

## When Density Matters: Environmental Control as a Determinant of Crowding Effects in Laboratory and Residential Settings

Sheldon Cohen and Drury R. Sherrod  
*University of Oregon and Pitzer Collegè*

The relationship between density and environmental controllability is clarified with effects previously attributed to density reinterpreted as due to the loss of environmental control. A selected review of the experimental literature is used to demonstrate the central role of environmental control in a wide range of crowding situations. Moreover, an analysis of correlational data relating residential density to health and social organization suggests that density has deleterious effects *only* on those (susceptible populations) who lack control over their environments.

When does density matter? A recent review of the crowding literature (Sundstrom, 1978) cites over 100 studies published between 1970-1975. On the surface, it seems that together with 50 years of ecological studies of population density (see Altman, 1975 for review) this abundance of experimental evidence would provide us with a definitive answer. Science, however, is cautious and, more importantly, the data are not that consistent. Density, after all, can occur in numerous settings (cf. Karlin, Epstein, & Aiello, 1978), can last anywhere from a few seconds to a lifetime, and can (at least theoretically) affect a wide range of behaviors. Thus it is probably an oversimplification to suppose

---

Preparation of this paper was supported by grants from the National Science Foundation (SOC 75-09224 and BNS 77-08576). Requests for reprints should be sent to Sheldon Cohen, Department of Psychology, University of Oregon, Eugene, Oregon 97403.

*Journal of Population*. Vol. 1(3) Fall 1978

0146-1052/78/1500-0189 \$00.95 © 1978 Human Sciences Press

that any single theory of human crowding can account for what occurs in this myriad of situations.

In complete disregard of the truisms stated above, this paper will present the argument that a perceived lack of control over one's environment is a sufficient (and possibly necessary) cause for a density effect. A selected review of the experimental literature will be used to demonstrate the central role of environmental control in a wide range of crowding situations. Moreover, an analysis of correlational data relating residential density to health and social organization will similarly suggest that density will have deleterious effects only on those who lack control over their environments.

### THE IMPORTANCE OF PERSONAL CONTROL

The concept of control has emerged as perhaps the most significant element in understanding the effects of stressful environments on human behavior. When stressful environments such as noise and density are seen as potentially controllable, they exact a smaller toll on human task performance and social behavior than non-controllable environments, even though actual control may never be exercised (cf. Glass & Singer, 1972; Sherrod & Cohen, 1978).

Why should perceived controllability influence human responses to stressful environments so strongly? Theoretical answers to this question have been formulated at several levels of psychological analysis. At the most general level, several theories assert that perceived control affects an individual's self perceptions, expectancies, and motivation. According to this perspective, when people perceive themselves as effective manipulators of the environment, they develop a sense of personal causation (de Charms, 1968), intrinsic motivation (cf. Deci, 1975) or self efficacy (Bandura, 1977) that increases an individual's felt competence in the face of environmental stress.

A narrower focus on specific behavior-outcome expectancies is taken by learned helplessness theory (cf. Seligman, 1975). From this approach, people and animals who experience inescapable environmental stress develop the expectancy that their own instrumental responses are ineffective in producing desirable outcomes. In effect they become "helpless" when confronted with subsequent environmental stressors. These feelings of helplessness are associated with deficits in task performance (Seligman, 1975) as well as the deterioration of

health and feelings of well-being (Langer & Rodin, 1976; Schulz, 1976). In contrast, when organisms have previously been able to escape or control stressful environments, they expect their responses to matter. In subsequent stressful situations, they continue to emit a high rate of voluntary responses and easily learn new and adaptive behaviors.

Finally, Cohen (1978) has explained the negative consequences of environmental stress and the facilitative effects of perceived control with a theory of cognitive overload. This information processing view asserts that perceived control over environmental inputs allows a relaxation in an individual's monitoring of the environment for unpredictable and threatening inputs. The relaxation of vigilance results in a conservation of attentional capacity, which, in turn, allows a greater responsiveness to other attentional demands such as task performance or social behavior.

Although each of these theories explains the effects of control at a different level of analysis, they all emphasize the beneficial effects of perceived control, whether the environmental stressor is loud noise, electric shock, bureaucratic delays, or human density.

The concept of control is particularly important in understanding the effects of density on human behavior, because high density environments are often uncontrollable environments. The present authors have argued elsewhere that density affects the perceived controllability of environments in two principal ways (Sherrod & Cohen, 1978). First, the close presence of other people can restrict and interfere with the attainment of an individual's goals. Second, when high density involves the close presence of strangers, the environment is not only restricting but also unpredictable—a possible source of irritation or surprise—and thus potentially uncontrollable. When density does not affect the perceived controllability or predictability of environments, there should be no negative effects of density on behavior.

A similar argument has been advanced by Baron and Rodin (1978), who in addition emphasize the role of perceptual and attribution processes in determining the effects of density on environmental controllability. Specifically, density may not be experienced as uncontrollable unless the other people present are perceptually salient and blame for restriction on one's freedom is attributed to their presence rather than to other factors within the situation. Like the present authors, Baron and Rodin conclude that density is not necessarily stressful unless

features of social or physical environment imply or foster a loss of perceived control.

### EXPERIMENTAL RESEARCH RELATED TO DENSITY AND CONTROL

The burgeoning experimental research on human crowding in the last few years has obtained very inconsistent results. While the inconsistencies are partly due to differences in manipulations, duration, and measures of laboratory crowding, we believe that the confusion in density findings can be explained by focusing on the concept of control. Specifically, it may not be high density per se that produces negative effects on human behavior, but only uncontrollable high density that is responsible.

The links between density and control have been empirically demonstrated in several recent experiments. One study has established that controllable density is perceived as less crowded than non-controllable density. In this study, Rodin and her colleagues (Rodin, Solomon, & Metcalf, 1977) found that, under high density conditions, group members who exercised control over (i.e., managed) the group's tasks felt less crowded and less constrained than group members who lacked control. The same authors obtained similar results in a field study in which a naive subject's position in an elevator was manipulated by a group of confederates. Riders with direct access to the elevator's controls felt less crowded and judged the elevator to be larger than riders standing on the other side of the car without direct access to the controls. Thus, in both laboratory and field setting, controllability diminished perceived crowding.

Controllability has not only affected perceptions of density but also behavior in response to density. In another study, Rodin (1976) demonstrated that children from high density residential environments performed in a laboratory setting as if they had experienced prior "learned helplessness" training. Specifically, children from apartments with high person-per-room density were less likely to exercise their own choices in a laboratory/free-response situation than were children from low density apartments. In addition, the high density children made more errors in a laboratory puzzle solving task and were more adversely affected by initial exposure to an unsolvable puzzle than children from low density apartments. If we assume that children in high density homes experience more restriction on their freedom of choice, then these children may develop little sense

of personal control over their environment. In contrast, children from low density homes may experience fewer restrictions of freedom and therefore acquire a greater sense of personal control over the environment.

Research has also established that perceived control can directly alleviate the negative behavioral effects of short-term crowding. For example, in a study reported by Sherrrod (1974), high-density subjects who were told that they could leave the crowded room whenever they chose performed better on post-crowding measures of frustration tolerance than subjects who had no such control. Similar positive effects of control were demonstrated in a field study of crowding in New York City supermarkets. Langer and Saeger (1977) increased shoppers' sense of predictability and control by providing them with information about typical reactions to crowding. Informed shoppers performed shopping tasks more efficiently, made fewer errors, and enjoyed the experiment more than did uninformed shoppers in both crowded and non-crowded conditions.

Other density research can be interpreted in light of Cohen's theory of cognitive overload. If uncontrollable density depletes attentional capacity by requiring high rates of vigilance, as discussed earlier, then uncontrollable density should affect performance on complex, attention-demanding tasks but not on simple tasks requiring less attention. This pattern of results has been found in several experiments in which short-term uncontrollable density had no effects on simple task performance (Evans, 1978; Freedman, Klevansky, & Ehlich, 1971; Rodin, 1976; Sherrrod, 1974; Worchel & Teddlie, 1976), although high density did produce adverse effects on complex task performance (Aiello, DeRisi, Epstein, & Karlin, 1977; Evans, 1978; Paulus, Annis, Seta, Schkade, & Matthews, 1976).

Clearly, uncontrollable high density has produced a variety of negative effects on human behavior in laboratory and field settings. These effects have been ameliorated, however, when subjects had a perception of control over density. Thus, it is likely that laboratory density effects are attributable to uncontrollability rather than to density per se.

### RESIDENTIAL DENSITY

We argued earlier that environmental control plays a central role in determining instances in which residential density will affect behavior and health. Consistent with that perspective, the

following analysis of large-scale studies of population density suggests that residential density effects occur under conditions in which a "susceptible" population is exposed to high levels of uncontrollable density. Susceptible populations are ones that are characterized by a general lack of control over their environmental outcomes. Residential density has adverse effects on these populations when it functions to further deprive individuals of environmental control. Thus, it is assumed that only certain specifiable types of density will deprive individuals of control over their environments and that this uncontrollable density is most likely to affect identifiable population groups who are susceptible to helplessness and thus to density effects.

A number of laboratory studies have suggested that Externals—those who generally feel controlled by their environments—are more susceptible to learned helplessness than are Internals—those who feel control over themselves and their environment (Cohen, Rothbart, & Phillips, 1976; Hiroto, 1974). Laboratory studies of density similarly suggest that Externals are more strongly affected by density than Internals (Karlin, Epstein, & Aiello, 1978; Schopler & Walton, 1974). In line with these results, we propose that particular population groups can be characterized on the basis of their generalized expectancies concerning control as susceptible to density effects. Such groups include those who characteristically lack control over their environments for various historical, cultural, or socio-structural reasons<sup>1</sup>—the very young, the old, the poor and uneducated, and those living in institutions.<sup>2</sup> For example, children are typically unable to control their outcomes, for their lives are largely determined by parents and other supervising adults. Similarly, institutions (e.g., prisons and nursing homes) often deprive adults of control over both their social and physical environments by dictating where and with whom they interact. Finally, those with low incomes and low levels of education often lack the organization and power necessary to affect their environment. The addition of uncontrollable density to the stressors typically associated with the above-mentioned groups can only operate to reinforce their feelings of power-

lessness and helplessness. As suggested earlier, such feelings are likely to increase one's susceptibility to both physical and mental distress.

A similar approach focuses on various populations' abilities to control their density exposure. Many populations who live under high levels of residential density have the ability to periodically escape. For example, they spend a good part of their day at work and occasionally take vacations, days in the country, etc. Populations with a general lack of environmental control often lack such opportunities. Due to insufficient income and/or mobility, they are unable to escape their high density environments. This is clearly true of the populations specified earlier: the very young, the very old, the institutionalized and the poor. This inability can cause both an increase in feelings of helplessness as well as an increase in the overall duration of high density exposure. As a consequence, these groups are more likely to show signs of distress than groups with more control over their environments.

#### *Uncontrollability and Residential Density*

Since the hypothesis of this paper is that environmental control is the central mediator of density effects, the following analysis of large-scale studies of residential density will include studies that focus on architectural-social conditions which can *deprive or threaten one's environmental control*. This includes studies of *internal* but not *external* density (cf. Cohen, Glass, & Phillips, 1978; Zlotnick & Altman, 1972). Internal density is a measure of dwelling space per person, e.g., rooms per person or square feet per person. It occurs in primary environments (Stokols, 1976), those in which a person spends more of his time and relates to others on a personal basis. Thus experiences of internal density are prolonged and often inescapable. Moreover, social interactions which one wishes to control under conditions of internal density are ones which are personal and consequential.

External density is the number of people occupying a large residential area, e.g., people per acre, kilometer, or mile. External density, most often (but not always) occurs in secondary environments, those in which one's interactions with others are transitory, anonymous, and inconsequential. Thus, external density does not necessarily imply prolonged exposure nor does it necessarily imply a threat to one's control over important social interactions. For these reasons studies of external density will

<sup>1</sup>There is no attempt here to distinguish between the characteristics of individuals which lead to ineffective control and those aspects of the environment which lead to ineffective control. In either case, the outcome is the same—an increased susceptibility to uncontrollable density.

<sup>2</sup>There is reason to believe that these categorizations are too broad and that subgroups of certain of these populations (e.g., self-supporting, healthy, noninstitutionalized elderly) may be highly resistant to control-related effects (Krantz & Stone, 1978).

not be reviewed in this paper. (For a review of studies of external density, see Cohen, Glass, & Phillips, 1978.) Finally, several of the studies discussed in this section focus on architectural conditions that force people to be in constant contact with others, even though the actual space per person does not vary (e.g., the work of Baum & Valins, 1977, in college dormitories). According to our analysis, these situations should threaten one's control over his/her level of social interaction and thus lead to control-related effects characteristic of density.

The studies to be reviewed in the following pages are correlational and thus the data are not in a form that allows casual inference. Relationships between density and pathology can be attributed to: (1) density acting as a causal agent, e.g., increasing susceptibility of disease, (2) people who exhibit pathologies being attracted to or forced into high density areas, or (3) a third factor such as income, education, or sanitation, that is correlated with both density and the specific pathologies in question. The present discussion will be confined to those studies that attempt to control for the effects of third factors through the use of partial correlations, multiple regression, or a stratification technique.

### HOUSEHOLD DENSITY

Most recent reviews of the population density research conclude that there is no convincing evidence that human population density causes or is related to pathology, mental disorder, or social disorganization (Fischer, Baldassare, & Ofshe, 1975; Freedman, 1975; Lawrence, 1974). This argument is supported by a number of studies that have used statistical controls for potentially confounding factors. For example, in a study by Schmitt (1966) of 29 Honolulu census tracts, after statistical controls for income and education were employed, persons per room was moderately related to only one, rate of juvenile delinquency, of nine measures of health and adjustment. Nonrelated measures included rates of death, infant death, suicide, TB, VD, mental hospital admissions, illegitimate births, and imprisonment. Similarly, in a study conducted in the Netherlands, Levy and Herzog (1974) found that the number of persons per room has rather uniformly low and negative associations with nine indices of mental and physical health. That is, density works to reduce rather than to augment various pathologies.

Studies conducted on the United States mainland and Canada reveal a similar lack of association between internal density and pathology in the general population. In a Canadian study, Gillis (1974) examined 30 Edmonton census tracts. After controlling for income and ethnic background, he found that the proportion of dwellings with more than one person per room is marginally related to public assistance rate and is unrelated to juvenile delinquency. Similarly, Freedman, Heshka, and Levy (1975) analyzed data culled from 338 New York City health districts. After controlling for ethnicity and social class, they found no relationship between person per room and a variety of ills, including rates of mental illness, delinquency, infant death, number of children born out of wedlock, and venereal disease.

While the above studies suggest that internal density does not affect the general population, a number of studies support the argument that internal density does affect susceptible population groups—the young, the old, and those under other forms of stress. In a survey conducted by Booth (1975; Booth & Edwards, 1976; Booth & Johnson, 1975; Booth, Welch, & Johnson, 1976; Welch & Booth, 1975) for the Canadian Government, members of 560 households were interviewed and given physical examinations. Booth concludes that internal (and external) densities "seldom have any consequences and even when they do they are modest" (Booth, 1975). However, he does point out that: (1) household crowding has small adverse effects on child health and physical and intellectual development, and (2) crowded conditions occasionally have greater adverse effects when people are already under stress due to low income or other problems. This study deserves some emphasis since it deals with individual rather than aggregate data and thus avoids the problems involved in interpreting correlations of proportional data (cf. Fischer et al., 1975).

Further evidence for internal density affecting children but not adults appears in a paper by Winsborough (1965). In a study of 75 Chicago area communities he reports that, after socioeconomic status, quality of housing and migration were controlled for, increased numbers of persons per room was unrelated to rates of public assistance to persons under 18, and related to decreases in rates of death, tuberculosis, and public assistance. Only infant death rate increased with density.

Mitchell (1971) reports similar susceptibility among the lower class. After interviewing a large sample of residents in Hong Kong, Mitchell concludes that the number of rooms in a dwelling unit is unrelated to emotional stability. However,

square feet per person is related to superficial signs of psychological stress in low (but not high) income families.

Some evidence suggesting minimal effects of internal density on the entire population has also been reported. In a later study of the same 75 Chicago communities investigated earlier by Winsborough (1965), Galle, Gove, and McPherson (1972) report small pathogenic effects of internal density. After controlling for income and ethnicity, they report that the number of persons per room is positively related to mortality rate, public assistance to persons under 18, and fertility rate. This last finding is the inverse of the relationship between density and fertility reported in many animal studies. In addition, they find that the higher the average number of rooms per housing unit, the fewer the mental hospital admissions. A reanalysis of the same data (Ward, 1975) and a second analysis including additional data on the same population (McPherson, 1975) suggest that the relationships are weaker than those originally observed. Moreover, these studies have come under criticism for their statistical and methodological techniques (Freedman, 1975).

It appears that while an occasional investigator reports weak to moderate relationships between internal density and various pathologies, the overall impact of the available evidence is that household density is not an important factor in the physical and mental health of the general population. Moreover, even TB, an infectious disease that is often presumed to be more prevalent under high residential density, is consistently unrelated or negatively related in existing studies. The data do suggest, however, that household density may operate to aggravate existing stress conditions, e.g., in low income populations, and as a moderate stressor for the very young. Thus for certain susceptible populations, and when in combination with other stressors, density may have deleterious effects on mental and physical health.

The above review suggests that certain groups are more affected than others by high levels of household density. However, it provides no direct evidence that this susceptibility is mediated by environmental control. Direct evidence for the hypothesis that household density is related to a susceptible population's perceptions of helplessness and associated cognitive, emotional, and motivational responses is provided, however, in a paper by Rodin (1976) discussed earlier. Rodin reports that children living in high levels of internal density are less likely to exercise their own choices than children from low density apartments. In addition, children from high density apartments

are more adversely affected by a learned helplessness pre-treatment—insoluble puzzles—than their low density counterparts. Thus, at least for children, density can result in feelings of helplessness.

### DENSITY IN INSTITUTIONS

Internal density may not be a major contributor to ill health in family households, but several recent studies in prisons, naval ships, and college dormitories suggest an opposite conclusion for institutional populations. For example, D'Atri (1975) reports that prisoners housed in dormitories have higher systolic and diastolic blood pressure than those housed in single occupancy cells. Similarly, Aiello, Epstein, and Karlin (1975) find that when three females live in college dormitory rooms designed for two, they report more health problems than those living with only one roommate. There was no effect of "tripling" on the health of male students. A study by Baron, Mandel, Adams, and Griffen (1976) also reports no increase in number of visits to the health center for males tripled in double rooms. Increased visits to the dispensary are, however, reported for males crowded aboard naval ships (Dean, Pugh, & Gunderson, 1975).

Other dormitory research indicates that density can result in interpersonal problems; for example, a desire to withdraw and avoid others (Baum, Harpin, & Valins, 1975; Valins & Baum, 1973), and a dissatisfaction with roommates (Aiello, Epstein, & Karlin, 1975; Baron et al., 1976). These studies suggest that residential crowding with strangers may be experienced differently than crowding within a family household. Thus the nature of the social relationships between residents, especially as it affects the predictability of others' behavior, and thus control over one's own interactions, may be important in determining the impact of internal density (cf. Cohen, 1978).

Direct evidence that those crowded in institutional, non-family settings are susceptible to density-produced helplessness effects and related negative outcomes is provided by Baum and Valin's (1977) work on crowding in college dormitories. It is important to note that this work did not actually compare those under high or low density. Rather it compared dormitory residents who, because of dormitory design, were exposed to prolonged and repeated personal encounters with large numbers of other residents versus those whose forced encounters

included a comparatively small number of others. Baum and Valins report a number of behavioral and self-report measures suggesting a passive surrender or learned helplessness on the part of the crowded (high level of personal encounter) residents. Crowded residents used a withdrawal strategy more often in a prisoner's dilemma game, and were less likely to assert themselves by asking questions in an ambiguous situation. Crowded residents also reported feeling more helpless and feeling that their attempts to change things and make them better were, relative to their less crowded counterparts, worthless. The Baum & Valins data, however, does not indicate a total lack of coping by crowded residents. As cited earlier, crowded residents actively attempted to avoid contact with others. They conclude that crowded residents display helplessness in situations in which interaction with another person is not likely but that they actively avoid contact when interaction is expected.

In sum, it is clear that internal density is not a major pathological agent for the general population, but does seem to affect certain susceptible population groups. We have characterized these susceptible populations as ones in which people are generally deprived of control over their environment. This suggests that these groups would be particularly susceptible to control-related effects of density (cf. Cohen, Rothbart, & Phillips, 1976) and receives some support from studies of children and college dormitory residents that find decreased perceptions of control and increased signs of learned helplessness among those living in high density vs. low density environments.

### CONCLUSION

We have argued that the influence of high levels of density on human health and behavior may be determined more by the individual's beliefs about his/her relationship to the environment than by the environment itself. An important implication of this analysis is that the behavior and health of those experiencing high density conditions can be altered (improved) not only by changing their environment, but also by changing their attitudes toward their environment. Thus both interventions that actually provide people with the opportunity to terminate, periodically escape, or modify unwanted stimulation and those that otherwise provide them with the belief that such changes are within their power should similarly ameliorate the negative impact of high density.

### REFERENCES

- Aiello, J.R., Derksis, D.T., Epstein, Y.M., & Karlin, R.A. Crowding and the role of interpersonal distance preference. *Sociometry*, 1977, 40, 271-282.
- Aiello, J.R., Epstein, Y.M., & Karlin, R.A. Field experimental research on human crowding. Paper presented at the annual meeting of the Western Psychological Association, Sacramento, California, 1975.
- Altman, I. *The environment and social behavior*. Monterey, CA: Brooks-Cole, 1975.
- Bandura, A. Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review*, 1977, 84, 191-215.
- Baron, R.M., Mandel, D.R., Adams, C.A., & Griffen, L.M. Effects of social density in university residential environments. *Journal of Personality and Social Psychology*, 1976, 34, 434-446.
- Baron, R.M., & Rodin, J. Perceived control and crowding stress: Processes mediating the impact of spatial and social density. *Psychological Review*, 1978, in press.
- Baum, A., Harpin, R.E., & Valins, S. The role of group phenomena in the experience of crowding. *Environment and Behavior*, 1975, 7, 185-197.
- Baum, A., & Valins, S. *Architecture and social behavior*. Hillsdale, N.J.: Lawrence Erlbaum Associates, 1977.
- Booth, A. *Final report: Urban crowding project*. Ministry of State for Urban Affairs, Government of Canada, August, 1975.
- Booth, A., & Edwards, J.N. Crowding and family relations. *American Sociological Review*, 1976, 41, 308-321.
- Booth, A., & Johnson, D.R. The effect of crowding on child health and development. *American Behavioral Scientist*, 1975, 18, 736-747.
- Booth, A., Welch, S., & Johnson, D.R. Crowding and urban crime rates. *Urban Affairs Quarterly*, 1976, 11, 291-321.
- Cohen, S. Environmental load and the allocation of attention. In A. Baum, J.E. Singer, & S. Valins (Eds.), *Advances in environmental psychology*. Hillsdale, N.J.: Lawrence Erlbaum Associates, 1978.
- Cohen, S., Glass, D.C., & Phillips, S. Environmental factors in health. In H.E. Freeman, S. Levine, & L.G. Reeder (Eds.) *Handbook of medical sociology*. Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1978.
- Cohen, S., Rothbart, M., & Phillips, S. Locus of control and the generality of learned helplessness in humans. *Journal of Personality and Social Psychology*, 1976, 34, 1049-1056.
- D'Arin, D.A. Psychophysiological responses to crowding. *Environment and Behavior*, 1975, 7, 237-252.
- Dean, L.M., Pugh, W.M., & Gunderson, E. Spatial and perceptual components of crowding: Effects on health and satisfaction. *Environment & Behavior*, 1975, 7, 225-236.
- Decl, E.L. *Intrinsic motivation*. New York: Plenum 1975.
- de Charms, R. *Personal causation*. New York: Academic Press, 1968.
- Evans, G.W. Behavioral and physiological consequences of crowding in humans. *Journal of Applied Social Psychology*, 1978, in press.
- Fischer, C.S., Baldassare, M., & Oshie, R.J. Crowding studies and urban life: A critical review. *American Institute of Planners Journal*, 1975, 41, 406-418.
- Freedman, J. Crowding and behavior. San Francisco: W. H. Freeman & Co., 1975.
- Freedman, J.L., Heshka, S., & Levy, A. Population density and pathology: Is there a relationship? *Journal of Experimental Social Psychology*, 1975, 11, 539-552.
- Freedman, J.L., Klevansky, S., & Ehrlich, P.R. The effect of crowding on human task performance. *Journal of Applied Social Psychology*, 1971, 1, 7-25.
- Galle, O., Gove, W., McPherson, J. Population density and pathology: What are the relations for man? *Science*, 1972, 176, 23-30.
- Gillis, A. Population density and social pathology: The case of building type, social allowance, and juvenile delinquency. *Social Forces*, 1974, 53, 306.
- Glass, D.C. & Singer, J.E. *Urban stress: Experiments on noise and social stressors*. New York: Academic Press, 1972.



## JOURNAL OF POPULATION

- Hiroto, D.S. Locus of control and learned helplessness. *Journal of Experimental Psychology*, 1974, 102, 187-193.
- Karlin, R.A., Epstein, Y.M. & Aiello, J.R. A setting specific analysis of crowding. In A. Baum & Y. Epstein (Eds.) *Human responses to crowding*. Hillsdale, N.J.: Lawrence Erlbaum Associates, 1978.
- Krantz, D., & Stone, V. Locus of control and the effects of success and failure in young and community residing aged women. *Journal of Personality*, 1978, in press.
- Langer, E.J., & Rodin, J. The effects of choice and enhanced personal responsibility for the aged: A field experiment in an institutional setting. *Journal of Personality and Social Psychology*, 1976, 34, 191-198.
- Langer, E.J., & Saegert, S. Crowding and cognitive control. *Journal of Personality and Social Psychology*, 1977, 35, 175-182.
- Lawrence, J.E. Science and sentiment: Overview of research on crowding and human behavior. *Psychological Bulletin*, 1974, 81, 712-720.
- Levy, L., & Herzog, A.N. Effects of population density and crowding on health and social adaptation in the Netherlands. *Journal of Health and Social Behavior*, 1974, 15, 228-240.
- McPherson, J.M. *Population density and social pathology: A reexamination*. Sociological Symposium, 1975, 11, 77-90.
- Mitchell, R.E. Some social implications of high-density housing. *American Sociological Review*, 1971, 36, 18-29.
- Paulus, P.B., Annis, A.B., Seta, J.J., Schkade, J.K., & Matthews, R.W. Density does affect task performance. *Journal of Personality and Social Psychology*, 1976, 34, 248-253.
- Rodin, J. Density, perceived choice and response to controllable and uncontrollable outcomes. Unpublished manuscript, Yale University, 1977.
- Schmitt, R.C. Density, health, and social disorganization. *Journal of the American Institute of Planners*, 1966, 32, 38-40.
- Schopler, J., & Walton, M. The effects of structure, expected enjoyment, and participants' internality-externality upon feelings of being crowded. Unpublished manuscript. University of North Carolina at Chapel Hill, 1974.
- Schulz, R. Effects of control and predictability on the physical and psychological well-being of the institutionalized aged. *Journal of Personality and Social Psychology*, 1976, 33, 563-573.
- Seligman, M.P. *Helplessness: On depression, development, and death*. San Francisco: W. H. Freeman & Co., 1975.
- Sherrod, D.R. Crowding, perceived control, and behavioral aftereffects. *Journal of Applied Social Psychology*, 1974, 4, 171-186.
- Sherrod, D.R. Crowding, perceived control, and behavioral aftereffects. *Journal of Applied Social Psychology*, 1974, 4, 171-186.
- Stokols, D. The experience of crowding in primary and secondary environments. *Environment and Behavior*, 1976, 8, 49-86.
- Sundstrom, E. Crowding as a sequential process: Review of research on the effects of population density on humans. In A. Baum & Y. Epstein (Eds.), *Human Response to Crowding*. Hillsdale, N.J.: Lawrence Erlbaum Associates, 1978.
- Valins, S., & Baum, A. Residential group size, social interaction and crowding. *Environmental and Behavior*, 1973, 5, 421-439.
- Ward, S.K. Overcrowding and social pathology: A re-examination of the implications for the human population. *Human Ecology*, 1975, 3, 275-286.
- Welch, S., & Booth, A. Crowding and civil disorder. *Comparative Political Studies*, 1975, 8, 58-74.
- Winsborough, H.H. The social consequences of high population density. *Law and Contemporary Problems*, 1965, 30, 120-126.
- Worchel, S., & Teddlie, C. Factors affecting the experience of crowding: A two-factor theory. *Journal of Personality and Social Psychology*, 1976, 34, 30-40.
- Zlutnick, S., & Altman, I. Crowding and human behavior. In J.F. Wohlwill & D.H. Carson (Eds.), *Environment and the Social Sciences: Perspectives and Applications*. Washington, D.C.: American Psychological Association, 1972.