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Understanding Complex Urban Systems

Integrating Multidisciplinary Data in Urban Models

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Preface

Integrating Multidisciplinary Data in Urban Models is the second volume of the book series Understanding Complex Urban Systems. With the articles published in the first volume, we aimed at contributing to understanding urban complexity by means of different ways of modeling. This second volume aims to point out how the modeling of complex urban systems can be improved by overcoming data-related challenges.

One aspect of these challenges is related to data availability and data validity. Another aspect is related to producing results that are valid—despite limitations in input data quality—which involves using appropriate modeling techniques. The validity of models and of modeling results depends on data availability, quality, and quantity, as well as on comprehensiveness and temporal scales of models—i.e., the part of the system the model captures and the time that is passed between data gathering and modeling.

Thus, four notions of data and models are relevant in this book: "Quality and Availability," "Scale," "Time," and "Quantity."

Quality and Availability: Each modeling methodology defines the criteria for data sets to be used. However, in practice, the exact quality of data required may not be available; e.g., data may only be available from different sources of varying quality.

Scale: A representation of complex urban systems on more than one scale requires the integration of different types of data into models of potentially varying degrees of simplification, which are chosen according to their purposes. Both aspects of scale are discussed in the present book: scale referring to the granularity of data, and scale referring to the level of simplification of a model.

Time: Data used in urban models typically originates from one (or a few) specific time period(s). Simulation of future scenarios is then based on tendencies that are linked to these time periods. Furthermore, another aspect of the granularity of data and modeling is the frequency of dynamics of change that can be simulated. Thus, articles featured in this volume will deal with both the aspects of timeliness of data and the dynamic timescale of the model.

Quantity: Modelers are dealing with problems, such as choosing the most appropriate data from large data sets. Some contributions to this volume deal with the pros and cons of large data sets. For example, it may be argued that Big Data methods and sufficiently large data sets can be used to discover principles and relationships that could not be discovered by using smaller data sets.

Furthermore, if complex systems can be sensitive to even minor changes, then not having data available—or leaving out just a little bit of data, or having just a little offset in the data—may yield completely different results. Thus, it may not be sufficient to review and question current approaches, current data-gathering methods, and current use of data—and to get to know their limits. Rather, it may be required to develop new approaches. In this volume, we will also present some new approaches that are now up for discussion.

The present volume is targeted at both researchers and professionals in the fields of urban planning, urban policy design, and decision-making, as well as urban modelers who approach cities by using complex system concepts.

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