Preface

The last four decades have witnessed the emergence of two interrelated domains of research: the first – *complexity science*, is a collection of theories that deal with open and complex systems that exhibit phenomena such as self-organization, chaos, or nonlinearity. The second domain, that emerged some 10 years later, applies the various theories of complexity to the study of cities; in this book I want to refer to it as *CTC – complexity theories of cities*.

This is my second book on CTC. The first – *Self-Organization and the city (SOCity)* – published some 10 years ago, had two main aims: one, to link complexity theories with cities by means of the conceptual and methodological tools of complexity theories; two, to link CTC with urban theory as developed throughout the 20th century. The present book still follows the above aims but adds a third one: to create a triple link between complexity, the city, and *cognition* as developed in cognitive science – hence the title of the book *Complexity, Cognition and the City*.

Complexity theories have developed in the "hard" sciences in order to deal with a special kind of systems that are open and complex in which local interactions between the parts give rise to an emerging global structure. In the classical prototypical complex systems the local entities have usually been molecules, atoms, and the like, that is, entities that by their nature are simple. Complexity has thus been seen as the property of the global emerging system alone but not of its elementary parts. This conception has characterized also the various applications of complexity theories to systems studied in the life sciences, sociology, and also to the study of cities. In the latter case while it was recognized that each of the social or urban "parts" is a complex system, too, it was further assumed that this property could methodologically be ignored. The notion of *agents* as currently used in urban simulation models is a good example: it is a kind of automaton that mimics the behavior of urban agents in a predetermined way.

The central thesis of this book is that this is not sufficient: that we have to treat each urban agent as a complex self-organizing system too. The implication is that in the city (as in society at large) we deal with *dual complex systems* in which the city and each of its parts (the urban agents) is a complex system. The science that deals with the complexity of agents in general and of the human agents in particular is

cognitive science. The central thesis of this book thus further suggests that in order to appreciate the complexity of the human-urban agents one has to consult the science that explicitly deals with this issue, namely, with human spatial behavior as revealed by cognitive science.

Of all complexity theories, Haken's theory of *synergetics* is the one that best fits to the above aim of treating the city as a dual, complex, cognitive system. This is due, firstly, to the fact that synergetics was intensively applied to the domains of cognition and brain functioning, secondly, to its notions of *order parameter*, *enslavement*, and *circular causality*. Thus, similarly to my previous book, this one too is strongly and directly inspired by synergetics; however, not only by the elegance and beauty of the theory, but also, probably mainly, by the personality of its founder Hermann Haken – a great scientist, a marvelous person, a friend, and a colleague. Hermann Haken's encouragement and support, the many conversations we had during our many years of fruitful collaboration, and his detailed comments on an early draft of the present text, were seminal in the production of this book.

Several chapters in the book were written in collaboration with colleagues: Chapters 8 and 9 on information theory as well as Chap. 19 on decision making were written with Hermann Haken; Chap. 20, that further elaborates on decision making, was written by Andreas Daffertshofer, Herman Haken, and myself; while Chap. 13 that links complexity, cognition and planning, was written in collaboration with Roni Sela. And while I bear full responsibility for any mistakes that might be found in the text, I would like to emphasize that without these collaborations the project of writing this book would not be complete.

As implied by the above discussion, this book can be seen as a continuation to SOCity that was published some ten years ago and indeed, few of its chapters are extended or revised versions of chapters in the previous book: Chapters 2–4 and 10 extend and revise Chaps. 2, 3 and 1 in SOCity; Chap. 17 is a reinterpretation of my collaborative Chaps. 7 and 8 in SOCity, with Izhak Benenson and Itzhak Omer. Finally, Chap. 19 is a nonmathematical version of my collaborative Chap. 14 in SOCity with Hermann Haken. The book has further benefited from several of my studies in the last decade. Some prominent cases are Chap. 7 that closely follows my paper from 2002 on "The Seven Basic Propositions of SIRN (Synergetic Inter-Representation Networks)", in *Nonlinear Phenomena in Complex Systems* 5(4): 428–444. Chapters 8 and 9 are based on Haken and Portugali's (2003) paper "The face of the city is its information" (2003) in *Journal of Environmental Psychology* 23: 385–408, and, on our (Haken and Portugali) not-yet published paper "Information adaptation". Part III on planning has greatly benefited from my collaborative work with Nurit Alfasi; in particular Sect. 13.5.2 of Chap. 13 makes use of our collaborative paper "An approach to planning discourse analysis": Portugali and Alfasi (2008) *Urban Studies* 45(2): 251–272; while Chap. 16 is based on our collaborative Chap. 11 in SOCity and on our (Alfasi and Portugali) paper "Planning rules for a self-planned city" (2007) *Planning Theory* 6(2): 164–182. Finally, Chap. 18 is based on my paper "Toward a cognitive approach to urban dynamics" (2004) *Environment and Planning B: Planning and Design* 31: 589–613, and Chap. 20 is a nonmathematical version of Daffertshofer, Haken, Portugali (2001)

Self-Organized settlements. *Planning and Design: Environment and Planning B* 28(1): 89–102.

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