

URBAN DYNAMICS

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Summary

Urban dynamics is a management tool for urban policy analysis. An urban dynamics model permits computer simulation of alternative policies to improve city management. Policy testing can help to achieve goals for growing cities and to revive declining cities. Simulation reveals why some past policies have failed and why alternative policies may succeed. For cities with high unemployment, urban dynamics implies a need for policies that balance jobs and people in a more viable social and economic proportion.

Decision makers in many cities responded with great interest to the publication of *Urban Dynamics* in 1969, even though the book did not translate its broad policy guidelines into specific management actions for city decision-makers. The gap between theory and recommendations for day-to-day decision-making in the book left the public unsure of urban dynamics applications. A fuller understanding of how to use urban dynamics was explored by additional modeling and the analysis of policies in specific cities. Urban dynamics models have since been developed to explore many types of urban problems and policy alternatives.

Urban dynamics theory postulates three primary forces that underlie urban growth and decline: migration guided by perceptions of relative attractiveness, aging of housing and business structures, and the feedback connections among population, housing and jobs. All successful urban dynamics models have embodied these principles in some degree. The strength of urban dynamics theory lies not in any specific model but in the insights it offers to urban analysts and policy-makers.

1. Introduction

The publication of *Urban Dynamics* by Jay W. Forrester in 1969 marked a unique event in the analysis of social systems. The book combined Professor Forrester's methodology of computer simulation modeling with the practical expertise of a committee of urban managers and businessmen, headed by the former mayor of Boston, John F. Collins. *Urban Dynamics* refuted the conventional wisdom that urban problems are caused by such factors as rural-urban migration, dwindling fiscal resources, and sub urbanization, which are beyond the control of central cities. Using a computer simulation model the book showed that most urban problems arise, instead, from the interactions of processes that occur within the cities themselves. It also identified policies that enable cities to exercise some control over their own futures.

Following the publication of *Urban Dynamics*, research in urban dynamics proceeded in a variety of directions at M.I.T. Many of the controversies surrounding the *Urban Dynamics* model were explored and resolved in two volumes of collected works that were published in 1974 and 1975. Members of the System Dynamics Group undertook to integrate the urban dynamics perspective into the decision-making processes of a number of cities and towns in Massachusetts.

A book providing an introduction to urban dynamics, presented the fundamentals of the system dynamics method to produce a self-contained, step-by-step explanation of the basic concepts of urban dynamics. Although interest in urban dynamics has lagged for many years, it has never disappeared and periodically still stirs the imagination of urban advocates.

2. The Urban Political Background

In most cities, administrative authority is distributed vertically according to specialized tasks and responsibilities. Different agencies oversee economic development, housing, environmental protection, and public assistance. Because of this delegation of authority, the traditional approach to urban problem solving has been one of individual agencies working to contain problems arising within their jurisdictions.

In several respects, urban dynamics has shown that vertical forms of municipal government may be relatively ineffective because urban functions administered by separate agencies are in fact highly interconnected. The attractiveness principle in urban dynamics implies that all cities tend toward attractiveness equilibrium with their external environments. Because people migrate to areas that they perceive as being relatively attractive, efforts by local government to improve a single component of urban attractiveness (such as housing availability) always lead to (rising urban population and the degradation of other components of attractiveness (such as job availability)). Urban dynamics demonstrate how cities can operate within the attractiveness principle and more effectively coordinate individual policy measures to enhance the quality of urban life.

The political environment, however, often precludes effective cooperative action, both within cities and across urban boundaries. Instead, many individual programs

proliferate. Behind each program there is someone who believes that a problem has been identified and that it can be solved through direct action. These programs are based upon a common premise: through the solution of individual problems the city will become a better place in which to live and work.

Yet the quality of urban life in most cities around the world has not improved since the 1960s. By any objective measure, the individual problem-solving approach seems to have failed. Reports and statistics on urban crime, pollution, slums, traffic, taxes, and welfare attest to this fact. Most observers of the urban scene would agree that, relative to our expectations, cities are getting worse, not better.

3. Understanding the City as a System

Urban dynamics presents the viewpoint that there is not much use, and there may even be harm, in meeting these discouragements by redoubling our commitment to methods that have, on balance, failed. An increase in the efficiency of current programs is not enough. If we could achieve a vast improvement in the operation of current urban programs through the application of better tools, neither a better city nor the solution of current problems would be ensured. Merely raising the operational efficiency of the city is not sufficient because the urban structure we have developed does not necessarily satisfy the goals that went into its making.

Rather, urban dynamics theory views the city as a complex social and economic system formed by the interactions of individual efforts to achieve personal goals. Unfortunately, in modern life such a system does not operate to further individual goals—or even, in some cases, human goals generally. Large corporations tend to ignore individual contentment; government agencies often seem to possess a will of their own; cities do not reflect the values of their residents. Complex systems such as these are not structured to pursue objectives defined in personal terms.

Urban dynamics underscores this point. Many individuals can take actions that appear to satisfy their own objectives; the aggregation of these efforts constitutes a complex social system. The characteristics of that system may cause it to behave in some very different ways from the expectations and the desires of its creators. The city is an excellent example of this perversity. Created so that efficiencies of scale could provide better physical, cultural, and economic opportunities for its inhabitants, the city has worked to trap many in poverty and to lower the physical and psychic health of those living in it.

Urban dynamics provides a theory that embraces a conceptual understanding of the city as a whole. It can facilitate analyzing the city's various activities as interrelated functions. Only when we work within such a conceptual framework can we be certain that new urban programs will actually solve urban problems. Through simulation analyses of urban dynamics models, it is possible to study the effects of alternative programs and policies on the city as a whole. Analyses indicate that programs often have an effect exactly the opposite of that intended. Considerable research remains to be accomplished to identify acceptable urban revival policies and to create a framework for the development of more effective future urban programs.

4. The Theory of Urban Attractiveness

The concept of urban attractiveness is familiar. Individuals all make distinctions between urban areas that appeal to them and those that do not. The term “attractiveness” relates to individual preferences and biases in distinguishing among urban places. The sum total of all individual conceptions about the desirability of a given urban area constitutes the aggregate attractiveness of that area. Insofar as one has a choice, it is this combination of influences that determines where one will choose to live and work. On a larger scale, it simply defines the ability of a city to draw and to hold people.

Attractiveness is related to the movement of people to and from places. Throughout the world, population tends to be increasingly mobile. A significant percent of the population decides each year to move, among countries, among cities, within cities, and from rural to urban areas.

The decision to settle in a specific area may depend on many factors. It can involve job opportunities, the availability of housing, nearness to friends and family, climate, economic costs, quality of schools, racial attitudes, and welfare benefits. Although attractiveness is a composite index and not a single objective measure, it has real meaning. People are quite consistent in their assessment of relative attractiveness.

A city’s attractiveness is closely related to its population growth or decline. When an area is perceived to be more attractive than its surrounding environment, its population will increase, as many people settle there in preference to other areas. Time lags are, of course, inherent in the perception of attractiveness. New job opportunities today will not mean new residents tomorrow. But over the long run, perhaps ten to twenty years, any perceived increase in attractiveness relative to other areas will result in net migration into that city. In-migration will continue so long as the area is thought to be relatively more attractive than the rest of the country or the world. Only when this attraction fades will net growth resulting from migration cease. Migration will continue, but the number of new arrivals will tend to be offset by the number of those leaving the area.

If changes in the perceived attractiveness of a city always result in migration flows until the net attraction is rebalanced, from the viewpoint of the potential migrant, no city can remain more or less attractive than its surrounding environment. In the short term, delays in our perception of what a city is may produce uneven flows of people and the popular attitude that some city is “better” than another. In the long run, however, areas will tend to be equally attractive to the potential migrant.

Understanding how the attractiveness principle can be applied to urban analysis is the key to understanding a city as an urban system, the key to understanding why urban programs fail, and the key to understanding urban dynamics theory as an approach to the solution of urban problems.

5. Growth and Feedback

Increased perceived attractiveness leads to population increases. And more people eventually decrease the perceived attraction of any area. No city can escape this law.

Unsettled areas may temporarily seem to be more attractive as initial population increases stimulate the creation of industry and urban amenities. Ultimately, however, the attraction of the area will be depressed by further population increases. Industrial expansion may enhance job opportunities in a city, but as these jobs are filled, the larger population drawn to the area will tend to depress other elements of the city's attractiveness. In countries with high rates of population growth and limited economic opportunities, people are drawn to cities that are often perceived as overcrowded, unsanitary, and unsafe. Yet, to the in-migrants, the city appears more attractive than the life they leave behind. Ultimately, however, urban conditions can become so bleak that further in migration stops.

This feedback phenomenon that tends to create a constant relative attractiveness between cities is nothing extraordinary. The same dynamics are at work in the lines that form before the tellers' windows at a bank or in the lines of traffic in the lanes at a turnpike toll plaza. Each new arrival attempts to minimize his or her waiting time by joining the shortest line. On the average, all lines tend to be of equal length and therefore equally attractive to the next car entering the plaza. The concept of relative attractiveness implies that it is impossible to raise the aggregate attractiveness of any one city relative to its environment for any significant period of time. This conclusion has profound implications for urban programs. Any program that successfully improves a given city along some dimension will initiate a feedback response from the environment that worsens other aspects of the city.

The failure of many current programs suggests that the urban system is too complex to analyze intuitively; we cannot guess how the system will respond to the initiation of a new program. Individual parts of the system are sufficiently well known, however, to warrant the construction of a formal model to examine urban behavior. The model then allows us to analyze the system's response to programs and reach conclusions about policy decisions. Alternative policies that change the component indices of attractiveness will affect migration patterns in different ways. We wish to look for policies that will produce beneficial changes in the well being of urban residents.

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Bibliography

Alfeld L. E. (1975). *Urban Dynamics—the First Fifty Years*. *System Dynamics Review*, Vol. 11, No. 3, Fall. Chichester, West Sussex, UK: John Wiley & Sons, Ltd. [A review author's of urban dynamics applications in the 1970s.]

Alfeld L. E. and Graham Alan K. (1976). *Introduction to Urban Dynamics*. Cambridge, Mass.: Productivity Press. [Presents the fundamentals of the system dynamics method to produce a self-contained, step-by-step explanation of the basic concepts of urban dynamics.]

Alfeld L. E. and Meadows D. L. (1970). *A Systems Approach to Urban Revival*. Fifth Systems Symposium, Case Western Reserve University, 9–11 November. [Summary explanation of the urban dynamics theory.]

Alfeld L. E. (2000). *CSM: The Community Simulation Model*. [UD learning model available free on the web as an electronic file.]

Forrester J. W. (1971). *Counter-Intuitive Behavior of Social Systems*. *Technology Review*, **73**, (3). [Overview of urban dynamics conclusions.]

Forrester J. W. (1975). *Urban Goals and National Objectives*. Chap. 15 in: *Collected Papers of Jay W. Forrester*. Cambridge, Mass.: Wright-Allen Press. [Long-term perspective on urban dynamics applications.]

Mass N. J. ed. (1974). *Readings in Urban Dynamics*, Vol. 1. Cambridge, Mass.: Wright-Allen Press, Inc. [Collected research papers.]

Schroeder III W. W. et al., ed. (1975). *Readings in Urban Dynamics*, Vol. 2. [Collected research papers.]