Managing Space for All of Us

GENE WUNDERLICH and WILLIAM DYER ANDERSON

Fellowship of man is fine, in moderate amounts. After a point, however, the presence of others may annoy—and even destroy us. The increase in human numbers presents us with a problem of managing diminishing average space.

A strategy for coping with this problem is to (1) promote the art and science of understanding space relationships; (2) design and engineer structures and population for effective use of space; and (3) design and develop organizations and procedures for regulating human interaction. Some of the ingredients of this strategy follow below in this and other chapters.

In this chapter we treat the space problem narrowly as a human problem. Viewing spaceship earth strictly as a human enterprise is subject to many dangers, as ecologists have made us painfully aware. Nevertheless, if our chapter is to focus on human relationships, we will simply have to acknowledge that the earth contains many creatures and features and let it go at that. The message of this chapter is mostly about the distances among people.

But what is the meaning of space to an individual? North Americans, for example, feel intruded upon if a stranger invades the 4-foot-distance barrier. They are uncomfortable if even a friend converses closer than 2 feet. Yet 25 feet is a "public" distance and people do not care to do private business at such lengths even if they can be heard. Distance has important effects on human relationships in work, living, and recreation.

Within limits, perceptions of distance are a result of culture. It is known, for example, that the typical Latin American prefers to stand about six inches closer to his partner in conversation than the North American. Unless this cultural differential is understood by parties involved, the North American is "cold and standoffish" and the Latin American is "pushy and overbearing." Distance can be measured psychologically, socially, and culturally.

We can extend the idea of linear distance into a two-dimensional area or territory. Even further, we can say that man surrounds himself in a psychological "space bubble"—of variable dimensions for different functions. Intrusions into this space may be regarded as hostile or at least disagreeable.

In order to voluntarily yield a portion of this space, some compensation is required. For example, one will accept a crowded bus if it is cheaper or more convenient than riding one's own car. Or a person will accept a smaller residential lot because it is cheaper than a large one. When one's private space is invaded, one expects the compensation of a graceful "thank you" or "excuse me."

* 

GENE WUNDERLICH is an economist in the Natural Resource Economics Division, Economic Research Service.

WILLIAM DYER ANDERSON is an attorney in the Division.
Space can be traded off against other desired ends. For some the value of space is high. For others, space can be foregone easily in favor of other ends. Because space can be traded off against other ends, and because space has a value, even if not always in money, it has an economic quality.

The need for space may have deep psychological roots. We are aware that overcrowding can result in pathological behavior. Animal experiments have revealed antisocial, cannibalistic, and suicidal behaviors which if projected into human populations would destroy the fabric of society. Yet, research is far from providing final answers to questions on man’s need for space.

For the present, the uses of space for privacy, escape, reflection, esthetic interest, recreation, and other purposes must be assumed on the basis of personal feeling by our designers, land use planners, engineers, and social scientists.

These psychological relations of space to individuals are important in the planning and construction of better communities, transportation systems, and industries. Space is, therefore, an important factor in public policy.

Space can be taken into account in the way we build our houses, factories, parks, and roadways; where we locate our cities, industries, and agriculture; and how we develop our technology. Space also can be taken into account in our social and economic organization and the means by which we control our collective behavior.

A search for some absolute numbers of acres, square feet, miles, or cubic feet of space needed for 60 million to 100 million more persons expected around the turn of the century is not likely to be fruitful. Space is an idea. Each person has his own perception of space needs for different functions. These needs become absolutes only in the extreme, and they change over time.

Some space, like your home, you will occupy the whole year. Other space such as motels, hospitals, and barbershops you may occupy only a portion of their total available time. Recreation space may vary widely from a theatre seat to a hiking area.

Concentric model town built since 1962 at Uruacu, in the Brazilian interior. A model farm takes up the core. The spiral growth protects the agricultural areas from urban sprawl.
Some uses of space: Top, Minnesota farmland. Center, children in District of Columbia park (left) and two boys using “tree finder” along a trail in George Washington National Forest, Va. (right.) Bottom, heavy traffic at San Ysidro, Calif.
Space such as road right-of-way is made use of by you although you will not occupy it. Some areas, which you never see or experience directly, provide goods and services for you: manufacturing plants, public utilities, and farmland. These shared or reserved areas may enter into a community or national space budget but not directly into the space budget of an individual.

The space needs of an urban apartment dweller whose recreation is the theatre, and who uses public transportation to a compact office, will be much smaller than those of a suburbanite who prefers camping and commutes by car to his occupation as a park attendant. Both may require less space than the Wyoming rancher requires just for his homestead.

People make residential, occupational, and travel decisions according to their preferences and opportunities. These preferences change, often to accommodate the situations individuals find themselves in.

Besides an understanding of the psychological, social, and economic functions of space, we need to know how the environmental characteristics of space can be conserved and created.

Can space be created? The earth's surface area is fixed. For practical purposes, the geographic boundaries and general topographical features of the Nation are fixed. All 3.6 million square miles of the United States are habitable, but in some areas only at extreme cost. Industry can be placed anywhere but at what cost, and to whom will the cost accrue? Homes can be built anywhere but would people want to live in them?

Decreasing the population is probably the simplest, least expensive, and most direct way of "creating" space for people. The arithmetic of space for the nation with a fixed total area requires that average space for people can be created only by decreasing the population. In specific locations, however, space—or the sense of space—can be created in a number of ways.

Dispersal of population obviously

![Population Density Map](image)

**POPULATION DENSITY, BY STATES, 1970**

- Under 10
- 10 – 24.9
- 25 – 49.9
- 50 – 99.9
- 100 – 249.9
- 250 or more
would expand per capita space of some densely settled areas. A uniform distribution of the 300 million people projected in the highest population forecast for the United States around the turn of the century would produce community densities of about 100 people per square mile. The State of North Carolina has an average density of 101 persons per square mile now.

An average density per State allows wide variation, however. Even the most densely populated State in the Union—New Jersey with 941 persons per square mile—has large areas of open countryside. Nearly two-thirds of New Jersey's land is in farms and forests.

How congested we feel will depend on how we design and use our space. Space per capita can be created by expanding the usable area. About 12 percent of the area of the United States is swamp, desert, mountains, and other areas unsuitable for use without radical alterations. However, nuclear energy, earth moving and excavation machinery, high-speed transportation and communication, water recycling, and other technologies make environmental alterations possible—whether desirable is another question.

New microclimates can be created within enclosed areas. Geodesic domes enclosing 2,000 acres can be constructed for $2 a square foot, at current prices. Such domes could have profound effects on the clustering of people and the means for meeting their space demands.

Floating cities have been designed and proposed to relieve congestion of urban areas. A British firm has developed plans for a city built on stilts for shallow portions of the ocean. The United States has over 800,000 square miles of continental shelf, much of it capable of supporting structures. Oil drilling platforms already have been erected in depths to 295 feet at a cost of $1 million per 98 feet.

Agriculture's traditional function of supplying food and fiber may be assumed by factories, either by producing substitutes such as synthetic fibers or by intensifying biological processes such as high-rise confinement feeding of livestock. Technologies for these changes already exist. If factories replace farms in producing food, then the space and environmental features of agriculture will take on a relatively greater importance. Today's farmers may become tomorrow's landscape architects.

Very rapid underground transportation travelling in deep tubes could permit dispersal of population without use of surface area for roadways or airports. New tunneling and subsurface construction techniques anticipate vast changes in transportation, hence population distribution.

Much of the apparent congestion of urban surface areas can be relieved by effective use of subsurface levels. By the year 2000, utilities, transportation, and the other services can be provided below ground so as not to obstruct visual enjoyment of surface

---

**Diagram:**

 Ebenezer Howard's ideal concentric city (1898) had a glass-covered Crystal Palace in the form of a circular shopping street and a hierarchical core of culture and good government. The inviolate greenbelt separating it from its smaller satellite duplicates was to be filled with sheep, grain, and orchards, instead of factories and cluster housing.
space, or above ground to serve multiple purposes such as office buildings erected over highways.

Above-surface opportunities are expanding with new materials, designs, and construction techniques. Today's cities are a product of technological developments such as the elevator, automobile, telephone, and structural steel. Frank Lloyd Wright's dream of a mile-high building comes closer to reality each year. High buildings, more widely spaced, increase the number of planes of vision and the separation of buildings and people thus create the effect of more space in our urban areas.

But the creation of space is often expensive. Where the cost of congestion is most acute, in our cities, the use of below-surface and above-surface levels, the construction of cities in the sea, and the development of transportation may be necessary.

In most areas of the Nation, however, space simply can be conserved or managed better or innovatively. Space, in other words, can be used to save our other valuable resources. The countryside—farmland, forests, open areas—can be managed so (1) it is accessible to more people and (2) its quality is maintained or enhanced.

A national system of highways has provided easy, inexpensive access to open areas for recreation. Limitations on access are due more to crowding of public facilities largely at peak loads, or the lack of means to mobilize privately controlled space, than to lack of physical mobility.

The more critical problems of open areas are in maintaining those qualities for which open areas are sought. Freedom, privacy, cleanliness, and tranquility are expected in the great open spaces. In the face of growing numbers, these qualities may be preserved only through organization, management, and control.
With increased mobility and interdependence of people, their statistical assignment to a unit of space becomes less and less meaningful in describing our space problems. Do 70 percent of the people live on 2 percent of the land? No. They "live" on all the space they use.

Such statistics are derived by conveniently assigning people's "living" to a statistical boundary such as a SMSA (Standard Metropolitan Statistical Area), county, or city. It takes no account of how this 70 percent uses the other 98 percent of the space. Neither does it describe extreme congestion occurring when 10 percent of the people attempt to use .00001 percent of the space at the same time.

The widening access to space is true even of our national boundaries. Ecumenopolis—the world community—is in our near future. A decade from now the travel time to the other side of the earth will be just a few hours. Furthermore, many of our present transportation needs will be replaced by 3-dimensional, all sensory systems which are now technologically available. These communication systems will provide electronic presence to long distance communications so natural that they will seem to be living presence. In three decades earth distances won't matter.

So perhaps the idea of average or per capita space is becoming more and more realistic. Technology is eliminating opportunities for natural monopolies of territory. One can no longer secure space by traversing unpeopled distance. Space will increasingly become a matter of coordinating activity, including presence, among people. The physical experience of space will depend upon timing. Timing requires organization and control.

How is organization and control to be brought about? What are the instruments of control, who will use them, and how? What policy guidelines are we to follow in using these instruments of control? Only recently have we thought in terms of a specific policy on population and its distribution.

One of the largest known population migrations in the world was made from rural to urban places in the United States, a nation committed to democratic principles and individual freedom, by people who, according to many polls, preferred to live in small towns and rural areas.

Thus we conclude that the policy of having no policy with respect to population distribution did not result in much freedom of choice as to where people live. Economic forces which determine the location of jobs shape our migration patterns. Government policies and programs have not been neutral. Social welfare legislation, expenditures for transportation, housing programs, even agricultural programs have tended to provide incentives for migration to urban areas.

Efforts to redirect growth must not only remove the incentives influencing present location but must also assign priorities for growth in areas where it is not likely to occur. The rationale for this action has been set out specifically in policy discussions in recent years. Typical of the arguments offered are the diseconomies associated with urban concentrations and the social burdens of congestion.

A variety of policy instruments are available to influence national population distribution. For example, public investments in power, communication, transportation, sewer and water supplies, health facilities, recreation facilities, and housing could carry assigned priorities for location and thereby induce private development in those areas. Direct Federal Government involvement in large scale urban developments and new communities is another possibility.

The problems of employment location could be attacked more directly by providing incentives for industrial or business location through the tax structure, direct payments, or low interest loans. Use and disposal of publicly-owned property may have significant effects in some areas. Direct relocation payments could be made to individuals. Job training and improved
employment information systems are other alternatives that have been offered.

Population distribution of the future will be influenced by the development of technology. While we recognize that present land settlement patterns are largely a product of past technological developments, few policymakers suggest intervention in the technology development and adoption process to positively influence future population location.

We could assume in the past that technology was spontaneous—almost an act of God. This is no longer the case. However, emphasis in the area of technology assessment seems to be largely on protecting society from adverse effects—an understandable bias in view of past experience.

The catalytic effect of major technological developments on population distribution could be used as a powerful policy instrument. For example, a new regional airport may attract support activities equal to a city of 80,000 people. We are relatively certain that these facilities will be placed somewhere. The decision will be made by relatively few individuals and groups, private and public, and thus could be simpler to implement as a population redistribution measure than, for instance, a tax incentive. It could be more target specific.

A complete population policy includes unpeopled places. In terms of irreparable damage to unique space, the wilderness and other natural areas probably stand to suffer most from 60 million to 100 million more people.

Approximately 10 million acres of land are now protected under the Wilderness Act of 1964 but as the President's Council on Environmental Quality notes, less than one percent is east of the Mississippi River. The potential for preservation of areas representative of our natural heritage rapidly diminish with the increase in population and mobility.

Natural areas marked for more intensive use are likewise threatened. Overcrowding of park space in particular areas has reached the point of negating its purpose. Some effort at rationing the use of park space has been undertaken in the form of required advance reservations. Automobiles have been banned in certain places. These forms of control on use will become common.

Changes in the workweek over the next 30 years will also have major impact on use of this space. Will we eventually need different workweeks for different individuals in order to allocate the weekend use of such unique resources as seashores and recreation areas among increasing populations?

There is probably general agreement on the need for planning and controlling the use of some space on a subnational but greater-than-local basis. New concepts of regionalism, variously defined, have been advanced. The optimum organizational level will probably still be a subject of controversy in the year 2000.

What seems most likely to occur is a more active role by States. They are the units of government in our Federal system with the broadest range of inherent government authority. All land use will probably be subject to some form of regulatory control, and direct regulation by the States over areas of more than local concern seems almost inevitable.

Traditional local governments will be consolidated both in areas of population growth and relative decline, for different reasons. Primary decisions regarding the use of space where people live and work will continue to be made by territorially larger local governments. This trend, which tends to remove government from the people, will be countered by an increase in both formal and informal organizations within localities to represent smaller community interests.

The nature of local controls over the use of space will change consider-
ably. Zoning, which has been the major space regulator of local governments, has traditionally dealt with height, use, setback, and area requirements. In the future, amenity controls dealing with noise, traffic pattern and volume, population density, water and air pollution, and open areas will be essential components.

One does not have to be an Einstein to accept the idea that space is not only a question of where but also a question of when. Timing use will become increasingly important in space management. Church buildings, for example, are now being used by different denominations at different times as an alternative to maintaining separate facilities which are essentially unoccupied a majority of the time. Changes in the education process may call for shorter formal class periods and thus give rise to "shifts" using school facilities at different times.

The same concept could apply in many areas including the management of office space. Peak load design is generally not conducive to an efficient use of space.

But providing for 60 million to 100 million more people is not just a question of technical capability or institutional strategy. The question is, if we effectively exercise physical and social controls, what will be the consequences on the individual? The problem has been stated as the conscious and purposeful control over the development of the physical and social environment while at the same time maintaining a relatively free society.

To maintain a democratic system of government, space must be planned to foster an environment conducive to democratic life styles, systems, and patterns of government and behavior.

Our past population increases have produced collective actions both private and public which tend to diminish the status of individual values. The possibility of future intrusions on individual values gives cause for concern. Some have suggested we should adopt a new Bill of Rights. Others believe an entirely new Constitution is necessary.

As a minimum in strategies for social control over space, we must consider the psychological impact of involuntarily changed life styles and behavior. Schemes using fine-tuned incentives for voluntary individual response must be coupled with selective applications of regulatory and coercive powers of government.

Individual privacy should be a major concern in space planning. Besides the issue of protecting rights, which is important, there is a need to assure conditions which make the exercise of the privilege possible.

Indirect effects of public action to control space must be anticipated and greater effort made to provide equal opportunity and equal treatment.

Notwithstanding the complexity of dealing with larger numbers of people in decision making, there will be an increasing need to involve those individuals who will be directly affected by the public decisions to be made. Short term efficiencies gained at the expense of participatory democracy may in the long run prove very costly.

Property will incur far more social obligations, such as restrictions on use and transfer, than we presently consider acceptable.

Efforts to maintain the integrity of our property system will call for many changes in ownership form; some are well underway.

In summary, the space needs for future man can be met by:

1. Controlling population increases.
2. Improving our understanding of the psychological, sociological, and economic meaning of space and designing preferred distributions of people.
3. Organizing and controlling the use of space to minimize competing demands.
4. Protecting the individual while the policies for 1, 2, and 3 are being implemented.