DEMOGRAPHY Volume 9, Number 4 November 1972

POPULATION DENSITY AND THE CITY*

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It is possible that in no previous age has so large a proportion of the citizenry been so directly and so vocally concerned about environmental deterioration and its threat to the quality of life. If the fervor and the insistence with which the matter is discussed is a measure of its importance, then it surely is one of the most significant issues of our time. The clamor rises to an emotional peak when its attention fastens upon the city. There, it would appear, our reckless disregard of standards of efficiency, resource conservation, health and aesthetics reaches its fullest expression. Cities, we are told, are cancerous growths. They occupy space where wildlife once lived, they overlay arable land with ugly structures that soon will be reduced to blight, they pollute the atmosphere, the soils and the streams, they foster mean, antisocial and materialistic behaviors, and they harbor the poor, the lawless and the underprivileged. The indictment is sweeping. It is strange, indeed, that so many people live in cities.

Critics of urban life have been among the more vociferous members of American society from the beginning. The anti-urban tradition, which started with Thomas Jefferson, was carried through the nineteenth century by men of letters —the Adamses, Thoreau, Emerson, Melville and many others.[1] In the late nineteenth century the attack was pressed by city planners, who sought an urban antidote in constructing the city beautiful. As planners grew more preoccupied with the technical problems of their profession the license for urban criticism was relinquished to environmentalists. At the outset the complaints were inspired by fears of cultural dilution caused by swarms of foreign-born residents and the divorce of life from the soil. It became, in the hands of planners, a lament over the neglect of aesthetic values in design to which institutional and moral defects were attributed. Most recently the urban problem has come to be viewed as an aspect of the larger environmental problem. It is said to be caused by population growth and the continuing concentration of population in urban areas.

The censure of cities has had some basis in fact. They have always been unstable, unruly and somewhat unsightly places. That is because cities have served as the vortexes of change. The avenues of traffic and trade that have converged upon cities to supply their nourishment have also exposed them to innovations and influences from near and far. The crisis of the city—and crises are endemic in cities—is the crisis of change. Unfortunately, the problems of the moment tend to obscure the achievements of the preceding moment and the promise of the next moment. Nowhere else than in the city has it been possible to have access to so much information and to such a diversity of opportunity. If they have lacked beauty and symmetry, cities have at least been free of the stultifying parochialisms of the insular village. No amount of romanticism can raise the village to the level of creativity and liberal thought enjoyed in the

* Presented as a Presidential address to the Population Association of America at its annual meeting in Toronto, Canada, April, 1972.

city. In fact, if the truth could be fully known, urban life and the commerce on which it is built would probably prove to be among the most powerful factors in the development of ethical systems and the growth of civil institutions. Interdependence cannot long last without mutual understanding and trust. The standardization of moral principles and criteria of justice is as necessary as the standardization of coinage, weights and measures, and language. But this is a topic for another discussion.

We are told that many of the difficulties in which cities find themselves today can be traced to the crowding of people into the limited spaces available, that is, to density.[2] This is a reversion to an earlier theme. Not since the empirical work of Raymond Pearl and the speculations of Louis Wirth have we heard much about density, not, that is, until the past decade. Now it is a popular interest once again. This can hardly be explained by any new definitive light having been cast by social science research on the social significance of density, for none has been published. Whatever might have provoked the renewal of interest, it appears to have been nourished from several sources, among them criticisms of planners' neglect of old, interior sections of cities voiced by Jane Jacobs,[3] the publicity given to a few bizarre instances of noninvolvement on the part of residents of New York City, and the discovery of John Calhoun's experimental studies on the effects of crowding on the behavior of Norwegian rats.[4]

The attention given to Calhoun's work in current thinking about density is itself a curious phenomenon. There is hardly a book of readings on either population or urban problems published in the past few years that has not included his paper on "Population Density and Social Pathology".[5] This from people who have so studiously held their work aloof from any comparison with findings of biological researches is rather ironic. But the acknowledgment of Calhoun seldom extends beyond juxtaposition. No one has gone so far as to indicate what analogy is to be drawn between the rat in an experimental setting and the human being on a city street. If reputable biologists such as René Dubos [6] and Dennis Chitty [7] can discover no useful application of the experimental findings to the human situation, the social scientist may be excused for his inability to appreciate Calhoun's contribution.

This is not to say that there are no instructive parallels to be observed as between lower and higher forms of animal life. A comparison is on much sounder ground, it seems to me, when it deals with aggregates rather than individuals. For example, in so far as density generates a competitive situation it may indirectly exert a distributive effect. Competition for territory among members of animal species grows more severe, with consequent higher mortality, as density increases. This simple relationship, as the bioecologist John Christian has pointed out, assumes for both lower forms of animal life and for human beings that (a) there is a given mode of social organization operative, and (b) that the organization remains constant through a period of interaction.[8]

But discussions of density in human populations are often confused and sometimes frustrated by the various meanings attributed to the term. On the one hand, the word is used to denote the resident population per unit of land space. On the other hand, density is frequently employed to mean the number of interactions or messages exchanged per unit of time. These two meanings may be identified as physical and social density, respectively.[9] A third meaning which overlaps the first two to some extent applies to temporary aggregates, such as the number of vehicles at an intersection at a given time, the size of a crowd on a city sidewalk at a particular hour, or the telephone calls handled by an exchange at peak load periods. Congestion is a word used occasionally to refer to transitory aggregations, though the term has acquired no technical standing. Needless to say, the hypotheses one advances about the implications of relative numbers will be affected by the conception of crowding he has in mind.

The separation of physical and social density is under certain circumstances a matter of abstraction, for the distance between people is an important factor in their ability to exchange communications. Increases in the number of people per unit of territory raise the level of interpersonal and interinstitutional accessibility and, at the same time, the probability of interaction. Thus, in any given state of transportation and communication technology, physical and social density are positively correlated, up to a point at least.

The dependence of social upon physical density is a fact of great historic importance. It lies at the roots of the nucleation of human settlement, whether as village, town or city. Only by crowding together, *multum in parvo,* have people been able to join their special abilities in close working relationships. Increases in the productivity of the soil freed more people for specialization in non-extractive industries and fostered enlarging concentrations within which the accumulating specialties could be interrelated. The industrial city in the nineteenth century grew, in its early stages, as much by the concentration of previously scattered rural industries as by the emergence of new industries. Each addition of another industry exerted a multiplier effect, drawing ancillary industries and services to the site, thereby developing a complement of producing activities and external economies. Compact agglomerations were imperative, as economic historians have shown,[10] since intramural transportation and communication facilities remained in a primitive state until well into the nineteenth century. Density is thus an economizing circumstance; it is a way of minimizing the time and cost of exchanges of goods and information.

High densities also permit economies in the physical and service structures of cities. Where the housing space per unit of land is large the rental cost per dwelling may be relatively low. Similarly unit costs of utility lines, street surfacing, sidewalks, police and fire protection, and delivery and other services can be lower as density is increased. Yet high intensity of use may keep maintenance costs at a high level, for breakdowns can spread considerable chaos. But maintenance costs may not pose a problem until rents begin to fall, as a result, for example, of obsolescence. If then there is a tapering off of maintenance service, it may begin a downward spiral in the use value of buildings.

There is a limit to the gains in communication efficiency that can be realized from increases in physical density. The frictions and collisions that accumulate in the mounting volume of traffic, the consequent delays and missed appointments, and the losses of information due to breakdowns of overloaded circuits raise the costs of communication to prohibitively high levels. The system, other things having remained constant, is unable to make the necessary compensatory adjustments.[11] As that point is approached the growth of an integrated system tends to come to rest at an equilibrium state. Accumulation of population beyond the equilibrium point leads to a fragmentation of an aggregate and the formation of a number of systems at the equilibrium scale.

This is the condition in which many of the cities of developing areas find themselves today. Their physical densities have risen to such high levels that internal integration cannot be supported by the existing transportation and communication facilities. Consequently the aggregates resolve themselves into numerous cellular compartments between which there are comparatively few exchanges. Since the urban systems are unable to attend adequately to the needs of the people the social costs of great densities are high.[12] Still, although in many cases the high densities are premature, there is no other way to assemble a labor force or a market where transportation and communication are either primitive or beyond the financial reach of most of the people. The massed population could prove to be a resource of great value in the further development of industrialization. In this respect the early history of western industrial cities is being repeated.

But if the facilities for local movements and exchanges are improved even though slightly, as began to occur around mid-nineteenth century in industrial cities, an integrated system can grow to larger sizes. The radius over which centralized activities could extend their influences was lengthened and the scale of organization was increased correspondingly. Intensive users of space increased in number at the center and crowded extensive space users toward outer zones. In general, information handling industries supplanted goods handling industries. These changes accelerated perceptibly with each further improvement in short-distance movement.

The advance of centralization and of the scope of its domain multiplied the volume of interactions by some exponential power. Every further institutional specialization added a new set of permutations to the flows of information. Communications specialists—messengers, telephone operators, record keepers, despatchers, coordinators, radio broadcasters, managers, administrators and technical consultants—increased to the point of constituting a major industry. In short, social density became increasingly independent of physical density; the former began to increase much more rapidly than the latter. It would be surprising to discover that the rapid growth of social density did not require progressively larger expenditures for the installation and maintenance of communication networks.[13] A fair assumption is that the greater expenditures paid dividends in higher productivity. Were that not true it would be difficult to find an economic explanation for the growth of a system. In any case, if there are higher costs, they should be assigned to organizational maintenance, not to physical density.

Although the deconcentration of institutional activities was accelerating noticeably after 1920, at least in the United States, population densities continued on their rising curve to as late as 1950, reaching averages in the larger cities of 15,000 people per square mile, and ranging up to 100,000 per square mile in inner zones of the very large places. No doubt there were many advantages in such densities. Workers could be close to places of employment, personal and household services could be located conveniently, neighbors were close at hand for mutual aid and conviviality, and individuals could enjoy a stimulating environment composed of people from many different experiences and backgrounds. But Louis Wirth exposed the negative side of population density.[14] As he saw it, density, if only because of the sheer numbers present in a limited space, encouraged an impersonality in relationships, a view of one's fellows as means to ends, and in general an exploitative attitude of persons toward one another. These were put forth as the ingredients of the urban way of life, and they have been so accepted down to the present. In one short paper, Wirth determined the interpretation of density for an entire generation of social scientists. He also, inadvertently I am sure, bestowed respectability upon sweeping generalization from a limited case. Whether for that or other reasons there is now a fairly long history of the making of pronouncements about the dispiriting and debilitating effects of density without benefit of comparative data. This tendency has persisted despite counter evidence supplied by O. D. Duncan [15] and A. J. Reiss.[16] A more recent paper by Stanley Milgram, on "The Experience of Living in Cities",[17] once again underscores the need for comparative study of density effects.

It is true, of course, that densities in cities have been shown to be positively correlated with frequencies of delinquency, of low educational attainment, of broken homes, of mental disorders, and of other deviations from the average and perhaps the desirable. Data problems aside, social characteristics such as these are more readily explained in terms of poverty and underprivileged status than as consequences of high physical density. In fact, exceptionally high physical density in contemporary urban areas quite probably is a function of the same causes that produce abnormal behaviors.[18] It may be noted in passing that Europeans of all social-economic classes have lived in crowded quarters for generations without exhibiting unusual frequencies of aberrant behaviors.

Nor is there any convincing evidence that physical density exerts a measurable effect on health. Indeed Western history argues for the contrary. Mortality and morbidity rates declined more or less continuously as urban densities increased. Robert Schmitt, however, reported contradictory findings from his study of census tracts in Honolulu. He distinguished between density, as persons per acre, and congestion, as persons per room, and, with crude controls on education and income, he found that density explained more variance than did congestion in variables such as infant death rate, suicide rate, tuberculosis rates, venereal disease rates, and other pathologies.[19] This conclusion finds no support in a study of Hong Kong by the same researcher [20] or in other studies that have dealt with the problem.[21]

In a very careful review of the research literature John Cassell concluded that there is no demonstrable direct effect of density on infectious disease.[22] The incidence of that class of diseases is more readily explainable, according to Cassell, by events in the social environment in which density may or may not be an operating condition. That is, the stresses and strains encountered in group situations may activate latent infections which then appear in increased morbidity. In this connection, too, it seems that disease is more directly a consequence of poverty, ignorance of proper diet, and neglect of sanitary practices than it is of population density.

The concern over density most commonly heard at present harks back to the problems of the rat in the experimental setting. We are told that the effects of density include the following:

1) Interference with goal-attainment efforts;
2) Deprivation of gratifications;
3) Intrapersonal incompatibility of values and motives;
4) Overload of demands and claims from others;
5) Interpersonal opposition arising from incompatible claims to scarce facilities and rewards;
6) Failures of support for norm-following behavior; and
7) Involuntary exposure to noxious stimuli.[23]

How such effects can be assigned a priori to density is far from clear. Nor is it self-evident that they do not occur under other conditions. Assuming that the listed traits have some connection with physical density, each one has a complement that might also be a density function. Thus, while there may be "interference with goal attainment efforts", there is also a greater chance of finding support for goal attainment efforts. If there is "deprivation of gratification", there are also numerous provisions for gratification. Again, "failures of support for norm-following behavior" is countered by the availability of many opportunities to associate with like-minded persons. A matching list of density effects, then, would include:

1) Institutional support for goal attainment efforts;
2) Unparalleled opportunity for gratification;
3) Opportunity for selective association relative to compatibility of values and motives;
4) Overload of opportunity and stimulation;
5) Mutual assistance in achieving access to scarce facilities and rewards;
6) Easy availability of like-minded associates for support in norm-following behavior; and
7) Involuntary exposure to education, cosmopolitanism and innovative ideas.

This difference of opinion suggests that the psychological as well as the economic analysis of physical density should be submitted to a cost-benefit treatment.

No doubt the most serious risk generated in congestion is that resulting from communication overloads, though it must be admitted that the evidence pointing to this danger is fragmentary. Nevertheless, it seems reasonable that the numerous formal and informal flows of information which converge upon the individual in a modern metropolis, the many admonitions regarding instructions, rules and procedures to which he is subjected, the innumerable visual, tactile and other sensory stimuli which impinge upon him, and the demands on his time and attention made by work, family and community together might very well be enervating and tension-producing to the point of danger to the person's mental health. Richard Meier has estimated that in a modern metropolitan area of 5,000,000 people the daily per capita bits of information circulated is of the order of 274,000, or about 2800 per waking minute.[24] A great part of this incredible volume must flow through institutionalized channels and be mechanically processed. Still the magnitude of the flow is such that the fraction reaching individuals directly could be considerable.

An important factor in the mitigation of the possible hazards in communication overloads is the human being's inventiveness of ways to secure protection from excessive or unwanted influences. The concept of property and the rules of privacy associated with it, the elaborate codes of etiquette, and the many formalities of behavior that characterize social situations serve the purpose of insulating the person against the abrasive effects of too many contacts and too much information. These means of protection are supplemented by individual mobility. Periodic escapes into sheltered places provide a respite from incessant attacks upon one's sensory organs. A question of some moment in this respect concerns how the capacity to acquire and employ such behavioral devices is distributed in a population. If it varies by socioeconomic class a community might be faced with a serious problem. On the other hand, if exposure to communication impulses also varies by social–economic class the problem is less severe. It is not unlikely, however, that the ratio of exposure frequency to ability to accommodate to it is constant across all classes.

As I have already suggested, a great deal of the information that circulates in an urban system is deflected into organization channels. Numerous specialists funnel to the consumer the distilled effects of a vast amount of producing, transporting, financing, risk-taking and administrative activity. His role as a citizen is simplified by various other specialists. The politician takes care of one's political responsibilities, the social worker relieves him of direct involvement in charity, and the preacher is his proxy in communications with the deity. An occasional vote at election times and the payment of relatively small fees hires these services and leaves the person free to attend to more urgent matters. Organization is a means of ingesting, coding, and selectively distributing information to the participating members of a system. Organizations, of course, can have various imperfections, so that some individuals are much more vulnerable to communication overloads than is necessary.

In any event, the revived interest in the social effects of physical density has failed to take one set of facts into account. Population densities in central cities of metropolitan areas have been in decline for the past 20 years. When central cities are classified by age, the census date at which they first attained 50,000 population or more, it is found that all classes of cities reached their peak densities in 1950. In the following decade all classes of central cities experienced declines of population within their 1950 territories. The reductions varied from three percent in the oldest areas to 46 percent in the youngest ones. In the 1960-70 decade declines continued in the classes of old metropolitan centers, but there were some small reversals of the trend among central cities that qualified as metropolitan after 1900. Density increases occurred in but a third of all centers and these had 1960 areas that averaged 50 percent larger than the two-thirds that had density losses. Taken together all central cities lost population within their 1960 boundaries. The entire increase of population within central cities of metropolitan areas during 1960-70 was due to annexation. It seems unlikely that the reversals that have occurred can be more than momentary, though it is conceivable that massive federal aid to cities could alter the density trend.

The trend toward a decline of density in metropolitan cores is consistent with the long-term trend in the growth of urban areas of industrial societies. If we were to observe that trend within an area with a radius of 35 miles centered upon a favorably located city, we would note two rather well-marked though overlapping phases. In the first phase growth and distribution of population were primarily centripetal. Settlement within the radius defined, as well as new increments to the total population, congregated increasingly in the center at the expense of absolute losses in the outermost zones of the area. But before this phase of central growth was concluded the second or centrifugal phase began. That is, population growth in the innermost zones of the central city slowed and then fell below zero. Subsequently the zone of negative growth surrounding the business core has widened steadily. In the meantime population and growth increments have moved outward, spilling over the boundaries of central cities and invading even the outer zones that had earlier been the scenes of population declines.

The centrifugal movement of urban population has a history that extends back into the nineteenth century. Density declines and absolute losses in the inner zones began shortly after 1850 in New York, London, Hamburg and other large cities and became apparent in many smaller ones before that century closed.[25] They have since become commonplace, as I have noted. The factors underlying the centrifugal drift initially were improvements in local transportation and communication facilities and the continued expansion of the business core. Population retreated as the approach of business and industrial uses blighted the land for residential occupance and drove land values above what low intensity residential uses could sustain. A significant shift has occurred, however, in the centrifugal trend. Whereas until 1950 or thereabouts there were usually high intensity uses available to bid for residential properties adjoining industrial and commercial districts, that kind of replacement has diminished and has ceased entirely in some metropolitan centers. Hence, the cycling of land from low to high intensity uses can no longer be expected. As a result the continuing centrifugal movement of urban population and urban institutions leaves a widening core of obsolescent, deteriorated and abandoned buildings where once stood the richest sources of municipal revenues. On the positive side, the spreading disuse of interior space offers a unique opportunity to completely redesign the cores of metropolitan areas. Persons concerned with the quality of urban environment might take some comfort from the course of change.

The reduction of density associated with the centrifugal movement of urban population is not just that and nothing more. It marks a general subsiding of the importance of proximity. Whereas it was once necessary that closely related activities be located within hailing distances of one another, that is no longer the case. The distances that can separate interdependent units at no loss of access continues to increase. The other side of the coin is that units are no longer under any compulsion to accept what is close at hand, whether that be services from nearby institutions or associations with neighbors. One can choose his services and his personal associations from a progressively widening area. Accordingly, the vicinage seems to be in decline as a social unit.

Costs of transportation and communication have been and are still being substituted for the costs of limited choice. Not all units are able to make the substitution. The marginal enterprise and the poor urban resident, lacking the wherewithal for unrestricted use of the facilities for movement, must be content with what is available within the immediate locality.[26] Thus emancipation from the rule of proximity varies more or less directly with the resources at the disposal of the unit in question, though units at all levels are less confined by distance than was formerly the case.[27] The neighborhood, as it is conventionally thought of, is by way of becoming an exclusive possession of the poor and the handicapped.

As local distances have lost much of their limiting effects traditional units have sunk into obsolescence. This appears to have happened not only to the informal neighborhood, but to the city as a whole. The city has been stripped of most of its unique functions and lingers on as a political anachronism. The effective urban unit is now the metropolitan area, uncoordinated and awkward though it may be. Even that, however, in the shape of the Standard Metropolitan Statistical Area, seems to be losing its adequacy as a definition of the urban unit. The deconcentration of population and institutions is reaching beyond metropolitan boundaries. We can expect physical densities in and around urban centers to continue to decline. Not so with social density, however. As organizations grow in scale and complexity (and there is no reason to believe that they will do otherwise), the volume of information will increase in exponential fashion. There is a growing need for innovation in the redesigning of urban systems in order to accommodate the mounting flows of communications while preserving integration in the systems.

FOOTNOTES

[1] Morton and Lucia White, *The Intellectual and the City* (Cambridge: MIT Press, 1962).

[2] Nathan Glazer, *Cities in Trouble* (New York: Quadrangle, 1970), pp. 3–4; and William Michelson, *Man and His Urban Environment: A Sociological Approach* (Reading, Mass.: Addison-Wesley, 1970), pp. 152–159.

[3] *Death and Life of Great American Cities* (New York: Random House, 1961).

[4] "Population Density and Social Pathology", *Scientific American*, CCVI (1962):139–148.

[5] *op. cit.*

[6] *Man Adapting* (New Haven: Yale University Press, 1965), p. 168.

[7] Review of *Behavior and Environment*, ed. by Aristede H. Esser, *Science*, 173 (2 July 1971):42–43.

[8] "Social Subordination, Population Density, and Mammalian Evolution", *Science*, 168 (3 April 1970):84–90.

[9] The similarity to Emile Durkheim's "material" and "moral" density will be recognized. (*The Division of Labor in Society*, trans. by George Simpson [New York: Macmillan, 1933], pp. 233ff.)

[10] See Eric Lampard, "The History of Cities in the Economically Advanced Areas", *Economic Development and Cultural Change*, III (1955):90–92.

[11] See Kenneth Boulding, "Toward A General Theory of Growth", *Canadian Journal of Economics and Political Science*, XIX (1953): 326–340.

[12] Nathan Keyfitz, "Population Density and the Style of Life", *BioScience*, 16 (1966):868–872.

[13] See Joseph J. Spengler, "Megalopolis: Resource Conservor or Resource Waster?", *Natural Resources Journal*, 7 (1967):386–387.

[14] "Urbanism as a Way of Life", *American Journal of Sociology*, XL (1938):1–24.

[15] "Optimum Size of Cities", in Paul K. Hatt and Albert J. Reiss, Jr. (eds.), *Cities and Society* (Glencoe, Ill.: The Free Press, 1956), pp. 759–772.

[16] "An Analysis of Urban Phenomena", in Robert M. Fisher (ed.), *The Metropolis and Modern Life* (New York: Doubleday, 1955), pp. 45–51.

[17] *Science*, 167 (13 March 1970):1461–1468.

[18] This suggestion finds support in Omer R. Galle, Walter R. Grove and J. Miller McPherson, "Population Density and Pathology: What Are the Relations for Man?", *Science*, 176 (7 April 1972):23–30.

[19] "Density, Health and Social Organization", *American Institute of Planners Journal*, 32 (1966):38–42.

[20] Robert Schmitt, "Implications of Density in Hong Kong", *American Institute of Planners Journal*, 29 (1963):210–217.

[21] A. E. Martin, "Environment, Housing and Health", *Urban Studies*, 4 (1967):1–21; and G. Rosenberg, "High Population Densities in Relation to Social Behavior", *Ekistics*, 25 (1968): 425–427.

[22] "Health Consequences of Population Density and Crowding", in National Academy of Sciences, *Rapid Population Growth: Consequences and Policy Implications* (Baltimore: Johns Hopkins Press, 1971), pp. 462–478.

[23] Robin Williams, "Social Congestion and Social Conflict", unpublished manuscript (1971).

[24] *A Communications Theory of Urban Growth* (Cambridge: MIT Press, 1962), p. 130.

[25] Adna Weber, *The Growth of Cities in the Nineteenth Century* (New York: Columbia University Press, 1899), ch. IX.

[26] See Donald Foley, "The Use of Local Facilities in a Metropolis", *American Journal of Sociology*, 56 (1950):238–246; and Amos H. Hawley, *Urban Society: An Ecological Approach* (New York: Ronald Press, 1971), pp. 193–197.

[27] In the light of recent trends it seems ingenuous of a panel of technological experts to propose a highly sophisticated urban communication system in which the unit parts are to be "no larger a scale than that of a rural village." (Committee on Telecommunications, National Academy of Engineering, *Communications Technology for Urban Improvement* [Washington, D.C.: National Academy of Engineering, 1971], pp. 6ff.)