

# Explorations in Urban and Regional Dynamics: A case study in complexity science (Routledge Advances in Regional Economics, Science and Policy)

Joel Dearden, Alan Wilson

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The task of modelling the evolution of cities – the dynamics – is one of the major challenges of the social sciences. This book presents mathematical and computer models of urban and regional dynamics and shows how advances in computer visualisation provide new insights. Models of non-linear systems in general have three characteristics: multiple equilibria, 'path dependence' over time and phase transitions – that is, abrupt change at critical parameter values. These phenomena all exhibit themselves in reality, and it is an ongoing task to match model-based analysis with real phenomena.

There are three key features of cities and regions to be represented in models: activities at a location – residence, health, education, work and shopping; flows between locations – spatial interaction; and the structures that carry these activities – buildings, transport and communications networks. Spatial interaction and many elements of activities' location can be modelled by statistical averaging procedures, which are related to Boltzmann's methods in statistical mechanics. This is while the evolution of structure can be represented in equations that connect to the Lotka-Volterra equations in ecology.

Within this broad framework, alternative approaches can be brought to bear. This book uses entropy-maximising versions of spatial interaction models. The authors explore the dynamics in more detail, using advanced visualisation techniques. These ideas have wide potential uses, and the book illustrates this with applications in history and archaeology.



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