

A second class of models is used to simulate the actual as opposed to the desired course of land development. These models are commonly classified as positivistic models. Such models vary in usage from pure forecasting models which attempt to predict future land use patterns without regard to modification to policy or control models which provide conditional forecasts as a function of certain policy variables which usually represent governmental activity. These control models are used to formulate governmental policies needed to bring about a desired land use pattern.

Our primary interest here today is with the second class of models which are essentially based on explicit or implicit theories of human behavior and more particularly human decision-making.

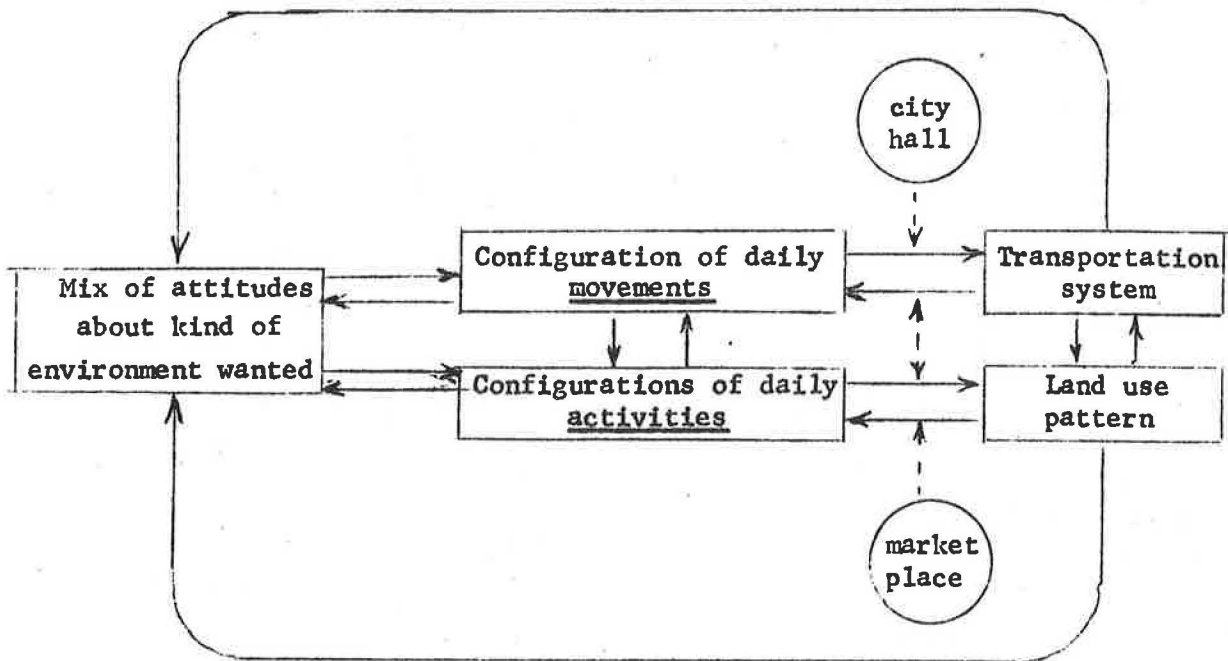
A. Household Activities And Residential Location

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This presentation aims to sketch out in rough form some of the principal conceptual elements which would need to be considered in developing a theory for the structure and growth of residential areas. It is drawn from research undertaken at the Center for Urban and Regional Studies at the University of North Carolina over the past ten years. It reflects a drift of thinking rather than any disciplined attempt at a systematic coverage of the subject matter.

A Framework for Study of Urban Processes

These conceptual elements may be juxtaposed in the form of a chart as follows:



Attitudes in the box to the left may be thought of as articulated values preconditioning the interaction in the central pair of boxes. In contrast to the right-hand pair of boxes, which represent improvements on the ground in the physical community, the central pair represent behavior patterns of the human community -- behavior patterns of households, firms, or various institutional entities.^{1/} With respect to households, which are of special concern in this presentation, "activities" have to do with the very substance of urban life, and "movements" are instrumental forms of behavior which enable members of households to engage in out-of-home activities.

Viewed as interdependent forms of behavior, activities and movements provide very fundamental insights into land use and transportation decisions as these take form on the ground. Indeed, when activities and movements are repeated with rhythmic regularity day in and day out and are similar for large numbers of households, they can be conceived as "causative" phenomena, with distinct "effects" on location decisions represented in the right-hand pair of boxes. The market place is the medium by which households accommodate their particular mix of activity preferences, and the city government (in cooperation with state and federal agencies) is the medium by which households obtain the mix of transportation and other community facilities and services they need. Individual household decisions in the housing market produce a pattern of residential land use, and the bundle of community facilities needed to serve these residential areas are produced by location decisions in city hall with the two interacting to a lesser or greater extent as shown in the diagram. And finally, it may be noted that both the central and the right-hand pairs of boxes feed back and influence attitudes to set in motion a new series of response patterns.

Household Activity Systems

Concentrating on the lower band of relationships and continuing with the emphasis on households, the activities box in the center with the relevant antecedent attitudes to the left constitute in effect a social perspective of the city, or what may be called "household activity systems." In some recent work in this research area activities have been grouped into nine general classes:^{2/}

- | | |
|--|-----------------------------|
| (1) Income-producing | (5) Religious |
| (2) Family-related | (6) Recreation & relaxation |
| (3) Intellectual-cultural
development | (7) Participation (clubs) |
| (4) Socializing | (8) Community Service |
| | (9) Subsistence |

Each category can be subclassified into a range of activities.

The objective is to construct synthetically a representation of activity patterns of households in the city. This kind of model is based on the notion of a "time budget" in which special attention is given to the allocation of time

^{1/} See Chapin, Urban Land Use Planning, Second Edition, (Urbana: University of Illinois), pp. 90-95, 221-253, and 457-459.

^{2/} See Chapin and Hightower, "Household Activity Patterns and Land Use," Journal of the American Institute of Planners, August 1965.

to various activities for varying classes of households.^{3/} The identification of household types is based on distinctive differences in life styles as defined by socio-economic status and activity mixes. Particular consideration is given to activity mixes which have a wide appeal and are participated in with some frequency. Until recently work has centered on the 24-hour day and the week-long (7-day) time budget, but seasonal variations in the daily and weekly use of time and vacation and long weekend holiday time allocations are now included in the scope of this research.

In the analysis time allocation, "modal splits," as it were, between, first, discretionary-nondiscretionary uses of time, and then, the in-home and out-of-home uses of time are investigated. So far, work has concentrated on the discretionary (classes 2 through 8 above) and the out-of-home classes of activity. Of particular interest in the latter category are out-of-home activities which follow fairly similar patterns day in and day out, forming what we have been calling "activity communities."

Time, frequency, and spatial distribution of household activities are determined through survey research. From a spatially random probability sample of households, we propose to identify household types and develop a normalized household budget covering major classes of activity for each household type.^{4/} Within the broad categories identified in these time budgets, we propose to investigate the fine grain pattern of choices from frequency data, and then for each household type falling into our sample we propose to define the locus of activity communities for regularly and frequently engaged in discretionary and out-of-home activities. Our ultimate aim is to be able to model time allocation patterns of the activities of each household type and to construct "activity traces" in space for location-specific areas where these household types reside at the beginning part of the analysis. These place-fixed locations would be related to a given residential land use pattern. Although for purposes of this particular aspect of the overall framework these locations are exogenously determined, it is evident that this is the point where residential land use models hook into the activity model.

To make such a model useful in policy formulation, it would be desirable to design the model to be a dynamic tool, enabling us to introduce change factors and study activity patterns generated under differing combinations of these factors. One source of change will obviously develop out of shifts in the stage in the life cycle of families survived to later periods of time. Another source of change will come from intra-metropolitan area moves, out-and-in migration of households, and the creation of new households. Another related source of change would be feedback from land use--the systematic obsolescence of residential areas,

^{3/} These time budgets are based on blocks of time allocated by members of the household to major classes of activity noted above. We propose to take the time allocation pattern of the head of the household as the base budget and maintain an auxiliary accounting system of time for other members of the household engaged in other activities.

^{4/} "Normalized" is used here in the sense of deriving a synthetic time budget for a week based on the mean time spent during a typical day and typical Saturdays and Sundays on major classes of activity as reported by households falling into each household type.

the renewal of outworn areas, and the development of open land. Another source of change over periods of, say, ten and twenty years comes from shifts in the national economy, technology, the length of work week, and so on.

To monitor changes of this kind and to provide a basis for modifying parameters of the activity model, it would be necessary to establish and maintain a continuous inventory system. In this connection, it seems clear that the era of ad hoc transportation and planning surveys is passing and that in conjunction with the establishment of permanent and systematic metropolitan area data banking systems the activity survey and the O - D survey can be executed as a related series of investigations. I anticipate that in time we will establish in our metropolitan areas a continuous sampling survey focusing on activities and movements of residents and related attitudes. Also, I anticipate that quinquennial comprehensive surveys which are as systematic as the population and housing census will in time become established and be a widely accepted source of information. In supplement to these continuing base-line surveys, it is not inconceivable that panels of households could be established in a metropolitan area to enable analysts for short run periods to observe fine-grain changes in activity choices. Such panels might provide leads for design of survey instruments used in the more systematic investigations involved in the first two types of surveys noted above.

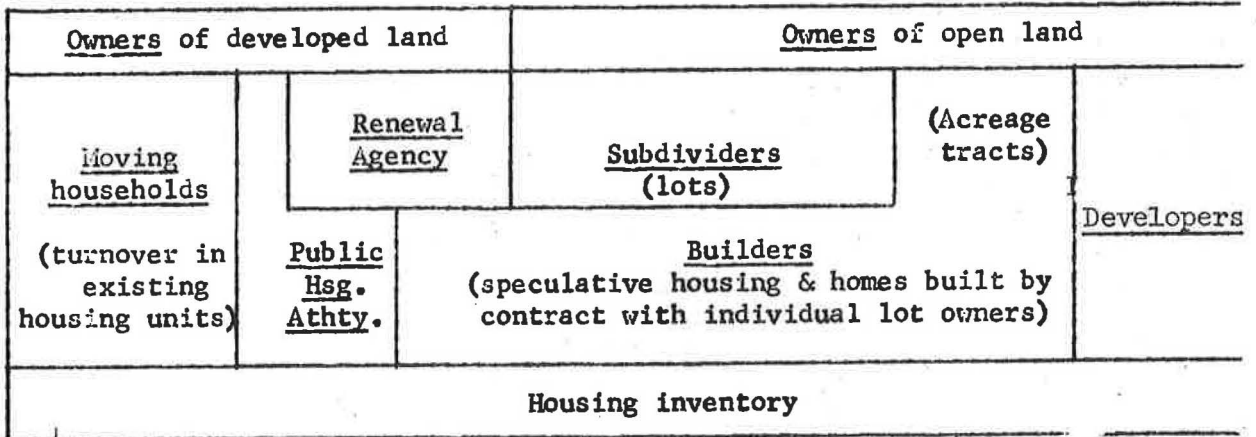
Residential Land Use Models

Shifting now to the land use box in the diagram above, this gets into an aspect of the framework where location models are introduced. Here is where our residential model would tie into the framework.^{5/} In its present form the model is an aggregative representation of the residential growth process. We are now engaged in work on a second generation set of models which sub-aggregates this process into two stages--one in which the developer acquires land, subdivides, and builds dwelling units and thus adds to the housing inventory, and the other in which the household shops for a home from the inventory thus supplied. We call the first a producer-type model, and the second a consumer-type model.

We anticipate several producer type models may eventually be required. This diagram indicates the variety of producers involved.

The diagram on the following page can be read from top to bottom. Thus, the agents which produce the housing inventory operate on both developed and undeveloped land in the metropolitan area.

^{5/} See Chapin and Weiss, Factors Influencing Land Development (August 1962); Donnelly, Chapin and Weiss, A Probabilistic Model for Residential Growth (May 1964), and Chapin and Weiss, Some Input Refinements for a Residential Model (July 1965), Institute for Research in Social Science, University of North Carolina, in cooperation with the Bureau of Public Roads, U.S. Department of Commerce.



Note the left-hand panel which is not strictly a producer type of phenomenon--although there are real estate, mortgage financing, and other agents involved here. Of course, this source of housing is a major one for a large proportion of the households in the market at any particular time. Clearly one set of moves triggers another, and in developing a set of producer models, the housing inventory produced by moving households in one interval of time is meshed with the producer-generated source of housing becoming available at the same time.

All other panels in the diagram involve a different combination of producer activities, ranging from slum clearance and renewal of developed areas to various combinations of producer activity on open or previously undeveloped land. Thus, this consortium of models should subdivide open land, select and renew outworn areas, and this source of housing supply would then be merged with the supply generated by family moves and housing turnover.

The second or consumer class of models would operate on the output of the producer class of models. We anticipate that certain subcategories of households with at least partially defined housing requirements will be identified corresponding to subclasses of the housing inventory. Obviously, provision will need to be made for a certain amount of cross-class "shopping" in these submarkets to represent the upward social mobility of families.

The consumer models would involve these major locating variables: (1) The price-rent level in relation to the household budget, (2) the activity requirements of the household, and (3) the tastes of the household with respect to the dwelling unit, its internal characteristics, and the surrounding social and physical environment at that location.

Clearly the inventory of housing as generated from the producer set of models would need to be tagged in location-specific terms with respect to all three of these variables. The first consideration, the price-rent level, would classify the inventory in the conventional manner and include density as well as price-rent options. The activity requirements would be represented in a set of accessibilities households of different types seek, with the activity model as discussed above supplying the inputs. So the housing inventory must also be structured to define accessibility opportunities for defined activity mixes in location-specific terms. The third variable is concerned with consumer livability preferences which we anticipate will eventually need to be modeled if the

full system is made operational.^{6/} Here again the housing inventory will need to be tagged with respect to living qualities offered.

While these three locating variables represent bases of the household's location decision, in recognition of the imperfect knowledge of the household and the occasional decision based on whim, we anticipate that the Monte Carlo type of model we have been using will prove to offer an advantageous approach from an operational point of view. Thus, as in the present aggregative model, the attractiveness of various locations for various classes of households would be established based on the mix of the three location factors noted above, and then households would be distributed to locations on a probabilistic basis in a manner similar to our present aggregative residential model.

In summary, then, the conceptual elements identified in the first diagram above appear to fit into a systems approach to modeling household activities and residential development processes. This is not intended to be a well-honed statement of a conceptual system for housing and residential area analysis. Rather it is a rough-hewn framework for relating elements which must be recognized in an eventual statement of theory covering this aspect of urban processes.

B. Residential Location And Household Travel Behavior

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Residential activities constitute one of the primary space consuming uses to be found in the American city, and residential transactions make up the great bulk of activity in the urban land market. However, despite this seeming importance only a small proportion of the increasing level of attention being given to problems of urban areas is devoted to the process by which a household selects and finally obtains a residential site in the city. Admittedly, a number of studies are available dealing with the institutional aspects of the urban land market but these completely fail to illuminate the basic behavioral problem that is involved. Attempts at explaining the spatial structure of metropolitan areas have been prevalent for a number of decades but the current state of the arts does not represent any significant improvement upon the situation of a decade or two ago.

Most attempts to investigate the factors influencing the spatial structure of the city have tended to deal with rather gross aggregates. Residential land, for example, appears to be frequently regarded as an entity which is relatively homogeneous or which may be regarded as showing at best only a limited amount of internal differentiation. Recent empirical studies based upon data from the U.S. census have shown that while certain homogeneities exist, especially on an areal basis, the structure of residential land use is considerably more complex than has been postulated by many workers in the past. Perhaps an even more serious handicap to progress in this area has been the selection of improper units

^{6/} For exploratory work in this direction see Wilson, Chapter 11, "Livability in the City: Attitudes and Urban Development," in Chapin and Weiss, Urban Growth Dynamics, (New York: John Wiley & Sons, Inc., 1962).