crowding.

The extent to which an individual perceives himself to be competing with others for scarce resources represents another social variable which heightens the salience of limited space. In the

previous example, access to the stadium exits represents a commonly desired resource. The individual's realization that the other fans are competing with him for a direct path to the exits is likely to exacerbate his sensation of spatial restriction. In other situations, competition may concern nonspatial commodities such as power and prestige. In such instances, competitive feelings arouse a tendency to view the presence of others as a threat to the individual's general welfare and an infringement on his privacy. In the context of spatial limitation, these perceptions are likely to promote the experience of crowding and a heightened concern for personal space.

For a group which is characterized by a high degree of organization and clearly defined goals, the susceptibility or immunity of its members to crowding stress can be considered in terms of the two basic aspects of group structure suggested by Homans (1950), the internal and external systems. The first facet of social structure encompasses those factors which promote cohesion and minimize conflict among group members (for example, a well-defined leadership hierarchy, status consensus, and widely held norms). The second system of social structure concerns variables which enable the group to adapt to the demands of its external environment (for example, the division of labor, which facilitates task efficiency).

The internal and external systems operate to maintain social equilibrium. To the extent that these systems are weak, group structure breaks down and its members experience stress. Since limited space can be characterized as an external contingency which threatens the group's equilibrium, the capacity of the internal and external systems to deal effectively with spatial constraints determines whether or not members of the group will experience crowding stress. For example, if the group members are unable to coordinate their activities efficiently, the restrictions of limited space are likely to become salient. Or, if the "correspondence of outcomes" (Thibaut and Kelley, 1959), that is, the commonality of interest, among group members is low, interpersonal relations within the group will tend to be quite competitive. As noted earlier, intragroup competition interferes with the ability of each member to cope with spatial constraints and thereby promotes the experience of crowding.

Personal Factors This set of variables includes momentary states of arousal, idiosyncratic skills, weaknesses, and personality traits which affect an individual's ability to cope with the limitation of

space. It is quite plausible that certain personal attributes serve to protect an individual from the ill effects of crowding, while others tend to predispose him to the dissatisfactions and health hazards of crowding situations.

The temporary states of hunger and sexual arousal, for example, may heighten a person's experience of crowding by making salient his competition with others for scarce resources, or by increasing his need for privacy. Under conditions of spatial limitation, then, prolonged hunger and sexual deprivation would intensify an individual's frustration, dissatisfaction, and sense of crowding.

Idiosyncratic skills and weaknesses will also have some bearing upon a person's ability to cope with spatial constraints. An intelligent person, for example, will be more able to find creative solutions to problems of crowding than will an unintelligent one. Similarly, a strong person will be able to exert control over limited resources more readily than will a weak person. And, under conditions of limited space, an agile individual will find it easier to coordinate his actions with those of other people than will a clumsy one. The personal traits of intelligence, strength, and agility, thus, would contribute to the minimization of crowding stress.

The dimension of "internal-external locus of control" (Rotter, 1966) represents a personality characteristic that may be quite relevant to the intensity of the individual's crowding experience. This dimension concerns the degree to which a person perceives the quality of his experiences as being under either personal or environmental control. In situations of crowding, it is plausible that "internal" individuals will be able to perform more efficiently than "external" individuals within the constraints of spatial restriction. This would be especially true if behavioral modes of alleviating crowding stress were available. But if conditions of crowding are prolonged and unrelievable, "internals" may experience more frustration with being confined and unable to exert their usual control over the situation. "Externals," however, perceiving themselves to be generally under environmental control anyway, might experience relatively less dissatisfaction with spatial restriction. In situations such as these, "externals" may be more readily adaptable to crowding stress than "internals."

The concept of "comparison level," as formulated by Thibaut and Kelley (1959), is also relevant to a consideration of personal factors which affect the individual's perception of crowding. Comparison level (CL) is a criterion of outcome accepta-

bility with which an individual evaluates the attractiveness of a situation in terms of what he expects or feels he deserves. Individuals who are generally used to having large amounts of space at their disposal (for example, individuals raised in a rural setting) would be likely to develop a higher CL regarding the amount of space considered to be adequate in any situation than would individuals who have had more experience with spatial limitations (for example, residents of a large city). Hence, the former would be more apt to experience frustration over spatial constraints than the latter. This conceptualization may explain Cassel's (1970) observation that newcomers to a situation of crowding tend to be more vulnerable to its adverse effects than persons who have had previous experience with crowded situations.

Another individual characteristic which may mediate the experience of crowding is the coronary-prone behavior pattern described by Jenkins (1971). This behavioral syndrome is characterized by extremes of competitiveness, impatience, and overinvolvement with work. Individuals who manifest this pattern are referred to as "Type A's," whereas individuals who tend to be patient, easy-going, and relaxed are labelled "Type B's."

In situations of crowding, Type A's should be highly susceptible to the dissatisfactions and bodily imbalances caused by spatial restriction, while Type B's should be relatively resistant to these strains. The characteristics of impatience, competitiveness, and restlessness, embodied in the coronary-prone behavior pattern, would be likely to arouse an accentuated sense of frustration and anxiety under conditions of prolonged and unalterable crowding.

THE EXPERIENCE OF, AND RESPONSE TO, CROWDING STRESS

Psychological Stress Two manifestations of psychological stress in situations of crowding have been distinguished above, cognitive inconsistency and emotional imbalance. In many instances, the former type of stress precipitates the latter.

Cognitive inconsistency, in the context of crowding phenomena, has been characterized as the recognized disparity between an individual's supply of and demand for space. A person's realization that he is unable to supplement his supply of space evokes an awareness that his range of behavioral freedom is restricted. According to Brehm (1966), such an awareness should provoke "psychological reactance," that is, a motivational state involving feelings of preemption and infringe-

ment, and resulting in behavior directed toward the reestablishment of threatened or eliminated freedom. A similar conclusion is reached by Proshansky, Ittelson, and Rivlin (1970), who consider crowding to be a situation involving the restriction of an individual's behavioral choice. They point out that a person's reactance against crowding will be especially intense if his restriction of freedom is due to the presence of other persons who infringe upon his privacy.

In situations of crowding, then, psychological reactance can be viewed as the motivational or emotional consequence of cognitive inconsistency stemming from the recognized discrepancy between one's supply of and demand for space. According to the present model, an individual will alleviate his reactance to crowding through an appropriate adjustment of either environmental variables, personal factors, or both. Furthermore, his adoption of a behavioral, perceptual, or cognitive mode of response will depend upon the relative intensity and flexibility of these factors.

Brehm's reactance theory, Festinger's (1957) dissonance theory, and the cognitive consistency theory of Rosenberg and Abelson (1960) provide a basis for considering some of the manifestations and determinants of the three modes of response to psychological stress under conditions of crowding. According to Brehm, the greater the magnitude of an individual's reactance, the more he will attempt to reestablish his lost or threatened freedom. The magnitude of reactance will depend upon the importance of that freedom to the individual, as well as upon the degree of freedom of behavior eliminated or threatened. Brehm discusses two basic means of reestablishing freedom. The first involves a direct reestablishment of freedom through the enactment of the forbidden or threatened behavior. When there are restraints against this type of response, the second mode of reestablishing freedom, which involves the symbolic attainment of freedom "by implication," will occur. In this case, the person will engage in behavior similar to that which has been prevented.

An example of direct reestablishment of freedom would be an individual's exit from an overly crowded room. If, however, the person was confined to the crowded area, then he might attempt to reestablish his freedom symbolically, by withdrawing from social interaction. This type of behavior would symbolize, or approximate, the unavailable behavioral option of leaving the room. Through this mode of response, the person would reestablish his autonomy by implication.

The methods of alleviating reactance, discussed by Brehm, represent behavioral modes of inconsistency-resolution. Yet, in certain situations of crowding, the costs of attempting to reestablish one's behavioral freedom, either directly or indirectly, far outweigh the potential advantages of such action. Conditions of crowding may arise from which it is physically impossible to withdraw and within which withdrawal from social interaction would be maladaptive. The members of a jury, for example, may find themselves operating under such conditions, especially if their chamber is cramped and their deliberation prolonged. In such situations, where reactance against spatial restriction cannot be alleviated behaviorally, a perceptual or cognitive mode of stress-resolution must be employed.

The members of the jury might alleviate their reactance by becoming thoroughly engrossed in deliberation so as to minimize the salience of their spatial restriction. By concentrating on the gravity of their decision rather than on the discomforts of their chamber, they are able to alleviate the strain of feeling crowded. This type of reactance-resolution represents a perceptual mode of response to crowding. By focusing upon the task dimensions of the situation, the spatial constraints which cannot be eliminated directly or indirectly become less noticeable and hence less stressful.

The adjustment of cognitive elements so as to render them less discrepant represents an alternative mode of reactance-resolution and is especially adaptive in situations where reestablishment of freedom is either impossible or too costly. The jurors, in our example, realizing that they must remain together until a final verdict is reached, make an implicit decision to give up the freedom of voluntarily leaving the jury chamber. Such a decision should elicit reactance against behavioral restriction to the extent that room space is inadequate and the deliberation prolonged. In terms of Festinger's (1957) dissonance theory, reactance against spatial and temporal stress factors can be characterized as a cognitive element, dissonant with the decision to remain in the situation. Cognitive dissonance, deriving from the discrepancy between the discomforts of crowding and the decision to endure them, can be alleviated, essentially, by increasing the desirability of the chosen alternative (remaining in the jury chamber) and decreasing the desirability of the rejected alternative (leaving the chamber). For example, the jurors may attempt to convince themselves that the case on which they are deliberating is extremely inter-

esting and unique. Participating in jury deliberation would therefore seem enjoyable. Or they may persuade themselves that withdrawal from the jury would represent a dishonorable abdication of civil duty.

According to the cognitive consistency theory of Rosenberg and Abelson (1960), the jurors' attitude toward remaining in the chamber should become more favorable to the extent that their action can be instrumentally linked to positively evaluated objects or values. For example, the decision to remain on the jury may be judged as a good, wise, useful, or moral action if it is associated with the "pursuit of justice" or the attainment of valuable experience. In terms of reactance-resolution, the more favorable the jurors feel about their decision to remain in the chamber, the more tolerable will be their spatial restriction and the less reactance they will feel toward it.

Physiological Stress It has so far been assumed that the individual will be able, ultimately, to alleviate his psychological reactance against crowding through the utilization of behavioral, perceptual, or cognitive modes of inconsistency resolution. Yet under certain conditions, the person will be unable to cope successfully with psychological stress resulting from involuntary or prolonged exposure to crowding. The maladaptive consequences of inappropriate (or inadequate) response to crowding will be manifested as feelings of frustration, alienation, and impatience, but they become particularly noticeable and potentially dangerous as manifestations of physiological disorders.

Physiological stress arising from reactance against the experience of crowding can be quite detrimental to an individual's health and general well-being. Researchers in the medical and public health professions have continually emphasized the general relationship between stress and physiological maladies (Cannon, 1932; Levine and Scotch, 1970; Selye, 1956). Rene Dubos (1968) reports that "physiological tests have revealed that crowding commonly results in an increased secretion of various hormones which affect the whole human physiology. An adequate hormonal activity is essential for well-being, but any excess has a variety of harmful effects" (p. 153).

Cassel (1970) has also discussed the relationship between hormonal disequilibrium and the incidence of disease. He contends that crowding increases the risk of disease by heightening social and emotional strain, rather than by increasing the opportunity for spread of infection. Cassel pro-

poses that the role of social factors is to increase the susceptibility of the organism to disease through "the activation of inappropriate neuro-endocrine arousal mechanisms" (p. 18).

In certain instances, physiological imbalance may have adaptive value for the individual, especially if it continues to provoke responses which finally eventuate in an alleviation of crowding stress. A detailed analysis of human adaptation to physiological stress is provided by Dubos (1965) and Selye (1956). For the purposes of the present discussion, though, it is sufficient to point out that prolonged exposure to the psychological and physiological stresses of crowding can have detrimental consequences for the individual's health.

A SET OF EXPERIMENTAL HYPOTHESES CONCERNING CROWDING

The preceding analysis of human crowding phenomena suggests several hypotheses which can be tested experimentally.

1. The limitation of space will engender an experience of crowding to the extent that it introduces noxious physical effects (for example, rise in temperature, stuffiness) or places constraints on personal or social activities (e.g., the restriction of free movement).

2. Under conditions of spatial limitation:

(a) a noisy situation will be perceived as more crowded than a quiet one;

(b) a cluttered area will appear more crowded than one in which physical objects are neatly arranged;

(c) situations involving social interference (for example, competition) will be perceived as more crowded than those in which such interference is absent;

(d) individuals who perceive their reinforcements, in general, to be internally controlled will feel more crowded as time of exposure to the situation increases, and

(e) persons who are, by nature, aggressive or impatient will experience a stronger sensation of being crowded than individuals who are characteristically easygoing and relaxed.

In order to test the above hypotheses, independent variables representing physical, social, and personal sources of crowding stress can be factorially combined to assess their additive and interactive impact upon the individual. This approach permits an orthogonal manipulation of factors such as the amount and arrangement of space, noise level, or social interference. The quantity of available space per person, for example, can be

varied through the use of large and small rooms, as suggested by Freedman (1970). Personality measures may also be included in the design as group composition variables or covariates.

The experimental analysis of human crowding also requires careful specification of dependent measures designed to assess the experience of crowding. Four types of assessments may be employed: subjective reports of discomfort (for example, in terms of feeling "cramped") or of dislike for other people in the group; observational indices of stress in terms of reduced eye contact with others, hostile remarks, or facial expressions; performance criteria relating to task efficiency; and physiological indicators of strain such as increased blood pressure or galvanic skin response.

Although the proposed model is primarily concerned with the psychological aspects of crowding phenomena, the experimental approach outlined here is potentially relevant to macrocosmic levels of crowding. Since urban crowding can be conceptualized as an aggregation of microcosmic crowding phenomena, the understanding of crowding at the psychological level could have broad implications for dealing with sociological manifestations of crowding.

Author's Note: The preparation of this paper was supported by United States Public Health Service Grant 5-T01 MH 07325. The author wishes to express his appreciation to John Schopler, Marilyn Rall, Bepi Pinner and C. David Jenkins for their comments and suggestions concerning the issues discussed in this paper. Thanks are also due to Nehemia Friedland and Jeannette Stokols for their critical readings of the manuscript; and to Sidney Cohn and Vaida D. Thompson for their comments on an earlier version of the paper.

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