



# Modeling Cities and Regions as Complex Systems: From Theory to Planning Applications (MIT Press)

By Roger White, Guy Engelen, Inge Uljee

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Cities and regions grow (or occasionally decline), and continuously transform themselves as they do so. This book describes the theory and practice of modeling the spatial dynamics of urban growth and transformation. As cities are complex, adaptive, self-organizing systems, the most appropriate modeling framework is one based on the theory of self-organizing systems -- an approach already used in such fields as physics and ecology. The book presents a series of models, most of them developed using cellular automata (CA), which are inherently spatial and computationally efficient. It also provides discussions of the theoretical, methodological, and philosophical issues that arise from the models. A case study illustrates the use of these models in urban and regional planning. Finally, the book presents a new, dynamic theory of urban spatial structure that emerges from the models and their applications.

The models are primarily land use models, but the more advanced ones also show the dynamics of population and economic activities, and are integrated with models in other domains such as economics, demography, and transportation. The result is a rich and realistic representation of the spatial dynamics of a variety of urban phenomena. The book is unique in its coverage of both the general issues associated with complex self-organizing systems and the specifics of designing and implementing models of such systems.

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## **Editorial Review**

### Review

This book's authors are among the most respected, experienced, and accomplished innovators in land change simulation modeling. This book is essential reading for scholars of cellular automata and of other spatially explicit landscape models concerning complex systems. The book connects theory, with methodology, with planning.

(Robert Gilmore Pontius Jr, Professor of Geography, Clark University; coauthor of *Advancing Land Change Modeling: Opportunities and Research Requirements*)

Twenty years ago White, Engelen, and Uljee established the field of cellular automata modeling of urban dynamics. Now these universally recognized leaders offer us a pathbreaking book on urban and regional modeling. Based on complexity paradigm, they develop an operational theory and demonstrate the strengths of their approach with exciting applications. Anyone who wants to obtain a conceptually refined and practically useful perspective on urban and regional planning and forecasting should read this brilliantly written book.

(Itzhak Benenson, Professor of Quantitative Geography, Tel-Aviv University)

Complexity science reveals new limits to our knowledge and predictive powers. Modeling can allow us to explore possible futures with or without various actions, policies, and interventions. Complex systems models such as those presented in this book capture the collective effects of multiple interactions, allowing possible problems to be revealed in advance and avoided, and possible opportunities grasped. Such models are invaluable.

(Peter Allen, Emeritus Professor, Cranfield School of Management)

At last a book that tells us how to build and apply cellular automata models of cities. It provides an important benchmark in our armory of tools that help us unravel the intricate nature of cities as systems. Essential reading for urbanists as well as planners and policy makers alike who are grappling with problems of urban growth and decline requiring powerful methods to inform their predictions.

(Michael Batty, University College London, author of *The New Science of Cities*)

### About the Author

Roger White is Honorary Research Professor in the Department of Geography at Memorial University of Newfoundland. Guy Engelen and Inge Uljee are Researchers at the Flemish Institute for Technological Research.

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