EVALUATION OF LAND USE PATTERNS

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If the development and redevelopment of urban land in the world is to be anything more than an evolutionary process of incremental growth, we must have at least a means of evaluating alternative developments. While many planners are rightly concerned about implementation, this paper will attempt to examine some of the problems involved in evaluation and suggest the broad areas of research which might be undertaken to strengthen evaluation techniques.

WHAT IS MEANT BY SHAPE OR PATTERN OF THE LAND USE PILE

The term land use has gradually given way to terms such as space use and activity structure. Human society exists in three dimensions and an industrial or post-industrial society must be concerned with space, not just land. The pattern of urban land use may be viewed in a three dimensional form. There have been a rich variety of such forms.

The shape of these patterns has most often been represented by an outline of the developed land in a region. Such shapes have given rise to terms such as stellate, linear city, strip development, and urban sprawl. There has been some recognition of the vertical dimension of cities with analyses of density patterns and three dimensional renditions of city form.

These dimensions, the height of the pile and the shape of the base of the pile are certainly useful in describing urban settlement. But when we make even the most casual appraisal of cities in the United States, we find a variety of shapes and heights. How can we say that any given shape is better than some alternative shape?

Differences in shape have often been attributed to particular aspects of technologies characterizing the period of a city's growth. Thus high-rise or dense industrial cities in the United States tend to be older and associated with mass transit, mechanical transmission of power, and assembly of raw materials at a break in water and rail transport. Low-density dispersed settlement has accompanied the development of the automobile, the ubiquitous highway, electrical power and improved communication systems.

To the extent that city shape is a response to evolving technologies, the question might become not so much one of evaluating alternative shapes, but one of anticipating changing technologies of transportation, building, power transmission, energy sources, and so on.

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COMPOSITION OF THE PILE

Another important consideration is the composition of the urban activity pile. That is, what kind of activities characterize a particular cross section or plug of the pile. How are residential activities distributed throughout the pile? How are manufacturing and service activities distributed throughout the pile and with respect to each other and residential activities? Are different mixtures found even within piles of the same general shape? Do different mixtures result in greater efficiency within the pile? That is, is the composition of activities within the pile a response to transport facilities or can the composition be manipulated independently? Are there significant factors associated with varying composition that suggest a better or best mix?

A critical factor in examining the pile is how closely we examine it. Should one deal with individuals, families, neighborhoods, or groups of neighborhoods? Our ability to make meaningful observations and measurements will hinge on the selection of the appropriate unit. Aggregations that are too coarse will mask significant patterns and relationships while units that are too fine may exhibit seemingly random behavior.

IMPACT OF SHAPE AND COMPOSITION ON SOCIETY

While we can see differences in shape and composition among cities, are these differences responsible for variations in the quality of urban life? Proponents of the dense, compact city are so certain of the superiority of this form that they would take any action which would foster a denser development. Yet the low-density "spread" city obviously has able promoters.

In the absence of rigorous definitions and measurements of the impact that shape and composition have, discussions of the best, or even a better city form, become mere exercises in rhetoric. Is it safer to live in dense cities? Do low-density cities have less air pollution? Does a green belt make people happier? Are the costs of governing a sprawling metropolis higher than the costs of a compact city with the same population?

These are the kinds of questions we must be able to answer. They suggest that we must begin our process with an examination of the goals.

GOALS FOR URBAN LIVING

We have listed ten goals from which one might expect to find some agreement among city dwellers. There are undoubtedly many more.

1. Reduce transportation, utilities, and communication costs. These would include costs of construction, operation, and maintenance.
2. Reduce pollution, including dirt, noise, air and water pollution.
3. Reduce danger.
4. Reduce hunger, lack of shelter, and poor clothing. This concern may be felt strongly in other countries.

5. Reduce the costs of government.

6. Increase personal wealth, that is, increase productivity and assume an equitable distribution.

7. Increase the opportunity for personal development, including opportunities for education, for physical development, and for recreation.

8. Increase freedom. Mobility is a kind of freedom and there are people who are relatively immobilized in some present settlement patterns.

9. Increase the energy power available to people.

10. Decrease social unrest.

More could be listed, although the majority of additions would probably be more exact specifications from the above first ten. Granting that the discussion of goals tends to be a never ending debate, we would still insist that an evaluation of land use patterns must begin with a tentative list of goals and an investigation of the goal achievement levels associated with alternative patterns of land use.

This is not easily accomplished. The relationship between land use patterns and transportation facilities, so clearly seen in a historical perspective, has yet to be harnessed productively in city planning. There have been speculations that particular modes of travel will induce particular city forms. That this is so has not really been demonstrated. Nor would a valid demonstration have real planning relevance without a parallel demonstration of relative goal achievement associated with alternate forms of development

POSSIBLE STRATEGIES FOR DEVELOPMENT OF EVALUATION TECHNIQUES.

We live in a continuing experiment. There are a variety of existing city forms all around us. One time honored approach is simply to make observations within alternative forms and compare the results. This is probably an excellent beginning point. Measures of the quality of life, however, are not easy to come by. The profile of crime in a city is not easily perceived using reported statistics and especially, existing indexes. The quality of education, medical care, and utility provision all tend to be somewhat vaguely portrayed by currently available data and indexes.

Recent years, however, have seen the development of great interest in social goals and indicators. Out of the interest and enthusiasm generated by the social scientists in this movement, we may expect to see a greatly expanded data base. With improved statistics on the quality of urban life, we may be able to design some comparative studies of urban form as it relates to urban living.

A major difficulty with such "real-life" experiments is the problem of control. With so many factors varying simultaneously, it is difficult to observe, much less measure, the operation of a single factor. Even with an understanding of the basic relationships, the complexity—the sheer bulk of numbers—places analysis and manipulation well beyond the reach of the pencil and yellow pad. The electronic computer has given us the potential to simulate urban life and conduct experiments wherein we may "pre-live" alternative environments.

Efforts to improve transportation planning have resulted in the development of several simulation models which permit the measurement of the consequences of alternative transportation decisions. Many of these models have been integrated with an evaluation process which measures the transportation costs (accident, operating, personal time, construction and maintenance, and investment costs) associated with a particular proposed plan. These methodologies do not absolutely guarantee the optimum or least cost plan. They do enable one to select the best of all the given alternatives. This is no small achievement. While there is always the possibility that there is a superior plan lurking somewhere behind the scenes, the planner has the comfort of knowing that he has chosen the best from among the available or competing candidates.

Of course, what he cannot measure with existing methodology are the non-transport consequences of the alternative transportation plans. Will the region, in fact, develop as anticipated by the planning process and thus fit the selected transportation plan? Is there an alternate form of development which would be better served by a different transportation system? While we have seen attempts to deal with these questions, no satisfactory model currently exists.

DEVELOPMENT OF THE SUPER MODEL

One approach to the problems posed by increasing the scope of the goals and the dimensions of urban life to be represented is to build a bigger model (bigger computers are on their way). A first effort to develop such a model or series of models is illustrated in the following two diagrams.

The basic components of the planning process as it has evolved is shown in Figure 1. The first step is to have an agreed upon set of goals. These goals must be measurable, singular, relevant and represent system performance standards. Alternative proposals are required as an input to the simulation model. The origin of these proposals runs the gamut from political favorites to planning staff design. Their origin is not as significant as the range of possible actions which they should represent. If the range is too limited, one runs the risk of missing a really significant improvement. Too rich an assortment drastically increases the cost of the planning process. In preparation of the transportation system plan, the testing phase involves the actual simulation of vehicular traffic under the conditions of a particular transportation plan and urban development at some specific point in time. Parenthetically, one should note that simulation requires not only ingenious mathematical and programming skills, it requires knowledge of the phenomenon being simulated. The computer gives us the ability to manipulate enormous volumes of data at incredible speed; it gives us no knowledge of human behavior. The evaluation process consists of comparing the system performance with respect to stated

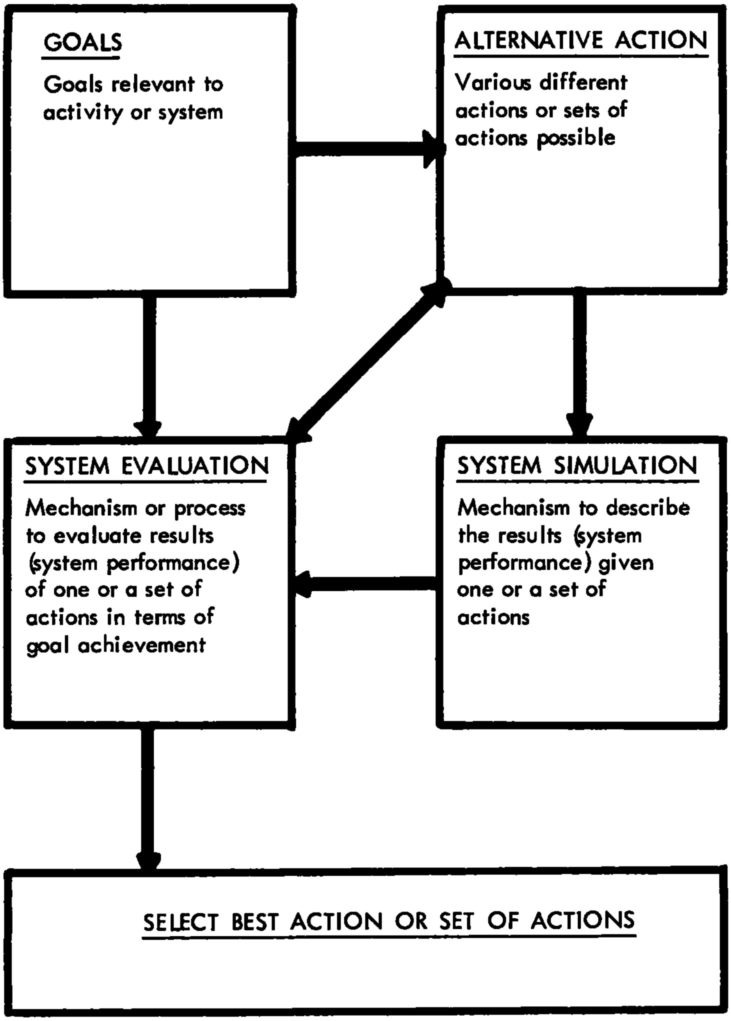

Figure 1. The single system planning process.

goals of the several proposals. The proposal with the best goal achievement is the winner. The two-directional arrow between proposals and evaluation indicates both the cut and try nature of the process and the potential learning that can take place during the process. That is, results of a given series of tests may suggest new proposals with potentially higher goal performance.

The difficulties of goal definition and measurement are manifold. Without a common metric, trade-off decisions are both difficult and subjective. One tech-

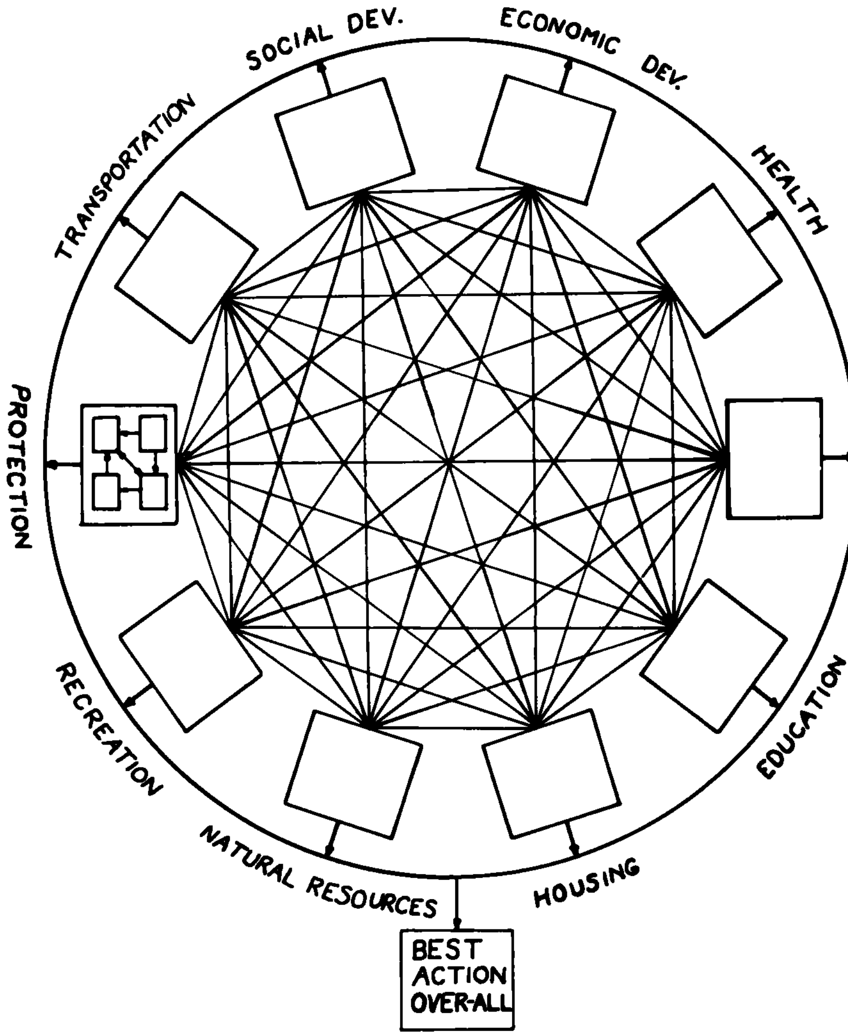

Figure 2. Planning process—multiple systems.

nique which might be used more frequently is the use of constrained simulation. That is, where the measurement of the value of a particular goal achievement is difficult or impossible to measure, we may still be able to assess the cost of achievement. For instance, a minimum level of public transportation service may be recommended as a goal to provide greater access to employment, educational, and cultural facilities. While we might not be able to evaluate at this time the benefits associated with these minimum standards of service, we could constrain our plan to meet these levels. The difference in measured goal achievement between the plan with the minimum levels of service and the plan without such service represents the cost of providing such minimum levels of service.

However, the single system approach has been deservedly criticized for its failure to consider impacts in other systems. In short, the problem of suboptimization. Figure 2 is a sketch of how the extension of the single system approach might be expanded. The basic phases of goal selection, plan proposals, simulation, and evaluation are carried on in each system. However, the lines connecting the individual systems represent the impact that a proposal in one system would have on the operation on all other systems. For example, the line connecting transportation and housing represents the impact that a proposed housing plan would have on the transportation system and, coming the other way, the impact that a proposed transportation facility would have on the housing system.

There is an arbitrariness to the selection of the 10 systems represented. We are not certain that each of them truly qualifies as a system. Moreover, we are certain that reality might be represented with fewer than 10 subsystems or with an almost infinite number.

The diagram does, however, represent a logical methodology towards which we should be moving. Unless one has simulation capability with one of these systems, one can scarcely hope to be able to simulate impact on other systems. Therefore, this direction carries two levels of concentration. The first, and the one most susceptible to attack by existing institutions, is the investigation of single systems. The second requires a far broader focus. This level may only be feasible by state and federal agencies. An investigation of the interrelationships between systems would hopefully pinpoint those systems which require joint planning and those which seem relatively independent of other systems.

At this writing, one would speculate that computer capability to perform such a task exceeds our present understanding of intersystem relationships.

EVOLUTIONARY-INCREMENTAL NATURES OF CITY FORM

In our desire to "pre-live" a rich variety of regional environments through simulation techniques, we should not ignore the way in which cities have grown and continue to grow. They are not ejected whole from a vast cosmic machine. They grow through a process of developing vacant land at the periphery and redeveloping land within the region. This process goes on during times of changing power, building and transportation technologies. Therefore, there might be greater potential savings by a complete and integrated design for a whole city than might ever be realized in the usual piecemeal approach of planning for change in existing cities. For example, if we were to design a city of 1,000,000 people in which the automobile were to be the dominant form of transportation, we would never get a city resembling those we see today in which the automobile is dominant. There would be no parking on streets. There would be no intersections at which cars would stop to wait for crossing vehicles. There would be no opposing streams of traffic. Pedestrians would not risk their lives by cutting across the traffic stream. People would not walk several blocks from their parked vehicle to get where they were going. A transportation system with this capability is easy to conceive, but impossible to build block by block as we have been building cities in the past.

Such a system must be designed into the land use system (activity structure) at the design stage and then carried forward throughout the building of the city. Unless the city or region is viewed as a complete entity, and designed and built as such, the potential savings of integrated systems will not be reachable.

CONCLUSION

Evaluating alternative land use patterns must be based on the impact that differences in city form and composition have on the goal structure of society. To attack the problem of evaluation therefore requires (a) a definition and a means of measuring land use patterns (form and composition), (b) a compilation and measurement of relevant goals, and (c) the identification and measurement of the impact of differences in land use patterns on societal goals.

The expanding interest of social scientists in the area of social goals and indicators holds promise for the development of a better data base. This in turn could stimulate comparative studies of form and composition of existing cities as related to the quality of urban life.

The rapid growth in computer technology, coupled with systems and simulation capability in single systems areas such as transportation, housing and water resources, gives some promise of a super-model, which would integrate these and several other systems into an overall model.

Finally, it should be remembered that the incremental nature of urban growth in itself may preclude the potential benefits of multi-system integration which would be possible if a city were designed and built as a whole.