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Integrated land use and transport modelling: Decision chains and hierarchies
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Integrated Land Use and Transport Modelling: Decision Chains and Hierarchies. Tomas de la Barra. (Cambridge Urban and Architectural Studies Series, Vol. 12). Cambridge University Press, 33 East 57th Street, New York, NY 10022, U.S.A., 1989. 179 pp. + xii. ISBN 0-521-24318-1. \$49.50.

The analysis of the ways in which human activities bring about spatial patterns of land use and interactions has a tradition that goes back to early civilization. What is new about it in modern times is the scientific conceptualization and methodology by which it is carried out; it consists of concepts and techniques that in part have been borrowed from other areas of scientific endeavor and in part represent the accomplishment of original research by those who have developed the field over the last few decades.

At least from this viewpoint it makes good sense that the author starts out with a major chapter on what is usually not part of a specialized text: a review and discussion of the scientific method and what he argues to be a growing similarity between the paradigmatic foundations and methodologies of the natural and social sciences. When planning is dealt with as a formal-scientific-technical exercise, the broader anthropological framework of history, of cultural values and sentiments, of belief systems and political-educational forces usually do not command much attention nor do the peculiar roles of the modern scientist and planner within this setting. The author's treatment of this enormous topic is (necessarily) incomplete and sketchy, and (less necessarily) positivistic. The main objective of the chapter is an attempt to construct a firm conceptual base for social scientific research and planning by translating and adapting Popper's scheme of the construction of scientific knowledge from the domain of natural to that of social phenomena. Especially for the young reader who has never been confronted with the principal assumptions and foundations of the scientific enterprise in general (and its implications for him/her as a citizen in particular) this is a welcome introduction.

The second chapter of the book reviews a series of early land use models—Thuenen, Wingo, Alonso, Christaller, and Loesch—none of which is capable of modeling real-world land use patterns at a level of accuracy that would be minimally adequate for actual planning decisions. Yet, all of them demonstrate the essential prerequisite for scientific progress, that is, the great intellectual accomplishments of conceptualization and abstraction, and of structural insights and their translation into formal language, that lead to the emergence of comprehensive theories. On the down side, these models are derived from classical microeconomic theory; thus, they are primarily deductive in design and tend to be based on a set of simplifying assumptions that are unrealistic to a degree that they virtually ensure poor test performance of the model. Part of this problem is the representation of relations and processes by continuous functions which again restrict the range of these models.

The following chapter on spatial interaction models briefly reviews gravity-type approaches. It then provides a detailed coverage of the well-known model by Wilson in which the interaction between different zones is formally interpreted as an entropy-maximizing process subject to the constraints of total trip origins and trip destinations for each zone and an overall transport cost constraint. From among the various theoretical efforts to model the location of urban activities, the author presents the Lowry model; based on the distribution of basic employment, land, and accessibility this model estimates for each zone the number of residents and service jobs. However, the subject matter of this chapter is not merely a review of models on interactions as they relate to land use; rather, the author presents them as a dramatic contrast to the preceding land use models with regard to basic modeling strategies: the contrast of (i) axiomatic-deductive theory building based on the assumption of rational behavior, versus inductive model construction combining random components with relatively weak operationalized hypotheses so as to closely reproduce observed data distributions; (ii) theorizing about the individual behavior of suppliers and consumers versus the study of supply and consumption activities after they have been aggregated by type and location into clusters which generates internal variability; and (iii) modeling based on the familiar set of differentiable functions versus modeling based on discrete formulations and algorithms, that is on sets of calculating instructions that are implemented by means of a computer. This methodological comparison goes far beyond the particular interaction models reviewed and constitutes an excellent discussion of some of the fundamental considerations, difficulties and options of formal modeling; thus, it should be read as an extension of the first chapter's presentation of this important topic.

Chapter Four on random utility theory and discrete choice models is a rather uneven discussion of this subject matter. In particular it is puzzling that the author discusses at length the obvious (e.g. that the aggregated utilities of the members of a group lead to a utility distribution the variability of which is the result of a host of sources). On the other hand, the reader is expected to be able to appreciate the operational advantages of choosing the Weibull over, say, the Cauchy distribution in modeling variability and, generally, to follow some concentrated theoretical discussions that require

fairly high-powered background knowledge. Even though the numerical examples are very helpful they cannot make up for the assumptions and gaps in what is otherwise a lucid explication of a demanding subject matter.

The following chapter on spatial accounting models is much more successful in presenting major concepts from economic theory in a concise and very readable fashion. There is a description of a skeleton version of Keynes' model of a general economic system followed by an equally brief but clear and concise review of Leontief's input-output model and its multi-regional extension. The author then proposes a multi-region input-output model in which the distributions resulting from the aggregation of individual supply and demand figures into regions and sectors are modeled with the help of the random utility principle discussed earlier (thus leading again to a multinomial logit model). The model accommodates the important concepts of elasticity and substitution; its versatility as an analytical and planning device is later demonstrated by simulating the spatial distribution of activities.

The next two chapters reap the benefit of the diverse concepts and methods developed in previous chapters and focus on the particular analytical tools that are essential in the comprehension of, and the planning for, the interrelated pattern of land use and transportation flows. Chapter Six discusses the modeling of the dynamic interplay between available land and floor space, land use (activities), and land values. Incorporated in the simulation effort are many features of the real estate market: the amount of vacant land available, the demolition and replacement of existing buildings, size and age distribution of the existing stock, existing and planned zoning regulations, and changing space utilization over time. Unfortunately, the application of the simulation in actual planning projects (Chapter Eight) is not explicitly evaluated since the model is just one component within an integrated battery of sub-models that together make up the TRANUS system. Applications of this integrated land use and transportation model are presented in Chapter Eight, but only the overall simulation results are discussed.

Chapter Seven ("The Transportation System") first presents the linkage between, and then the integration of, transport analysis and land use analysis. The main connection between the two emerges as the functional relationship linking the choice of the location for an activity (in part) on the cost of the (spatial) interaction required by that activity. These costs in turn depend on a series of transport-related choices, that is, the choices of trip destinations, of transport mode(s), and of the routing through the transportation network(s). The author then critically reviews the well-known array of trip generation/distribution/modal split/assignment models, some in explicit operational detail, but others only by way of conceptual summary so that the reader who wants to apply the decision sequence to some concrete problem will have to consult the existing relevant literature quite extensively.

The last chapter presents a particular integrated land use and transport model ("TRANUS"). As any other model of such comprehensive scope it actually consists of a series of interactive models each of which performs a particular well-defined task the results of which form the input for subsequent models or feedback for those preceding it. The individual models are essentially those described and reviewed in the preceding chapters. In a clear and concise narrative, the author discusses their respective place and functions in the overall package and concludes the chapter with the description of several applications of TRANUS to specific real-world planning problems. Very likely, the distinction between models and that which is modeled has been blurred since the first time that models were created by the human mind to explain that which is or to envision that which will be. Equally likely, that fallacy was recognized from the beginning but is nevertheless ignored time and again, despite the stately record of ill-advised planning decisions informed by the output of models that could not reasonably deliver what they were asked to deliver. Of course, all of that is well known, and the author, in reviewing a large number and variety of models throughout the book, comments on their shortcomings and limitations. But not so when it comes to their actual application as reported in the last chapter. There is the repeated claim that the simulations were "very useful" which would indeed be true if predicted population growth or congestion or transport demand figures would, at least in rough approximation, come to pass as predicted. But we will never know whether the potential world of tomorrow as simulated on the basis of particular land use zoning and investment policies was adequately simulated if these policies (whether existing or intended) were abolished because of the results of the simulation. While there is as yet no better method available than to adopt or reject certain policies or plans on the basis of skillful simulations, these simulations cannot — at least in the social science arena — prove the correctness of any planning decision, notwithstanding the author's (careless, I guess) assertions to the contrary (e.g.: "The results from the assignment model proved that a major ring-road project was redundant, and [it] was consequently eliminated from the investment programme" (p. 152)).

To stay away from believing in particular simulations as an act of faith it is crucial that they be

tested on data of the past and present. However, by and large such evidence is not provided in the book. At other times, the author claims cause/effect relationships that are no more than plausible, or he says almost certainly something else than what he means (e.g.: "On the transportation side, it was proved that the bus system had capacity problems, and that the increased revenues of a larger fleet would pay for the necessary capital costs. In fact, more buses were bought, which proved that the results were correct" (p. 152)).

But, quite aside from these irritants, the main deficiency is the widespread absence of attention to the uncertainties that invariably permeate every real-world analysis and decision-making process. Researchers and planners have developed strategies that try to assess error distributions or to maximize future planning flexibility or to adjust input and structure of models on the basis of a systematic learning process over time; but they get little attention in this book. In view of the book's focus which is much more theoretical analysis than practical planning, the restricted scope might be justified; however, by the time that real-world planning decisions are actually made and implemented (as in the examples presented in the last part of the book), at least a brief coverage of the uncertainty issue would have been appropriate.

In general, the book is well organized, and its topic and subtopics are stated and treated in a clear and straightforward fashion. Broadly speaking, the book reviews and effectively integrates a fairly cohesive body of research, and it does so at a level that generally avoids any simplification or trivialization of what is a complex and complicated subject matter that brought about the emergence of a sophisticated research methodology. It is a text for researchers, for professionals, and graduate students. Part of it could also serve as an authoritative and challenging text for seniors who major in the fields of urban and regional planning or transportation planning, and who have acquired a substantial level of mathematical and subject matter knowledge during their earlier years of study.

Finally, it is important to note that the book is by no means a self-contained and self-sufficient coverage of its subject matter (even though the author claims otherwise); in this regard he is right only if he intended to address his professional and scientific colleagues and nobody else. Rather, in part it requires previous familiarity with some of the relevant literature including a fair amount of mathematics and economics, and in part it provides guidance and orientation for those who wish to become more thoroughly acquainted with that literature. Overall, this is a competent and demanding book, and an intellectually rewarding experience for anybody seriously interested in the scientific exploration of land use and transportation and their interplay.

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Urban Land-use and Transport Interaction: Policies and Models. Report of the International Study Group on Land-use/Transport Interactions. F. V. Webster, P. H. Bly, and N. J. Pauley, editors. Gower Publishing Co., Old Post Road, Brookfield, VT 05036, U.S.A., 1988. 520 pp. + xiv. ISBN 0-566-05726-3. \$78.95.

The usual view in a mixed economy is that some goods and services are produced privately and some, such as transportation, are produced publicly. Private institutions, such as households and entrepreneurs, produce and consume goods in pursuit of their parochial interests; the public sector attempts to broaden the public interest. More precisely, the public sector constructs new transportation systems, improves their capacity, and regulates services and prices; the private sector chooses locations of production, modes of transportation, and routes of shipment. At the same time, all forms of transportation influence our lives and have an impact on our environment, health, and safety. Transportation is intimately woven into the daily life of individuals and organizations in society. Because of its constant presence, transportation is easy to overlook until it fails in some way.

There are many books on transportation system models available to students of urban planning, geography, regional science, operations research, and economics. Yet, there are few books that deal with the question of the long-term impacts of transportation policies on land use, and how these land use outcomes, in turn, might affect the transportation system. There are also only a few books that deal with public-private interaction: how the public sector's decisions on transportation investment affect the private sector's reactions to locational and land use decisions.