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Book Review

Self-Organization and the City. By Juval Portugali. With 120 figures and a Foreword by Hermann Haken; includes chapters in collaboration with I. Benenson, I. Omer and N. Alfasi; two special chapters on 'Synergetic Cities' with Hermann Haken. Springer-Verlag, New York, 2000, 352 pages. ISBN: 354-065 4836.

Traditional urban studies have been split into two, disconnected, parallel currents: one quantitative and positivist, termed regional science, and the other qualitative-hermeneutic, called social theory of the city. It is held that through applying self-organization theories to issues related to spatial urban evolution, the two split urban currents can be united. The book makes an initial step toward this direction, illustrating how the notion of self-organization can provide a common language and a conceptual and methodological framework for the study of cities and urbanism. The book also attempts to find a common language allowing discourse, cooperation and exchange of ideas between disciplines such as geography, architecture, town planning, engineering, economics, sociology, psychology, anthropology, and archaeology.

In addition to the introduction and conclusion, the book consists of five parts: on cities and urbanism, city games, self-organizing, planning, synergetic cities, self-organization, and urban revolutions. In the introduction, the author illustrates the background and the purpose of the book project. The motivation for writing the book stemmed from the rise of the self-organization paradigm in domains such as physics, chemistry, biology, and mathematics and the split within human geography into regional sciences and social theory of the city. The book attempts to explore the possibility of integration between the notion of self-organization and sociocultural theories of cities and urbanism.

Part I, On Cities and Urbanism, examines cities from varied perspectives. The Aristotelian view, for instance, sees cities as geometrical shapes that regardless of their variable quantitative sizes and properties, still share some structural-topological properties which constitute the necessary and

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sufficient conditions for their definition; Wittgenstein's view experiences cities in terms of networks stretching in time and space. Cities may also be perceived like a language. The author also introduces concepts such as prototypicality of core cities, the ideal-type of Max Weber, and Inter-Representation Networks (IRNs) to describe varied perceptions about cities and their evolution. An interesting classification is the ecocity which studies the city in terms of location theory with its economic principles supported and supplemented by the ecological theory with evolutionary principles. The well-known urban theories by, for instance, von Thünen, Alonso, Burgess, Christaller, Lösch, and Hoyt belong to the ecocity framework. The author also discusses Newton's cities (typically, Wilson's gravity models), metropolis, urban planning, the city of justice, the humanistic city, the Marxist city, de-visualized cities, postmodern city, and the hypermodern self-organizing city. It is argued that cities can be treated as self-organizing systems and thus urban evolution can be examined with self-organization as a conceptual-theoretical framework. A concise introduction to theories of self-organization by Haken, Prigogine, and others is made with a comprehensive review of the literature. Applying self-organization theory, the author defines cities with dissipative structures, synergetic cities, chaotic cities, fractal cities, cellular automata cities, sandpile cities, FACS (free agents on a cellular space) cities, and IRN cities.

Part II, City Games, also covers multiple topics of spatial evolution with multiple perspectives. The author proposes a modeling approach, which incorporates in its structure properties of both self-organization and social theory. The approach builds a family of models, called City, City-1, . . . , City-6 and applies these models to varied urban issues, such as processes of sociocultural segregation, relations between international migration and internal structure of cities, and sociocultural morphogenesis. The City is considered as an open complex system which exchanges with its environment not only matter and energy but also human population. The City is generally described by: $S^H(t+1) = F_t(S^H(t), S^{U(H)}(t), S^A(t), E(t))$, where $S^H(t)$ is the current state of city H, $U(H)$ is a neighborhood of city H, $S^A(t)$ represents the dependence of the transformation rule on the City as a whole, $E(t)$ is the external environment, and F is the transformation rule. The City is used to examine phenomena of residential sociospatial segregation in a city and the existence and the role of local regions of instability within an otherwise stable urban system. As shown in Chapter 5, the City is a typical system in self-organization. It is open because it is part of its environment through a flow of immigrants from the environment inward into the City and from it outward to the environment. The City's global properties are not the sum of its parts and it exhibits phenomena of nonlinearity.

City-1 is a direct extension of the City. It is a two-layer model: a population model of human agents describing the migration and interaction activities of individuals, superimposed on a cellular automat (CA) infrastructure describing various domains of the urban landscape. City-1 is applied to examine the impact of international migration on intra-urban migration, the urban space economy, and sociospatial segregation. City-2 is structurally similar to City-1. It differs from City-1 in that it includes the circumstances where spatial cognitive dissonance in the city may arise and lead to changes in individuals' intentions, cultural affiliation, and identity. In both the City and City-1 the sociocultural properties of individuals and their sociospatial intentions/wants were determined externally, while in City-2, these properties are determined internally. City-3 is a refinement of City-2. In City-2, individuals' decisions are made in relation to local information; but in City-3, individuals' decisions are made in relation to both local and global information. City-4 defines the individual agent by means of a cultural code (c-code) or memetic code (m-code). A personal identity is multi-dimensional. Formally, in City-4, one needs multiple dimensions to describe the dynamics of an agent's cultural identity. The form of City-4 expands that of City-2 and City-3. City-5 moves from CA-city to GIS-city, that is, from an infrastructure based on an abstract cell space to one based on the real structure of the city as encoded by means of GIS (geographical information systems). The author represents a city's infrastructure by a GIS-based vector map consisting of a number of layers of streets, houses, open spaces, etc. and puts on top the layer of free agents as defined in the five City models developed before. City-6 is related to City-4. However, in City-4, there is no a-priori dependencies between any two components of cultural identity, but in City-6, each individual has a hierarchical identity. An agent might thus have more than one cultural identity. The purpose of this model is to specially study the effects of groups' internal complexity on the dynamics of residential distribution in the city space. Applying these general models to varied spatial issues from Chapter 5 to Chapter 10, the author examines various nonlinear phenomena, emergence of slaving variables, coexistence of order variables, stability versus instability, predictability versus unpredictability, bifurcation, chaos, sudden emergence and extinction of the sociocultural groups, structural change, in spatial evolution.

Part III, Self-Organizing Planning, examines complexity of planning in the light of self-organization. The purpose of this part is to show how to take the whole of the self-organizing city as a metaphor for the development of a new planning theory and methodology. The new approach promises to have the potential to make urban, regional and environmental

planning more innovative and productive. The author first shows limitations of the traditional planning visions and then proposes a self-organization approach to spatial planning. This new approach begins with a distinction between two forms of planning: just-in-case planning versus just-in-time planning. The concept of just-in-time planning is a "copy" of the concept of just-in-time management. The former refers to the traditional mode of planning and the latter to what in a self-organizing system might be. Based on this discussion, the author develops preliminary principles for a self-organizing planning system and elaborates them in light of the current literature on the issues. The preliminary principles include the parallel distributed planning (which is influenced by the concept of parallel distributed processing which is the name for the neo-connectionist approach to the study of brain functioning and cognition) in a self-organizing city, decision making agents as self-organizing systems, self-organization in private and collective planning, planning synergetic cities, plans as patterns of routinized activities, enslavement to and emergence of a city's order-parameter plans, and distinction between fast local plans and slow global plans.

Part IV, Synergetic Cities, applies Haken's theory of self-organization, synergetics, to deal with phenomena of complex spatial systems. There are four approaches in synergetics: the microscopic, the macroscopic, the phenomenological, and the conceptual or hermeneutic. The microscopic approach is a bottom-up approach, starting with an interaction between the individual parts of the system which then enslaves the system. The macroscopic approach is a top–down approach typical of cases where a description of some macroscopic properties of the system can be performed, whereas information on the individual parts of the system is not sufficient or doesn't exist. The phenomenological approach begins with the finding that close to instability points the behavior of the system is governed by a few order parameters, the equations of which can often be written directly. The hermeneutic approach is a useful framework for the interpretation of soft, nonquantifiable phenomena such as language, nationalism, or planning. As far as urban and regional systems are concerned, two lines of research have been developed. The first approach is the so-called master-equation approach in sociology, economics, and urban dynamics. The formation of a master equation with properly chosen transition probabilities determines the temporary evolution of the probability distribution of socio-economic configuration. The second approach, the pattern recognition approach, starts from state variables for which evolution equations are formulated with chance events as stochastic forces. Part IV mainly applies the self-organization of cities from the perspective of Haken's synergetic approach to pattern formation and pattern recognition. This part is too abstract and too general. It is difficult to see how the general ideas from synergetics

can be applied to urban and regional issues in a meaningful way. Part V, Self-Organization and Urban Revolutions, examines urban evolutions over history in the light of self-organization.

The book attempts to integrate the theories of complex self-organizing systems with the rich body of discourse and literature in social theory of cities and urbanism. It is intended for students of self-organization as well as students of cities and urbanism. It is designed to stimulate thinking about spatial evolution and complexity of self-organization. The book is an insightful and interesting but not an easy book. The reader needs knowledge of multiple fields, such as mathematics, philosophy, self-organization, chaos, fractal, sociology, urban planning, and geography, not to mention urban economics, regional science, and economic geography to fully comprehend the meanings of the book. Its arrangements appear to be chaotic but are actually well structured. Although it might not have succeeded in constructing a comprehensive theory in a high sense, the book provides a comprehensive literature on and deep insights into many important issues related to spatial evolution. Conclusively, this book is highly recommended for those who are interested in self-organization as well as evolution of cities and regions. It is highly recommended.

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