



The Structure and Dynamics of Cities: Urban Data Analysis and Theoretical Modeling

By Marc Barthelemy

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With over half of the world's population now living in urban areas, the ability to model and understand the structure and dynamics of cities is becoming increasingly valuable. Combining new data with tools and concepts from statistical physics and urban economics, this book presents a modern and interdisciplinary perspective on cities and urban systems. Both empirical observations and theoretical approaches are critically reviewed, with particular emphasis placed on derivations of classical models and results, along with analysis of their limits and validity. Key aspects of cities are thoroughly analyzed, including mobility patterns, the impact of multimodality, the coupling between different transportation modes, the evolution of infrastructure networks, spatial and social organisation, and interactions between cities. Drawing upon knowledge and methods from areas of mathematics, physics, economics and geography, the resulting quantitative description of cities will be of interest to all those studying and researching how to model these complex systems.

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- Rank: #2164810 in Books
- Brand: Marc Barthelemy
- Published on: 2017-01-09
- Original language: English
- Dimensions: 9.72" h x .67" w x 6.85" l, .0 pounds
- Binding: Hardcover
- 278 pages

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Editorial Review

Review

'Every so often along comes a book that attempts a grand synthesis. Marc Barthelemy has put together many ideas from statistical physics with theory in urban economics, fashioning an approach that demonstrates its essential logic and empirical relevance. A book that must be absorbed by urbanists of every persuasion and used to advance our science of cities.' Michael Batty, University College London

'Collective effects are often counterintuitive and defeat our imagination. We need specific models to anticipate financial crashes, traffic jams, mass panics. The spontaneous organization of cities falls in the same category of phenomena created by ourselves, humans, but that -- paradoxically - we struggle to understand. This wonderful book summarizes a large number of data and ideas about how cities grow and self-organize, sometimes not in the most efficient way. In his plea for a new science for cities, Marc Barthelemy musters methods from statistical physics for a problem that concerns an ever-growing fraction of humanity.' Jean-Philippe Bouchaud, Capital Fund Management, Paris

About the Author

Marc Barthelemy is a senior researcher at the Institute of Theoretical Physics in Saclay (CEA) and a member of the Center of Social Analysis and Mathematics (EHESS). He has worked on applications of statistical physics to complex networks, epidemiology, and more recently, spatial networks, and is the co-author, with Alain Barrat and Alessandro Vespignani, of *Dynamical Processes on Complex Networks* (2008). Focusing on both data analysis and modeling, he is currently working on various aspects of the emerging science of cities.

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