COUNTERINTUITIVE BEHAVIOR OF SOCIAL SYSTEMS

by

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ABSTRACT

This paper addresses several social concerns: population trends; quality of urban life; policies for urban growth; and the unexpected, ineffective, or detrimental results often generated by government programs.

Society becomes frustrated as repeated attacks on deficiencies in social systems lead only to worse symptoms. Legislation is debated and passed with great hope, but many programs prove to be ineffective. Results are often far short of expectations. Because dynamic behavior of social systems is not understood, government programs often cause exactly the reverse of desired results.

The field of system dynamics now can explain how such contrary results happen. Fundamental reasons cause people to misjudge behavior of social systems. Orderly processes in creating human judgment and intuition lead people to wrong decisions when faced with complex and highly interacting systems. Until we reach a much better public understanding of social systems, attempts to develop corrective programs for social troubles will continue to be disappointing.

This paper cautions against continuing to depend on the same past approaches that have led to present feelings of frustration. New methods developed over the last 30 years will lead to a better understanding of social systems and thereby to more effective policies for guiding the future.

1 This paper was first copyrighted © 1971 by Jay W. Forrester. It is based on testimony for the Subcommittee on Urban Growth of the Committee on Banking and Currency, U.S. House of Representatives, on October 7, 1970. The original text appeared in the January, 1971, issue of the Technology Review published by the Alumni Association of the Massachusetts Institute of Technology. All figures are taken from World Dynamics by Jay W. Forrester, Pegasus Communications, Waltham MA. Updated March, 1995.

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III. COUNTERINTUITIVE NATURE OF SOCIAL SYSTEMS

Our first insights into complex social systems came from corporate work. Time after time we went into corporations that were having severe and well-known difficulties. The difficulties would be obvious, such as falling market share, low profitability, or instability of employment. Such difficulties were known throughout the company and were discussed in the business press.

One can enter a troubled company and discuss what people see as the causes and solutions to their problems. One finds that people perceive reasonably correctly their immediate environments. They know what they are trying to accomplish. They know the crises which will force certain actions. They are sensitive to the power structure of the organization, to traditions, and to their own personal goals and welfare. When interviewing circumstances are conducive to
frank disclosure, people state what they are doing and can give rational reasons for their actions. In a troubled company, people are usually trying in good conscience and to the best of their abilities to help solve the major difficulties. Policies are being followed that they believe will alleviate the difficulties. One can combine the stated policies into a computer model to show the consequences of how the policies interact with one another. In many instances it emerges that the known policies describe a system which actually causes the observed troubles. In other words, the known and intended practices of the organization are sufficient to create the difficulties being experienced. Usually, problems are blamed on outside forces, but a dynamic analysis often shows how internal policies are causing the troubles. In fact, a downward spiral can develop in which the presumed solutions make the difficulties worse and thereby cause greater incentives to redouble the very actions that are the causes of trouble.

The same downward spiral frequently develops in government. Judgment and debate lead to a program that appears to be sound. Commitment increases to the apparent solution. If the presumed solution actually makes matters worse, the process by which degradation happens is not evident. So, when the troubles increase, the efforts are intensified that are actually worsening the situation.

IV. DYNAMICS OF URBAN SYSTEMS

Our first major excursion outside of corporate policy began in February, 1968, when John F. Collins, former mayor of Boston, became Professor of Urban Affairs at M.I.T. He and I discussed my work in system dynamics and his experience with urban difficulties. A close collaboration led to applying to cities the same methods that had been created for understanding corporations. The resulting model structure represented fundamental urban processes. The computer-model structure showed how industry, housing, and people interact with each other as a city grows and decays. The results are described in my book *Urban Dynamics* (Forrester, 1969).

I had not previously been involved with urban behavior, but the story emerging from the urban model was strikingly similar to what we had seen in corporations. Actions believed to alleviate the difficulties of a city can actually make matters worse. We examined four common programs for improving the depressed nature of central cities. One program was creation of jobs by busing the unemployed to suburban jobs or through governmental jobs as employer of last resort. Second was a training program to increase skills of the lowest-income group. Third was financial aid to depressed cities from federal subsidies. Fourth was construction of low-cost housing. All of these were shown to lie between neutral and highly detrimental regardless of the criteria used for judgment. The four programs range from ineffective to harmful judged either by their effect on the economic health of a city or by their long-range effect on the low-income
population. The results both confirm and explain much of what has been happening over the last several decades in cities.

The investigation showed how depressed areas in cities arise from excess low-income housing rather than from a commonly presumed housing shortage. The legal and tax structures have combined to give incentives for keeping old buildings in place. As industrial buildings age, employment opportunities decline. As residential buildings age, they are used by lower-income groups who are forced to use them at higher population densities. Therefore, aging buildings cause jobs to decline and population to rise. Housing, at the higher population densities, accommodates more low-income urban population than can find jobs. A social trap is created where excess low-cost housing beckons low-income people inward because of the available housing. Unemployed people continue coming to a city until their numbers sufficiently exceed the available jobs that the standard of living declines far enough to stop further inflow. Income to the area is then too low to maintain all of the housing. Excess housing falls into disrepair and is abandoned. Extreme crowding can exist in those buildings that are occupied, while other buildings become excess and are abandoned because the economy of the area cannot support all of the residential structures. Excess residential buildings threaten an area in two ways—they occupy land so it cannot be used for job-creating buildings, and they attract a population that needs jobs.

Any change, which would otherwise raise the standard of living, only takes off the economic pressure momentarily and causes population to rise enough that the standard of living again falls to the barely tolerable level. A self-regulating system is thereby at work which drives the condition of the depressed area down far enough to stop the inflow of people.

At any time, a near-equilibrium exists affecting population mobility between different areas of a country. To the extent that there is disequilibrium, it means that some area is slightly more attractive than others and population begins to move in the direction of the more attractive area. Movement continues until rising population drives the more attractive area down in attractiveness to again be in equilibrium with its surroundings. Other things being equal, an increase in population of a city crowds housing, overloads job opportunities, causes congestion, increases pollution, encourages crime, and reduces every component of the quality of life.

A powerful dynamic force establishes equilibrium between all areas in total attractiveness. Any proposed social program should take into account the eventual shifts that will occur in the many components of attractiveness. As used here, attractiveness is the composite effect of all factors that cause population movement toward or away from an area. Most areas in a country have nearly equal attractiveness most of the time, with only sufficient disequilibrium in attractiveness to account for the shifts in population. But areas can have the same composite attractiveness with very different mixes in the components of attractiveness. In one area component A could be high and B low, while the
reverse could be true in another area that nevertheless had the same total composite attractiveness. If a program makes some aspect of an area more attractive than its neighbor’s, and thereby makes total attractiveness higher momentarily, population of that area rises until other components of attractiveness are driven down far enough to again establish an equilibrium. Efforts to improve some condition of a city will result primarily in increasing population until other conditions deteriorate to reestablish an equilibrium. The overall condition of urban life, for any particular economic class of population, cannot be appreciably better or worse than that of the remainder of the country to and from which people may come. Programs aimed at improving a city can succeed only if they result in eventually raising the average quality of life for the country as a whole.

V. ON RAISING THE QUALITY OF LIFE

There is substantial doubt that urban programs have been contributing to the national quality of life. Concentrating population in urban locations, undermining the cohesiveness of communities, and making government bureaucracy so big that individuals feel powerless, all reduce the quality of life.

Any proposed program should deal with both the quality of life and the factors affecting population. “Raising the quality of life” means releasing stress from crowding, reducing pollution, alleviating hunger, and treating ill health. But these pressures are the influences that control population movement. If one pressure is relaxed, population will then move in until other pressures rise to stop the inflow. To raise one component of quality of life without intentionally creating compensating counter pressures to prevent a rise in population will be self-defeating.

Consider the meaning of interacting attractiveness components as they affect a depressed ghetto area of a city. First, we must understand the way population density is already being controlled. A set of forces exist that determine why population density is not far higher or lower than it is. There are many possible combinations of forces that an urban area can exert. The particular combination will determine the population mix and the economic health of a city. The depressed areas of most American cities are created by a combination of forces in which there is a job shortage and a housing excess. The availability of housing draws the lowest-income group until they so far exceed the economic opportunities of the area that the low standard of living, the frustration, and the crime rate counterbalance the housing availability. Until the pool of excess housing is reduced, little can be done to improve the economic condition of an inner city. A low-cost housing program alone moves exactly in the wrong direction. It draws more low-income people. It makes the area differentially more attractive to the poor who need jobs and less attractive to those who create jobs. In the new population equilibrium that develops, some characteristics of the social system must counterbalance the additional attractiveness created by the low-
cost housing. That counterbalance is a further decline of the economic condition of the area. Unfortunately, as the area becomes more destitute, pressures rise for still more low-cost housing. The consequence is a downward spiral that draws in the low-income population, depresses their economic condition, prevents escape, and reduces hope. All of this is done with the best of intentions.

My paper, “Systems Analysis as a Tool or Urban Planning” (Forrester, 1969), from a symposium in October, 1969, at the National Academy of Engineering, suggests a reversal of present practice by simultaneously reducing the aging housing in decaying cities and allocating land to income-earning opportunities. The land shifted to industry permits the “balance of trade” of an area to be corrected by allowing labor to create and export products to generate income streams with which to buy the necessities of modern life from the outside. The concurrent reduction of excess housing is absolutely essential. It supplies the land for new job-creating structures. Equally important, the resulting housing shortage creates the population-stabilizing pressure that allows economic revival to proceed without being inundated by rising population. Revival of an urban area can be done without driving the present low-income residents out of an area. Revival policies should create upward economic mobility to convert the low-income population to a self-supporting basis.

Many people, at first, believe these revival policies of less low-cost housing and conditions to favor business to create jobs will not be accepted by elected officials or residents of depressed urban areas. However, some of the strongest support has come from within those groups that are closest to the symptoms, who have lived through the failures of the past, and who must endure present conditions until lasting solutions are found.

The country has slipped into short-term policies for managing cities that have become part of the system that is generating even greater troubles. If we were malicious and wanted to create urban slums, trap low-income people in ghetto areas, and increase the number of people on welfare, we could do little better than follow present policies. The trend toward stressing income and sales taxes and away from the real estate tax encourages old buildings to remain in place and block self-renewal. The concessions in the income tax laws to encourage low-income housing do, in the long run, actually increase the total low-income population. Highway expenditures and government loans for suburban housing have made it easier for higher-income groups to abandon urban areas than to revive them. Expanding the areas incorporated into urban government, in an effort to increase revenue base, has been more than offset by lowered administrative efficiency, more citizen frustration, and the accelerated decline that is triggered in the annexed areas. The belief that more money will solve urban problems has taken attention away from correcting the underlying causes and has instead allowed the problems to grow to the limit of available money.
VI. CHARACTERISTICS OF SOCIAL SYSTEMS

Many characteristics of social systems mislead people. Behavior that people do not anticipate appears in corporate and urban systems and in world-wide pressures now enveloping the planet. Three counterintuitive behaviors of social systems are especially dangerous.

First, social systems are inherently insensitive to most policy changes that people choose in an effort to alter the behavior of systems. In fact, social systems draw attention to the very points at which an attempt to intervene will fail. Human intuition develops from exposure to simple systems. In simple systems, the cause of a trouble is close in both time and space to symptoms of the trouble. If one touches a hot stove, the burn occurs here and now; the cause is obvious. However, in complex dynamic systems, causes are often far removed in both time and space from the symptoms. True causes may lie far back in time and arise from an entirely different part of the system from when and where the symptoms occur. However, the complex system can mislead in devious ways by presenting an apparent cause that meets the expectations derived from simple systems. A person will observe what appear to be causes that lie close to the symptoms in both time and space—shortly before in time and close to the symptoms. However, the apparent causes are usually coincident occurrences that, like the trouble symptom itself, are being produced by the feedback-loop dynamics of a larger system. For example, human suffering in cities is accompanied (some think caused) by inadequate housing. As a result, housing is increased and population rises to defeat the effort. More people are trapped in the depressed urban system. As another example, symptoms of excess population are beginning to overshadow all countries. Symptoms appear as urban crowding and social pressure. Rather than face the rising population problem squarely, governments try to relieve the immediate pressures by more policemen, financial aid, busing to suburban schools, and subsidized health facilities. As a consequence, increasing population reduces the quality of life for everyone.

Second, social systems seem to have a few sensitive influence points through which behavior can be changed. These high-influence points are not where most people expect. Furthermore, when a high-influence policy is identified, the chances are great that a person guided by intuition and judgment will alter the system in the wrong direction. For example, in an urban system, housing is a sensitive control point but, if one wishes to make the city a better place for low-income as well as other people, it appears that low-income housing should be reduced rather than increased. Another example lies in the world-wide problem of rising population and the disparity between the standards of living in the developed and the underdeveloped countries. System dynamics models suggest sensitive control points for increasing the world-wide quality of life exist in the rate of generation of capital investment and in food production, but that expansion of industrialization and food output are the counter productive
directions, both should be restrained. The common answer to world distress has been to increase industrialization and food production, but hope for long-term improvements probably lies in reducing emphasis on both. Contrary to intuitive expectations, the opposite of present practice may actually raise the quality of life and contribute to stabilizing population.

Third, social systems exhibit a conflict between short-term and long-term consequences of a policy change. A policy that produces improvement in the short run is usually one that degrades a system in the long run. Likewise, policies that produce long-run improvement may initially depress behavior of a system. This is especially treacherous. The short run is more visible and more compelling. Short-run pressures speak loudly for immediate attention. However, sequences of actions all aimed at short-run improvement can eventually burden a system with long-run depressants so severe that even heroic short-run measures no longer suffice. Many problems being faced today are the cumulative result of short-run measures taken in prior decades.