

## Chapter 1

# Editors' Introduction

MARTINA KOLL-SCHRETZENMAYR, MARCO KEINER, AND GUSTAV NUSSBAUMER

Man has been impelled to scientific inquiry by wonder and by need. Of these, wonder has been incomparably more fertile. – F.A. Hayek

### 1.1 A Universe of Higher Reality

In his famous philosophical doctrine, the so-called 'Theory of Forms,' Plato distinguished between an invisible Universe of Higher Reality that constituted the unchanging and determinate 'forms' of all things and a Visible World of change and flux that is only a copy or reflection of the Universe of Higher Reality. According to Plato's Theory of Forms, true and certain knowledge can only be obtained from the Universe of Higher Reality, whereas the Visible World of experience, i.e., the real world we live in, cannot produce true or certain knowledge. Plato's "idea of explaining the visible world by a postulated invisible world" invented "a new approach towards the world and towards knowledge of the world" (Popper 1963:89) by explaining visible matter with theories about invisible structures. However, theories can describe even 'deeper layers of reality' that are not 'real matter' but are of a hypothetical character, for example, forces, fields of forces, or, in a more general sense, interaction.

"Discoveries are guided by theory [...] rather than that theories are the result of discoveries due to observation," (Popper 1963:118) and theories demand that something is observable under certain conditions. Popper points to this important statement concerning the tasks of theories and observations repeatedly in his book *Conjectures and Refutations*, for example:

Scientific theories are not just the result of observation. They are, in the main, the products of myth-making and of tests. Tests proceed partly by way of observation, and observation is thus very important; but its function is not that of producing theories. It plays its role in rejecting, eliminating, and criticizing theories; and it challenges us to produce new myths, new theories which may stand up to the observational tests. (Popper 1963:128)

Theories are only approximations of truth (or reality) and usually describe only one or just a few aspects of reality. One can speak of better agreement with reality or of more explanatory power when one theory (compared to others) explains more observable facts or explains them with higher precision or has a higher degree of universality. But even contradictory theories may have the power of explaining observable phenomena, for example, when considering the

wave-particle duality of light and matter. Krugman (1999:6) even speaks of 'modeling tricks', i.e., "assumptions that reflect not so much a realistic view of how the world works as a judgment about what will make the analysis of geographic issues manageable without doing too much damage to the relevance of that analysis."

The growth of scientific knowledge is related to the repeated defeat of theories and their replacement by more suitable ones. The development from the Copernican view of the world through Newton's theory of gravity, down to Einstein's theory of relativity in the 20th century was marked by competition, debate, denunciations, cross-fertilizations and proof, proof, proof. More recently, modern atomic physics, which explores what matter is made of and what forces hold it together, had to readjust its theories of matter several times. First when Nils Bohr's popular electron orbit model proved to be a very rough geometric approximation and then when the dynamic theory of the quantum world founded on Heisenberg's and Schrödinger's quantum mechanics had to be taken into account. With the atomic model and its related theories, our thoughts on matter changed and thus of reality as well, because theories are "self-made instruments of thought." (Popper 1963:117)

The discoveries of thousands of physicists resulted in the Standard Model of Particles and Forces that is now a well-tested theory of the fundamental structure of matter. Though this model explains and exactly predicts a large variety of phenomena and creates a very close picture of matter, physicists are still doing research on the 'new physics beyond the Standard Model.'

## 1.2 Earth: The Big Atom

Physical laws of matter never change. Though we still do not comprehensively understand matter or the atom, the object of atomic physics' research and the rules that govern its behavior will remain the same for all eternity. More precisely, according to the Standard Model of Particles and Forces, scientists believe that everything in the universe is made up of a set of 'building blocks' of twelve matter particles that are governed by only three fundamental forces, which are communicated by four force-carrier particles. That is the good fortune of physics!

In contrast, spatial planning and related socio-economic sciences that explore life on the 'Big Atom,' i.e., the globe we live on with its man-made environment ruled by complex socio-cultural, economical, and political effects, are confronted with the ability of mankind to adapt its behavior and to invent new technologies, and thus change the rules that manifest themselves in space. Even more complicating is the fact that there is only one Earth and we cannot perform reproducible experiments in a socio-spatial environment. We cannot send our one 'Big Atom' into an accelerator, thereby making the building blocks and governing forces of life visible in order to understand the creation, formation, and dynamics of the man-made environment, never mind the economy, society,

politics, and all the other socio-spatial phenomena on Earth. Therefore, the world we live in continues to avoid any clear analytical glimpses and proves its lack of predictable behavior. Pity the poor spatial planners!

However, the world is a treasure trove of information and diversity. Initial conditions and historical preconditions, the operation of chance and accidental circumstances, competition and selection, and changes in behavior through adaptation has caused a vast spectrum of natural, cultural, and socio-economic diversity. For instance, according to the United Nations Center for Human Settlements (Habitat), today the planet hosts 19 cities with 10 million or more people, 22 cities with 5 to 10 million people, 370 cities with 1 to 5 million people, and 433 cities with 0.5 to 1 million people. In sum, 844 cities with more than half a million inhabitants exist and there are countless small cities, towns, and villages. And no two of them are alike or even similar, and they are each an individual urban phenomenon.

The variety of spatial phenomena, and with it socio-cultural, socio-economic, and historic-political phenomena, is impressive. The theoretical and practical impact related to the diversity of the real world on spatial planning is twofold. First, the existence of diversity enables the discovery of trends, and the observation of trends can be of general value because trends require explanation. However, while the laws of nature are universal, in socio-spatial reality, a trend only indicates the statistical significance based on individual incidents. This is a crucial point when it comes to theoretical approaches in the socio-spatial sciences.

Second, when it comes to intervention and politics, we cannot speak of 'the city', 'the region' or 'the economy' and we have to keep in mind that no unique, i.e., universal solution to socio-spatial challenges like 'urban poor' or 'traffic congestion' exists. Moreover, we cannot compare the outcome of alternative interventions or politics as time goes on and development proceeds, and we never can return to the starting position, change experimental variables, and fire the pistol once more – in order to find the policy that works 'best.'

### 1.3 Theories of Spatial Planning

The search for theory is governed by the search for order – and so is planning. Traditional spatial planning was also born out of the desire for order (Hillier 1995) and predictability. It seemed to demand absolute knowledge and a set of more or less simple but universal rules. Throughout the 20th century, spatial planning has been dazzled by the glamour of pure sciences like thermodynamics or atomic physics and consequently wanted to participate in the fascinating method of capturing the world through hard scientific knowledge and Plato's Universe of Higher Reality. Thus, as Sandercock (1998:59) points out, the application of scientific approaches from natural sciences to social sciences, and with it spatial planning, has a long tradition:

With the scientific revolution of the seventeenth century ushering in what has come to be called the Age of Reason, the scientific method of empiricism became the dominant way of knowing. Observation, hypothesis, experiments; the search for mathematically based laws of nature; and a sharp distinction between reason and emotion, these became the defining characteristics of the empirical method which has dominated Western approaches to truth/knowledge since the Enlightenment, and out of which developed the social sciences of the nineteenth century, earnestly trying to replicate the methods of the paradigmatic physical sciences.

For example, ‘social physics’ tried to describe the behavior of society by comparing it to gases and using concepts like pressure and densities, or describing spatial interaction in analogy to Newton’s theory of universal gravity (see Bertulia et al. 1998). However, we cannot predict the future of socio-spatial units such as neighborhoods, cities, or regions because they are not isolated, stationary, and recurrent systems but are constantly changing and continually undergoing rapid, non-repetitive developments that are caused by and emerging from the interaction of adaptive agents. Thus, we have to be constantly aware of uncertainty and of the individual path of development. As Popper (1963:340) points out, “The fact that we predict eclipses does not, therefore, provide a valid reason for expecting that we can predict revolutions.”

The critiques of ‘social empiricism’, or the social sciences that imitate the methods of the physical sciences, is widespread and shakes the pillars of modernist planning, which is a child of the Age of Reason. Moreover, the overall problem with planning theory is that the common positivist meaning of theory, which is derived from the natural sciences, does not fit the socio-spatial object of planning. Allmendinger (2002a:1 – emphasis in original) points out that, in general, “theory is normally required to include some elements of prediction or prescription so as to guide action [...] Accordingly, theory could be seen as having a number of elements; *it abstracts from reality a set of general or specific principles to be used as a basis for explaining and acting with the theory being tested and refined if necessary.*” Yet it turned out that positivist techniques and methods did not include the ability to predict socio-spatial behavior. Therefore, modernist optimism about rational planning waned and with it comprehensive planning and the planners’ belief in universal computer modeling in planning science and practice (Allmendinger 2002b).

Planning practitioner and philosopher Bent Flyvbjerg (2001:3) asserts that “social science has set itself an impossible task when it attempts to emulate natural science and produce explanatory and predictive, that is, epistemic theory.” Hence, “the goal is to help restore social science to its classical position as a practical, intellectual activity aimed at clarifying the problems, risks, and possibilities we face as humans and societies, and at contributing to social and political praxis.” (Flyvbjerg 2001:4) Moreover, Bent Flyvbjerg (2001) argues that the Aristotelian concept of *phronesis*, which goes beyond *episteme* (analytical, scientific knowledge) and *techne* (technical knowledge or know-how) by in-

volving judgment, values, and interests, is the core of social science and, thus, of spatial planning.

Moreover, Richard W. Miller (1987:139) developed alternatives to the positivist's accounts of explanation by setting up a causal model of explanation and interpreting a theory as "a description of underlying causal factors which, in actual circumstances, are sufficient to bring about more directly observable phenomena of the kind studied by the field in question. [...] Thus, one might say that a theory is a description of a repertoire of causal mechanisms, a theoretical explanation, an explanation appealing to instances of such a repertoire." This definition of theory has been adapted by planning (see Hopkins 2001) because it is not grounded in universal prediction but deals instead with a set of relevant causal mechanisms in a specific field, as well as an agreement on criteria for the quality of explanatory power. Moreover, it is useful and reliable for explaining specific real situations. Therefore, Miller's causal theory of explanation provides spatial planners with a framework to deal with the diversity of spatial phenomena and the multifold nature of causalities in socio-spatial reality.

However, there is still nothing like a unified theory of spatial planning or even a theory of spatial planning at all. Moreover, though some scholars state that spatial planning is a science in that it expands our knowledge about how the world works and how we can deal with it (Hopkins 2001), others question whether there can be any science to spatial planning at all. The first issue concerns the dual nature of the subject of spatial planning, i.e., an environment that is both natural and social. Whereas some planning-related disciplines, like geology, hydrology or civil engineering, are applied natural sciences, others, like sociology and psychology, are social sciences. Second, spatial planning is considered an applied discipline because it "is that professional practice that specifically seeks to connect forms of knowledge with forms of action in the public domain" (Friedmann 1993: 482) and is concerned with "alternative futures" (Holston 1999). The third issue concerns the integrative nature of spatial planning, i.e., "planning's occupation of multiple worlds" (Beauregard 2001:437), that makes 'planning theory' seem like a 'scientific parasite' because it is based on a series of scientific pontoons and only survives by sucking fresh blood from other sciences. So, as has happened to other sciences in similar ways, planning science was strongly influenced by a series of major scientific paradigms during the course of the 20th century. In this tradition, planning theorists and practitioners adapted general problem-solving approaches from other, mainly natural and engineering disciplines, and applied them to planning.

In the second half of the 20th century, one of the most influential and inspiring scientific approaches to planning was systems theory. In the 1960s and 1970s, systems planning theorists such as McLoughlin (1973) hoped to provide effective methods for the study and control of social/urban systems by means of cybernetic models and systems theory. The work of McLoughlin influenced planning researchers in many countries. The success of systems theory in the realm of spatial planning is closely related to the rational approach in planning

after the Second World War that is best described by modernist planners Harvey S. Perloff (1957) and L. Brian McLoughlin (1969), who sketched the rational ideal of planning:

Planning involves the careful elaboration and integration of a series of projected actions to attain the desired goals. Planning thus centres on the making of decisions and scheduled effectuations of policies. It takes form in a number of closely integrated steps, from the analysis of problems, the setting of broad objectives and the survey of available resources, to the establishment of specific operating targets; and through various succeeding stages until the result can be checked against the targets established and needed adjustments proposed. (Perloff (1957) – cit. in Sandercock 1998:62)

Planning seeks to regulate or control the activity of individuals and groups in such a way as to minimise the bad effects which may arise, and to promote better 'performance' of the physical environment in accordance with a set of broad aims and more specific objectives in the plan. (McLoughlin (1969) – cit. in Allmendinger 2002a:169).

In the 1980s, when planners realized that things were more difficult than they had thought at first glance and they lost interest in planning objectives and comprehensive plans that proposed an alternative future, one of the most appealing paradigms was chaos theory. In parallel, an interest in fractal geometry arose (see Batty and Longley 1994), which offered the opportunity to explain complex spatial patterns by means of the simple rules of fractal growth. But neither paradigm ever gained the power that systems theory had had for planning, which had even developed a systems planning branch (Allmendinger 2002).

During the 1990s, a new scientific paradigm entered the scientific limelight, i.e., complexity theory, which tries to deal with non-linear complex systems by linking the emergence of certain behaviors or phenomena to the non-linear interaction of individual agents or single entities (e.g., atoms, genes, individuals) based on a finite set of rules. The concept of complex adaptive systems appealed to a broad range of natural sciences, social sciences, and the humanities. Though Allmendinger (2002) mentions complexity theory as a new concept influencing planning science, he does not seem to comprehend its full importance for the planning realm and the extent to which complexity theory has already been applied in the planning disciplines. The power of the paradigm of complex adaptive systems in planning theory is to enhance our understanding of complex socio-spatial reality. In our opinion, the multidisciplinary framework of a theory of non-linear complex systems offers a philosophy of science that is beyond Popper's 'historicism' as it has become an integrative approach for gaining insight into the natural sciences as well as being useful as a concept, paradigm and metaphor in social, economical, ecological, and political issues. In addition, the approach of non-linear complex systems has altered models and thus the thinking about perceivable phenomena in the natural and social realms.

When planners realized that planning reaches beyond rational decisions, is decentered, cannot be exclusively linked to the sphere of the state, and is

strongly influenced by power, then the planning paradigms changed and diversified (Friedmann 1998). John Friedmann (1993, 1998) calls the new concept of planning the post-Euclidian mode of planning. It is linked to four intersecting and overlapping spheres of action and social valued practice, i.e., the sphere of the state, the sphere of civil society, the sphere of the political community as well as political conflict, and the sphere of capital. Whereas, according to Friedmann, the conventional concept of planning, i.e., the Euclidian mode of planning, has been linked to a static, carefully controlled world and planning has been guided by an scientific approach and the tradition of engineering, the post-Euclidian mode of planning has to tackle uncertainty, multiplicity, a fast pace of change, and politics of social transformation.

After decades of intensive research all over the world, the science of planning today is only certain of the fact that socio-spatial reality is more complex and dynamic, creates difficulties in understanding, and is less governable than planners expected it to be up until the 1970s. During the course of the last 50 years, planners gained experience in socio-spatial systems and arrived at the conclusion that they know very little about the deeper mechanisms in complex socio-spatial systems and hardly anything that would allow them to manage socio-spatial realities efficiently. According to Batty and Longley (1994:1), urban planners in particular are faced with a patchwork-like and incomplete state of knowledge:

After a century of sustained effort at [...] understanding [cities], our knowledge is still partial and fragmentary, based on a kaleidoscope of viewpoints and ideologies. What, however, is widely accepted, perhaps a little reluctantly by some, is that cities are mirrors and microcosms of society and culture at large, with every viewpoint contributing something to their understanding.

Planning, in the sense we decided to use in the context of this book, is embedded within both the general social theory that influences socio-spatial planning of the environment in a cultural, economic and political context, and the technical practice of engineering that is linked to, among others, transportation planning or infrastructure provision and maintenance. We assume that both the socio-spatial and the engineering aspect of planning involve theoretical assumptions and theories of existing reality that influence and guide the work of planning practitioners. Therefore, the main task of planning theory is, first, to systematically provide planning practitioners with an insight into their theoretical assumptions and related theories of reality and help them reflect on it, and, second, to continually improve the practice of planning (Friedmann 1993, 1998).

The central challenge for spatial planning research and practice is to cope with the overwhelming complexity, dynamism, and diversity of both landscapes and urban/infrastructural systems. Though the role of the planning enterprise is often seen as a narrow regulatory activity, it is more a general policy and managing process seeking to optimize opportunities for economic and social life,

for environmental quality, social justice and sustainable development. In this context, theorizing planning is context-sensitive, thus, it has to happen in the context of socio-cultural and political traditions, and is based on exploring theoretical concepts, paradigms, and discoveries that originate from natural, applied, social, and political sciences as well as the humanities. Therefore, we conclude that planning is not concerned with a theory of planning, but with theories of planning that help delineate the world of spatial planning.

#### 1.4 The Real and the Virtual World of Spatial Planning

It is time now to return to Plato's visible world of change and flux and his invisible world of the Universe of Higher Reality with which we began.

The issue of spatial planning requires information on and knowledge of spatial processes, architecture of spatial systems, rules of change and principles of urban and landscape formation and transformation. But, the question remains: How do we learn about the real world of spatial planning? In his book *Making Social Science Matter* Bent Flyvbjerg (2001) argues that case studies matter for social sciences as they have the power to support human learning and are useful for both generating and testing hypothesis as well as supporting trend detection in social sciences. According to Flyvbjerg (2001:135), the power of the case study is based on the fact that "practical rationality and judgment evolve and operate primarily by virtue of deep-going case experiences." Among the central assets of case studies is their context-dependency that corresponds to the nature of socio-spatial reality. Although case studies do not verify hypothesis and tend to have a greater bias towards falsification (Flyvbjerg 2001; Popper 1963), they do, however, provide learning about spatial reality and are thus an appropriate and even essential key to a planner's trove of information.

Thinking in models that are based on theories as a way to better understand the complicated state of reality by reducing its complexity remains a favorite way of considering and debating the invisible and exploring the 'deeper layers of reality' that rule the visible. Without any doubt, the disciplines, or the realms of spatial planning that are related to natural sciences and engineering are very close to and very familiar with the concept of Plato's Universe of Higher Reality. Moreover, the realms of spatial planning that are related to the designing task, for example, architecture, urban design, landscape architecture and planning, are used to develop, communicate and negotiate alternative futures by virtual worlds made from brush and paint, plaster or wood, or created with the computer. However, we argue that the social sciences and thus the realms of spatial planning that are engaged in socio-spatial processes also require a postulated invisible world. The invisible world of social science is not concerned with a Universe of Higher Reality that constitutes unchanging forms, but is needed instead to tackle the main task of social sciences, i.e., "to trace the unintended social repercussions of intentional human actions" (Popper 1963:342), "to understand even the more remote consequences of possible actions"



(ibid:343), and, as a result, to give support to the political realm. For example, every car driver wants to reach her/his destination as soon as possible, that is, without being entangled in traffic jam, but, nonetheless, traffic jams are a very common occurrence in metropolitan regions and on highways. Therefore, in order to be able to suggest policies, for example, for efficient and sustainable metropolitan transport systems, we need to propose hypotheses on how these unintended repercussions are provoked. Moreover, the task of giving support to the political field requires hypothesis on what can and cannot be done. Thus, tracing unintended social repercussions of intentional human actions and understanding the even more remote consequences of possible actions that are related to alternative futures, require hypothesizing and building both theories and models by means of 'invisible worlds.'

Scientific reasoning and design of policies often are based on a certain kind of metaphor that is not limited to a narrow linguistic sense, but is used in the sense of metaphoric models, i.e., both internal and external metaphorical representations of reality by means of structuring conceptual systems. Or, as Heisenberg puts it:

Bohr uses classical mechanics or quantum mechanics like a painter uses brush and paint. The picture is not determined by brush and paint, and paint is never reality; but when one, like a painter, has the image in mind beforehand, then one can make the image visible for other people's eyes, even though it may remain incomplete. (Werner Heisenberg 1988:49 – translation by the authors)

In general, models, i.e., substitutes for the real world or parts of it, are intended to interpret the invisible world behind the immediate world of perception by using various forms of abstraction, and, thus, to explain our perceptions. In sum, models try to visualize and explore invisible worlds. Moreover, model simulation can be utilized to enable evaluation of behaviors and universal characteristics by comparing simulations with varying variables. Thus, they are a kind of 'experimental laboratory' in a virtual world that is derived from the real world.

The purpose of models and model simulation in the dynamic and complex world of spatial planning is not point prediction or even prediction at all, but to improve the understanding of the real world of spatial planning (Ford 1999). Within the realm of spatial planning, a wide range of theoretical concepts or paradigms have currently been adopted to understand and model these complex, dynamic, and evolutionary socio-spatial systems, for example, catastrophe theory, synergetics, theory of complexity, self-organization, bifurcation theory, fractal geometry, and chaos theory. Borrowing from other sciences, new paradigms related to non-linearity attained interesting results in developing dynamic approaches of economic and spatial models.

Moreover, by definition, models are simplifications of real systems under study. This enables researchers to focus on fields of study with varying scope and depth. By creating virtual worlds with artificial agents and building mod-

els of the real world, planners gain experience in exercising judgment and acquire specific knowledge that can be used for understanding, designing and managing the real world.

However, we would like to emphasize the need for planners to keep in mind the comprehensive nature of the environment. Though deeper insight into spatial reality requires one to become engaged in and gain knowledge of distinct socio-spatial, cultural, economical, political, and natural processes that produce the urban-rural habitat by exploring the real world and by building up virtual worlds, the professional domain of planning has to be predominately influenced by the planners' concern for an integrative view of socio-spatial reality and socio-spatial processes. Thus, planners have to devote their lives in science and in practice to interdisciplinarity, expressed here by Nobel laureate Murray Gell-Mann (1994:346):

We live in an age of increasing specialization, and for good reason. Humanity keeps learning more about each field of study; and as every specialty grows, it tends to split into subspecialties. That process happens over and over again, and it is necessary and desirable. However, there is also a growing need for specialization to be supplemented by integration. The reason is that no complex, nonlinear system can be adequately described by dividing it up into subsystems or into various aspects, defined beforehand. If those subsystems or those aspects, all in strong interaction with one another, are studied separately, even with great care, the results, when put together, do not give a useful picture of the whole. In that sense, there is profound truth in the old adage, 'The whole is more than the sum of its parts.' People must therefore get away from the idea that serious work is restricted to beating to death a well-defined problem in a narrow discipline, while broadly integrative thinking is relegated to cocktail parties.

Negotiating alternative futures with the public and decision-makers is a very crucial task in spatial planning. It is currently widely acknowledged that visuo-spatial representation is a favorite appliance for humans to use to tackle problems related to the complex real world, and to decide about alternative futures. Commonly, mental representation is divided in analogue or visuo-spatial representations (mental images), propositional or verbal representations, and metaphorical representation. During the process of problem-solving, thoughts are transferred, according to Popper (Popper and Eccles 1977), to objects of thought, which are analogous to material things we are used to handling in daily life and which enable us to come back to these thoughts later during the process of problem-solving or during a process of creativity, i.e., objects of thought are allocated to a thought endurance in time. In a dialogue with Karl Popper in 1974, neurobiologist John C. Eccles (ibid:461ff) adds the argument that recognition of objects, for example, faces, is much quicker than verbal analytical operations.

More recent research in cognitive neuroscience is generally in line with Popper and Eccles: First, object recognition is fundamental to the behavior of

higher primates and influences the human brain's overall functional architecture. Second, the human visual system is able to accomplish the detection of an object within 150 milliseconds (Riesenhuber 2002), whereas the human brain needs between 900 and 2000 milliseconds to performed a sentence verification task, though "words representing concrete concepts are processed more quickly and efficiently than words representing abstract concepts." (West and Holcomb 2000) West and Holcomb (2000) observed that the difference in reaction time for processing abstract and concrete words was greatest for imagery tasks compared to semantic decisions and letter search. Third, seeing and imagining are very similar to the brain, i.e., the two different actions create very similar patterns of response in the human brain and, thus, mental imagery engages many of the same processing mechanisms involved in visual perception (O'Craven and Kanwisher 2000).

These scientific findings suggest that spatial planning has to apply and extend the wide use of virtual reality, visuo-spatial decision-support-systems, agent-based artificial worlds, geographic information systems (GIS), and new visual analysis paradigms and techniques for analysis and negotiation in urban and landscape planning and management tasks.

## 1.5 Conclusion

Planning is that "professional practice that specifically seeks to connect forms of knowledge with forms of action in the public domain," and the aim of planning theories is "to continually improve the practice of planning." (Friedmann 1993, 1998) In this context, we believe that it is critical that spatial planners acquire an imagery of reality and related socio-spatial processes, dynamics and building blocks in order to be able to think about the complex reality of the world we live in. Imagery of reality and related socio-spatial processes requires the ability, first, to cope with the complexity of socio-spatial reality by efficiently representing and comprehending abstract concepts provided by a wide range of social and natural disciplines, second, to trace out the dynamics of socio-spatial, economic, political, and cultural processes, and thus continually readjust and alter the spatial planners' imaginary of space, society, and economy, third, to continually acquire knowledge and experience in socio-spatial processes and their manifestation in space by exploring reality, i.e., case studies, and, fourth, to adapt existing virtual worlds and to develop new virtual worlds in order to learn about socio-spatial as well as physical-technical reality and simulate alternative futures.

In a liberal democratic society, the design of alternative futures has to be bottom-up, participatory, and empowered by a heterogeneous public in multicultural cities and regions. To achieve this, there is a strong need to communicate and negotiate alternative futures to the public by means of imagery. Though imagery has a long tradition in urban design, architecture, and landscape architecture and planning, Danahy (Chapter 11) concludes that "dynamic and im-

mersive forms of visual media remain largely underdeveloped both technically and in terms of intellectual discipline in landscape architecture and planning.“

The emergent potential of visualization, data management and simulation technology adds a new dimension to exploring the complexity, dynamism, and diversity of urban-rural landscapes and negotiating alternative futures. The use of this potential will be crucial for spatial planning.

## 1.6 Presentation of the Book

This book aims to provide an integrated approach to the understanding, planning, and governing of ‘landscape’ and ‘cityscape’ covering the real and the virtual world of planning. The book is divided in two parts. Part 1, chapters 2 through 10, explores the challenges for planning in the real world that are caused by the complexity and dynamics of socio-spatial systems and processes, as well as by the contradictions of their evolutionary trends related to their spatial layout. Case studies from developed as well as developing countries are presented. Part 2, chapters 11 through 19, deals with the virtual world of spatial planning and presents diverse concepts for modeling, analyzing, visualizing, monitoring, and controlling socio-spatial systems by using virtual worlds.

### 1.6.1 The Real World of Spatial Planning

In Chapter 2, Willy A. Schmid, Martina Koll-Schretzenmayr and Marco Keiner argue for the paradigm of sustainable development as a *leitmotif* for spatial planning in the 21st century. Currently, the continuing latent overuse of land resources in both quantity and quality threatens our living space. It is expected that the pressure on land will not only continue, but will increase dramatically worldwide, especially in developing countries and countries in transition. However, the paradigm of sustainability currently in use tends to be too dogmatic and too utopian; it aims at implementing an alternative future from the top-down by decontextualizing socio-spatial habits. The authors argue that sustainability should be re-interpreted from an absolute to a relative meaning, and that it should include diversity, i.e., allow alternative futures.

In Chapter 3, Klaus R. Kunzmann presents the threefold reality of the European city. The authentic city is the traditional European city that lends our picture of urbanity its character. The authentic city has survived wars and the atrocities of planners, realtors, bungling architects, intrigues of local politicians, and poor development plans, and now its core can be transformed into international entertainment centers that are in search of well-funded local clients and tourists. The fake European city is the deliberate commercial collage of architectural elements of one or more authentic cities. It is located where investors are searching for profit. Prime locations are secure and easily-accessible sites where consumer demand can be generated in entertainment centers and shopping malls. Finally, the virtual city is the perfect virtual replica of the authentic city that can be visited and experienced in your own home, without the need for long and expensive travel.

In Chapter 4, Marco Keiner discusses the global phenomenon of rapid urbanization that is the main challenge to planning in the beginning of the 21st century and he draws attention especially to primate cities, i.e., mushrooming cities that account for the highest proportion of the urban population in the country they belong to. The regional focus of this chapter is on sub-Saharan cities. Although currently Africa is the continent with the lowest proportion of urban population, it is experiencing both the highest rate of overall population growth and the highest rate of urban population growth. This chapter discusses whether those fast growing primate cities can develop on a sustainable path. In addition, necessities and new opportunities for action in urban management are discussed and local examples of 'good practice' in sustainable urban development are presented.

Over the last few years, there has been intensive discussion about indicators within the discourse on sustainable spatial development. Many cities, regions, and countries have decided to use indicators to measure the progress towards sustainability. The function of an indicator set can vary from communication and awareness-creation concerning sustainable development to monitoring and controlling functions. However, until now, integrating indicator sets into the current planning and decision-making processes has been widely neglected. In Chapter 5, Barbara Schultz and Marco Keiner present two case studies from Switzerland where indicator-based planning tools have recently been developed and implemented: a sustainability indicator set for the City of Zurich and an indicator-based controlling tool as part of *Richtplanung* (Cantonal Guidance Planning) in the Canton of Lucerne.

For the last 10 years, the city and region of Kunming, China has been marked by rapid urban growth and a strong trend towards modernization. Due to this high pace of growth, the city partnership between Zurich and Kunming developed gradually from a cultural exchange into an intensive technical collaboration between the two cities, aimed at steering the strong development of Kunming towards a more sustainable path. The main successes were the implementation of the first bus line in China and the continuing efforts to establish a strong regional public transport system. Furthermore, the project-based collaboration over the last ten years has strongly contributed to the improvement of urban planning and management skills in Kunming, especially when dealing with sustainability issues. In Chapter 6, Jacques P. Feiner describes the knowledge and experience gained from the project Kunming Urban Development and the Public Transportation Master Plan.

In Chapter 7, Martina Koll-Schretzenmayr explores urban dynamics within the global city of Zurich and sketches a comprehensive urban morphology. Cities are not stable 'things,' but products of fluid, irreproducible, unpredictable, highly dynamic and evolutionary 'social processes' in a complex urban-regional environment dominated by buildings, infrastructure, 'spaces and places', geographic proximity, and local-to-global impacts. In contrast to the infrastructural ideal of the modern metropolis, the contemporary cityspace is un-

dergoing discontinuity and deformation. The building stock is being transformed continuously and neighborhoods enter new life-cycles with ever-increasing frequency. The dynamic conception of the urban fabric resists simple and long-term categorization of function, interaction, and interdependence. The rigid routines of planning have been ruptured and static planning instruments are useless in an urban-regional multiplex creeping from one unsteady state to the next.

In Chapter 8, Alain Thierstein, Thomas Held, and Simone Gabi suggest a 'city of regions' for the 'Glattal-Stadt,' which is an essential part of the global city-region of Zurich. Glattal-Stadt, a booming urban area and economic center between the City of Zurich and Zurich International Airport, is affected by urban sprawl, traffic congestion, limitations on accessibility, and the overwhelming influence of the international airport on the quality of future urban development. The chapter focuses on the question: Who is directing this city-like structure, a 'city' which has neither a mayor nor a city council? The term 'city of regions' is elaborated to cover the complexity of overlapping realms of multiple governance units, i.e., formal institutions on the federal, cantonal, and community levels, as well as informal agencies for certain tasks and problems. 'City of regions' is also used as an action-oriented model, serving as a basis on which to develop future ideas for improved forms of governance by encompassing three interrelated elements: products, representing governance structures and regulations, processes, to be described as management activities and functions within the regions, and awareness, representing cultural background, norms and values influencing processes and products.

Spatial planning is a public responsibility; at the same time, it is a multi-disciplinary field. With these two characteristics, spatial planning naturally lends itself to political consulting. The need for political consulting arises out of the demand for both substantive guidelines and for recommendations with regard to the political process. Political consulting is often difficult to identify. It appears in the form of presentations from experts, special reports, or testimony from permanent or ad hoc commissions. Outside of the parliamentary realm, political consulting appears without any specific mandate, as is the case with business associations who closely follow the political process and make their opinion heard. Special interest groups also act as self-proclaimed political consultants, yet their pursuit of interests must not be understood as the equivalent of political consulting in the strictest sense of the term. Academia plays a particularly important role, since political consulting is often but not always tied to research. Recently, political consulting has been experiencing declining resonance, even resistance. In Chapter 9, Martin Lendi discusses problems and challenges linked to the increasing resistance to political consulting.

Multiple Land Use Planning is derived from more simple single-purpose land use planning in the past, for example, housing plans, farming reallocation plans, forest plans, outdoor recreation plans. In Chapter 10, Hubert N. van Lier discusses the change of evaluation and decision support systems in land use

planning over the years and briefly gives attention to the reasons for the changes from these single purpose plans to multiple land use projects focusing on the Netherlands. In addition, an overview is given of four evaluation and decision support systems that have been developed to evaluate projects and alternative plans as a tool for the decision-making process. The system is discussed within a broader perspective, i.e., the top-down vs. bottom-up approach.

### **1.6.2 The Virtual World of Spatial Planning**

Opening Part 2, Chapter 11 by John W. Danahy examines the dynamics of the human visual system and outlines how visual experience can be represented using real-time immersive virtual environments. Robust interactive visualization has the potential to change the nature of planning and design by making it possible for people to see complex spatial phenomena for themselves. Visualization affords people the opportunity to see, think and express ideas that can be represented in visual and spatial form. It acts as a prosthesis to visual-spatial literacy. Visual issues are often dismissed as too complicated or too subjective to be given serious weight in planning decision-making. The dynamic and ever-changing nature of visual experience has been extremely difficult to capture using traditional media. The new technologies that automate the function of systematically representing, analyzing and communicating visual experience can overcome this impediment to giving visual considerations equal attention to those problems that are considered computable and systematic. Real-time visualization makes it practical to study visual experience and time-based analysis in virtual environments. This chapter explains the considerations required to build effective virtual models for use in a real-time visualization system and reviews ways to realize this potential for transforming the nature of planning.

Virtual environments provide an opportunity for researchers to study the influence of environmental conditions or changes in the way in which people use urban spaces. Such an experiential approach to understanding people's preferences and behaviors has considerable advantages over questionnaires or on-site monitoring. One aspect of the urban environment that is of particular interest is the design and subsequent use patterns of urban parks. These are typically a major investment in terms of the value of the occupied real estate, and a major factor in the 'livability' of a city. The virtual environment should provide people with a surrogate that is as close as possible a surrogate to the real experience of a particular, proposed or redesigned park. This includes the sights and sounds of the park and surrounding streets, and an ability to interact with and influence aspects of the environment. Such a research environment will not only provide information on the response patterns of research subjects, but the results may also be used to support autonomous agent models of human behavior, which in turn can generate emergent patterns and a wider understanding of the way in which parks are used – and how they might be used better. In Chapter 12, Ian D. Bishop describes work on the development of an urban virtual environment, some experiments with changes in park features, and work on the role of sound

in park use and appreciation. It also illustrates the potential use of this information, in conjunction with automated view interpretation software and an agent modeling shell, to predict mass patterns of behavior.

In Chapter 13, Eckart Lange, Sigrid Hehl-Lange and Isabella Mambretti discuss the contribution that green space makes to the quality of life through the use of visualization techniques that capture the visual and aesthetic quality of case study sites. By applying digital visualization methods, the values that people attach to different green space attributes is explored. Both static and dynamic (i.e., walk through) representation modes are used to generate and test the responses of experts, users, and citizens in general. Of principal interest is the extent to which it is possible to visualize various potential maintenance practices, management strategies, design alternatives and scenarios for change in general.

In Chapter 14, Christophe Girot postulates that a moving picture can and should become the visual reference mode for contemporary landscape design. Using a video technique in landscape architecture enables an approach to perceive landscape from the reference of a subject moving in a landscape, which is the reference that modern man is used to, first, because of the intensive use of mass media images in motion, and, second, because of moving in space by car, train, or other vehicles. Girot argues that the technique of 'movism' is superior to traditional techniques of analysis and two-dimensional plans. Thus, the paradigm of movism is a means of accepting the diversity of vistas in reference to the landscape under analysis.

Predicting the general public's response to changes in the landscape is a difficult task, as many people find evaluating proposed design and management alternatives difficult without actually 'being' in the landscape. Computer-generated virtual environments provide an opportunity to test prospective landscape changes on subjects by allowing them to 'be' within the proposed changes. This methodology is particularly well suited to assessing the proposed intervention's impact on visual quality. However, there are significant issues relating to the calibration of the simulation in order to ensure that subjects' responses in the virtual world are equivalent to those experienced by subjects in the real world. In this context, the project: Planning with Virtual Alpine Landscapes and Autonomous Agents uses spatial data on hiker preference and path choice from the Gstaad/Sannenland region of Switzerland. In Chapter 15, Duncan Cavens and Eckart Lange draw on this empirical survey to explore the issues of calibration and validation of virtual worlds for the purposes of evaluating landscape change.

In a multi-agent transportation simulation, travelers are represented as individual agents who make independent decisions about their actions. In chapter 16, Kai Nagel and Bryan Raney implement a large-scale version of such a simulation in order to model traveler behavior in throughout Switzerland. The simulation is composed of interdependent modules: an activities generator module that generates a complete 24-hour day-plan for a given agent, a route



planner module that determines the mode of transportation, and a traffic simulation module that executes all the agents' plans simultaneously. The feedback mechanism is implemented with a so-called agent database that allows agents to have a 'memory' of the plans they have used during past days in the current iteration sequence. The agents also use the events data from the traffic simulation to determine performance 'scores' for each plan. The chapter presents the results of testing the above set-up, with OD-matrices in place of the activities generator, for Swiss morning rush hour traffic. It also presents the initial results of adding the activities generator to the system, implementing a second level of feedback that updates the activities plans at a slower rate than that of the route plans.

Humans are territorial in their repeated use of a very small subset of the possible number of activity locations. While these activity spaces have been measured extensively for animals, there is virtually no literature on the size and structure of human activity spaces, or rather the existing literature is severely limited by its insufficient databases. A recent data collection effort, a six-week travel diary in Karlsruhe and Halle (*Mobidrive*), allowed us to derive credible measures of the size and structure of human activity spaces for individuals for the first time. In Chapter 17, Stefan Schönfelder and Kay W. Axhausen develop a series of measures of these spaces, starting from the simple (adaptations of the Jennrich-Turner home range) and moving to the complex (buffered minimum spanning networks). The second part of the chapter reports the distribution of the sizes of these measures and analyzes the socio-demographic and situational determinants of their size. The conclusion develops the further research agenda and highlights the consequences of these results for the modeling of human behavior in transport and spatial planning.

In Chapter 18, Wolfgang Kröger and Ralf Mock introduce some of the most established techniques of risk, safety, and availability (RSA) analysis, for example, failure modes and effects analysis, and fault/event tree analysis. The well-being of developed countries, i.e., their economy, efficiency, and functionality, depends upon highly networked technical systems. Countries are interwoven with a variety of vital infrastructures (e.g., traffic systems, energy and water supply systems). Remarkably, systems' availability and risk-free functioning is often taken for granted in everyday life. On the other hand, the press coverage is a daily reminder of the simple fact that there is no perfect technical equipment, i.e., systems fail and cause tremendous harm in many cases. In order to avoid or at least to minimize the consequences of failures, systems are analyzed in terms of their risk, safety, and availability, whereby specific techniques are used. As the established RSA techniques often do not satisfy companies' demands (e.g., IT operating companies demands for risk analysis results within six months), Petri nets (PN) are introduced in the field of risk and reliability analysis. PNs enable a fast system representation and modeling of discrete events, for example, failures. A variety of operational aspects can be introduced in PN models, for instance, costs, failure-repair cycles of equipment, and maintenance strategies.

In Chapter 19, Susanne Kytzia reports on the economically extended material flux analysis (EE-MFA), which is an analytic tool that extends a civil engineering approach, i.e., material flow analysis (MFA), by economic input-output analysis (IOA). MFA investigates pathways of selected materials whereas IOA assesses a region's economic structure and can provide information on environmental burdens, costs and benefits that supports decision-making in the field of management of the built environment. Infrastructure construction is frequently discussed in regional sustainable development because it causes extensive movements of material. Yet in industrial countries, the process of construction is almost complete. Recent studies applying these methods have shown that developing the built environment is crucial for regional sustainability. Utilization of buildings, roads and railways accounts for almost 70–80% of the total regional energy demand. The magnitude of material stocks in roads, railways and buildings is high, and these can be future supplies for construction material. The studies also reveal the need for an integrated resource management system of both buildings and transport infrastructures.

### References

- Allmendinger P (2002a) *Planning Theory*. Palgrave, Houndmills, New York
- Allmendinger P (2002b) *Planning Futures: New Directions for Planning Theory*. Routledge, London, New York
- Batty M, Longley P (1994) *Fractal Cities: A Geometry of Form and Function*. Academic Press, London
- Beauregard RA (2001) The Multiplicity of Planning. *Journal of Planning Education and Research* 20:437–439
- Flyvbjerg B (2001) *Making Social Science Matter*. Cambridge.
- Friedmann J (1993) Toward a Non-Euclidian Mode of Planning. *APA Journal* 59:482–485
- Friedmann J (1995) Teaching Planning Theory. *Journal of Planning Education and Research* 14:156–162
- Ford A (1999) *Modeling the Environment. A Introduction to System Dynamics Modeling of Environmental Systems*. Island Press, Washington, DC
- Forester J (1998): Reflections on the Future Understanding of Planning Practice. Paper prepared for the AESOP Conference, Aveiro, Portugal, July 1998
- Gell-Mann M (1994) *The Quark and the Jaguar*. Freeman, New York
- Heisenberg W (1988): *Der Teil und das Ganze*. dtv, München
- Hillier J (1995) The Unwritten Law of Planning Theory: Common Sense. *Journal of Planning Education and Research* 14:192–296
- Holston J (1999): Spaces of Insurgent Citizenship. In: Holston J (Ed.): *Cities and Citizenship*. Duke, Durham

- Hopkins LD (2001): Planning as a Science. *Journal of Planning Education and Research* 20:399–406.
- Kuhn TS (1993). *Metaphor in Science. Metaphor and Thought*. A. Ortony. Cambridge University Press, Cambridge
- O'Craven KM, Kanwisher N (2000) Mental Imagery of Faces and Places Activates Corresponding Stimulus-Specific Brain Regions. *J Cogn Neurosci* 12:1013–1023
- Popper KR (1963): *Conjectures and Refutations*. Routledge and Kegan Paul, London
- Popper KR, Eccles JC (1977) *The Self and Its Brain*. Springer International, Berlin
- Riesenhuber M (2002) *How the Visual Cortex Recognizes Objects: The Tale of the Standard Model*. Ph.D. thesis, MIT, Boston
- Scott AJ (1971) *Combinatorial Programming, Spatial Analysis and Planning*. Methuen & Co., London
- Swyngedouw E, Moulaert F, Rodriguez A (2002) Neoliberal Urbanization in Europe: Large-Scale Urban Development Projects and the New Urban Policy. In: Brenner N, Theodore N (eds) *Spaces of Neoliberalism. Urban Restructuring in North America and Western Europe*. Blackwell Publishing, Malden
- Travers MD (1996) *Programming with Agents: New metaphors for thinking about computation*. Ph.D. thesis, MIT
- West WC, Phillip J, Holcomb PJ (2000) Imaginal, Semantic, and Surface-Level Processing of Concrete and Abstract Words: An Electrophysiological Investigation. *J Cogn Neurosci* 12:1024–1037

