
Contents

Introduction	ix
Denise PUMAIN	
Chapter 1. Complexity in Geography	1
Denise PUMAIN	
1.1. A first bifurcation in the epistemology of geographic modeling	3
1.1.1. “Vertical” explanations for the “science of places, not people”	4
1.1.2. “Horizontal” explanations for the science of the spatiality of societies	5
1.1.3. The discussed status of modeling	7
1.2. Modeled regularities	10
1.2.1. Proximity and distances	11
1.2.2. The scale	15
1.2.3. Concentration and accumulation: geographical inequalities and scaling laws	19
1.2.4. Spatial change and trajectory dependence	21
1.2.5. Territorial drifts, space-time compression, and globalization	25
1.3. Conclusion	29
Chapter 2. Choosing Models to Explain the Dynamics of Cities and Territories	31
Lena SANDERS	
2.1. Introduction	31

2.2. Explaining by reasons or laws: choosing an epistemological framework	32
2.3. The modeling approach: diversity of models	36
2.4. Explaining through statistical relationships or mechanisms	38
2.5. Choosing the level of abstraction for the phenomenon to be explained: general versus particular.	41
2.6. Choosing the level of abstraction for the model: stylized or realistic, <i>KISS</i> or <i>KIDS</i>	44
2.6.1. Modes of representation of space: from a stylized space to a realistic space	45
2.6.2. Formalizing spatial mechanisms: from stylized to realistic.	48
2.7. Conclusion	50
Chapter 3. Effects of Distance and Scale Dependence in Geographical Models of Cities and Territories	53
Cécile TANNIER	
3.1. Three fundamental principles for modeling cities and territories.	55
3.1.1. Effects of distance	57
3.1.2. Effects of scale dependence	58
3.2. Role of distance in spatial simulation models.	61
3.3. Modeling scale dependence	76
3.3.1. Scale dependence as a result of processes acting at different scales	77
3.3.2. Scale invariance for the description of geographical phenomena	83
3.3.3. Scale dependence as a generative mechanism for simulated spatial configurations.	88
3.4. Conclusion	93
Chapter 4. Incremental Territorial Modeling	95
Clémentine COTTINEAU, Paul CHAPRON, Marion LE TEXIER and Sébastien REY-COYREHOURCQ	
4.1. The map and the territory	96
4.1.1. Modeling as one map: selection and schematization	96
4.1.2. The representation of territory as an input of the model.	100
4.1.3. The representation of territory as an output of the model	102
4.2. Generality and specificity: explaining by ways of geographical models	106
4.2.1. Historical contingency and non-ergodicity	106

4.2.2. General/specific/singular	109
4.3. Incremental territorial modeling	110
4.3.1. Identifying the object, scale, configuration, and stylized facts	111
4.3.2. Gathering the different theoretical explanations.	112
4.3.3. Hierarchizing the interaction processes between agents.	113
4.3.4. Hierarchizing the interaction processes between agents and their environment	114
4.3.5. Implementing mechanisms and their formal alternatives	115
4.3.6. Combining, simulating, and comparing.	116
4.4. Challenges and limits of multi-modeling	117
4.4.1. The combinatorial curse.	118
4.4.2. Human and technical costs	118
4.4.3. Subjectivity in the choice of building blocks.	119
4.4.4. Comparing models of different structures	119
4.4.5. Sharing and accumulation of knowledge	121
4.5. Conclusion	121
Chapter 5. Methods for Exploring Simulation Models	125
Juste RAIMBAULT and Denise PUMAIN	
5.1. Social sciences and experimentation	126
5.2. Geographical data and computer skills	127
5.3. New generation simulations.	130
5.3.1. A virtual laboratory: the OpenMOLE platform	131
5.3.2. The SimpopLocal experiment: simulation of an emergence in geography	134
5.3.3. Implementation of SimpopLocal, from NetLogo to OpenMOLE	137
5.3.4. Calibration and validation	139
5.4. Other examples of OpenMOLE applications: network–territory interaction models.	143
5.5. Perspectives.	147
5.5.1. Methods.	147
5.5.2. Tools.	148
5.6. Conclusion	149
Chapter 6. Model Visualization	151
Robin CURA	
6.1. Introduction	151
6.2. Visualization as modeling	153
6.2.1. Visualization as a tool for interdisciplinarity.	155
6.2.2. Visualization and reproducibility	160

6.2.3. Visualizing a model means learning	162
6.3. Visualize to evaluate	163
6.3.1. Visualize before modeling	164
6.3.2. Visualize during the simulation	166
6.3.3. Visualizing after the simulation	169
6.4. Visualizing to compare.	172
6.4.1. Which models should be compared?	172
6.4.2. How should visual comparison be done?	174
6.5. Visualizing to communicate	178
6.5.1. Visualizing to disseminate	179
6.6. Some obstacles inherent in model visualization	182
6.6.1. Producing and visualizing massive data.	183
6.6.2. Visualization of aggregated data	187
6.7. Conclusion	191
References	193
List of Authors	221
Index	223