Preface

In memoriam:
Bill Hillier 1937–2019
Alasdair Turner 1969–2011

For Alexander, Robert, Aurelius, and Valerius

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Space syntax

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The Need for a Textbook on Space Syntax

Space syntax's popularity has grown rapidly in recent years. It connects the fields of urban spatial analysis and urban design in the arena of transport, land use, and people's behaviour. An ever-growing number of international scholars and practitioners are applying space syntax at various scales, from buildings and neighbourhoods to metropolitan areas and entire regions. Also, universities worldwide now include space syntax theory and methods in their curricula.

As pioneers of space syntax in our home countries—Norway, Austria, and the Netherlands—we are regularly asked to give lectures, talks, and workshops about space syntax to students and colleagues in the fields of architecture and urban design, urban planning, urban geography, road engineering, sociology, archaeology, and criminology as well as to practitioners and urban developers.

However, until now there was no textbook at hand providing an elementary introduction to space syntax, including exercises, in order to study and learn it in an easy to understand way. Thus, it was natural for us to respond to the need for a holistic textbook. The presented textbook provides a knowledge foundation on which the space syntax novice can build upon to become the most experienced space syntax researcher, and it is a resource for scholars who want to use space syntax in teaching and research. Likewise, practitioners can benefit from this book.

Both of us, like so many others interested in spaces syntax, got started with the well-known and challenging readings of Bill Hillier and Julienne Hanson's *The Social Logic of Space* (1984), Bill Hillier's *Space is the Machine* (1996), and Julienne Hanson's *Decoding Homes and Houses* (1999). Alexander R. Cuthbert, in his article 'Urban design: Requiem for an era—review and critique of the last 50 years' from 2007, not only acknowledges Hillier and Hanson's work to be "one of the most erudite and scholarly expositions of urban spatial theory" (Cuthbert 2007, p. 200), but also confirms that their *The Social Logic of Space* can be "extremely difficult to understand, much of it buried in mathematical concepts and formulae" (Cuthbert 2007, p. 200). This is in contrast to Kevin Lynch's, Rob Krier's, and Christopher Alexander's writings that are much easier to access for the reader.

After many years and a thorough insight into space syntax obtained from the perspective of academia and practice at The Bartlett School of Architecture, University College London (UCL), and Space Syntax Limited (SSL) in London, and from attending several international space syntax symposia, we observed the increasing need for a textbook to allow easy access to space syntax knowledge for all who are interested in the method.

The accumulation of personal and professional experiences was the impetus for us to write this book. This textbook gives the reader a guided tour through various aspects of space syntax in urban studies, and it further connects space syntax to urban morphology, phenomenology, and network traditions. However, this book has a long history. It has been under constant development since its first draft idea in 2004 and is based on the authors' lecture notes, research projects, scientific writings, and knowledge from practice. To test its applicability and pedagogical approach, excerpts of it have been given to students and colleagues for feedback over the years. With their valuable feedback, we developed the book's approach, clarified the content, and increased its applicability. Therefore, it serves as a pedagogical complement to the more difficult to understand body of existing space syntax literature.

In many countries, the scientific aspects of architecture and urban design do not receive sufficient acknowledgement. This is mirrored in the way that most urban designers and architects are educated and trained to intervene in the built environment without any evidence-based knowledge and skill set about how to approach and analyse the socio-economic impact of their urban interventions. Thus, there is a need and a challenge to introduce urban analytical research in the curriculum of architects and urban designers. The challenge is to combine while at the same time balance urban design and urban analytical research without falling into the trap of becoming overly normative. An introduction to a basic set of spatial analytical tools and their application in urban design research and practice is definitely needed.

Following this, the main aim of this book is to present and explain the basic elements of the space syntax method as applied to the analysis of the built environment on different scales, from buildings and local streets to large metropolitan areas. It shows how urban phenomena can be understood through configurative studies connected to people's socio-economic behaviours. We present a basic platform for carrying out space syntax analyses, and this book seeks to bridge the gap between the theoretical concerns of the scientist and the practical interests of the practitioner. It is not, however, a manifesto on urbanism. We do not judge what kinds of urban interventions are 'right' or 'wrong'. Nor is it a normative description of how one should design urban areas. Instead, it explains some solid scientific methods for analysing the built environment in order to understand how it functions both spatially and socially.

In the first chapter, we first give an overview of the three main research traditions regarding the physical aspects of the built environment. This chapter introduces the basic components of the space syntax method and how they relate to other analytic methods. The various concepts of space from various urban research traditions are also presented. In the second chapter, we explain the various spatial techniques for analysing the urban street and road network based on the axial line. Here, some of the basic mathematical formulae of space syntax are presented and discussed. In the third chapter, we present the techniques for measuring and analysing visibility, such as isovist, all-line, and point-depth analyses. In chapter four, we present the urban micro-scale tools used to analyse the relationships between buildings and streets as well as between public and private spaces. Here, the focus is on the neighbourhood level. In chapter five, we present some methods to connect and correlate data about people's activities and other data with numerical results obtained from the spatial analyses. Chapter six reflects upon how a space syntax approach contributes to theory building and understandings of how the built environment works. Here, some aspects from the elementary theory of science relevant to space syntax are presented. We conclude in chapter six with a discussion on urban sustainability and compactness connected to space syntax. Finally,

chapter seven provides a discussion and demonstration of how space syntax is applied in urban design and urban planning practice.

In Brief: What Is Space Syntax?

Space syntax, originated in the 1970s by Bill Hillier and his colleagues at The Bartlett School of Architecture, University College London, is a theory and method for analysing spatial relationships. In its wider context, space syntax is a set of techniques that can be applied individually and in different combinations with one another. The combination of these different analytical techniques depends on the research or urban design and planning question(s) for one or several urban systems under scrutiny. The space syntax toolkit provides methods for finding spatial answers to these questions. In essence, the space syntax method consists of calculating configurative spatial relationships in the built environment. Hillier and Hanson (1984, p. 176ff) understood at an early stage of the method development that for the field of anthropological studies, space syntax can provide a spatial understanding of the social organisation in settlements from different cultures by demonstrating how buildings and settlements play a role in social relations.

Originally tested and applied in analyses at the scale of small settlements and buildings, the development of computing power has made it possible to analyse the complex relationships in larger cities and metropolitan areas and even entire regions. According to Hillier et.al (2007), the application of the space syntax method to urban studies consists of four things. First, the concept of the spatial units at issue is clarified and well defined. Second, space syntax is a family of techniques for analysing cities as networks of space formed by the placing, grouping, and orientation of buildings. These techniques make it possible to analyse how a street interrelates spatially with all other streets in a built environment. Third, space syntax provides a set of methods for observing how networks of space relate to functional patterns such as vehicle and pedestrian movement flows through cities, land use patterns, area differentiation, crime dispersal, property prices, migration patterns, and even social well-being and malaise. Fourth, research results from applications of space syntax have contributed to new theories and understandings of how cities are constituted spatially as an effect of social, economic, and cognitive factors and how urban space, in turn, functions as a generative power for societal and economic activities and cognitive factors. The space syntax method has been applied to a large number of cities in different parts of the world, and a substantial database now exists of cities that have been studied by using the space syntax method (Hillier et al. 2007).

Space syntax measures how every public space or street segment in a built environment relates to all other public spaces. On the one hand, space syntax measures the *to-movement potential*, or *closeness*, of each street segment with respect to all others. On the other hand, space syntax measures the *through-movement potential,* or *betweenness,* of each street segment with respect to all others. The street network's to- and through-movement potentials represent various accessibility potentials. Both types of relational patterns can be weighted by three different definitions of distance. The metric distance measures the city's street and road network as a system of shortest-length paths, while the topological distance calculates the city's street and road network as a system of fewest-turn paths. The geometrical distance gives a picture of the city's street and road network as a system of least angle-change paths. Each type of relation can be calculated at different radii from each street segment by defining the radius in terms of shortest length, fewest turns, or least number of angle changes (Hillier and Iida 2005, pp. 557–558).

Space syntax can be applied at many scales, from the arrangement of furniture in a workplace to enhance collaborative interactions all the way to understanding different centralities in urban regions. The method is also a useful tool for comparing before and after conditions such as the spatial changes resulting from urban restructuring. Because the tool is a method for analysing the physical and spatial setup of buildings and cities, the analysis results

must be interpreted in correlation with an understanding of societal processes and human behaviour.

Another field where the method is applicable is in spatial layouts of excavated towns. In cases where walls of buildings and street patterns remain intact, a space syntax analysis of the spatial organisation can contribute to a more comprehensive understanding of urban life and societal organisation in the past (van Nes 2011). In the field of anthropological studies, space syntax can provide spatial understandings of the social organisation in settlements from different cultures, demonstrating how buildings and settlements play a role in social relations (Hillier and Hanson 1984, p. 176ff; Stöger 2007; Aleksandrowitcz et al. 2019).

The application of space syntax allows an insight into complex spatial problems (Yamu, 2014) and can also give an indication of future socio-economic impacts of urban design proposals. In impact assessments of proposed alternatives for urban renewal or new large-scale developments, the space syntax method can contribute by evaluating the effects on locations of economic activity and the degree of vitality of urban centres as a result of new roads and street links (van Nes 2007; van Nes and Stolk 2012).

As research has shown, there is a correlation between pedestrian and vehicular movement and the spatial configuration of the street network (Hillier et al. 1993, 1998, 2012). The space syntax method makes it possible to identify regeneration opportunities, ensuring that new proposals respond to the spatial potentials of existing urban areas. The spatial setup of new design ideas can also be tested using space syntax analysis (Czerkauer-Yamu and Voigt 2011; Karimi 2012; van Nes et al. 2017). Space syntax can also be combined with other spatial modelling techniques such as complexity-based modelling to identify regional and urban development and revitalisation potentials using an iterative logic (Czerkauer-Yamu 2012; Yamu and van Nes 2017). However, one limitation of space syntax is that it cannot measure place identity, place character, or spatial order. These aspects are taken into account in the work of, for example, Kevin Lynch (1960), Christian Norberg-Schulz (1971), Rob Krier (1984), and the various urban morphology groups (Moudon 1997). Space syntax does not analyse spatial patterns, but rather spatial structures. Likewise, space syntax does not analyse building forms, but instead looks at the spatial configuration of the spaces shaped by buildings and other urban artefacts.

Overall, space syntax can support the design and planning of safe and vital cities and neighbourhoods. There exist a remarkably large number of poor-quality neighbourhoods built from the 1950s onwards worldwide. These provide ample opportunities to gather evidence for identifying and understanding the role of spatial properties for creating a safe and vital built environment. Raising awareness of the active role of urban space can be done by applying scientifically grounded spatial analysis tools to assess these poorly functioning neighbourhoods. This will also be beneficial for strengthening research about the built environment's spatial properties.

Nevertheless, 'panta rhei' (everything flows), the famous quote associated with the Greek philosopher Heraclitus, also applies to space syntax because it is under constant development. This constant development emerges at the intersection of natural, technical, and social sciences in contributing to theories on the built environment. Space syntax research has ranged from anthropology and cognitive sciences to applied mathematics and informatics and has even touched upon philosophical issues. The evolution of space syntax requires communication not just between various cultural contexts, but also between different scientific domains.

In the arena of research and the communication of results, international Space Syntax Symposia have been held bi-annually since 1997. The number of contributors from all over the world is increasing at every symposium, indicating that the theoretical and methodological interest in and the purposeful application of space syntax is increasing worldwide. Space syntax has become a well-recognised method of urban analysis and contributes to an understanding of the relationship between socio-economic effects and the planning and design of the built environment.

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