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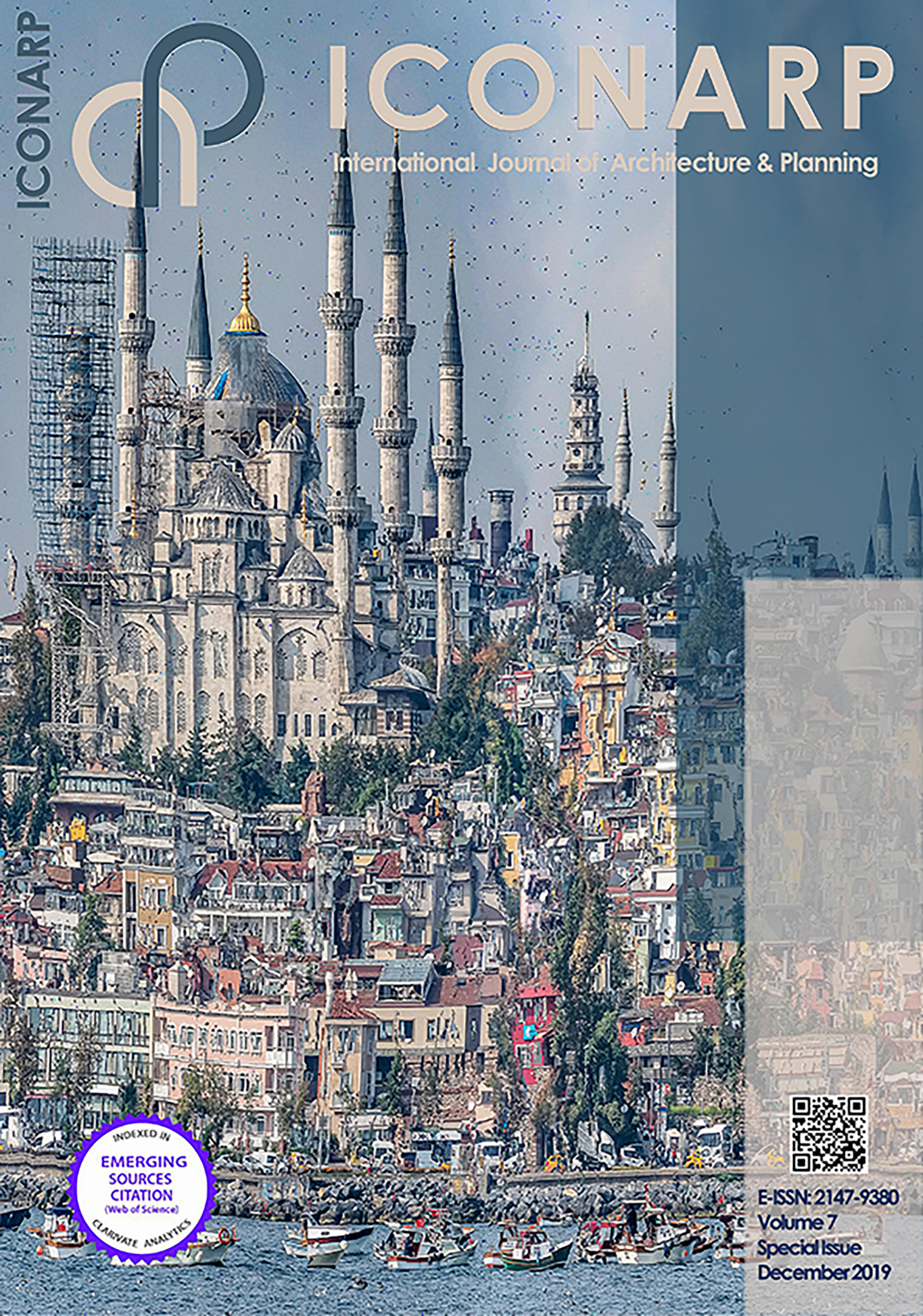

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ICONARP INTERNATIONAL JOURNAL OF ARCHITECTURE & PLANNING

ICONARP as an e-journal considers original articles, research briefs, book reviews and viewpoints in peer-reviewed. ICONARP is an exciting new venture occurred with experiences, theoretical approaches, critical and empirical studies in the field of architecture and urban planning.

SCOPE and AIM

The journal aims to be a platform for the studies of design, education and application and has a goal to be a bridge in between traditional/modern, east/west, local/global in the disciplines of Architecture / Planning.

Architecture and Planning, as two interconnected fields, are strongly affected by other disciplines such as fine art, urban design, philosophy, engineering, geography, economics, politics, sociology, history, psychology, geology, information technology, ecology, law, security and management. However, there are no academic journals which specifically focus on the connections of architecture and planning with other social fields. ICONARP aims to fill that gap. Our scope is to provide a suitable space for theoretical, methodological and empirical papers, which use global and local perspectives together, in architectural and urban studies.

ABSTRACTING AND INDEXING

ICONARP is an Open Access Journal which presents its content freely for online researches with the aim of contributing to the global exchange of knowledge. ICONARP believes that providing free online access ensures a wider spectrum of research base and reading rate to develop the related literature.

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DOSSIER EDITORIAL: Urban Morphology

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"Urban Morphology" started to take shape as an organized field of knowledge at the end of the nineteenth century. The use of town plans as a source of urban history and geography, and as data of urban planning led to major developments in the historical and analytical aspects of urban morphology (See Gauthier, 2004; Whitehand 2007). It has been only during the last decade of the twentieth century that an international organizing frame of the field came into existence, with the foundation of ISUF by a group of researchers from various geographical origins and from several disciplines. The first members were predominantly geographers, architects and historians. Many other academic and social associations, such as archaeologists or social anthropologists, analyse urban morphology from different viewpoints and the way of their addressing the subject vary according to their disciplinary background. It can be accepted that the core focus of urban morphology as being "the study of the city as human habitat" (Moudon 1997) or "the study of urban form" (Whitehand 2012). İts' aim is to progress "the dynamics of our build world" (Moudon 1989), in other words, to analyse the process of the formation and transformation of the man-made build environment. It can also be considered shortly as urban morphology is "the study of urban tissue". The study of "urban morphology" seeks to understand the spatial structure and character of a metropolitan area, city, town or village by examining the patterns of its component parts and the ownership or control and occupation. The city is the accumulation and integration of many individual and small groups of actions; they being governed by cultural traditions and shaped by social and economic forces over time.

Morphologists from several disciplines formalized the International Seminar on Urban Form (ISUF) in 1996, in order to coordinate meetings to explain, compare, and discuss their work. These meetings acknowledged the expansion of Urban Morphology beyond its' original boundaries in geography and its' emergence as an interdisciplinary field. They highlighted the need to promote international exchanges and to investigate the scope of the field's theoretical basis (Moudon 1997). Bringing together relevant researchers from different disciplines has identified several benefits from such interdisciplinary commitment, in particular the advantages of Muratorian, the Conzenian and the French Schools with their architectural, geographical, and social disciplinary backgrounds respectively. The contributions of the "Italian" school, first Muratori then Cannigia, principally on architectural typology, are well known today, as are the contributions of the "English" school initiated by M.R.G. Conzen (b. 1907). Conzen is best known for his detailed study of Alnwick, which can be accepted as a quantitative revolution in urban geography. On the other hand, Muratori used his self-termed "operational histories" of Venice and Rome (Muratori 1959, 1963) as the theoretical basis for architectural and urban design fields. Whitehand pushed the limits of urban morphology into urban economic fields, researching the relationship between the city, its' habitats, and the dynamics of building industry.

It is also possible to find more developments beyond the founding schools of thought. There are other perspectives that have been evident, for example, based on Geographical Information Systems, Historical GIS (Gilliard, 2005) and Space Syntax, (as a quantitative approach to Urban Morphology). See for example (Gil et al., 2013, Koster, 2009, Hillier and Hanson, 1984, 1998; Kubat 1997, 1999, 2004; Yu and Van Nes, 2014). Current advances in parcel based GIS can help to move the center of urban morphological research from its' foundation in the study of small historic towns to today's large urbanized regions, and from applications in urban conservation to management of future urban development (Moudon, 1997). As an advanced study in Urban Morphology, Historical GIS connects the past and the present using historical maps. By the use of Historical GIS, the digitized selected layers, which are created by scanning and rectifying historical maps, can be integrated with socioeconomic data in geo-database.

ISUF Regional Networks such as Italian (2007), Chinese (2015), Cypriot (2018), Polish (2016), Portuguese (2013), Serbian, Hispanic (2015) as well as Turkish (2014) were founded to provide contacts between members by organizing conferences, seminars and meetings and also to develop links with other international organizations concerned with the built environment. One of the main purposes of "the Turkish Network of Urban Morphology-TNUM" is to facilitate the sharing of studies concerned with urban morphology, and to discuss the development of collaborative studies of urban form at the national and international levels. It is also a platform for knowledge exchange and networking among researchers and practitioners in the field of urban, architectural and social studies that have a specific interest in Turkey and the wider Eastern Mediterranean region. It has been agreed to develop in particular a commonly accepted vocabulary of urban morphology in the Turkish language, and strengthen the place of urban morphology in education.

This special issue on "Urban Morphology" which is based on ten articles, addresses significant architectural, urban, historico-geographical, quantitative topics. It also confirms that several generations of scholars are active in urban morphology not only from England, Italy or France but also from Turkey and that many individual researchers from a variety of other countries are contributing to the field.

To conclude, I can proudly say that the papers in this special issue of ICONARP in "URBAN MORPHOLOGY" address not only the state-of-art in the field, but also the most recent methods and implementation tools.

1.

An impressive contribution to the field of Urban Morphology comes from the article titled **"Introducing supergrids, superblocks, areas, networks, and levels to urban morphological analyses"** by **Anne Vernes Moudon.** Moudon mentions the new elements and proposes that are formally recognized in urban morphology. As cities have grown in geographic size disproportionately to their growth in population over the past seven decades, new elements have been introduced that structure their form. A conceptual framework for a multilevel structure of urban space using areas and networks and including supergrids and superblocks to guide morphological analyses are presented in her manuscript. She also proposes a table that can serve studies in the framework that can be placed according to the specific elements they focus on. This will help to identify appropriate levels that are standardized to facilitate comparison between these studies.

2.

A fascinating piece of work comes from **Sigríður KRISTJÁNSDÓTTIR** with her article titled **"Roots of Urban Morphology"** which delves into a comprehensive review of the research field of urban morphology: the study of urban form. In her work, Dr. Kristjánsdóttir discusses the evolution of urban morphology from its conceptual foundations in research on the physical form of urban areas. This discussion will shed light on various research perspectives of urban morphology, as well as discussing similarities and differences between the geographical and the architectural approaches to urban form studies. This is followed by a closer look at the theories and works developed by Gianfranco Caniggia and MRG Conzen, which have been an inspiration for many practitioners and researchers, including Whitehand, Maffei, and Moudon.

3.

In recent decades, there has been a significant growth in the amount of research on the study of the phenomenon of architectural and urban "knotting", which is considered as one of the most interesting in the formation of the modern city in Italy. Therefore, this paper makes great contribution to the studies, which analyse urban form with this architectural methodology and morphological knotting. **Giuseppe STRAPPA** with his article titled, **"The 'Knotting' as a Morphological Phenomenon: An Interpretation of the Italian Chamber of Deputies Forming Process"** makes an innovative contribution to this special issue not only by presenting a study on transformation of existing buildings and designing them with the knotting idea, but also by focussing on an interesting case areas of modern Italian architecture, the palaces of the Chamber of Deputies in Turin, Florence and Rome.

4.

Another interesting paper titled **"Managing The Urban Change: A Morphological Perspective for Planning"** comes from **Tolga ÜNLÜ,** in which he argues the awareness of planners on the intrinsic qualities of the built environment in shaping of urban form in Turkey throughout a centennial period after the foundation of the Turkish Republic in 1923. The research work of Tolga Ünlü, suggests a morphological framework, to develop such an evaluation, which is based on three basic principles: the historicity of urban forms, the hierarchical nesting of urban form elements, and their reconciliation within a complex interaction with each other in a part-to-whole relationship. It is regarded as an initial attempt to develop a brief discussion about a morphological perspective to be utilized in planning practice. It is asserted that the centennial development of planning practice in Turkey brought to light that the professionals lost their concern on the intrinsic qualities of urban form, on how it is evolved historically, and on how its' elements are related to each other. The paper highlights the need for a new morphological perspective that would take into account the morphological unity of urban form elements within their interplay in order to develop a responsive planning approach.

5.

The fascinating piece of work comes from **Peter J. LARKHAM** and **David ADAMS** with their article titled "**Persistence, Inertia, Adaptation and Life Cycle: Applying Urban Morphological Ideas to Conceptualise Sustainable City-Centre Change"** in which they consider that the speed and scale of change of urban forms has a long history in urban morphological thought. Their paper explores issues of the persistence and adaptation of some urban forms, focusing on the central business district of Birmingham, UK. Much of this is now protected as a conservation area, and some of its' forms have persisted for centuries. Yet, there have been periods of rapid change, and we examine the extent of change following Second World War bomb damage. This allows discussions of the dynamics of change and the agents and agencies responsible for producing new urban forms or retaining existing ones; and this informs exploration of the potential contribution of longevity of form to sustainability. The rapid recycling of some structures, after only a couple of decades, may be very unsustainable – impracticable and unaffordable – in an urban context. With its brand-new perspective on the topic, the work, although exploratory, makes significant contribution to the field.

6.

This article of **Ayşe Sema KUBAT** deals with a topic "**Exploring The Fringe-Belt Phenomenon in a Multi-Nuclear City: The Case of Istanbul"** that is fundamental to understanding the historico-geographical structure of urban areas. The study, which is an attempt to codify the results from 10 years of academic research and a hard-working effort of Kubat, uses the concept of fringe-belt specifically adapting it to the multi-centered cities of the developing world with a special concern on Istanbul, a large-scaled and complex city. This work investigates the development of the fringe-belt concept and takes a detailed look at the five distinct areas in the European and Anatolian sides of İstanbul through the use of historical maps. Previous studies of the fringe belt have mostly focused on small-scale cities that still contain their original regions or structures, or on those, which have special meaning. However, there has been a limited examination of the fringe belt concept with regard to the multi-centered metropolises such as Istanbul. This study seeks to fill this gap by giving special attention to Istanbul, and by examining the impact of urban growth and CBD transformation on the formation and modification processes of its fringe-belt areas. Formation of a fringe belt can also give clues about the growth direction of the physical development of an urban area. The author reached to a conclusion that these once peripheral but now embedded fringe-belts adjust to the ever-changing dynamics of urban land-use and CBD development of Istanbul. Furthermore, this study of fringe-belts illustrates how Istanbul is different from its counterparts in other parts of the world and cannot be analysed in the same manner.

7.

A unique contribution to this special issue is the article titled **"Swedish Typo-Morphology - Conceptualizations and Implication for Urban Design"** by **Todor STOJANOVSKI.** The article addresses a significant and current issue on "Typo-morphology" which is a branch of urban morphology that deals with the formation and transformation of cities with use of types and typologies. The paper deals with the typo-morphological approaches of 1980's influenced urban planning and design practices from the point of the Swedish urban morphologists. Typo-morphological approaches and their applications both in practical world and research are described, and discussion in a context of urban design and planning practices is carried both in Stockholm and Malmö. The research extends to a new method on participatory planning based on building and neighbourhood types and this makes the article quite novel.

8.

In their work titled "**Design For Mitigating Urban Heat Island: Proposal of a Parametric Model", Olgu ÇALIŞKAN** and **Begüm SAKAR** address an innovative approach that researches the microclimatic conditions of cities, and induce the 'Urban Heat Island' (UHI) effect, which generates many undesirable conditions in the living environment. This research aims to propose a parametric model for analysing the key morphological components of urban tissues with regards to the UHI intensity on the basis of 'Sky View Factor' (SVF) while testing the alternatives in generative manner. The proposed (parametric) model, therefore, stands on the close-correlation between the algorithmic simulation based on the selected parameters and morphological analysis. The model calculates SVF values of the different building settings calculated with reference to the basic building codes of the development planning system in Turkey (i.e. FAR, building height and setback) in an actual context. Then the proposed model is tested in the case of one of the transformation areas in Ankara, Turkey. The major contribution of the study lies in its attempt to create a methodical framework for a climate responsive urban design process to mitigate urban heat island.

9.

All historical cities over the world, although with some differences, are growing quickly. Their elements are in constant transformation, and the new urban spaces take form with its' citizens, embedded with different cultures. Istanbul, embodying with its' distinctive morphological characteristics, has always been a "laboratory" for architectural and urban studies. A unique contribution that addressed this subject to this special issue is the article titled **"An Interstitial Reading of Istanbul"** by **Mahyar AREFI** and **Fatma Pelin EKDI.** The article addresses a significant and current issue on exploring a comprehensive model for reading the city. The city is constantly being woven with new layers, which change, flourish and overlap. This paper offers a reading of Istanbul's intersecting and interstitial layers, the constitutive features of urban space, and the impacts of the urban development processes over time. Using a qualitative approach from both the archival and visual data sources, this study provides a better understanding of complex layers of urbanism that guide urban planners, policy makers and decision makers in developing more convenient solutions to urban problems.

10.

Within the context of Space Syntax, an interesting article titled **"Morphological Structures of Historical Turkish Cities",** comes from **Mehmet TOPÇU**. The work of Topçu provides comparative analyses on the morphological structures of historical urban fabrics of selected cities from different geographic and climatic conditions of Turkey, which have been shaped under the influence of various cultures. Fourteen cities from the seven different geographical regions of Turkey are analysed quantitatively through a mathematical approach called Space Syntax. Detailed information was presented about the morphological structures of the urban forms both on urban and regional levels. It could be stated that the results obtained from this study, by adapting a quantitative and analytical technique as Space syntax, will made a significant contribution on the studies on urban morphology. The study on comparative analyses of the Turkish cities from Anatolia and Thrace within the framework of the specified methodological approach; deserves all the credit that it needs a very hard-working effort, especially in such complex and intrinsic historical backgrounds of the city structures of Turkey.

11.

Lastly the **"Viewpoint"** of the issue comes from **Tim STONOR** with his interesting work titled, **"Measuring Intensity – Describing and Analysing the Urban**

Buzz". As the managing director of the Space Syntax Ltd, Tim Stonor explains an important missing point of urban planners that "great urban places are not created by density; they are created by *intensity*". And he concludes by presenting a choice for designers: continue to disagree about the best way to measure density or embrace intensity and anticipate the radical transformation of place.

As the guest editor of this special issue on URBAN MORPHOLOGY, I would like to extend my deepest gratitude to **Mehmet Topçu**, the editor of the ICONARP Journal; and also to **Mihrimah Şenalp** and **Çiğdem Fındıklar Ülkü**, for their support throughout the publication process. I would also like to express my sincere gratitude to the following people for their efforts in helping me throughout the peer review process: **Hasan Serdar Kaya, Mehmet Topçu, Olgu Çalışkan, Özlem Özer and Tolga Ünlü**.

I am also very thankful for the unique cover design work of **Murat Germen** for this special issue of ICONARP.

I also appreciated the support of the authors and their contribution in this important publication of ICONARP that would further familiarize the Turkish researchers with "**URBAN MORPHOLOGY**" field of knowledge.

As it always has been, my last thanks go to all our readers for the support they provide to the Journal. We really look forward to your comments, contributions, suggestions, and criticisms.

ICONARP International Journal of Architecture & Planning is nothing without you. Enjoy your reading and meet with us again in the next issue of the forthcoming year, 2020.

References:

Gil J., et al (2012) "On the discovery of urban typologies : data mining the many dimensions of urban form" *Urban Morphology* 16, 20-40

Gauthier B., (2004) "The History of Urban Morphology", *Urban Morphology* 8 (2), 71-89.

Gilliard J., (2005) *"Imag(in)ing London's Past into the future by Historical GIS"* Annual meeting of Canadian Ass. of Geographers, University of Western Ontario. (unpublished)

Hillier B., Hanson J., (1984) *The Social Logic of Space*, Cambridge, Cambridge University Press.

Hillier B., Hanson J., (1998), "Space Syntax as a research programme", *Urban Morphology* 2, 108-10.

Konster, E, (2009) "Urban Morphology and computers 10 years on", *Urban Morphology* 13, 74-76.

Kubat, A. S, (1999) "Morphological History of Istanbul", *Urban Morphology*, 3 (1), 28-41.

Kubat, A. S, (1997) "Morphological Characteristics of Anatolian Fortified Towns"; *Environment & Planning B: Planning & Design*, 24, 95–123.

Kubat A.S., Asami Y., İstek C. (2004) "Application of GIS to network analysis: characterization of traditional Turkish urban street networks", Ed: Okabe A., *Islamic Area Studies with Geographical Information Systems-New Horizons in Islamic Studies.* 187-207.

Moudon A., V., (1997) "Urban Morphology as an emerging interdisciplinary field", *Urban Morphology* 1, 3-10.

Moudon A., V., (1989) "The role of typomorphological studies in environmental design research", in Hardie et al (eds) *Environmental design research association Conference Proceedings 20: Changing parameters* (Environmental Design Research, McLean, VA), 41-8.

Whitehand (2007), "Conzenian urban Morphology and urban landscapes", in Kubat et al. (eds), *6th Internatıonal Space Syntax Symposium Proceedings* (Istanbul Technical University, Faculty of Architecture, Istanbul), ii-01-09.

Yu Ye, Van Nes A., (2014) The spatial flaws of new towns: Morphological comparison between a Chinese new and old town through the application of space syntax, space matrix and mixed use index., *Kubat (ed.) A/Z İTU Journal of the Fcaulty of Architecture,* 11/2, 191-208.

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Research Article

Introducing Supergrids, Superblocks, Areas, Networks, and Levels to Urban Morphological Analyses

Anne Vernez Moudon*

Abstract

Urban morphological analyses have identified the parcel (plot), the building type, or the plan unit (tessuto in Italian) as the basic elements of urban form. As cities have grown in geographic size disproportionately to their growth in population over the past seven decades, new elements have been introduced that structure their form. This essay describes these new elements and proposes that they be formally recognized in urban morphology. It introduces a conceptual framework for a multilevel structure of urban space using areas and networks and including supergrids and superblocks to guide morphological analyses.

Keywords: Morphological elements; a posteriori approach; a priori approach.

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INTRODUCTION

The foundational concepts and frameworks used in urban morphology date from the mid-20th century, a time when cities were, by today's standards, small or even very small. So far, urban morphological analyses have focused primarily on the parcel (plot in British English), the building type, or the plan unit (tessuto in Italian), an approach that suggests studying urban form from the ground up. This approach remains entirely valid today since cities indeed continue to emerge building by building, from the ground up. However, cities have grown in size over the past seven decades and new elements have been introduced that structure their form. This essay describes these new elements and proposes that they be formally recognized and inserted into analytic methods used in urban morphology.

FUNDAMENTALS OF URBAN MORPHOLOGICAL RESEARCH

Urban morphological analysis rests on three elements: the building and its parcel (plot), the street and the city block, and the plan unit (tessuto) (Whitehand 1981, Moudon 1997, Scheer 2015, Scheer 2018). Different studies give different emphases to the different elements. Some focus on building without addressing the concurrent parcel, either because the parcel has the same size and shape as the building footprint, or because the parcel contains many different buildings; other studies concentrate on the plan unit or tessuto. Again, it is entirely valid to study any or all of the elements of urban form in order to focus on different issues and to reflect on different problematics. However, it is essential to take into account how urban form elements relate to each other in order to fully consider their characteristics. This is because urban form elements are *nested*: buildings are contained in city blocks, and city blocks are nested in plan units. The characteristic of *nestedness* places elements at different *levels*. Recognizing levels of nesting in urban form is conceptually simple, save some nuances that are worth addressing.

Caveat 1: Nesting is not scaling

Nested forms suggest *scales*—with small elements contained into larger ones, or, conversely, large elements containing smaller ones. However, scale and scaling are words that should be used carefully, especially so that they are currently fashionable and overused in the tech world. The words give rise to multiple quandaries. First, scale and scaling connote measures and measuring; in the case of urban form elements, it has not been possible to use a consistent, standardized measure to distinguish between a building, a city block, and a plan unit—words and graphics are needed to "measure" building, city blocks, etc. Hence

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it seems more fitting to conceive of these elements as being at different *levels*, rather than at different scales. Second, scaling elements of physical space is done differently by different disciplines, creating confusion. Geographers refer to the representation of buildings as looking at the "large scale"; planners refer to the same as looking at the "small scale." Indeed, geographers are scaling elements based on the ratio of objects as measured on a map to their distance from the earth surface, with 1/1 map scale being actual scale, and 1/100 map scale being where one map unit equals 100th of its actual size, as if it were 100 units away from the surface of earth. Hence maps depicting buildings are at a large scale because the buildings are mapped as being closer to the earth surface than would be the case of the map of an entire region. On the other hand, planners, as do engineers, use human perception to measure space, with buildings being small compared to an entire city or earth itself. Combining geographers and planners understanding of scale leads to two counterintuitive constructs that Hartshorn (1980, 8) characterized as "(1) large-scale or micro studies that involve a physically small study area, and (2) small-scale or macro studies that cover a very large physical area." Hartshorn being a geographer characterizes scale as it related to mapping and refers to levels as levels of abstraction (small-scale macro studies being more abstract than large-scale micro studies). Of note also, geographers use standard and precise measures of distance, while planners do not use engineers' precise measures of scale (e.g. macro scale representing "something large enough to be observed by the naked eye," and measured as 10^{-3} of a specified unit). And neither do planners formally label levels in urban space. Third, scaling is difficult to distinguish from sizing. Take for example a small building which is one of many on a street-block and compare it with a large building that covers an entire street-block. It can be said that the large building has been "scaled up," but it is useful to precise that in fact it has been both sized up and leveled up (since it now is at the same level as the street-block). Finally, and perhaps ironically, analyses using geographic information systems (GIS) are now "scaleless" because the tool can generate maps at almost "any" scale. GIS data is characterized with two scalar elements, the spatial extent of the data (e.g. an entire city) and the resolution or smallest spatial unit at which the data are available (e.g. street segment, building parcel, etc.)

Caveat 2: Nesting is not layering

The nesting of urban form elements is different from the *layering* of urban form. Layering refers to the characteristics of form that are grounded on the surface of earth –going down to below ground as well as up to above ground. Layering is what could be

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termed an *a-posteriori*, geological approach to urban form, serving to describe "what is" in a post-facto one-time snapshot and necessarily static state (Figures 1 & 2). The approach can be contrasted with what could be termed an *a priori* developmental or operational approach, which recognizes the nestedness of urban form elements; it addresses the processes by which cities are built and their dynamic state of change (Figure 3 & 4).

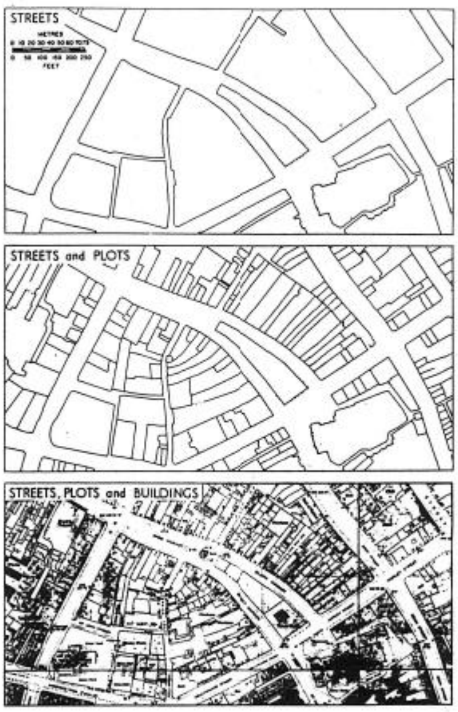

Figure 1. Use of layers for *a posteriori* urban morphological analysis: M.R.G. Conzen fundamental elements of the town plan, streets, streets and plots, streets, plots, and buildings
Source: Whitehand, J.W.R. ed. (1981). The urban landscape, Historical development and management. Papers by MRG Conzen. In *Institute of British Geographers*, Special Publications 13, 26.

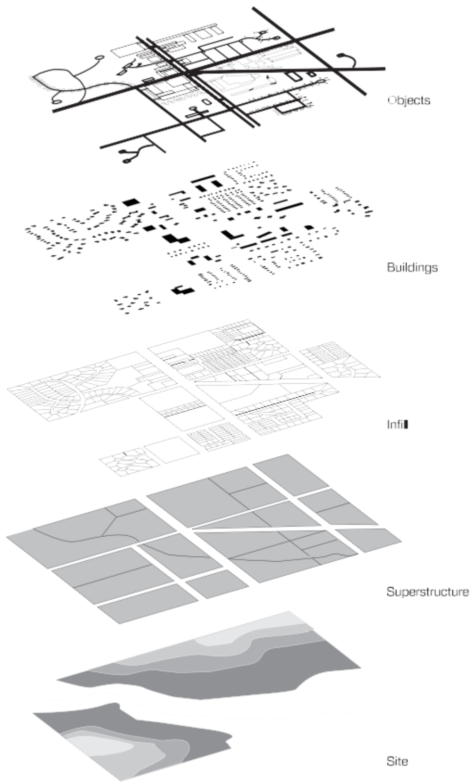

Figure 2. Use of layers for *a posteriori* "geological" approach to morphological analysis: B.C. Scheer spatio-temporal hierarchy introducing the element of time into urban morphological analysis.
Source: Scheer B.C. (2001) The anatomy of Sprawl. *Places* 14(2), 30.

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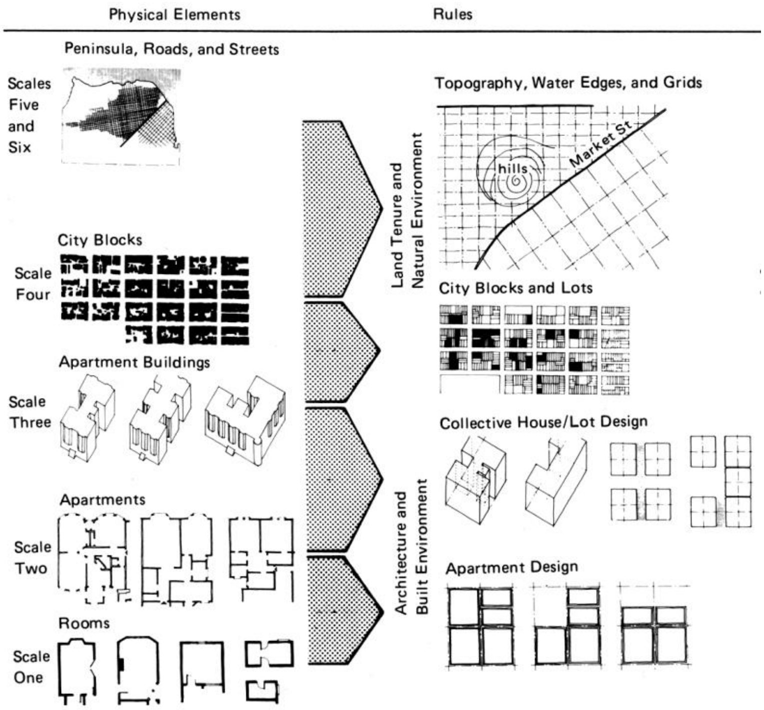

Figure 3. *A priori* multilevel structure of urban space with nested elements: a "developmental or operational" approach to city building, the case of San Francisco, 1920s. (Note the use of the term "scale" which, some 30 years later, I suggest is not appropriate and should be changed to "levels").
Source: Moudon A.V. (1986a) *Built for change, Neighborhood architecture in San Francisco*. Cambridge MA: The MIT Press, 124.

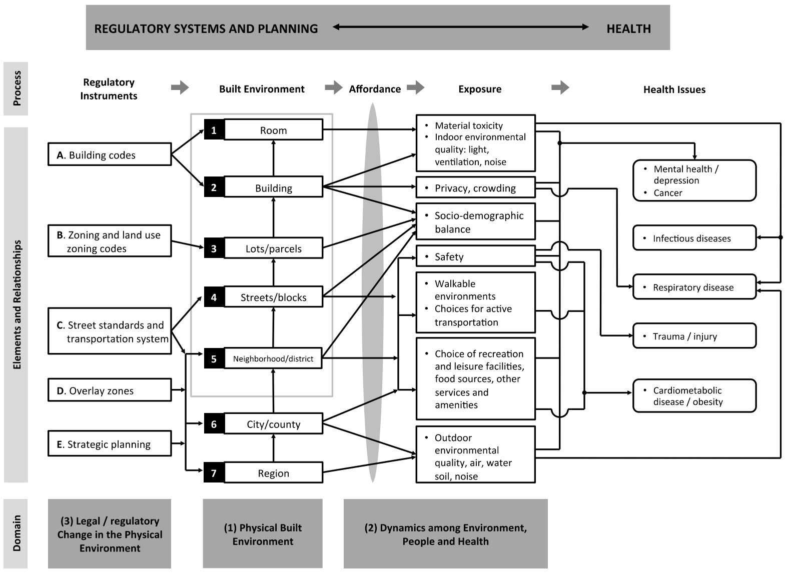

Figure 4. *A priori* multilevel structure of urban space with nested elements: theoretical structure of built environment change (BEC) for use in health research.
Source: Berke E.M., Vernez-Moudon A. (2014). Built environment change: A framework to support health-enhancing behaviour through environmental policy and health research. *Journal of Epidemiology and Community Health*, 68(6), 588.

In sum, the fundamentals of urban morphological research have consisted of three elements that are nested and define three core levels: buildings, street-blocks, and plan units. To wit, however, urban morphological research can stretch beyond the three core levels, that is it can either focus "down" within buildings or it can go "up" beyond plan units: rooms and corridors are nested in buildings just as plan units are nested into neighborhoods, districts, towns, or cities (Berke & Moudon, 2014). The multi-levelness of urban form parallels that of societal structures (the well-understood social structure that spans from individuals to groups) and as such, is essential to consider in the conceptual framework of urban morphological analysis.

LARGER ELEMENTS, LARGER CITIES

Based on its current fundamentals, urban morphological research can be challenging when applied to contemporary cities. This is because city building practices over the past half century have introduced major changes in the characteristics of the three basic elements and in how they relate to and nest with each other.

Most flagrantly observed is the unprecedented increase in the *size of buildings* over the past century. In middle-income countries and up, even the most modest houses are much larger now than they were a few decades ago for corresponding income or status level. The average residential unit size in Hong Kong has grown four-fold, from 3 to 12 m^2 per person since the 1960s. Even more obvious is the increase in the size of commercial and institutional buildings—as illustrated for example in the 2017 120,000 m^2 Paris Tribunal or the 1988 225,000 m^2 Ministry of the Economy and Finance buildings in Paris, France. And Paris has smaller institutional buildings than Dubai, Tokyo, or 1st and 2nd tier cities in China—Tokyo Metropolitan Government 1990 building has 196,000 m^2. The change in building size affects the relationship between buildings and street-blocks as larger buildings nest differently within street-blocks than small buildings.

Parcels have grown in size as well. For single-family housing development patterns, average parcel size has grown pretty much in proportion to the change in building (house) size (Chow, 2002). But for multi-family, commercial, and institutional development, parcel size has often increased independently from the size of buildings. For example, in North American suburban apartment development, the buildings themselves remain relatively small; they are two- or three-story structures with a central stairwell serving two to four units per floor. Yet these structures now often sit as a group on large parcels that correspond to the size of multiple traditional street-blocks. For commercial development, and for retail uses particularly, parcel size has grown from hosting single to multiple buildings, as is the case of shopping malls.

Increases in parcel size are the result of the aggregation of private wealth or greater public control over urban land: large companies, pension funds, insurance companies, labor unions, etc., now own large multi-family and commercial developments. In some economies, public entities also retain land rights in family-owned condominiums (as is the case in China and some European cities). Notably, in Chinese cities where land remains in public or

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collective ownership, *de facto* parcels mark territories controlled by one management entity that to all intents and purposes acts as a landowner, while residents or commercial entities occupying the parcel act as the co-owners of individual or parts of buildings with their immediate surrounding open space.

Changes in parcel size affect the relationship with and between buildings and with street-blocks. These changes have been documented. Focusing on Paris in the late 19th century, Panerai and colleagues (1977) analyzed the pre-modern consolidation of medieval street-blocks into planned block-sized developments, leading to the increase in the size of what Conzen called plan units (Panerai, Castex, & Depaule, 1977). For the 20th century, the case of San Francisco showed the disintegration of the individual parcel hosting row- and semi-detached houses or apartments, also leading to the increase in the size of the plan unit (Moudon, 1986a, 128).

Still, the increases in the sizes of either buildings or parcels pale in comparison to the increases in the size of cities themselves over the past seven decades. Worldwide, cities have grown in size as the result of the combination of population growth and the increase in the urbanization rates of the world population. The impacts of population growth and urbanization on urban form are multiple. The Seattle region conurbation experienced a 5-fold increase in its built-up area (now at 2,500 km^2), against a 3-fold increase in population since the 1960s (now at 3.4 million). A 3.5-fold increase in Shanghai Municipality's built up area took place in only two decades (1990-2010) (Yin, Yin, Zhong, Xu, Hu, Wang, & Wu, 2011). Yet while most cities have grown in population and built up areas, there are great variations in urban forms. As an example, the 25 million Shanghainese live in half of the area where 11 million New Yorkers live, and thus at densities that are more than four times their counterparts in North America's densest city.

NEW PROBLEMATIC

The growth in the size of city-region agglomerations has engendered two aspects of a problematic that affects the structure of urban form. One is the need for intra-city mobility in order to accommodate significant increases in the distances that separate urban activities. The Roman city of Florence could be traversed on foot in less than one hour, and Paris intra-muros could be traveled between east and west in about double that time up to the 18th century. In contrast, traversing most of contemporary cities on foot today would take a good part of a day and more! Higher-speed transport has had to come to the rescue and to shorten within-city distances so urbanites could frequently visit different areas of the expanded city. Horse-drawn conveyances first offered higher-speed travel, but they, and traditional city streets, failed to serve efficiently the large numbers of urbanites needing to travel the longer distances between activities in the same city. Motorized transport had to eventually be introduced to address the new urban mobility needs. In turn, new modes of transport had to be supported by new, large, city-wide infrastructure elements.

Second, large cities have demanded new ways to be conceptualized in order to structure their planning and their management. The term neighborhood captured a new planning concept that encapsulated the discrete part of a large city, giving it definable social, economic, geographic, and physical characteristics. The idea of neighborhood is said to be a British creation of the late 19th century (Smailes 1968), thought to be the basic structural element of increasingly large cities. Clarence Perry's Neighborhood Unit (1929) is perhaps best known as a conceptual model of neighborhood. However, an increasing amount of research is documenting similar early 20th century neighborhood models developed in China, Japan, and the Soviet Union (Peponis, Park, & Feng, 2016, Chen 2017). In all cases, the neighborhood came to be considered as the building block of the modern city.

City-wide mobility-serving infrastructure and neighborhoods introduce new dimensions to urban morphology analyses.

MOBILITY - SERVING INFRASTRUCTURE AND NEIGHBORHOODS

City-wide infrastructures are not new (Panerai, Depaule, & Demorgon, 1999, 139). They existed long ago in major cities not for mobility but for bringing in vital water in the form of aqueducts, and for defense, as fortifications and canals. The most well-known, and perhaps earliest, attempt at building infrastructures to improve intra-city mobility was Baron Haussmann's restructure of Paris surface transport and utilities. With the scheme of boldly carving boulevards within the medieval city fabric, he introduced new mobility-serving morphological elements at the city level. In vogue in the second half of the 19th century, urban restructuration schemes similar to Paris's were carried out in many of the major European and Middle Eastern cities that were suffering from overcrowding and needed expansion (Sarraf 2010). Today, the subways and motorways that used to be the privilege of capital cities until the early 20th century have become ubiquitous higher-speed transport infrastructure *that* serve most cities and city-regions with more than 1 million population in middle- and upper-income countries.

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For neighborhoods, a shared set of principles guides the definition of neighborhood models. Unlike its precedent, the quarter (quartier, quartiere, barrio), which was defined by its commercial use, the early 20th century neighborhood (term coming from "to be near, vecindad, or voisinage") is conceived as a place of residence. Housing is the neighborhood dominant land use, which is complemented by nearby services to meet daily or weekly needs. Travel within the neighborhood is slow and safe, with motorized traffic either tamed or eliminated. Higher-speed travel is accommodated on arterial streets delineating the neighborhood boundaries. These arterials are in turn lined by higher density housing (apartments) and stores. The neighborhood center itself consists of different land uses, depending on the model. Perry's early model put schools, community centers, and parks as central neighborhood services. New urbanists in the USA and Chinese planners located shops, schools, transit, and parks in the center (Duany & Plater-Zyberk, 1991). Neighborhood units vary in size from 400 m to 500 m square depending on the model. Units are often paired in order to share commercial land uses. There seems to be agreement that commercial facilities need to serve a minimum area contained within a 400 m buffer and equivalent to 800 m square (Figure 5).

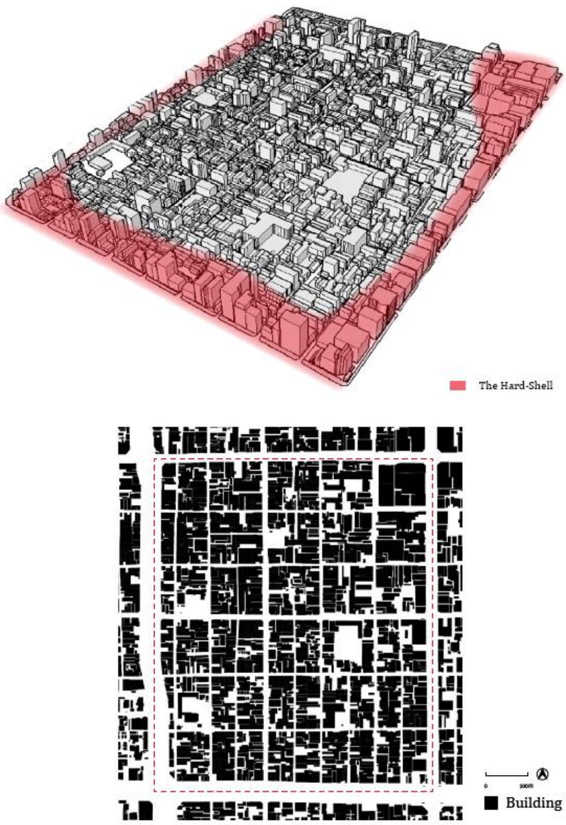

Figure 5. Shijo-Karasuma superblock in Kyoto's supergrid. Top: 3D model of "hard shell-soft yolk" form of superblock. Bottom: Figure ground.
Source: Chen, X. (2017). A comparative study of supergrid and superblock urban structure in China and Japan, Rethinking the Chinese superblocks: Learning from Japanese experience. Doctor of Philosophy thesis, Faculty of Architecture, Design & Planning, The University of Sydney, Australia, C6.9

All neighborhood unit models organize streets hierarchically. The unit is contained within streets where travel occurs at higher speed, while its core is served by narrower, lower speed streets and pedestrian paths. The neighborhood unit is thus a hybrid concept, encompassing both areas for dwelling and networks for mobility. The networks containing the neighborhood area operate at the inter-neighborhood or inter-district level, in contrast to slower-speed city streets that function at the intra-neighborhood level.

Given the nestedness of urban space, the inter-neighborhood networks become *intra-city networks*. The resulting intra-city transport infrastructure can be star-shaped-like networks of Haussmann's Paris, irregular as in turn of the 20th century subways lines, or grid-like as in Detroit's or Los Angeles's freeways.

THE NEW DUALITY OF AREAS AND NETWORKS

Mobility as a new aspect of contemporary cities was concisely captured by Gabriel Dupuy in his book *L'urbanisme des réseaux* (1991). He demonstrated how citywide, intra-city réseaux or networks have become important elements shaping the form of today's large cities. Recognizing their existence requires adding to the way urban morphologists have looked at cities. So far, urban morphologists have offered a primarily *area-based* approach related to understanding the traditional and relatively small city. They have focused on documenting the places where humans dwell; where space is used for living, working, and recreating. Buildings, street-blocks and plan units allow one to understand the city as territory for habitation, commerce, religion and other activities. Of course, locomotion being an intrinsic human characteristic, moving between dwells and activities was and has always been necessary. Urban morphologists have considered networks before, either in the form of corridors within buildings, or as streets providing access to parcels and buildings along block faces. To wit, M.R.G. Conzen was keenly aware of the duality between areas and networks, as attested by his neologism, the street-block. The word street-block magically captures the essence of urban space, which lies at the intersection of dwelling-inhabiting and moving-accessing; and of more private versus more public spaces. (Unfortunately, the term street-block cannot be easily translated into Romance languages). In another example of recognizing the duality of areas and networks, Cerdà had incorporated the idea of mobility and networks in the physical shape of Barcelona's Ensanche's blocks: those were chamfered, ostensibly to better accommodate directional change in movement patterns.

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Further, theories of neighborhood, which tacitly or explicitly heralded the concept of the superblock, suggested that morphologically speaking, the neighborhood was to be conceived of as a higher-level Conzenian street-block. A possible name for the neighborhood as a hybrid element defining both an area and a network, would be a hyphenated appellation superstreet-neighborhoodblock. These terms may be unduly complicated, and a simpler alternative could be superstreet-block, which would build on Conzen's nomenclature. For this publication, I selected combining a more familiar set of terms, supergrid-superblock, which Chen (2017) and others have used. Of note, however, the term grid does not only apply to orthogonal geometries, just like the term block does not imply orthogonality.

Caveat 3: A neighborhood is not a plan unit

The concept of neighborhood is similar to, but not synonymous with M.R.G. Conzen's plan unit. The plan unit is an area of a town that was planned and/or built as one spatial unit and that, as a result of this planning, contained similar building and street-block types. As such, the plan unit is a conceptual tool to capture *post facto* a city area's development characteristics. Distinctively, a neighborhood is an *a priori* urban planning and social concept. A neighborhood can be physically developed in different phases and have multiple building or street-block types, and therefore can be made of what would be considered several plan units. Therefore, while the plan unit and the neighborhood are both above the street-block in urban morphological analysis, they are at different levels.

N.B. Speed of movement, mobility versus accessibility

The concept of mobility necessarily exist at different levels. There is a micro and a macro dimension to urban mobility, just like there is a micro and a macro urban morphology (Moudon, 2002). The emergence of macro-level mobility in the form of intra-city motorized transport systems was gradual as the need for longer distance travel was being felt while cities grew in size. A multi-district hierarchy of streets eventually emerged to accommodate different speeds of travel, slow at the micro level and faster at the macro level. Further, transport planners distinguish between mobility and accessibility (Handy, 2002). To illustrate these dichotomies, travel on subways or motorways covers longer distances or is of longer duration than travel by foot or by two-wheeler; as a result, subway or motorway networks are of lower density than that of city streets, and have fewer intersections (for choice in directional change) and fewer access points per arial unit (in and out ramps for motorways; stations for subways) than networks used for walking or cycling for which access takes the form of doorways into buildings or entry points into facilities contained with a city block for city streets.

Intra-city, inter-neighborhood motorized transport systems introduce a new level of urban space, one above that of the plan unit, within which plan units become nested.

CONCLUDING WITH NEW ELEMENTS AND NEW LEVELS

The size and form of contemporary cities and their elements have evolved over the past several decades, suggesting that changes be made to the theoretical and conceptual frameworks used to guide urban morphological analyses. First, the primarily area-based approach used in morphological analyses so far needs to be complemented by a network-based conceptualization of urban space. Mobility-serving elements of urban form (e.g. streets, thoroughfares, etc.) need to be considered both separately and together with the areas to which they provide access (e.g. parcels, blocks, etc.). Urban morphological analyses need recognize the *dual function* of urban space, which includes dwelling, occupying, inhabiting, as well as locomoting, traveling, circulating, etc., links settlement to movement, the two dimensions of urban space.

Second, a new, higher level of analysis is needed to capture the larger elements characterizing today's large cities. This new level is defined dually as an area, called superblocks, which is contained within a network, called supergrids.

Table 1. *A priori* multilevel structure of urban space using areas and networks and including supergrids and superblocks

Accepted elements and levels

nestedness	element	
level 1	building	parcel/plot
level 2	street-block	
level 3	plan unit/tessuto	

Proposed elements and levels

NETWORKS		AREAS		
hierarchy	element	nestedness	element	
micro		level 0	room	
micro	corridor	level 1	building	parcel/plot
micro	street	level 2	block	
macro		level 3	plan unit/tessuto	
macro	supergrid	level 4	superblock	

Table 1 summarizes proposed changes in the morphological characterization of urban form. A level 4 is added to reflect intra-city elements. Also added is a level 0, for completeness, and to include the studies of the many morphologists who focus on the study of building types.

The parcel or plot is shown in the figure as the element that links buildings to city street-blocks in traditional cities. Since the early 20th century, changes in urban land ownership patterns have contributed to increasing the size of many parcels such that they individually can cover one or more street-blocks. The change in

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the size of parcel is translated into the parcel spanning level 1 to beyond level 2 and into level 3.

The proposed new elements and levels sketch out a conceptual framework for use in urban morphological analyses. Table 1 can serve to place studies in the framework, according to the specific elements they focus on, and help identify appropriate levels that are standardized to facilitate comparison between studies.

REFERENCES

Berke, E.M., & Vernez-Moudon, A. (2014) Built environment change: A framework to support health-enhancing behaviour through environmental policy and health research. *Journal of Epidemiology and Community Health*, 68(6), 586-590.

Chen, X. (2017). *A comparative study of supergrid and superblock urban structure in China and Japan, Rethinking the Chinese superblocks: Learning from Japanese experience*. Doctor of Philosophy thesis, Faculty of Architecture, Design & Planning, The University of Sydney, Australia, http://hdl.handle.net/2123/17986

Chow, R.Y. (2002). *Suburban Space: The Fabric of Dwelling*. Berkeley, CA: University of California Press.

Duany, A., & Plater-Zyberk, E. (1991) *Towns and town-making principles*. New York: Rizzoli

Dupuy, G. (1991). *L'Urbanisme des réseaux : théories et méthodes*. Paris: Armand Colin.

Handy, S. (2002). Accessibility- vs. mobility-enhancing strategies for addressing automobile dependence in the U.S. Paper prepared for the *European Conference of Ministers of Transport*, May, http://www.des.ucdavis.edu/faculty/handy/ECMT_report.pdf

Hartshorn, T.R. (1980) *Interpreting the city: An urban geography*. New York: John Wiley & Sons

Lu, D. (2006). *Remaking Chinese urban form: Modernity, scarcity and space, 1949-2005*. London: Routledge.

Moudon, A.V. (1986a). *Built for change: Neighborhood architecture in San Francisco*. Cambridge, MA: The MIT Press.

Moudon, A.V. (1986b). Platting versus planning: Housing at the household scale. *Landscape* 29, 30-38.

Moudon, A.V. (1997) Urban morphology as an emerging interdisciplinary field. *Urban Morphology*. 1, 3-10 http://www.urbanform.org/pdf/moudon1997.pdf

Moudon, A.V. (2002). Thinking about micro and macro urban morphology. *Urban Morphology*. 6(1), 37-39.

Panerai, Ph., Castex, J., Depaule, J.C., (1977). *Formes urbaines, de l'îlot à la barre*. Paris: Éditions Parenthèses.

Panerai, Ph., Depaule, J.C., & Demorgon, M. (1999). *Analyse urbaine*. Paris: Collection Eupalinos.

Peponis, J., Park, J., & Feng, C. (2016) The city as interface of scales: Gangnam Urbanism. In S. H. Kim, E. Cinn, K. Ahn, S. Kim, I. Chung, D. E. Jeong, & R. Enos. (Eds.), *The FAR game*. Seoul, Korea: SPACE Books, 102–111.

Perry, C. (1929). *Neighborhood and community planning comprising three monographs: The Neighborhood Unit*. New York, Regional Plan of New York and Its Environs.

Sarraf, M. (2010). *Vestiges of urban spirit, Isfahan's urban fabric through socio-spatial transformations*. Licentiate Thesis. KTH, Royal Institute of Technology, School of Architecture & the Built Environment, Stockholm.

Smailes, A.E. (1968 [1953]). *The Geography of towns*. Chicago: Aldine Publishing Company.

Scheer, B.C. (2001). The anatomy of Sprawl. *Places* 14(2), 28-37. https://placesjournal.org/assets/legacy/pdfs/the-anatomy-of-sprawl.pdf?0574aa

Scheer, B.C. (2015). The epistemology of urban morphology. *Urban Morphology* 19, 117-134.

Scheer, B.C. (2018). Toward a minimalist definition of the plot. *Urban Morphology* 22, 162-163.

Yin, J., Yin, Z., Zhong, H., Xu, S., Hu, X., Wang, J., & Wu, J. (2011). Monitoring urban expansion and land use/land cover changes of Shanghai Metropolitan Area during the Transitional Economy (1979–2009) in China. *Environmental Monitoring and Assessment* 177 (1–4), 609–621. https://doi.org/10.1007/s10661-010-1660-8.

Whitehand, J.W.R. (1981). The urban landscape, Historical development and management. Papers by MRG Conzen. In *Institute of British Geographers*, Special Publications 13.

Resume

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Roots of Urban Morphology

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Abstract

This paper provides a comprehensive review of the research field of urban morphology: the study of urban form. Urban morphology is a growing field of cross-disciplinary research, attracting worldwide interest among scholars in architecture, geography and planning. It aims to decipher the physical form, the urban landscape or townscape of complex contemporary cities. This paper discusses the evolution of urban morphology, from its conceptual foundations in research on the physical form of urban areas. Interestingly, the roots of urban morphology can be traced back to different disciplines in different countries. This discussion will cast light on various research perspectives of urban morphology, as well as discussing similarities and differences between the geographical and the architectural approaches to urban form studies. This is followed by a closer look at the theories developed by Gianfranco Caniggia and MRG Conzen. Their work has been an inspiration for many practitioners and researchers, including Whitehand, Maffei, and Moudon to name a few. Finally, a schematic diagram is presented, which reflects the heightened activity of research on physical form that is currently occurring in several disciplines simultaneously, and showing the relationships between research traditions and authors. As the formation and development of the urban landscape becomes ever more diverse, it is necessary to revisit and use

Keywords: Urban morphology, geographical perspective, architectural perspective, Caniggia, Conzen.

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the concepts and methods established by Caniggia and Conzen in the management of urban landscape changes.

URBAN MORPHOLOGY

Urban morphology is a branch of urban studies that deals with the form and structure of a settlement. It studies complex and intricate types of forms and how different factors set their mark upon the whole city. In this way urban morphology examines the configuration of the urban form as well as the relationship between the individual forms and the city as a whole, from the formative years of the city through its subsequent transformations.

(Kristjánsdóttir, 2007, p. 1)

Urban morphological researchers are concerned with the form and structure of an urban landscape. It was the great poet and philosopher Goethe (1790) who first expressed the essence of the idea of morphology in his writings describing internal structure and the history of variation in form. The word 'morphology' was first used in bioscience to describe form and structure, but now is increasingly being used in geography, architecture, geology, philology and other disciplines. The term urban morphology refers to the study of the physical (or built) fabric of urban form, and the people and processes shaping it (Larkham & Jones, 1991). According to Larkham and Jones (1991), English usage of the term dates at least from Leighly's (1928) study of towns in central Sweden. Much later, Larkham (2015) re-examined Leighly's (1928) study in terms of its background and the influence of Carl Sauer (1889–1975) (1925), the founder of cultural geography at the University of California at Berkeley.

However, in urban design, the term is principally used to describe "... a method of analysis which is basic to find[ing] out principles or rules of urban design" (according to Gebauer & Samuels, 1983). However, they also note that the term can be understood as the study of the physical and spatial characteristics of the whole urban structure, which is closer to the geographer's usage (Larkham & Jones, 1991).

The roots of urban morphology lie in geography in Britain and Germany, and architecture in Italy and France.

While the beginnings of the urban morphology 'discipline' can be traced back to the end of the eighteenth century, it did not become the main research approach to the urban landscape until after the Second World War. In fact, urban morphology can be viewed as part of a much wider movement that arose as a reaction against

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Modernism in architecture and urban planning during the period 1959 to 1961. At this time, several studies were published that represented an attack on the current approach to city planning and rebuilding, for example Kevin Lynch's *The image of the city* (1960), Gordon Cullen's *Townscape* (1961), Jane Jacobs' *The death and life of great American Cities* (1961), Muratori's study of Venice (1959), and Conzen's study of Alnwick (1960), which was followed up by Alexander, Ishikawa, and Silverstein's (1977) study of urban patterns, entitled *A Pattern Language*.

The Geographical Perspective

Within geography, Otto Schlüter (1899a; 1899b; 1903; 1906; 1919) played a central role in the development of the morphology of the "cultural landscape" (*g. Kulturlandschaft*) as the object of research in "cultural geography" (*g. Kulturgeographie*), which for him was the most important aspect of human geography (Whitehand, 1981). Schlüter asserted that geographers should consider the form and spatial structure created by visible phenomena on the earth's surface as their unifying theme. In other words, mountains, rivers, pastures, forests, roads, canals, gardens, fields, villages and towns become the object of study for the geographer. Further, Schlüter regarded economic, racial, psychological and political conditions as not of primary geographical interest, arguing they should be studied only as part of the explanation of material distributions (Holt-Jensen, 1999). Therefore, it was not only a descriptive morphology that he envisaged, but also an explanatory morphology. He was fully aware of the interdependence in geography of the three aspects of form, function and development (history) (Whitehand, 1981).

Schlüter systematically divided the cultural landscape according to the categories –settlements, land utilisation and lines of communication, thus giving rise to the three subdivisions of human geography, namely settlement geography, economic geography and transport geography. Settlement geography was then further subdivided on the basis of rural and urban settlements. Schlüter regarded the physical forms and appearance of the town, the "urban landscape" (*g. Stadtlandschaft*), as the main object of research within urban geography, viewing it as a distinct category of cultural landscape and as such, a regional unit in its own right. As JWR Whitehand (1981) points out, Schlüter's work imparted a marked morphological emphasis to human geography in general and urban geography in particular that was to become increasingly evident over the first three decades of the twentieth century.

Urban morphology was further developed by a number of researchers in German speaking countries, including Hassinger, Schaefer, Geisler, Dörries, Martiny, Fritz, Meier, Gradman, Rietschel, Frölich, Rörig, Hamm, Scharlau, Klaiber, Meurer, Siedler, and Louis. This development is documented in JWR Whitehand (1981, pp. 3-7).

MRG Conzen (1907–2000) was a student at the Geographical Institute of the University of Berlin from 1926. He was inspired by pioneers in the field of geography at that time, attending their seminars and field excursions. He was especially taken with the ideas of Schlüter and the work of Herbert Louis (1936). He was also influenced by geomorphology, the line of research within physical geography that focuses on studies of landform.

Conzen was interested in the man-made landscape and human settlements and applied ideas from geomorphology in his research, particularly in terms of the search for process and the forces underlying them. The development of the history of urban morphology within geography during the first half of the twentieth century, and its diverse research traditions, have been the subject of recent investigation (Slater, 1990; Whitehand, 1981, 1987, 1988) focusing on the urban morphogenetic tradition and the central role played by MRG Conzen.

The Architectural Perspective

In Italy there is a strong link between urban morphology and urban design, as urban morphology developed as a critique on modernist doctrines of architecture and planning. Architect Saverio Muratori (1910–1973) is the seminal figure in the development of systematic ways of investigating the evolution of the Italian City. Muratori was an architectural student during a period of profound renewal of Italian teaching institutions, with architecture well positioned to bridge the divide between art and engineering (Cataldi, Maffei, & Vaccaro, 2002). As a student in the late 1920s, he was inspired by great scholars in contextualised architecture, especially Gustavo Giovannoni among others such as Fasolo, Foschini, Calandra and Piacentini.

Muratori's work was based on the Roman interpretation of Italian rationalism. He believed that urban planning and urban design theory systematically ceased to be cultural devices deeply rooted in the history of the place during the first half of the twentieth century. Accordingly, Muratori saw urban analysis as a form of operative history, offering both an alternative to and criticism of the programmes and the methods of Modernist architecture and planning. His interest was to recover a sense of continuity in

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architectural practice. He devoted his life to the creation of a new theoretical framework to explain the creation and transformation of urban form over the centuries in the belief that "only a systematic understanding of history's laws of reproduction could recreate the role previously claimed by urban design" (Cataldi et. al., 2002, p. 3).

In *Vita e storia della citta*, Muratori (1950) identifies the need to determine the characteristics of an urban organism and then to adapt modern building to it. He emphasises the town as a living organism and collective work of art, and, for the first time, raises the idea of planning new buildings in continuity with the building culture of a place.

During post-war reconstruction in Italian towns, Muratori was responsible for the Tuscolano district in Rome, where town planning and building were influenced by the contemporary so-called Scandinavian empiricism. He also planned four major public buildings in three different Italian towns: the church of S. Giovanni al Gatano in Pisa, the Ente Nazionale di Previdenza ed Assicurazione Sociale office building in Bologna, the headquarters of the Christian Democratic Party in Rome, and the incomplete church of Tuscolano in Rome. All four stand out from the international panorama of contemporary architecture because the themes they embody were decades ahead of their time. Muratori's experience as a practising planner and architect led to his dissatisfaction with the evident conceptual gap between the plans of entire town quarters and the later designs of modern architects.

In 1952, Muratori was appointed Chair of the Instituto Universitario di Architectura of Venice and was one of the first architects in Italy to openly criticise Modernist doctrines of architecture and planning (Samuels, 1990). As a professor at the School of Architecture in Venice from 1952 to 1954, Muratori was able to re-examine the first urban surveys of the city's hub and the theoretical assumptions of his 1950 essay, employing the fundamental concepts of type, fabric, organism and operative history (Cataldi et. al., 2002).

Venice played a leading role in the development of his ideas, through lectures and student surveys. He required his students undertake investigations of the evolution of Venice through direct observation and examination of documentary evidence, the results of which were to be published as an 'operational history' (Muratori, 1959). Through these studies Muratori wanted his students to become technicians of the urban fabric, by learning to interpret the influence of societal needs in transforming the inherited urban fabric. He emphasised to his students that architects must have detailed knowledge of the medium in which they conduct their work, and that the proper basis for design was a thorough understanding of buildings. In *Studi per una operante storia urbana di Venezia*, Muratori (1959) re-examined the first urban surveys of the city's core and the theoretical assumptions underpinning the ideas he had put forward in his earlier paper, *Vita e storia delle citta* (Muratori 1950). As such, Muratori (1959) defines and applies the fundamental concepts of building type, urban fabric, urban organism, and operative history or working history.

His Venetian experience provided the trigger for his idea of operative history. Later, as a Professor of Architectural Composition in Rome from 1954 to 1973, he used it to provide the basis for students' plans, despite opposition from other tutors and students (Kropf 1993; Samuels, 1990). Muratori's rejection of the Modern movement before the popular rise of Post-Modernism led to criticisms that he was favouring the status quo instead of searching for new forms. His teaching was aimed at understanding the various values inherent in the phases of urban formation, ranging from the influences on and implications of projects involving existing buildings in historic downtown areas, to projects concerned with the creation of suburbs.

During his time in Rome, a team of resident assistants formed around Muratori, some of whom collaborated with him on the great atlas, *Studi per una operante storia urbana di Roma* (Muratori, Bollati, Bollati and Marinucci 1963) (Cataldi et.al., 2002). Muratori and his wider team got the chance to carry out his ideas in a design competition for a real town, creating the winning project for the S. Giuliano Sandbank competition in Venice in 1959. The idea of design in stages was presented as a logical result of "reading" the town's development (Cataldi, 1998).

> One can do anything but invent new things: real invention lies in not inventing anything (Muratori, quoted in Cataldi 1998).

Muratori was concerned that modern architecture was in crisis because architects were more focused on raising monuments rather than continuing the process of adding to the inherited form, as realised through history and so expressing the local culture. His stance on Modernism eventually cost him his post at the university. Saverio Muratori's work is documented in detail in a book dedicated to him, and edited by Cataldi (2013).

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Caniggia was one of Muratori's assistants, and was similarly concerned that the thread running through built inheritance had been broken because of the methods used by modern architects. As described later in more detail, he carried on Muratori's ideas, developing a typo-morphological approach to architecture and urban design (Cataldi 2003). Cannigia (1997) advocated studying the steps involved in the creation and evolution of the built environment in order to understand an urban landscape.

The French perspective

A third perspective on urban morphology was established in France in the late 1960s. As in Italy, the French school, based principally at the Versailles School of Architecture, was established as a rejection of the Modern movement (Moudon 1997). Muratori's work influenced French architects, along with that of Aymonino, Brusatin, Fabbri, Lena, Loverro, Lucianetti, & Rossi (1966)., and Rossi (1964 [1966]; 1982). The French school took a much broader perspective, aiming to understand the city in a multidisciplinary context (Moudon, 1994). A connection was soon established between the French and the Italian schools, however they differed in two important aspects of their approach to urban morphology – their approach to the dialectic of urban form and social action, and the dialectic of modern versus non-modern. As distinct from the Italian method, the social component is always the primary focus within the French school due to the influence of the French philosopher and sociologist Henri Lefebvre (Petruccioli, 1998b). Lefebvre introduced the concept of the right to the city in the book, *Le Droit à la ville* (Lefebvre 1968), after which he published several influential works on cities, urbanism, and space. *The Production of Space* (Lefebvre 1974) became one of the most influential and heavily cited works on urban theory.

The French school has generated extensive methodological knowledge for the analysis of urbanisation processes and related architectural models. The focus is the dialectical relationship between the built landscape and the social world, with each shaping the other and placing emphasis on the importance of built space for sustaining social practices. Castex (2013), Levy (1999), Darin (1998, 2000) and Ducom (2003a, 2003b), as well as Philippe Panerai and Jean Depaule, are a few representative members of the French school.

The Conzenian Approach

Conzen's study of Alnwick, Northumberland (first published in 1960; revised edition published in 1969) is the seminal work in the field of urban morphology in Britain. The method for town plan analysis that Conzen put forward in the Alnwick study, which is further elaborated in his studies of central Newcastle (Conzen 1962) and Ludlow (Conzen 1966, 1975, 1988), inspired much of the English-language work on plan analysis in the second half of the twentieth century, and established a basic framework of principles for urban morphology. Derived in part from earlier German work (Whitehand, 1981), concepts and terms developed by Conzen have become widely used in geography and other disciplines (Kropf & Larkham, 2000).

Conzen’s approach was historical and evolutionary in looking at the form of the town as the result of the sequence of events in its formation. These events are seen as part of the social and economic development of the local, regional and national context in which the town lies (Kropf, 1993). The systematic inclusion of plots as the fundamental units of analysis is one of the major contributions of Conzen’s method. Before Conzen’s Alnwick study, plots and plot patterns had received little attention in urban morphology (Conzen, 1960, p. 4). Conzen’s work generated an extended technical vocabulary, terminology and procedures for analysing the town plan, the aim being to explain the geographical character of towns, which he believed was determined by significant economic and social factors within the regional context.

According to Conzen, the townscape is a combination of a town plan, and patterns of building forms and urban land use (Conzen, 1960). Conzen describes the town-plan as the topographical arrangement of an urban built-up area and all its man-made features. The town plan itself is subdivided into three constituent parts or elements (Figure 1):

> (*i*) *streets* and their arrangement in a *street system*;
> *(ii) plots* and their aggregation in *street-blocks*; and
> (*iii*) buildings or, more precisely, their *block-plans* (Conzen, 1960, p. 5).

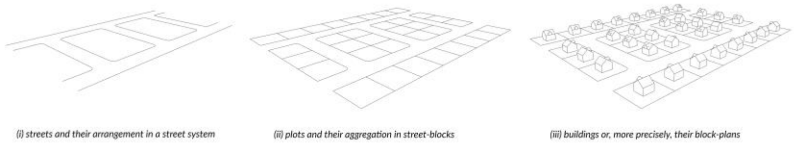

Figure 1. A schematic diagram showing the three distinct but integral kinds of town plan elements, based on Conzen 1960.

The elements which make up any plan or layout are:

> *Street:* a space (street-space) in a built-up area bounded by street-lines and reserved for the use of

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surface traffic. It is a plan element (Conzen, 1969, p. 130).

Plot: a parcel of land representing a land-use unit defined by boundaries on the ground. It is a plan element (Conzen, 1969, p. 128).

Block-plan of a building: the area occupied by a building and defined on the ground by the lines of its containing walls. Loosely referred to as the 'building'. It is a plan element (Conzen, 1969, p. 123).

A plan-unit is formed by individualised combinations of these three elements that are unique to their site circumstances, creating a measure of morphological homogeneity or unity in some or all respects over the area, in different parts of the town. Within the town, a geographical group of morphogenetic plan-units forms a plan-division. The urban plan-divisions arrange themselves in a hierarchy, with each successive order comprising a combination of divisions of the next lowest order (Conzen, 1969, p. 128). Morphogenetic regions are formed of a combination of the town plan, building fabric, land utilisation pattern and the site (Kropf, 1993, p. 38). A morphological period represents any period in the history of an area that creates distinctive material forms in the urban landscape to suit the particular socio-economic needs of its society (Conzen, 1969, p. 127). The Alnwick research provided the foundation for further research in urban morphology, and gave rise to the Conzenian tradition (Whitehand, 1981) and a number of concepts, including the burgage cycle, morphological frame and fringe belts.

The Caniggian Approach

Gianfranco Caniggia, an assistant of Muratori, continued Muratori's work on building types. Caniggia made his own contribution based on his research applying the interpretation method. *Lettura di una citta: Como* is a study of Como, a town of Roman origin in northern Italy (Caniggia, 1963). Caniggia divided buildings into residential and special buildings. The latter are buildings whose principal function is not as a dwelling – for example mosques, convents, or even palaces. This work is the basis for the material presented in *Composizione architettonica e tipologia ediliza,* published in four volumes.

He published the first two volumes with Gian Luigi Maffei (Caniggia & Maffei, 1979; 1984). The first volume, *Composizione Architettonica e Tipologia Edilizia: 1. Lettura dell'Edilizia di Base*, or *The Interpreting basic building*, contains a series of lectures, which focus on the residential building as the formative element of city building. The second, *Composizione Architettonica e Tipologia Edilizia: 2. Il Progetto nell'Edilizia di Base* further demonstrates Caniggia's ideology with examples from all over the world and includes exercises for students so that they can master his methodology. Together they form a manual for the interpretation and design of basic buildings, principles which are taught in many architectural courses. The first volume has been translated into Spanish, French and English. The final two volumes on the interpretation and design of special buildings were still in draft form at the time of Caniggia's death (Cataldi et.al., 2002).

Caniggia argued against the methods used by modern architects. In his view, the crisis in modern architecture arose out of a disparity between the products of building and the intentions of those using them. He addressed the tendency for modern buildings to be an expression of individual architects' personal language of forms, rather than an expression of common concerns or desires using a common local language of forms. If the common form is lost, the knowledge, experience and memories connected to it are not transmitted between generations. The aim of Gianfranco Caniggia's theoretical approach is to understand the built form by examining the historical process of its formation. He studied the steps involved in the creation and evolution of the built environment in order to understand the continuity of cultural inheritance. Then in order to understand the built environment, he reconstructed the city. Through examination of existing buildings and documents, he retraced the steps in its formation to learn how the components are put together.

The past is the key to the present and therefore by studying buildings, their rules of construction and development can be uncovered through systematic interpretation of the built form. Caniggia's approach can be compared to research in linguistic structuralism (Kristjánsdóttir, 2005). In the hierarchy of linguistic structuralism, the smallest element is the letter. Letters then combine to form words, and words are arranged into sentences, which in turn are grouped into paragraphs. Language is a living form that changes through the centuries with collective use, while reflecting the time and place that formed it. Architecture, as language, is a living form, through which people have achieved a sort of unwritten building codification by identifying history and structure (Kristjánsdóttir, 2005).

According to Caniggia, each society has unwritten rules on certain things (e.g., behaviour, language). Such rules are built on the

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common knowledge held by a society, which is based on its culture, and what is considered right or wrong – or what Caniggia and Maffei (2001, p. 43) refer to as spontaneous consciousness. These rules include the concept of a house. This concept is so well embedded within the society that when people refer to a house, they have the same picture in mind. This picture is called a leading type (*i. tipo portante*), and is the ideal to which everyone refers when building a house (Caniggia, 1997).

Within many cultural areas, the origins of the leading type can be traced all the way back to the first settlement within the area. The evolutionary process for building types across the world is documented in Cataldi (2015).

However, when a society undergoes major change, it loses connections to its roots. The commonly held picture of the house is lost, and the question what a house should look like remains. Critical consciousness takes over when the a priori type vanishes and a new type can be formed (Caniggia & Maffei, 2001, pp. 45-7). When people act with critical consciousness they are able to choose what they are doing, but, let us be clear, they do not choose having acquired greater maturity. In the absence of a community codifying what is right or wrong, there will be uncertainty. According to Caniggia, "…they have to deliberate because they have no firmly established way of acting, i.e. they have 'to think about it' because their behaviour in a certain state of need has a margin of possibility which ends up by turning into a margin of indifference as to whether to act in one way or another, evidently induced by a codification crisis of the community´s response to that state of need" (Caniggia & Maffei, 2001, p. 45).

Caniggia and Maffei (2001) define type (typo) in the following way:

> During a moment of greater civil continuity, builders, guided by their spontaneous consciousness, can produce an object "without thinking twice", only unconsciously conditioned by their cultural background. That object will be determined out of previous experiences in their civil surroundings, transformed into a system of integrated cognitions, assumed unitarily to satisfy the particular need to which that object has to correspond (Caniggia & Maffei, 2001, p. 50).

And further:

> The term building type was used in the past and still is today to indicate any group of buildings, with some characteristics, or a series of characteristics, in common (Caniggia & Maffei, 2001, p. 50).

In his analysis, Caniggia starts by making a distinction between the spatial correlation of built objects (copresence) and their temporal correlation (derivation), or the typological process. He looks at the form (type) and studies how individual forms are put together in time and space over the development of the city.

Notions of the form in space and time, i.e. *copresence* and *derivation*, are the fundamental 'conceptual tools' necessary for reconstructing a town.

The typological process is the reconstruction of the changes a type has undergone over time in significant intervals that are called phases. A phase is defined as a reasonable distance in time that allows distinctive and consistent differences between two consecutive types to emerge. The exception to the rule is always around the corner, as evidenced by all the exceptions that are realised under less optimal conditions, or synchronic variations due to topographical problems, or problems with placement in a block or in an incongruous tissue. The typological process is as complicated as the urban landscape it lies within (Petruccioli, 1998a).

Caniggia starts by looking at the smallest elements of construction – the individual stones, examining how these are grouped together to form walls, rooms and houses. The stones, walls and rooms of a particular house can be units formed centuries apart.

Caniggia's examination of the *spatial correlation* of built objects is based on a set of subdivisions that forms a hierarchy (Figure 2). The components are: elements, a structure of elements, a system of structures, and an organism of systems.

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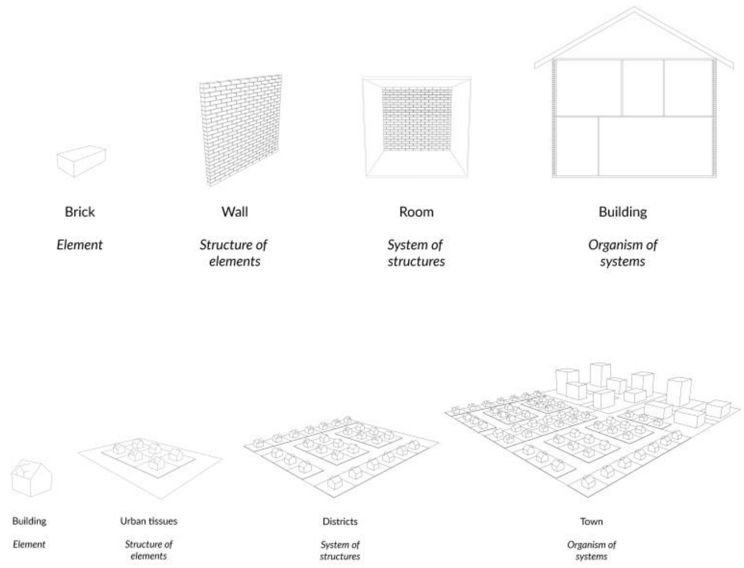

Figure 2. A schematic diagram demonstrating the spatial correlation of a building and a town according to Caniggia (1997).

Figure 2 shows a hierarchy of spatial arrangement. Elements are the smallest units of the system studied. Grouped together, the elements form structures that are the building blocks of the system itself. These building blocks can be different, but they are all formed by grouping together in some way a number of elements of the smallest type. A number of particular structures grouped together in a similar manner form a unit of a higher order, i.e. the system. The same idea can be taken further, whereby a grouping of systems forms a unit of an even higher order. In Caniggia's terminology, this is known as an organism of systems. To provide further clarification, it is useful to consider examples of how Caniggia used these concepts in his work.

Caniggia applied this schema to individual buildings. An element could be a brick, timber, tile etc. A structure of elements is formed through the combination of building materials, for example walls, interior floors, roofs etc. Arrangements of the latter into rooms, stairs, corridors, etc. is the system of structure, with the organism being the building (Caniggia, 1997).

He applies the same schema to the town, where a building is the element and the structure of elements is an aggregate of the buildings, referred to as urban tissue. Urban tissue is defined as the 'aggregation of building type, surrounding space and access ways'. The combination of tissues forms regions or districts (i.e., the system of structures (Figure 2), which together form the organism of the town (Caniggia, 1997).

Caniggia defines urban tissue as follows:

> Formative laws and categories that are as typological as the "building type" can be summed up in one single term, urban tissue. A tissue is to an aggregate what building type is to building: tissue is the concept of the coexistence of several buildings existing in the minds of builders before the act of building, at the level of spontaneous consciousness, as a civil result of the experience of putting together several buildings and summing up all interesting aspects, including aggregation. Briefly, it is "a priori synthesis" of "building type"; we can then transfer to the term "tissue" the characteristics of both "building type" and "type" in its more general accepted meaning (Caniggia, 1979, pp. 118-119).

In Italy, universities such as Florence University, the University of Ferrara and Bari Polytechnic have followed in the footsteps of Muratori and Caniggia, teaching their theories and approaches. In recent years, there has been growing interest in the work of Gianfranco Caniggia. A major conference on his work, followed by an exhibition, was held in the city of Como in 2002 (Samuels, 2002). Further, a recent volume by Strappa, Ieva, and Dimatteo (2003), *La cittàcome organismo. Lettura di Trani alle diverse scale*, is a useful addition to research on Muratori and Caniggia in Italy.

Whitehand's Urban Morphology Research Group

Today urban morphology is a growing subject, with research taking place all over the world. JWR Whitehand has played a central role in this development. He has not only extended MRG Conzen's work, but also encouraged academics from other fields to conduct urban morphology research. His knowledge and enthusiasm have provided the spark necessary to convince others to apply the principles of urban morphology and test the concept around the world. As a result, the concept is now firmly established in a global context.

Founded by Professor Whitehand in 1974, the Urban Morphology Research Group (UMRG) at the University of Birmingham is the major centre in the United Kingdom for the study of the geographical aspects of urban form. In 2000, the MRG Conzen Collection was opened at the School of Geography and Environmental Sciences at Birmingham University by Conzen's son, Professor Michael P Conzen. It comprises MRG Conzen's extensive archives.

JWR Whitehand has supervised several doctoral and postdoctoral students who have carried on with his line of thought, including Peter Larkham, Kai Gu, Karl Kropf, and Sigríður Kristjánsdóttir to

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name a few. On the occasion of his 80th birthday, a book was published to honour his contribution to urban morphology (Oliveira, 2019). Earlier, Larkham and Conzen (2014) had dedicated their book, *Shapers of Urban Form Explorations in Morphological Agency*, to Whitehand.

Kristjánsdóttir (2001) discusses a possible integration of Caniggia's theory on typological process with the fringe-belt concept put forward by Conzen. She introduced the concepts of fringe belts and leading type in Iceland (Kristjánsdóttir 2003, 2005, 2006). In her recent research Kristjánsdóttir (2015, 2018) & (Kristjánsdóttir & Sveinsson 2016) continues the exploration of how concepts from urban morphology can be applied and integrated in research on the urban landscape, analysing how town elements correspond to economic boom and bust in Iceland.

Kai Gu (2001), followed by Whitehand and Gu (2003), applied the concepts of urban morphology to study the Chinese city of Pingyao. Subsequently, an edited book of key papers on urban morphology (Tim, Gu, & Tao, 2014) introduced the topic in China and inspired new interpretations, such as Manfredini (2017). Gu's resent research involve analysis on Chinies cities (Wang and Gu 2020) and applying these approaches in to planning (Gu, Li and Zheng 2019), and teaching urban design (Gu 2018).

ISUF

The formation of the International Seminar on Urban Form (ISUF) in 1994 provided a stage for debate and diffusion and comparison of knowledge on the urban form around the world. ISUF seeks to advance research and practice in fields concerned with the built environment, drawing members from several disciplines including architecture, geography, history, sociology and town planning. In fact it has spread it seeds and several subgroups have be formed. ISUF publishes the journal *Urban Morphology* and holds conferences every year, providing an international framework for communication between members. There is not room here to list all the articles published in the journal, but safe to say it has been a major influence in communicating the results of research on urban morphology (figure 3). Hitherto, it is necessary to acknowledge all the work that Professor Whitehand and his wife Susan have put into editing the journal, which publishes manuscripts by authors for whom English is a second language.

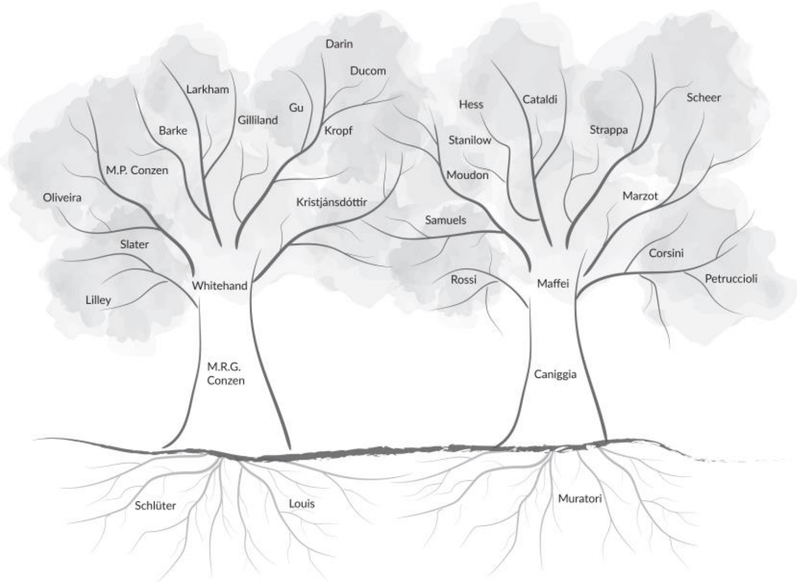

Figure 2. A schematic diagram depicting the heightened research activity on physical form that is currently occurring in several disciplines simultaneously, and showing the relationships between the various research traditions and authors.

In association with ISUF, several research groups that focus on specific cultural areas that often share the same language have formed, and teaching of urban morphology approaches has also grown worldwide (Oliveira 2016, 2018).

The contemporary city is a complex phenomenon. It is necessary to revisit and use the concepts and methods established by Caniggia and Conzen in order to understand it and better manage urban landscape changes.

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REFERENCES

Alexander, C., S. Ishikawa, and M. Silverstein, with M. Jacobson & S.A Fiksdahl-King (1977). *A Pattern Language*. Oxford: Oxford University Press.

Aymonino, C.M., Brusatin, M., Fabbri, G., Lena, M., Loverro, P., Lucianetti, S., & Rossi, A. (1966). *La Citta di Padova, saggio di analisi urbana*. Roma: Offician edizoni.

Caniggia, G. (1963). *Lettura di una Citta: Como*. Rome: Centro Studi di Storia Urbanistica.

Caniggia, G. (1997). *Ragionamenti di tipologia, Operativita della tipologia processuale in architettura.* (English translation by Nicola Marzot) Firenze: ALINEA.

Caniggia, G. & Maffei, G.L. (1979). *Composizione Architettonica e Tipologia Ediliza: 1. Lettura dell'Edilizia di Base* Venezia: Marsilio.

DOI: 10.15320/ICONARP.2019.79– E-ISSN: 2147-9380

Caniggia, G. & Maffei, G.L. (1984). *Composizione Architettonica e Tipologia Ediliza: 2. Il Progetto nell'Edilizia di Base.* Venezia: Marsilio.

Caniggia, G. & Maffei, G.L. (2001). *Composizione architettonica e tipologia edilizia. Lettura dell'edilizia di base.* (English translation by Susan Jane Fraser) Firenze: ALINEA.

Castex, J. (2013). The City as the Only Model. A Critical Study a Century after Muratori´s Birth. In Cataldi, G. (ed.) *Saverio Muratori Architetto (Modern 1910 – Roma 1973) a centro anni dalla nascita.* Firenze: Aión Edizioni.

Cataldi, G. (ed.) (2013). *Saverio Muratori Architetto (Modern 1910 – Roma 1973) a centro anni dalla nascita.* Firenze: Aión Edizioni.

Cataldi, G. (1998). Designing in stages: theory and design in the typological concept of the Italian school of Saverio Muratori. In Petruccioli, A. (ed), *Typological Process and Design Theory*, pp. 35-54. Aga Khan Program for Islamic Architecture at Harvard University and Massachusetts Institute of Technology.

Cataldi, G. (2003). From Muratori to Caniggia: the origins and development of the Italian school of design typology. *Urban Morphology,* ***7***, 19-34.

Cataldi, G. (2015). *Abitazioni Primitive, Il processo evolutivo dei tipi edilizi nel mondo. Primitive Dwellings, The evolutionary process of building types in the world*. Firenze: Aión Edizioni.

Cataldi, G., Maffei, G.L., & Vaccaro P. (2002). Saverio Muratori and the Italian school of planning typology. *Urban Morphology*, *6*, 3-14.

Conzen, M.R.G. (1960). *Alnwick, Northumberland: a study in town-plan analysis* (Institute of British Geographers Publication 27). London: Georg Philip.

Conzen, M. R. G. (1962). The plan analysis of an English city centre. In K. Norborg (ed.), *Proceedings of the IGU Symposium in Urban Geography, Lund 1960*. Lund: Gleerup.

Conzen, M.R.G. (1966). Historical townscapes in Britain: a problem in applied geography. In J. Whitehand, (ed.), *House: Northern geographical essays in honour of G.H.J. Daysh* (pp. 56-78). Newcastle upon Tyne: University of Newcastle upon Tyne.

Conzen, M. R. G. (1975). Geography and townscape conservation. In G. Uhlig & C. Lienau, (eds.), *Anglo-German Symposium in Applied Geography. Giessen-Würzburg-München* (pp. 95-102). Giessen: Lenz.

Conzen, M.R.G. (1988). Morphogenesis, morphological regions and secular human agency in the historic townscape, as exemplified by Ludlow. In D. Denecke & G. Shaw (eds.), *Urban Historical Geography: Recent Progress in Britain and Germany* (pp. 252-272). Cambridge: Cambridge University Press.

Conzen, M.R.G. (1969). *Alnwick, Northumberland: a study in town-plan analysis* (Institute of British Geographers Publication **27,** 2nd edn.). London: Institute of Geographers.

Cullen, G. (1961). *The concise townscape.* Oxford: Butterworth Heinemann.

Darin, M. (1998). The study of urban form in France. *Urban Morphology*, *2*(2), 63-76.

Darin, M. (2000). French belt boulevards. *Urban Morphology*, *4*(1), 3-8.

Ducom, E. (2003a). Urban growth and planning, the case of Rennes (Britanny, France). *International Seminar on Urban Form*, Trani, Italy, 3-6 July.

Ducom, E. (2003b). Fringe belts and planning: a French example. *Urban Morphology* **7**, 103-104.

Gebauer, M. & Samuels, I. (1983). *Urban Morphology: An Introduction* (Joint Centre for Urban Design Research Note No. 8). Oxford: Oxford Polytechnic.

Goethe, J.W.V. (1790). *Versuch die Metamorphose der Pflanzen zu erklären*.

Gu, K. (2001). Urban morphology of China in the post-socialist age: Towards a framework for analysis. *Urban Design International, 6,* 125-142.

Gu, K. (2018). The teaching of urban design: A morphological approach. Journal of Planning Education and Research, DOI: 10.1177/0739456XI8775480.

Gu, K., Li Y., & Zheng X. (2019). A typological approach to planning. Journal of Urbanism: International Research on Placemaking and Urban Sustainability, 12:4, 373-392, DOI: 10.1080/17549175.2019.1626264.

Holt-Jensen, A. (1999). *Geography: history and concepts- a student guide* (3rd ed). London: Sage.

Jacobs, J. (1961). *The death and life of great American Cities*. New York: Random House.

Kristjánsdóttir, S. (2001). The integration of architectural & geographical concepts in urban morphology: preliminary thoughts. *International Seminar on Urban Form*, Cincinnati, *Ohio, 5-9 September*.

Kristjánsdóttir, S. 2003: Jaðarbelti borga. in Björnsson, P. (ed). Borgarbrot, sextán sjónarhorn á borgarsamfélagið. Borgarfræðasetur and Háskólaútgáfan, Reykjavík, 104-118.

Kristjánsdóttir, S. (2005). The concept of a house – the dialect of Reykjavík, Iceland. In M. Barke (ed.), *Approaches in Urban*

DOI: 10.15320/ICONARP.2019.79– E-ISSN: 2147-9380

Morphology (pp. 9-33). Newcastle upon Tyne: University of Northumbria.

Kristjánsdóttir, S. 2006: Tradition and modernity in urban form: fringebelt as a pallet feature: preliminary thoughts. in Qviström and Saltzman (eds.) Landscape studies at the city edge, Department of Landscape Planning, Alnarp.

Kristjánsdóttir, S. (2007). *Deciphering the contemporary urban landscape of Reykjavík, Iceland, by applying the concepts and methods of Caniggia and Conzen*. Unpublished PhD thesis, University of Birmingham.

Kristjánsdóttir, S. (2015) The recent economic downturn and fringe-belt creation in Reykjavík, Iceland, Urban Morphology, 19(1), 94-96.

Kristjánsdóttir S. (2018). A suburb in limbo. From an idea conceived in an economic boom and realised during a crisis: a case study of a Reykjavík suburb. In S. Kristjánsdóttir (ed.), *Nordic Experiences of Sustainable Planning, Policy and Practice*. London & New York: Routledge.

Kristjánsdóttir, S. & Sveinsson, J. R. (2016). Phantom suburbs out of the ashes, in Gromark, S., Ilmonen, M., Paadam, K. & Støa, E. (eds.) Ways of residing in transformation: Interdisciplinary perspectives, 242-259, (Ashgate).

Kropf, K.S. (1993). *An enquiry in to the definition of built form in urban morphology*. Unpublished PhD thesis, University of Birmingham.

Kropf, K.S. & Larkham, P.J. (2000). Obituary: M.R.G. Conzen. *Urban Morphology, 4*, 90-95.

Larkham, P.J. & Conzen M.P. (eds.) (2014). *Shapers of Urban Form Explorations in Morphological Agency*. New York & London: Routledge.

Larkham, P. J. & Jones, A. N. (1991). *A Glossary of Urban Form*, Historical Geography Research Series no. 26. Geo Books, Norwich.

Larkham, P.J. (2015). Early ideas of urban morphology: a re-examination of Leighly's The towns of Mälardalen in Sweden, *Urban Morphology*, *19*(2), 59-65.

Lefebvre, H. (1968). *Le Droit à la ville* (2nd ed.). Paris: Anthropos (Paris: Ed. du Seuil, Collection "Points").

Lefebvre, H. (1974). *La production de l'espace*, Paris: Anthropos (Translation and Précis).

Leighly, J. B. (1928). *The towns of Mälardalen in Sweden.* University of California. Publications in Geography III [collected Vol. III dated 1931].

Levy, A. (1999). Urban morphology and the problem of the modern urban fabric: some questions for research. *Urban Morphology, 3*(2), 79-85.

Louis, H. (1936). Die geographische Gliederung von Groß-Berlin. *Länderkundliche Forschung Krebs-Festschrift*, 146–171.

Lynch, K. (1960). *The image of the city*. Cambridge, MA: MIT Press.

Manfredini, M. (2017). The Augmented Meta-Public Space. Interpreting emerging transductive territories in enhanced centres of consumtion. The Journal of Public Space, 2(3), Special Issue, 111-128, DOI: 105204/jps.v2i3.120.

Moudon, A.V. (1994). Getting to Know the Built Landscape: Typomorphology, from Ordering Space: Types in Architecture and Design. In M. Larice & E. Macdonald (eds.), *The Urban Design Reader.* New York: Routledge.

Moudon, A.V. (1997). Urban morphology as an emerging interdisciplinary field. *Urban Morphology, 1*, 3-10.

Muratori, S. (1950). Vita e storia delle citta. *Rassegna critica dárchitettura, 11-12*, 3-52

Muratori, S. (1959). *Studi per una operante storia di Venezia*. *I`, Palladio 3-4* (2nd ed, 1960) Rome: Istituto poligrafico dello Stato.

Muratori, S., Bollati, R., Bollati, S. & Marinucci, G. (1963). *Studi per una operante storia urbana di Roma*. Rome: Consiglio Nazionale delle Ricerche.

Oliveira, V. (ed.) (2016). *Urban Morphology. An introduction to the study of the Physical Form of Cities.* Switzerland: Springer.

Oliveira, V. (ed.) (2018). *Teaching Urban Morphology.* Switzerland: Springer.

Oliveira, V. (ed.) (2019). *J.W:R. Whitehand and the Historico – geographical Approach to Urban Morphology.* Switzerland: Springer.

Petruccioli, A. (1998a). Alice´s Dilemma. In A. Petruccioli (ed.), *Typological Process and Design Theory* (pp. 57-72). Aga Khan Program for Islamic Architecture at Harvard University and Massachusetts Institute of Technology.

Petruccioli, A. (1998b). Exoteric, Polytheistic Fundamentalist Typology, Gleanings in the form of an Introduction. In A. Petruccioli (ed.), *Typological Process and Design Theory* (pp. 9-18). Aga Khan Program for Islamic Architecture at Harvard University and Massachusetts Institute of Technology.

Rossi, A. ([1966] 1982). *The Architecture of the City*. Cambridge, MA: MIT Press.

Rossi, A. (1964). Aspetti della tipologia residenziale a Berlino. Casabella – continuita 288 (June) 10-20.

Samuels, I. (1990). Architectural practice and urban morphology. In T.R. Slater (ed.), *The built form of western cities* (pp. 415-435) Leicester: University Press.

DOI: 10.15320/ICONARP.2019.79– E-ISSN: 2147-9380

Samuels, I. (2002). The Caniggia Seminar, Cernobbio, Como, Italy, 5-6 July 2002. *Urban Morphology*, *6*, 90-93.

Sauer, C.O. (1925). *The morphology of landscape* (University of California Publications in Geography 2). Berkeley: University of California.

Schlüter, O. (1899a). Bemerkungen zur Siedlungsgeographie. *Geographische Zeitschrift, 5*, 65–84.

Schlüter, O. (1899b). Über den Grundriss der Städte. *Zeitschrift der Gesellschaft für Erdkunde zu Berlin, 34*, 446–462.

Schlüter, O. (1903). *Die Siedlungen in nordöstlichen Thüringen: ein Beispiel für die Behandlung siedlungsgeographischer Fragen*. Berlin.

Schlüter, O. (1906). *Die Ziele der Geographie des Menschen.* Munich.

Schlüter, O. (1919). *Die Stellung der Geographie des Menschen in der erdkundlichen Wissenschaft*. Berlin.

Slater T.R. (ed.) 1990. *The built form of western cities*. University Press, Leicester.

Strappa G., Ieva M. & Dimatteo M.A. (2003). *La cittàcome organismo. Lettura di Trani alle diverse scale*. ADDA Editore.

Tim Y., Gu K. & Tao W. (eds.) (2014). *Urban Morphology, Architectural Typology and Cities in Transition*. Beijing: Science Press.

Wang S., Gu, K. (2020). Pingyao: The historic urban landscape and planning for heritage-led urban changes, Cities: The International Journal of Urban Policy and Planning, DOI: 10.1016/j.cities.2019.102489.

Whitehand, J.W.R. (1981). Background to the urban morphogenetic tradition, The Urban Landscape: Historical Development and Management – Papers by M.R.G. Conzen. In J.W.R. Whitehand (ed.) *Institute of British Geographers Special Publication 13* (pp. 1-24). London: Academic Press, London.

Whitehand, J.W.R. (1987). *The changing face of cities, a study of development cycles and urban form* (The Institute of British Geographers Special Publication Series 21**)**. London: Basil Blackwell.

Whitehand, J.W.R (1988). Urban fringe belts: development of an idea. *Planning Perspectives*, *3*.

Whitehand, J.W.R. & Gu, K. (2003). Chinese urban form, a European perspective. International Seminar on Urban Form, Trani, Italy, 3-6 July.

Resume

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The “Knotting” as a Morphological Phenomenon. An Interpretation of the Italian Chamber of Deputies Forming Process

Giuseppe Strappa*

Abstract

The article proposes the study of the phenomenon of architectural and urban “knotting”, which the author considers one of the most interesting in the formation of the modern city.
It consists in the transformation of a special serial organism (consisting of units repeated and substitutable among themselves) in an organic structure, where the elements are linked together by a relationship of necessity, through the formation of a nodal space.
In Italy this phenomenon is quite evident in the formation of new building types for public services, as in the case of the large post offices obtained by transforming existing buildings and then designed ex novo with the knotting idea, giving rise to some of the most important architecture of modern Italian architecture

Keywords: Processual reading, morphological knotting, palaces for politics

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The phenomenon is particularly evident in the formation of the different palaces of the Chamber of Deputies in Turin, Florence and Rome.
The proposal by Carlo Fontana appears very important, indicating a new polarity in the urban fabric, a double knotting that links the public space with the architectural organism. The project will not be executed but will remain in the deep memory of the plan being formed. Ernesto Basile, author of the project that will be realized, in reality continues, stiffening it, the idea of Fontana to continue the internal corridors as routes of an urban fabric overturned inside, which is knotted in the central hall.
After three temporary experiments obtained in the existing spaces, Basile designed ex novo the large assembly hall in a virtual processual way, as in an existing space to be transformed, designing the structure of an organism organized around a central open space "subsequently" knotted from a light metal cover.

THE KNOTTING PROCESS

This article proposes the study of the Italian Chamber of Deputies transformation (from the first headquarters in Turin, then in Florence and finally in Rome) as a process that starts from the existing buildings and transforms them into a new architectural organism by "knotting". This term, which effectively indicates, in my opinion, one of the most interesting and fertile phenomena in the modern urban renovation, is not commonly used in urban morphology studies and needs some definition. I will try to clarify, first of all, what I mean by this word.

By "knotting" I mean, in general, the outcome of the constructive action of connecting different elements, or entire systems, to each other in order to shape a spatial node[1] within an architectural structure, often closing a space and tying it to the elements that surround it, usually consisting of a series of rooms. It is the passage, in other words, from a special serial organism to a nodal one through the formation of a central "nodal" space that "knots" the existing structures that become "collaborating" (Strappa, 2013,2).

Many types of modern buildings are formed by knotting, generated by the dialectic between enclosing and covering a space.

In the ancient world, clear forms of knotting developed with the transformations of the forum and the formation of basilicas.

But the knotting process is above all at the base of the formation of many modern building types characterized by the presence of a central dominant space, where the transition of the open space into a nodal one occurs through the reuse of existing buildings

[1] By node I mean a singular point of a continuum determined by the intersection of two continuous. The notion of "continuous" can be applied to the different scales, from the building to the territorial one: a "tectonic node" can be constituted by the intersection of two continuous walls; an "urban node" can be constituted by the intersection of two routes. Each component of a structure, connecting with the others, determines a nodality (knot quality) of different degree in relation to the congruence of the relationship established between the components and its scale (Caniggia , 1979; Strappa, 1995).

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arranged, around courtyards or cloisters surrounded by arcades, as in convents or palaces (Strappa 2013,1).

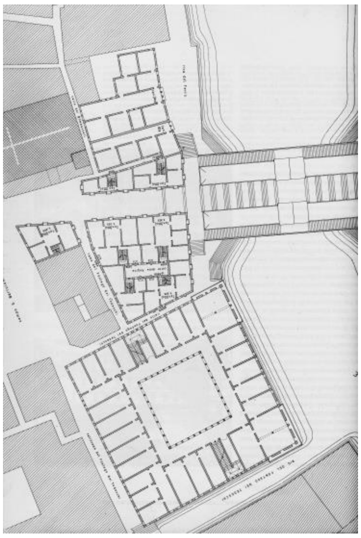
The initial formation of the Italian palazzo, for this is most interesting here, takes place through recasting, renovations, integrations of pre-existing houses. The fundamental process is the overturning of the external routes inside, which transforms a part of the fabric in a building and that reconstructs within it the characters of the urban fabric.

The palazzo is, therefore, a building type predisposed, one could say, to the densification of its center, to the knotting. Note how the knotting process does not consist in the simple covering of spaces, but in a sort of "genetic mutation" that originates new forms of buildings. An obvious example is the formation of large postal buildings at the end of XIX century, through the knotting of serial spaces, reused for offices and services, around the counter hall, a large public hall that becomes a mediation space between city and building.

Many of the largest XIX century postal buildings are organized on layout based on the palazzo type, such as the German ones organized around a vast open Hof (so in Wroclaw, Potsdam) but also protected by a transparent cover, as in Berlin.

In Italy, even at the beginning of the XX century, the same manuals still recommended considering the counter hall as a "spacious courtyard all covered in glass" (Donghi 1905).

Perhaps the antecedent that more clearly shows the different process phases is the transformation of the Fondaco dei Tedeschi in Venice.



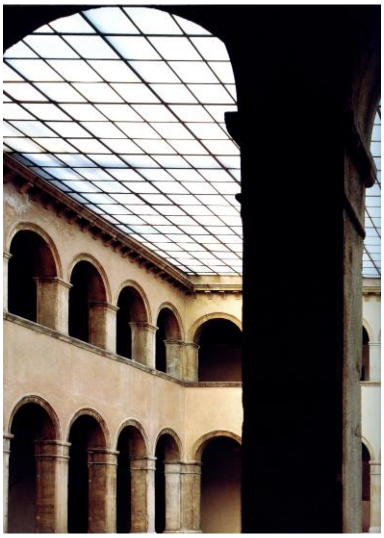


Figure 1. Plan of the Fondego dei Tedeschi in Venice
Figure 2. Covering of the central courtyard converted into the public counter hall of the new Post Office

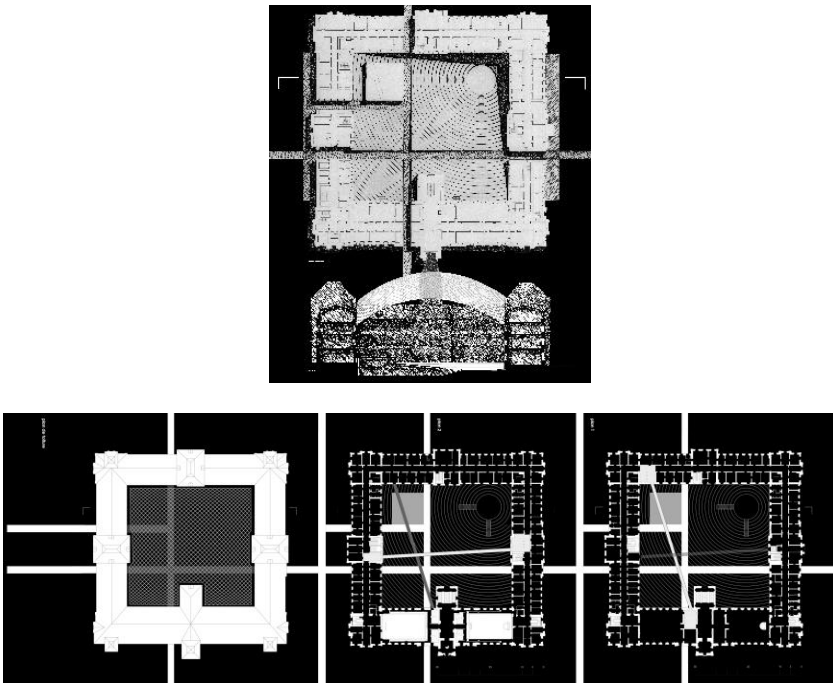


Figure 3-4. Proposal for the Quebec National Assembly knotting through the covering of the central courtyard, 2018 (G.Strappa, P.Carlotti, V. Buongiorno, G.Emmi, C.Sammarco)

It takes place through the introduction, in the XVI century serial special building, of a large iron and glass structure covering the open courtyard. This intervention triggers a transformation process that involves all the building components.

The new central hall is, as in every nodal building, "served" as IN the distributive layout, , statically "brought" (its covering resting on the structures of the courtyard) and spatially "nodal" while the outer rooms are functionally "serving", statically "bearing", spatially "serial".

A similar process can be identified in the large stock exchange structures, whose most widespread building type originated in the XVI century (see the Antwerp Stock Exchange) as large enclosed courtyards within the series of rooms for offices and warehouses, whose protection through a cover generates the sheltered space of the exchange (Halle au Blé in Paris, London Stock Exchange, Stock Exchange of St. Petersburg etc.). Often the need to light the central hall induces the formation of basilical type structures, where the function of the clerestory is carried out by iron and glass structures. A significant example of the beginning of this process is the Berlage's "basilica" for the Amsterdam Stock Exchange completed in 1903, while a significant contemporary example can be identified in the DZ Bank built in 2000 by Frank O. Gehry in Berlin.

The formation of a large central public space through the cover of the open courtyard we proposed in 2018 for the National

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Assembly Building in Quebec City (see figure) is an example of interpretation of the notion of knotting in contemporary terms.

Some urban knotting processes can also be recognized, starting from the XVIII century, in the new relationship between urban spaces and building interior spaces (routes becoming, from external and public, internal to the blocks as in the Parisian passages) also originating new commercial building types (Lemoine, 1990).

THE CHAMBER OF DEPUTIES AS A KNOTTING

The area on which the Chamber of Deputies in Rome was built is itself the result of a double, conflicting formation process. On the one hand the fabric formed by houses of medieval origin, clearly oriented according to the direction of the substratum of the ancient city, transformed over time by aggregation, into multi-family houses or palaces; on the other, the eruption of large institutional structures built by the Popes and inherited BY the new unitary state. These structures were formed by transformation of the existing fabric but then, gradually became autonomous.

Figure 5-6. Urban fabric transformations in the area of Via di Campo Marzio, in Rome

The forming of governmental structures expresses a deep cultural change in the life of the city and a new way of relating political power to the existing fabric that seems to progress through unions of serial and collaborating elements. These structures are grouped around the node first formed by the courtyard, then by the assembly hall which reuses the open space with temporary roofs, ending up forming the stable and symbolic spatial center around which the internal routes of the organism wrap. A "small town" is formed in which the logic of the fabric (the aggregation of the rooms structured by a route) is overturned inside.

It is important to grasp in this process, more than the contingent and particular, the universality of the phenomenon. In fact, this is a general process that can be recognized as a central feature of the transition to modernity in European culture (Strappa, 1996,

2014) where many organisms are formed through the formation of a new, large central space constructively "carried" by the collaborating elements , and functionally "served" by existing perimetral structures.

The phenomenon is evident, in different forms, also in different political structures. See, among others, the opposite cases of the recent Berlin Reichstag, in which Norman Foster recently transformed the XIX century courtyard into the assembly hall, or the headquarters of the French Senate at the Palais du Luxembourg, where, instead, the node shape has, over time, led to a progressive increase in the role of the central space.

The history of spaces for the politics of the new Italian State, in the several capital cities that have succeeded one another, can be read as A forming process in which successive phases starting from the re-use of architectures of great symbolic value, where the node is recognized within the existing structure, to the subsequent experimentation of new nodes through temporary structures, until the knotting of routes to form an entirely new organism structured around an intentionally designed spatial center.

In the initial formative phase, these are sudden transformations (the first central hall of Palazzo Carignano was built in just three months). When the problem of shaping the new Parliament arises, there is no time to think about a new construction: not only is the existing heritage reused, but temporary spaces are built, provisional nodes erected under the urgency of providing a space for assemblies. It seems that, just when the problem of a national language in architecture is posed, the first space nodes are limited to a declaration of intent. They are temporary structures decorated with A explicitly precarious repertoire (the first hall built by the Engineer Paolo Comotto at Montecitorio will be unusable after only thirty years), almost independent of the noble pre-existences in which they are located (Griseri,1988; Cerri,1990).

In a phase of transition and uncertainty, the true architectural choice is the selection itself of the monument that will house the new Parliament. As the program is explicitly intended to ensure the durability of the institutions and their symbols, the transformations should, indeed, alter the monuments of the past as little as possible.

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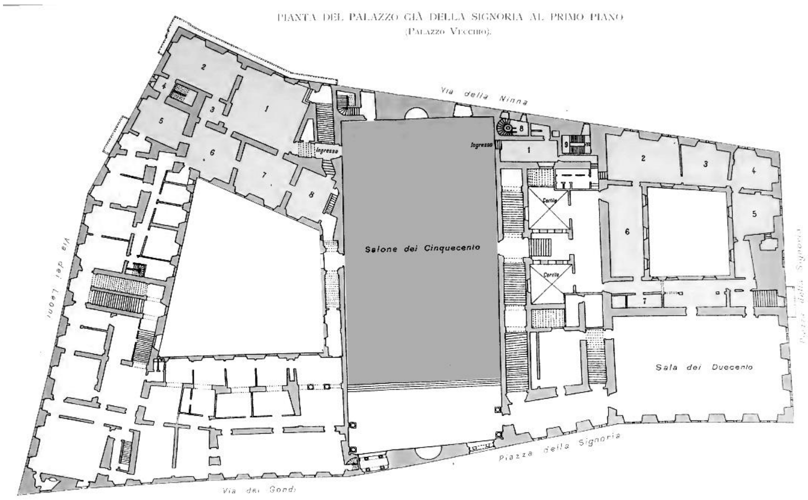

Figure 7. Formation of the parliamentary hall (in gray) in the Sala dei 500 in Palazzo Vecchio (Florence)

In the construction of the second chamber of the Italian Parliament at Palazzo Vecchio in Florence, the project of the engineer Mariano Falcini was much praised by the technical commission because of the discreet intervention in Vasari's Salone dei Cinquecento, where great attention was paid to the conservation of the works "which constitute the entire magnificence of Palazzo Vecchio.[2]

[2]. *Report of the Commission, 27 January 1865, State Archives of Florence.*

In a second phase these tentative structures undergo a process of “solidification”. See the transformation of the first Italian Parliament in Turin in Palazzo Carignano, where the spatial node is identified, in a first phase, with the restructuring of the Guarinian hall inaugurated in 1848, after the reforms of the Albertine Statute. The indication, which will be followed in the future, of choosing symbolic nodes as a unitary State shared heritage is evident.

The architect Carlo Sada only arranges the benches for the 204 deputies of the Subalpine Parliament following the elliptical configuration of the large central room originally intended for receptions.

**Parliamentary chamber formation through the re-use of the Guarino Guarini central hall*

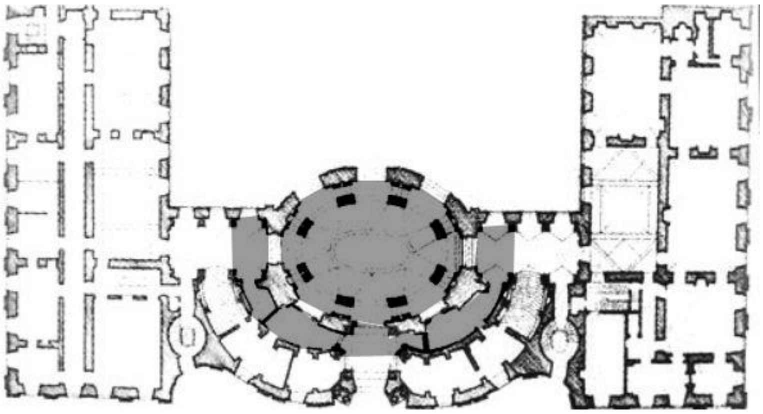

Figure 8. Re-use of the original structures

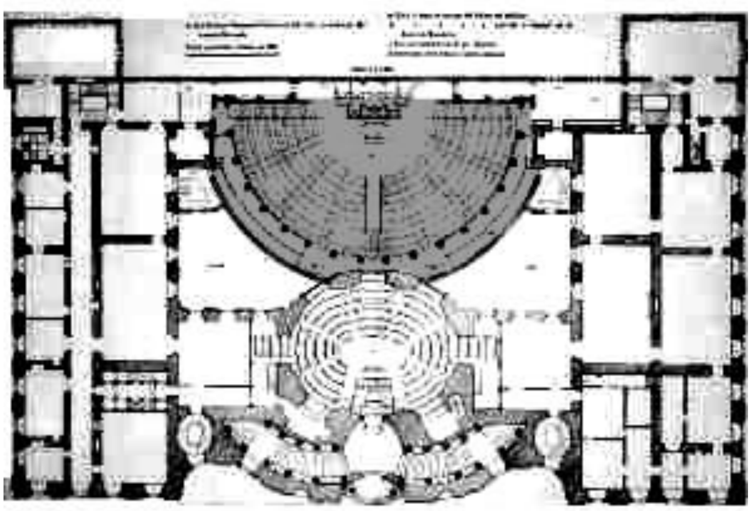

Figure 9. Formation of the second temporary hall in the gardens of Palazzo Carignano.

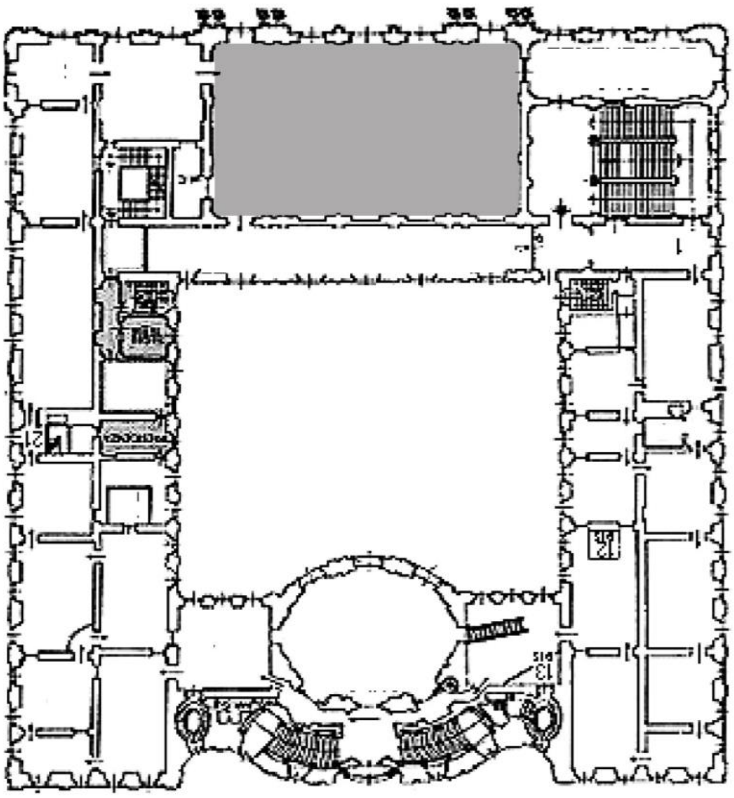

Figure 10. Formation of the definitive hall of the Italian Parliament in the enlargement of the Carignano Palace

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In a subsequent transformation phase, the placement of a new, still temporary hall is tried. The layout of the Guarini plan, in fact, is ill-suited to the new functional needs. The hall is not, in fact, the nucleus that generates a structure of routes on which to base the formation of a true parliamentary citadel. At the end the extension of the construction will take place around the open courtyard space obtained by the extension of the two short wings designed by Guarini (see figures).

The temporary solution in light materials realized by Ing. Amedeo Peyron seemed, however, to have influenced some subsequent projects. A solution is found where the central node unifies the building, which is also peremptorily envisaged by the unrealized proposal that Alessandro Antonelli submitted in 1860, where the hall for joint sessions, in the middle between the spaces for the two branches of Parliament, would have constituted a transparent and light space in the heart of the architectural organism, virtually open and public.

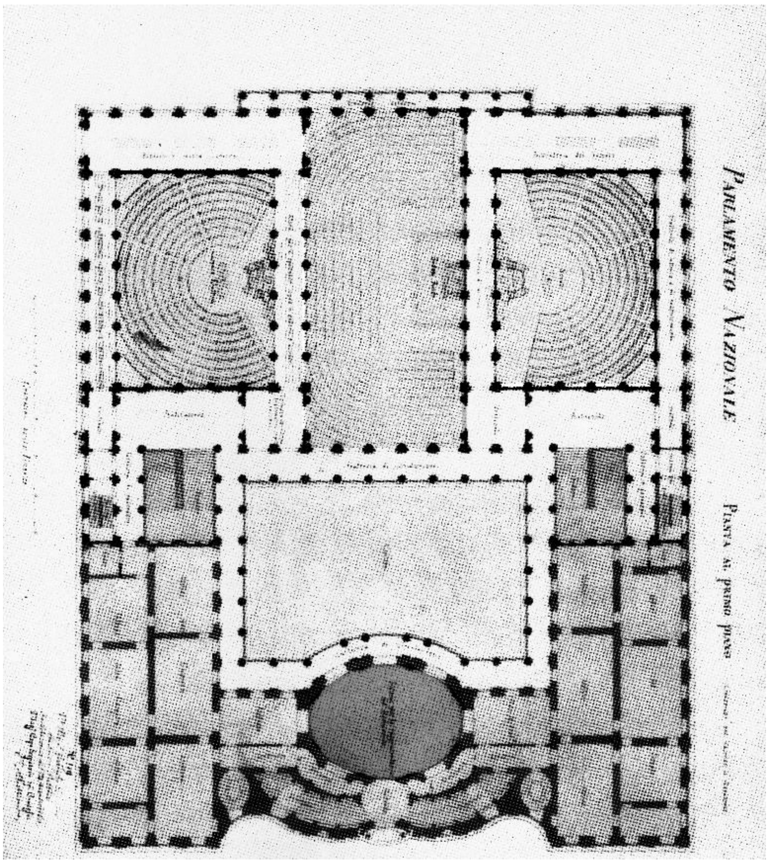

Figure 11. Alessandro Antonelli, Project for the new National Parliament in the gardens area of Palazzo Carignano, 1860.

The final phase of development of the new Parliament in Turin will free up, in fact, the space occupied by the Peyron roof, which will be demolished to form a central courtyard, while a new, more capable assembly hall will be built in the new building on Piazza Carlo Alberto generating a strange organism, formed by successive, almost autonomous additions, rather than by congruent developments. An expression of this multiple character is the doubling of the façade on Piazza Carlo Alberto, anticipating what will happen for the Montecitorio Parliament, when the Capital will be transferred to Rome. The new organism will therefore end up having a dynamic and vital facade on Piazza Carignano, and another on Piazza Carlo Alberto, with the nodal space expressed by the rigid stone volumes intended to give the idea of the duration of the institutions.

The phenomenon of an organism that increases due to progressive knotting becomes particularly evident precisely in the formation of the Palace of the Chamber of Deputies in Rome. It began with the transformation of the Curia Innocenziana (a structure destined for the justice administration) built by Carlo Fontana transforming the pre-existing Bernini's Palazzo Ludovisi, in turn derived from the transformation of the fabric between Piazza Colonna and Via degli Uffici del Vicario.

The form of the building derives from the progressively more evident awareness of a common, transmissible general order that emerges over time.

The interpretation that Carlo Fontana gives of the modern urban role of the new architectural organism appears relevant in this regard. One of his unrealized proposals proposed two different ways of forming the node of the Curia Innocenziana. A first version included the extension of the architectural node on an urban scale: the expansion of the internal paths to the external routes of Via della Missione, Via dell'Impresa and of what will become Piazza Montecitorio. The courtyard is therefore indicated, virtually, as a true part of the city, proposing a spatial revolution that will not be completed. The external square will in fact be settled in a conventional way.

In a second drawing, Fontana proposes a great innovation on an urban scale, indicating a new polarity in the fabric, a double knotting that would have gathered and unified the internal space around a central courtyard, and the external one formed by a new group of houses arranged in an exedra, a large urban courtyard around which a serial fabric would be gathered in a monumental way. Both were urban-scale designs, the result of a forming process which indicated the link between public space and the inner life of the architectural organism.[3]

[3]*Fontana communicated his projects in a "procedural" way, presenting a new design as a natural conclusion of transformations that took place over time. Consider, for example, the powerful volume on the Vatican Temple*

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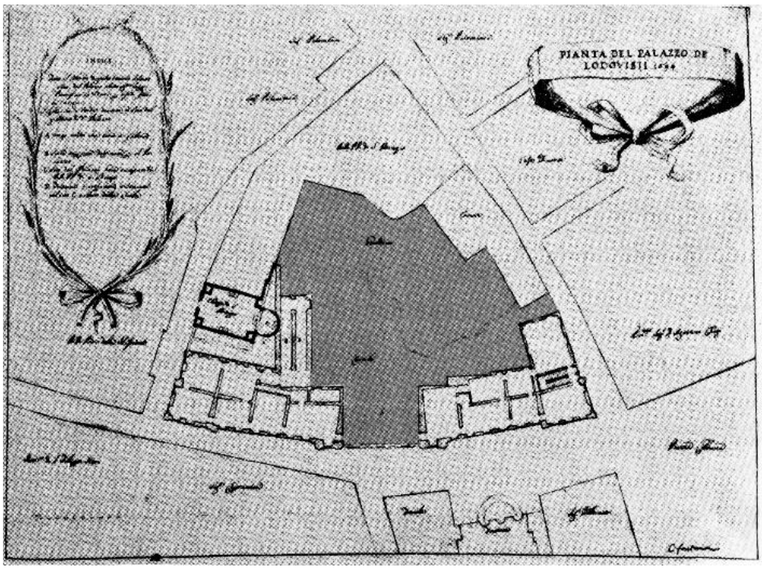

Figure 12. Carlo Fontana, survey of the Palazzo Ludovisi area in 1694, before the works of transformation in the Curia Innocenziana. The space of the court is the residual area of the perimetral building fabric (author's elaboration on the original drawing).

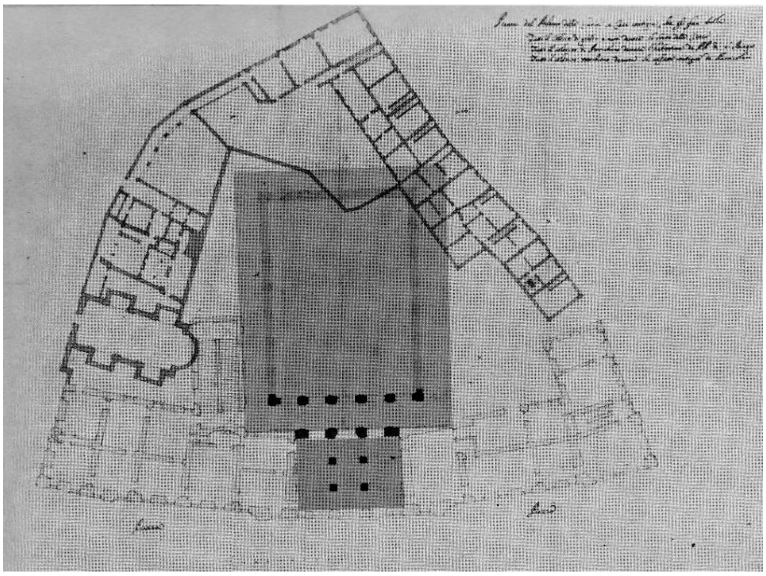

Figure 13. Carlo Fontana, first transformation hypothesis of Palazzo Ludovisi in the Curia Innocenziana with the introduction of a regular courtyard (author's elaboration on the original drawing).

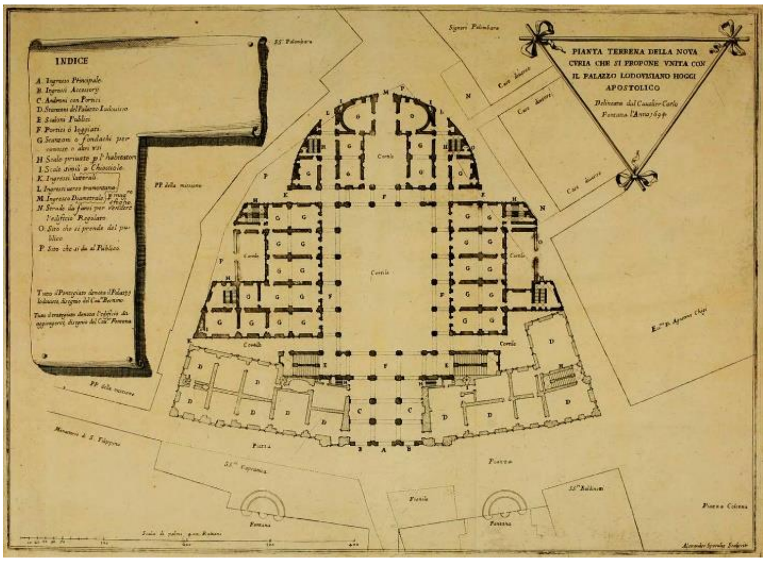

Figure 14. Carlo Fontana, hypothesis of transformation of Palazzo Ludovisi around a central courtyard.

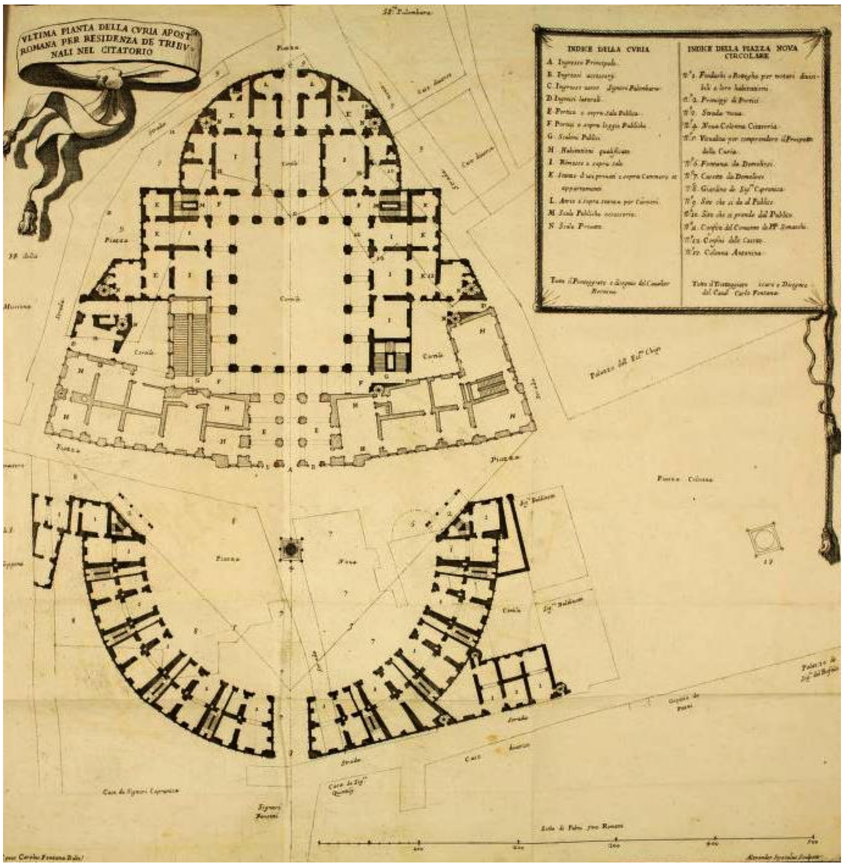

Figure 15. Carlo Fontana, hypothesis of transformation of Palazzo Ludovisi with the formation of an urban pole

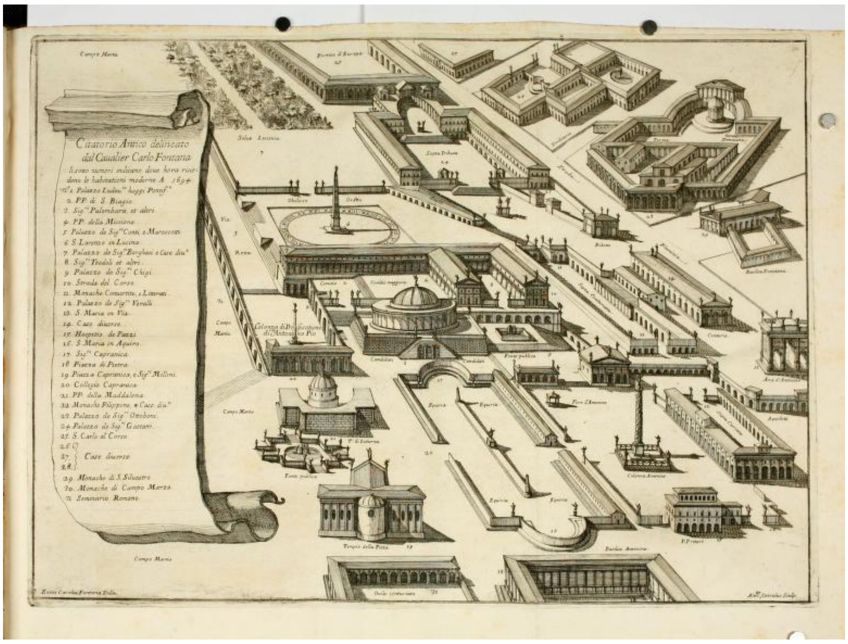

Figure 16. Carlo Fontana, ideal reconstruction of the area of Monte Citatorio (Montecitorio) in the imperial age

Fontana's proposal will not be realised, but his project will remain in the deep memory of the future layout, ending up acquiring almost a meaning in itself, a "pre-formative" value, one would say, that contains a finalized interpretation of the previous structures bent to the instances of the new needs. His proposals are themselves, in fact, the place of a generative process that originates from an imaginary substratum, an ideal ancient Monte

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Citatorio. Fontana describes it through a singular perspective of ancient monuments (Fontana,1694) organized according to only two orthogonal directions. Monuments translated into a language that seems to anticipate neoclassicism, carefully placed within a peremptory regularity where each building is a monad, each construction a microcosm whose external forms allow one to imagine a segregated and cryptic life.

THE KNOTTING PROCESS CONCLUSION

Fontana's vision is also the prelude to a long demolition period that includes those carried out by Ernesto Basile before starting construction work on the new Chamber in 1908.

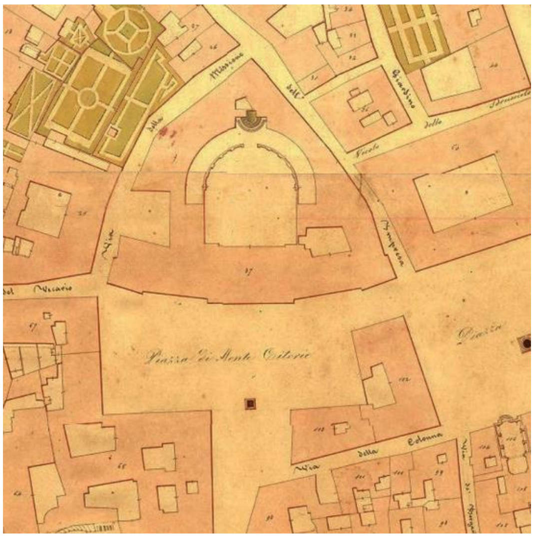


Figure 17. Gregorian Cadastre map in the Montecitorio area

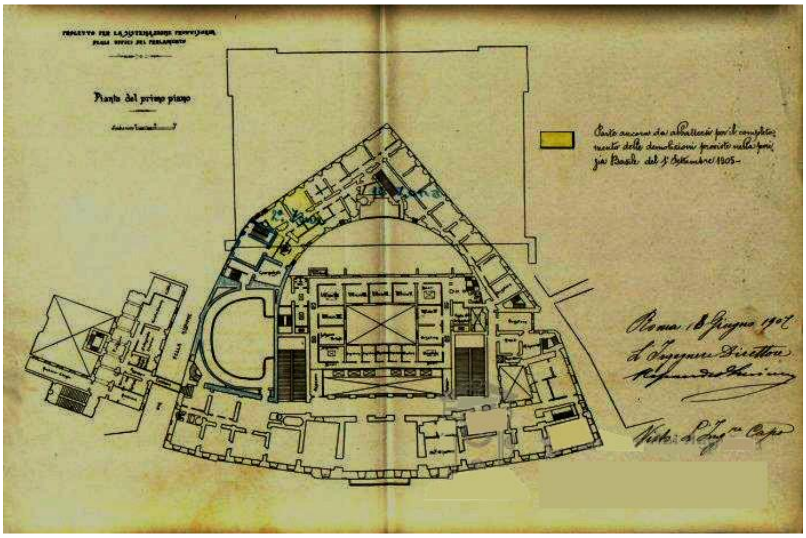


Figure 18. Project for the temporary placement of the parliamentary hall on Via della Missione

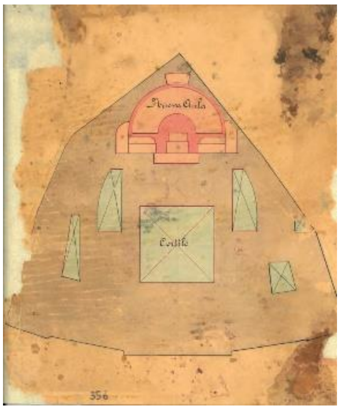


Figure 19. Formation of the first the parliamentary hall node in the Italian Chamber of Deputies, 1888 (Arch. Chamber of Deputies)
Figure 20. Parliamentary hall displacement hypothesis in the Italian Chamber of Deputies, 1888 (Arch. Chamber of Deputies).

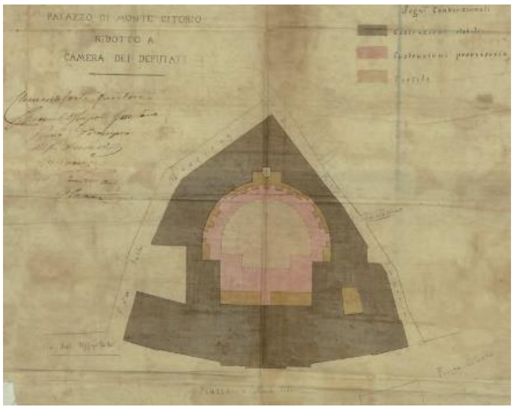
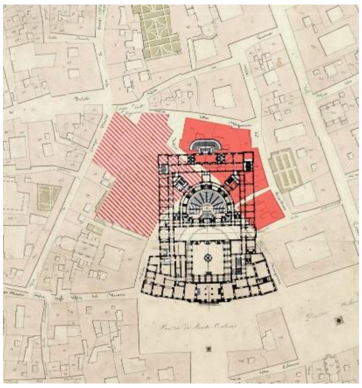


Figure 21. Provisional construction of the parliamentary hall in the Italian Chamber of Deputies, 1907 (Arch. Chamber of Deputies).



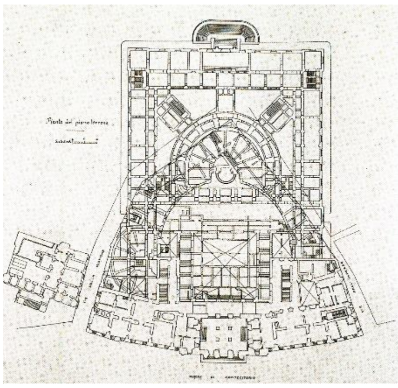


Figure 22. Demolitions carried out for the construction of the new Chamber of Deputies indicated on the Gregorian Cadastre.
Figure 23. Overlap of the new Chamber of Deputies project to the pre-existing structures.

The layout on which Basile's project is based clearly expresses the limits and perspectives of the urban culture of the time, the need to establish a clear, immediately legible order. Basile actually continues, strengthening Fontana’s idea of continuing the interior corridors as routes of an introverted city, organizing a true urban fabric reversed inside.

By removing the exedra from the existing courtyard, four new interior routes knot the space of a second courtyard, this time covered. As was the case for many public spaces, the architect thought of the new central space of the assembly hall as an existing space to be transformed “successively”, closing it with a light cover.

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It is no coincidence that the first room inaugurated in 1871 by engineer Paolo Comotto, is the temporary and fragile closure of a void. It takes explicitly, in the drawing and in the method, the shapes of the hall designed by Peyron for Palazzo Carignano.

As for the new façade composition on Piazza del Parlamento, the Sicilian Ernesto Basile uses an extravagant and new language, a hybrid outcome of opposite instances: on the one hand the need for a shared language originating in the forms of the XVI century Roman palace, with the usual architectural structuring layers (base, elevation, unification, conclusion), on the other hand, the need to consider the question of an architectural national language also formed by the local dialect contribution to the solid core of the classical legacy. All in the climate of the demand for modernity that the rhetoric of the young nation was proposing (Picone, 2011, Strappa, 2018).

The theme of a new architecture for the Capital appears after the Second World War, when some fundamental questions, remained unresolved for fifty years, were posed: the representation of a new relationship between city and politics; the old problem of the new interventions in the old city; the search for a specific character of contemporary Italian architecture. The competition announced in '67 for the enlargement of the Chamber of Deputies was therefore a historical event.

In the years of fascism , an intense activity of demolition and reconstruction in large areas of historical Rome had been carried out. They had often led to disastrous experiences in terms of results, but had also raised the theme of the relationship between modern architecture and historical context. (Strappa, 1996). In those years over 90 competitions had been banned, many in contact with ancient monuments, starting from the Council Chamber project in the ancient Palazzo Senatorio in 1924, up to that of the 1940s for the Ministry of Foreign Affairs in the Passeggiata Archeologica area (Strappa, 1989).. But since then no major initiative had been undertaken.

The new building design was therefore an opportunity to make a vital break with the practice of major interventions pursued by the unification of the Italian State until the end of the Fascist period. With the first major urban redesign of the center of the Capital, the new architecture seemed called, in disciplinary terms, to propose an alternative to the practice of isolating special buildings, in particular those with greater symbolic value, from the urban context. It was also the occasion, for the political class, to demonstrate its competence to take shared decisions on the major issues that contemporary culture was posing.

In line with the new urban role that was asked OF public interventions, the construction of the enlargement of the Deputy Chamber could have been put in organic relationship with the historic fabric of the Via della Missione and the huge space of Piazza del Parlamento, proposing an authentically contemporary building born from the city life.

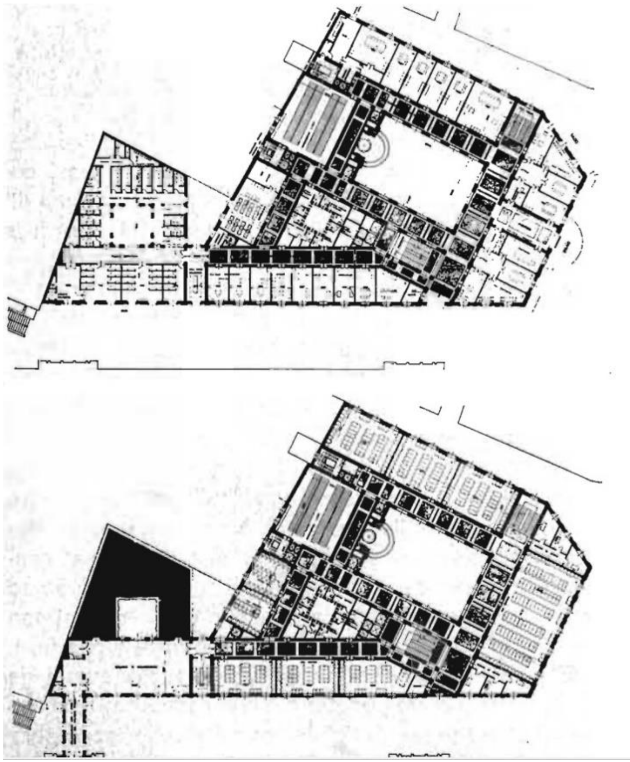

Figure 23. G. Caniggia proposal for the expansion of the Deputies Chamber (1967)

In fact, most of the '67 projects seem to interpret (with very few exceptions among which a remarkable one by Gianfranco Caniggia,) the image that Tafuri will explain with great clarity to consider the site of the new construction as an "empty area .... and to take it into account as a "pause to be exploited" (Tafuri, 1968). A choice that perhaps today would find motivated criticism, but which few then questioned. In the search for the exceptional form, the formative process of the Deputy Chamber and the complementary role of the new offices did not take into account the existing structures.

It really concluded the great Roman architectural period in which Borromini, in composing the extraordinary facade of his Oratorio dei Filippini (The new monastery of the Filippini Congregation) adjacent to the existing Santa Maria in Valicella, modestly stated that he had thought of it "as the daughter of the church's façade,

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that is, smaller, less ornate, and of inferior matter" managing, however, whilst understanding the formative process of the city, to contribute to a radical updating of the architectural forms.

REFERENCES

Strappa, G. (2018). *La città della politica e il nodo della camera dei Deputati*, in P.Carlotti, A.I. Del Monaco, D. Nencini (editors), *L'ampliamento della Camera dei Deputati*, Franco Angeli, Milano

Strappa, G. (2014).*L' architettura come processo. Il mondo plastico murario in divenire*, Milano

Strappa, G. (2013). Territorial organism and urban knotting. Design methods for minor centers of Lazio, *F.A. Magazine*, vol. n.23 / luglio agosto

Strappa, G. (2013). term *Annodamento*, in Wikitecnica, Online Encyclopedia of architecture, directors G. Carbonara e G. Strappa, https://www.teknoring.com/ Wolters Kluwer,

Picone, R. (2011.).*Restauro architettonico e unità. La 'nuova' Camera dei deputati da Palazzo Carignano a Montecitorio, in AA.VV., Architettare l'Unità. Architettura e istituzioni nelle città della nuova Italia. 1861-1911*, Pozzuoli

Strappa, G. (1996).*La grande tradizione moderna dei Palazzi Postali,* in Various Authors, *I Palazzi delle Poste*, Milano

Strappa, G. (1995). *Unità dell'organismo architettonico. Note sulla formazione e trasformazione dei caratteri degli edifici*, Bari

Cerri, M.G. (1990).*Palazzo Carignano*, Umberto Allemandi, Torino

Lemoine, B. (1990).*Les passages couverts*, Paris

Strappa, G. (1989).Tradizione e innovazione nell'architettura di Roma capitale (1870-1930), Roma

Griseri, A. (1988.). (a cura di), *Il Parlamento Subalpino in Palazzo Carignano: strutturee restauro*, Utet, Torino

Caniggia G. & Maffei (1979). G.L., *Lettura dell'edilizia di base*, Venezia.

Tafuri, M. (1968). *Il concorso per la nuova camera dei deputati*, Roma

Donghi, D. *Manuale dell'Architetto*, Unione Tipografica Editrice, Torino 1905-1935.

Fontana, C. (1694). *Discorso del Cavaliere Carlo Fontana Sopra il Monte Citatorio nel Campo Martio, ed altre cose ad esso appartenenti,* Roma

Resume

Prof. Giuseppe Strappa is senior professor (Professore di Alta Qualificazione) at School of Architecture – Università "La Sapienza" - in Rome. He taught Architectural and Urban Design and Urban Morphology since 1980 in "La Sapienza" in Rome, in Bari Polithecnic and in other universities in Italy and abroad. Since 2002

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Research Article

Managing the Urban Change: A Morphological Perspective for Planning

Tolga Ünlü*

Abstract

This study questions the awareness of planners on the intrinsic qualities of the built environment in shaping of urban form in Turkey throughout a centennial period after foundation of Turkish Republic in 1923. It suggests a morphological framework, to develop such an evaluation, which is based on three basic principles: the historicity of urban forms, the hierarchical nesting of urban form elements, and their reconciliation within a complex interaction with each other in a part-to-whole relationship. It is regarded as an initial attempt to develop a brief discussion about a morphological perspective to be utilized in planning practice. It is asserted that the centennial development of planning practice in Turkey brought to light that the professionals lost their concern on the intrinsic qualities of urban form, on how it is evolved historically, and on how its elements are related to each other. They abandoned themselves to the relative ease of application of insensitive planning with high confidence on the decency and convenience of procedural functioning of planning. It reveals that there is a need for a morphological perspective that would take into account the morphological unity of urban form elements within their interplay in order to develop a responsive planning approach.

Keywords: Morphological research, planning practice, morphological unity, part-to-whole relationship

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INTRODUCTION

In the last few decades, a number of studies in the field of urban morphology focused on the relationship between research and practice on the shaping of urban form. It has been one of the more important developments and one of the more significant opportunities for future development in urban morphology (Whitehand 2019). A very recent research, conducted through the responses of ISUF (International Seminar on Urban Form) members to a survey, revealed that the relationship between research and practice is one of the most remarkable categories within the field of urban morphology. Although most of the members prioritized urban morphology in understanding how urban forms are produced, stratified and modified, they also admitted that urban morphology has the potentiality to provide sound base to intervene in the process of urban development, and to manage the urban change in a better way (Barke 2019).

The central interest of this growing category is on the gap between the urban morphological research and planning and urban design practice (Gu, 2018). The reasons for such a gap has been stated in numerous ways: the complexity of vocabulary of urban morphology, insufficient demonstration of relevant methods to professionals, the dispersal of urban morphology across several disciplines (Samuels, 2019a); the reluctance to give a proper place to urban morphology in the education system of planning and architecture schools (Whitehand 2005, 2012); the unaware attitude of morphological agents (Samuels 1990; Whitehand 2007); unpopularity of urban morphology as a source of practice (Scheer 2008); requirement for much more time for research (Larkham 2006) and insufficient communication among different agents also may effect emergence of the gap between research and practice. In the same manner, Barke (2015) points out that the main reason behind this gap is the growing distance between academics and practitioners. While the former are criticized to be facing to engage with the real world, the latter are usually in search for solutions for short terms. Since the academicians get more specialized to get more points on a particular realm of research, practitioners become increasingly managerial, that distance between them continues to grow (Samuels, 2019b).

It is claimed in this study that the planners know very little about the intrinsic qualities of the urban space as the subject matter of their field of occupation. They are repeating their actions without

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or with little attention to the essential nature of urban space. That is to say, they usually act by rote in the planning process, and prefer to rely on the established procedures, written as rules to follow in the legislation. Consequently, they did not develop their intelligence on how urban forms are articulated in the historical and cultural development of societies and how to develop better interventions to deal with the urban change and to create successful urban environments. It is accepted that the successfulness can be achieved to the extent if the rules in planning legislation are followed without a question. This kind of planning is named in this study 'insensitive planning', in which high reliance on procedural aspects of planning and seeking quantitative measures of the legislation make planners oblivious and insensible to the qualities of the built environment, the subject matter they are supposed to initiate decisions on how to develop it. The priority is given to the piecemeal production of freestanding buildings without any control of a broader context.

Dominance of insensitive planning in any planning system and its application on urban development usually results in standardized urban environments that do not give response to the local context. This condition is defined as a crisis in the production of the built environment by Muratori (Cataldi, 2003). It is the 'loss of human scale' in the built environment (Conzen 1975), 'sacking of cities' (Jacobs 1961), 'antispaces' (Trancik 1986), 'placelessness' (Jacobs and Appleyard 1987).

This study questions the attitude of planners to what extent they are aware of the nature of the morphological characteristics of the city in their practice, and aims to contribute to development of a morphological perspective for planning. It takes Turkish planning practice in its centennial development, from the beginning of the young Turkish Republic, to scrutinize the attitude of planners whether they utilized a morphological perspective in dealing with urban change, intentionally or unintentionally.

A Morphological Perspective for Planning

A morphological perspective for planning is suggested in this part of the study in order to develop a more vigorous investigation into the planning practice. It relies on three basic principles (Moudon 1997). First, urban forms develop in their historicity, they are context-based and culturally bound and open to modifications through continuous morphological processes as a response to the changing needs, expectations and value judgements of the society. Second, the basic elements of urban form -plots, buildings and streets (Barke 2015, Conzen, 1969 [1960], Oliveira 2016, Kropf 2017, Whitehand 2001)- are interrelated to each other within a complex interaction that creates spatially distinct areas in the city. Third, the elements of urban form function within a hierarchical structuring in the whole city, from the plot, even from the materials of the building (Kropf 2014) and building to the street and block, neighborhood and the whole settlement. Varying character areas in the city at different levels of resolution emerge as a result of the hierarchical nesting and interplay of urban form elements.

The city is a historical phenomenon that is created and shaped in its socio-cultural context. The urban space provides the physical content to the functioning life of urban society to answer the varying needs of that society (Conzen, 2004, p.49). In Lynch's (1981) words, if human life is a continued state of becoming, then its continuity is founded on growth and development, and if development is a state of becoming more competent and more richly connected, then an increasing sense of connection to one's environment in space and in time is one aspect of growth. Then, the settlement is good as far as it enhances the continuity of a culture and the survival of its people, increases a sense of connection in time and space. The quality of a place develops through the joint effect of the place and the individuals that use it. Thus, the urban landscape is conditioned by culture and history (Whitehand, 1981, p.18)

The dynamic interrelationship between the urban landscape as a man-made object and the society was conceived in Schlüter's (1899) early works in the field of urban morphology. He postulated that the study of urban form should be conducted in relation to the aims and actions of man in the course of history and in its own cultural and natural context. Therefore, according to Schlüter, the urban landscape is viewed as a distinct category of research within the cultural landscape. Had been influenced by Schlüter's and later Bobek's (1927) works, M.R.G. Conzen studied on English towns to built the foundations of historico-geographical approach (Whitehand, 1981, p.11). In his early study on Whitby, Conzen (1958) conceived the urban landscape as an educational asset that provide the society a sense of continuity in its historicity. The historical and cultural development of the city influences its character through different development phases, in which the actions and attitudes of the inhabitants leave many relict forms. As new forms are added to the existing forms in the urban landscape in its historical and cultural development, the

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built environment becomes the objectivation of the human spirit, or *genius loci*, of that society (Conzen, 1975).

In this framework, urban landscape is not a static entity, or simply the container of events. It is not a ready-made thing; it is constantly evolved through endless maze of relations and interactions in the complexity of morphological processes. It is a place for the ceaseless state of movement and change within the cultural setting and it signifies the continuity of that culture, in which it is continuously reshaped. It embodies the past and present endeavours of the residents that had been living and using the space itself

Hence, the city is a dynamic unity that is reproduced through the articulation of ever-changing forms. It is in a continuous state of becoming and change through the morphological processes of accumulation, adaptation and replacement. Then, the city itself is manifested as a palimpsest through accumulation of forms in its historical development (Conzen 2004, p.68-70). The interaction of the basic elements of urban form - plots, buildings and streets (Barke 2015, Conzen, 1969 [1960], Oliveira 2016, Kropf 2017, Whitehand 2001)- in their context produces the uniqueness of any settlement. Combination of these elements constitute three systematic form complexes, namely town plan- the topographical arrangement of the urban built environment to form the street system, plot pattern and building pattern, building fabric -the three-dimensional composition and arrangement of buildings, and land and building utilization -the functional categories for the use of plot (Conzen, 1969). Within the hierarchical structuring of the morphological elements of urban form, the town plan contains the general frame of land utilization pattern, and land-use units in turn contain the building pattern (Conzen, 1975), while the component forms, such as fringe belts, plot series and character areas are recognized through different levels of solution within the interplay of the elements of urban form in their hierarchical nesting (Barke 2019). This accumulation of forms in its historical and cultural development and interrelation between the morphological elements that resulted in different levels of resolution in various ranks in the hierarchical structure give the city its unique character, diversity and complexity.

In this context, the city is the organic unity, created through its interrelating and interlocking parts to result in a coherent wholeness (Alexander et al, 1987). A successful city can be constructed through the consistent relationships between the morphological elements of urban form within their hierarchical nesting. Therefore, a successful city or a part of the city can only be formed through recalling and acknowledging the historicity of urban forms and their dialectical interplay to produce a coherent whole. The management of changes to urban form must be considered within the varying needs, expectations and value judgement of the society to comprehend the city as a whole. Urban morphological research is conducive to analyze the cyclical nature of urban growth, the internal processes of adaptation and redevelopment and the roles of various agents in the production of urban forms, and to provide ideas for the future developments and their management (Whitehand 2001). 'Through the detailed study of urban form, both of the present and the past, we learn both what we should not do and how we can do things better' (Barke, 2018, p.11).

Thus, a detailed study on how urban forms does not have solely a descriptive nature, but it also includes a more interpretative and explanatory nature through understanding, identification and recognition of the processes that shaped the urban landscape. Identification and characterization of changing processes in the urban landscape through morphological methods avail the professionals to understand the very nature of the making of urban forms (Whitehand, 2009). It is also conducive to professionals to develop proposals to intervene into the urban space and to manage the urban change. It provides a rational basis for successful management of urban landscape (Conzen, 1975).

Management of Changes through Urban Development Plans

The changes to urban form occur in various scales within the hierarchical nesting of morphological elements, and they are reflected in modifications in urban pattern. Any change in the hierarchy or roads, open space system, and distribution of functions among the whole city at a major scale; arrangement of street-blocks, plot series as well as plot pattern and building pattern at a medium scale; and the height, facade and materials of buildings and their disposition within the plot at a minor scale will give effect to any change in the character of a city.

From the morphological perspective, the planner should develop principles about the shaping of urban form in relation to its morphological elements within the hierarchical structure. That is not to focus solely on the physical restructuring of urban form. Rather, the planner should bear on his/her mind that the city (urban space) is a socially constructed phenomenon, and it should be created and shaped within its cultural context. Any change to urban form should be made with reference to the cultural and

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historical continuity and hierarchical nesting of urban forms. That is to say, the 'good city' is the one in which the continuity of its complex structure is maintained while progressive change is permitted (Lynch 1981). Such a view requires to develop site-specific decision on how the plots, buildings, plot series, blocks, street systems should develop within the part-to-whole relationship of urban form elements. In other words, the planner should develop responsive planning instead of insensitive planning through employing morphological investigations into urban form.

Oliveira (2006) points out that such a morphological perspective was developed during the planning of Porto, Portuguese, between 2001 and 2006, in which ten different urban tissues were identified and taken into consideration as the basis for developing context-based regulations. The plan and its morphological approach were utilized in order to maintain the character of Porto despite the incomplete understanding of some actors (Oliveira et al 2014). However, Porto example seems to be an exception within the whole Portuguese planning system through its eagerness to employ morphological insights into the management of urban change (Oliveira and Sousa 2012). Other cases from different cultural contexts also reveal that utilization of a morphological perspective in planning is very rare. In the plan of St Gervais-les-Bains, France, the building types are designed in relation to the natural characteristics of the site through setting relations between buildings and topography of the site (Samuels 1997). The morphological analysis of Mery-la-Bataille, France provides opportunities to develop planning decisions for different character areas in the city (Kropf 1996). The character of urban areas were at the very center of morphological investigations to develop responsive planning approaches in the historic core of Antequerra, Spain (Barke 2003), Bath, England (Kropf and Ferguson 2014) and Chelmsford, England (Hall 2008). These examples show that it would be possible to develop a morphological perspective in planning through employing a form-based approach to have a responsive planning as an alternative to the functional approach of insensitive planning.

A Morphological Assessment on Turkish Planning

Since the morphological perspective focuses on the hierarchical nesting of form complexes and the patterns that are produced through the interrelationships between elements of urban form, the morphological assessment of planning is also conducted within a consistent part-to-whole relationship between urban elements at various scales -major, medium and minor- in the hierarchical structure of the city. That is to say, the plans are questioned whether they were able to produce the organic unity through the relationship of urban elements with the proposed planning decisions. Therefore, the urban development plans are supposed to present an urban structure through road network and open space system, while supposing street and block types at the medium scale and plot and building patterns at the minor scale.

Although the results of any other similar studies are required to endorse, the study on Çamlıbel, the residential quarter in Mersin, Turkey, evidenced that residential accretions to the historic quarter of Turkish cities ran through three consecutive redevelopment phases during the centennial period after declaration of Turkish Republic in 1923 (Ünlü and Baş 2017). The first period, from the early decades of new Republic until 1960s, experienced the widespread emergence of single-family house in relatively large plots and gardens. In the second phase, apartment blocks began to emerge as new building types in the derivative plots, whilst the single-family houses on the plot heads were replaced by this new type in the third phase. As a further phase, in 2000s, housing estates began to appear in the newly developing peripheral areas. However, what was the role of planning in this transformation?

It was the idea of 'creating a new future' (Keskinok 2006) to generate a new society in the first decades of the young Turkish Republic, namely early Republican period between 1923 and 1945. When Hermann Jansen, the German architect-planner, won the international planning competition for planning of Ankara, the new capital of the country, a low-density city with single-family houses was taken as a model to develop cities (Tankut 1993, p.37). The garden city idea well suited to the shaping of new urban environments through its main principle of 'the progressive rejection of the big city, the desire for small town living and working, the search for real involvement in common affairs' (Ward 1992, p.1). Since Jansen was influenced by garden city idea, he adopted its principles to new residential quarters (Akcan 2012, p.41).

From a morphological perspective, Jansen dealt with the elements of urban form in a hierarchical nesting throughout the major, medium and minor scales. He used this method in all plans, prepared in Turkey for Mersin, Tarsus, Adana, Ceyhan, Gaziantep,

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and Izmit after planning of Ankara. Prior to these plans, he applied his principles comprehensively in Berlin Plan, of which he won the planning competition in 1910. In fact, he developed his planning approach during his professional life that began in Germany, where he was influenced by Camillo Sitte (Borsi 2015, Bozdoğan 2001, Tankut 1993).

At the major scale, he proposed a road hierarchy and open space system, in which fringe belt-like morphological units existed. It is not clear whether he was aware of the fringe-belt idea, nonetheless there is a probability that he was following the developments in urban morphology during his work as a professor at Berlin Technical University (Saban Ökesli 2009), where the pioneering studies of Schlütter emerged as well as the incipient fringe-belt concept, *Stadtrandzone* was used by Louis (1936) in order to explain the morphological structure of Berlin. Jansen combined recreation areas and public institutions as well as industrial zones to have a fringe belt-like structure, girdling the city centre. At the medium and minor scales, Jansen proposed plot pattern, building pattern, and a new block type and street type, as well as architectural plan types in combination. He also visualized the urban environment, he envisaged, through three-dimensional drawings, as subordinate documents to the development plans. At the medium scale, the main morphological unit for Jansen was the neighborhood, probably under the influence of *Siedlungen* approach of German planning (Rykwert 2010). In his plans, he separated neighborhoods from each other via open spaces of large-scale public parks, while they are also connected to the fringe belt-like structure to make a consistent whole of open space system. In the neighborhoods, at the minor scale, he developed decisions on plot sizes, in which a building would be located at the plot head with a large garden at the back. It was the residential street (*wohnstrasse*), around which the plots come together and create a morphological unit, similar to the use of 'close' and plots around it by Raymond Unwin, who also was highly influenced by the ideas of Sitte, in designing the Hampstead Garden Suburb (Panerai et al. 2004, p.45).

Jansen developed a morphological perspective in preparation of his plans and aimed to produce the city as a coherent whole through nesting of urban form elements from the minor to major scales (Figure 1). His approach influenced the planning practice of early Republican period, when the architect-planners undertook the plan-making process as a part of republican aims to reach the desired, modern and western-oriented future (Bozdoğan and

Akcan 2010, p.8). Many similar plans were prepared, especially after the issue of Buildings and Regulations Law in 1933.

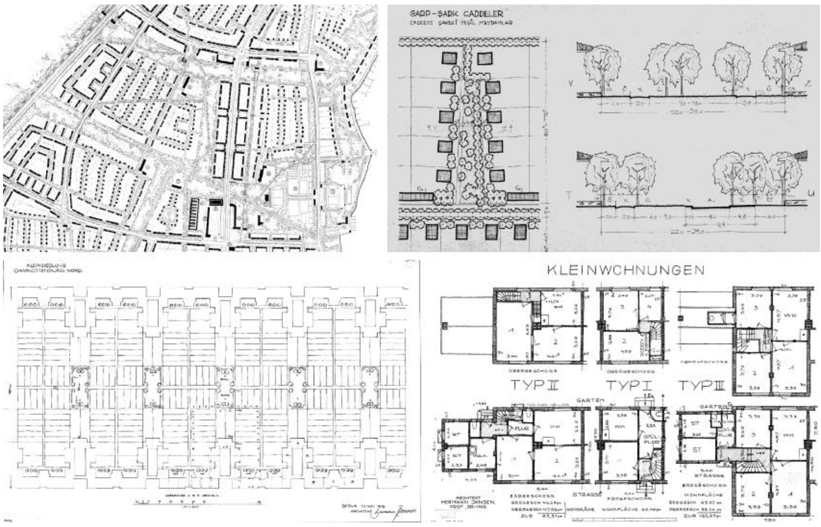

Figure 1. Jansen's drawings on the architectural plans, facades, building types, plot types, and their togetherness in a hierarchical nesting. Top left: a detail from a neighborhood plan "Neugestaltung Berlin - Gatow" (Source: TU Berlin Architekturmuseum Inv. Nr. 22469), top right: wohnstrasse, buildings and the block "Gesamtbebauungsplan Ankara" Source: TU Berlin Architekturmuseum Inv. Nr. 22982), bottom left: plot pattern in Charlottenborg-Nord, Berlin (Source: TU Berlin Architekturmuseum Inv. Nr. 20785), bottom right: building types in Berlin (Source: TU Berlin Architekturmuseum Inv. Nr. 21127)

Following the early Republican period, due to the rapid population increase, Turkish cities experienced from 1950s to 1980s, the priority was given to control the urban sprawl to the outskirts, and to establish a new urban structure at the major scale. In this vein, the planners utilized statistical methods to cope with the new social and economic problems, besides the physical ones, and employed transportation models to interact with the rapidly growing city. As much attention was given to controlling urban growth, the inner city was facing a transformation process, which was resulted in emergence of apartment block as a new building type. Although the apartment block was not a new phenomenon that it was firstly appeared in Istanbul during the late-nineteenth century as a symbol of Western way of life, when modernization of urban fabric was at stake (Bilgin 1999, Öncel 2010, Sey 1998a), it became the dominant building type after the early Republican period in response to the problems to find new places for accommodation to the newcomers from rural to urban areas (Balamir, 1975; Günay, 2005; Sey, 1998b). The apartment block replaced the single-family house of the early Republican period, following its first appearance in the derivative plots (Ünlü and Baş 2017).

In this process, development plans are sought to be the tools to produce the built environment in a repetition of the apartment block as an already established building type. They aimed to control the morphological processes at the minor scale through a quantitative approach, focusing on solely building heights, building types, setbacks and street widths (Figure 2). In this perspective, the focus is held upon production of the freestanding

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buildings, regardless of their interaction to other morphological elements of urban form in a part-to-whole relationship. The planners developed decision for the width of streets without imagining what qualities those streets would acquire; or they determined the height and type of buildings without thinking of the structure of the plot they would located in.

Therefore, the development plans and thus planners of the period between 1950s and 1980s failed to notice the organic unity of the city that would function through the hierarchical nesting of morphological elements of urban form. The concentration was on the single building at the minor scale, and on the road network and open space system at the major scale without or little attention to how to interrelate them to each other. In the absence of interrelationship of urban form elements, creation of the urban pattern was reduced to rapid replacement of old building types with apartment blocks within the plots, created for the single-family houses in the previous period. Increasing building heights and coverage, and production of identical buildings led to homogenization of the urban landscape at the minor scale that resulted in emergence of ‘static urban pattern’.

Figure 2. The apartment block began to emerge as a dominant building type in the development plans, following the early Republican period: Development plan for Mersin, 1986, a detail from Pozcu residential district and the apartment blocks that replaced the single-family houses (personal archive). The letters in the circle stand for building types (A for detached, B for attached, BL for semi-detached and row houses) while the numbers refer to the number of storeys.

The certainty of development plans and the quantitative approach embedded in plans, and emergence of mediocre (Tibbalds 2001) incoherent (Alexander 1966, Hedman and Jaszenski 1984) fragmented (Urban Task Force 1999) sacked (Jacobs 1961) faceless (Conzen 1975) ugly (Lynch 1960) dull, uninteresting and soulless (Cullen 1961) city through the static urban pattern steered the planning system to seek more flexibility. By this way, more discretion would be given to the decision-making process, in which the relationship between the plan and development decision is weakened (Booth 1995). In this vein, the content of development plans also changed from a rigidity that control quantitative measures, such as building heights, setbacks, road widths etc., to a flexibility that controls only the FARs (floor area ratio) of the proposed development. Therefore, in the last period that began during 1990s, but accelerated in the 2000s, control of the morphological characteristics has been dominated by the use of FAR in development plans. This brought about a new building type in the residential environments, called 'campus type' by Scheer (2010) since it is also widely seen also in the US cities. This type utilized a larger plot than the ones that were produced in the previous periods. This new plot consists of usually more than one building with its large garden and social utilities, such as playground, swimming pool and sports areas.

Although the new plot pattern and building pattern seem to find solution to the problems of the static urban pattern, the focus is still held upon the freestanding buildings. This time, the strategic control of a wider area is failed and the control is reduced to the plot, of which the area is usually equals to the building block, and the total construction area of buildings without any concern on other morphological element of urban form. The quantitate approach and focus on production of freestanding buildings remained as a dominant view in preparation of urban development plans during replacement of certainty and rigidity of previous periods by flexibility of the new period. The resultant form is the collocation of indifferent housing estates in various plots, having diverse building types, buildings height, materials, architectural styles, together which produced an indistinct urban pattern in the residential environments (Figure 3).

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Figure 3. The indistinct urban pattern and housing estates as a result of the dominant use of FAR in development plans during 2000s.

CONCLUSION

This study is triggered with questioning the awareness of planners on the intrinsic qualities of the built environment in shaping of urban form. It has suggested a framework to develop such an evaluation, which is based on three basic principles: the historicity of urban forms, the hierarchical nesting of urban form elements, and their reconciliation within a complex interaction with each other in a part-to-whole relationship. Functioning of the city through these three principles results in urban patterns and character areas in various scales (from minor to medium and major) at different levels of resolution. Many successful cities, such as Kyoto, Manhattan, Siena (Alexander 1966) produced their coherent whole (Alexander et al 1987) through the reconciliation of urban form elements in their historicity and hierarchical nesting congruously.

In this vein, the attitude of planners in Turkey is examined in relation to the evolution of planning practice during the centennial period after proclamation of the new Turkish Republic in 1923. It was scrutinized whether the planners were capable and aware of the entirety of urban form in its historicity and hierarchical nesting. Although it is not clear that the professionals conducted morphological investigations into urban form, It has been discerned that they were in search of the morphological unity of urban form elements in the early Republican period and they employed a morphological perspective to shape the built environment. They envisaged the city within its wholeness from minor to medium and major scales, and suggested plot pattern, building pattern, street system and street and block types at the minor and medium scales as well as road network and open space system at the major scale. And it was the concern of planners to think on how morphological elements of urban form would reconcile and produce a total effect on the living of society.

This morphological perspective was broke down in the following periods, basically in the second half of nineteenth century. The main focus was held upon on structuring of the city at the major scale, while the freestanding buildings were the basis of production of the built environment with the help of development plans. Production of the identical apartment block as a dominant building type at the minor scale was at the forefront in the shaping of urban form in the second phase. The insensitive planning that depends on ignoring the morphological elements of urban form was highly employed by the planners of the period. The quantitative approach, embedded in this type of planning, conduced to emergence of a static urban pattern throughout the city, which became focus of critics by many professionals.

Flexibility as a response to the rigidity of development plans could not change the quantitative approach and the focus on freestanding buildings, embedded in planning. Rather, it has deepened the problem of insensitive planning through loosening the morphological controls over the shaping of urban form. Freestanding buildings retained their importance as the most important element of urban form. They became to be shaped in a more quantitative way through employing only FAR (floor area ratio) measures, result of which is an indistinct urban pattern. Separation of urban form elements from each other and their isolation in different scales engendered emergence of a fragmented city.

This study has been an initial attempt to develop a brief discussion about a morphological perspective to be utilized in planning practice. It certainly requires in-depth studies on a plot-by-plot basis. However, at the very least, it is possible to assert that the centennial development of planning practice in Turkey brought to light that the professionals lost their concern on the intrinsic qualities of urban form, on how it is evolved historically, and on how its elements are related to each other. They abandoned themselves to the relative ease of application of insensitive planning with high confidence on the decency and convenience of procedural functioning of planning. It reveals that there is need for further studies to continue discussing on a morphological perspective that would take into account the morphological unity of urban form elements within their interplay in order to develop a responsive planning approach.

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REFERENCES

Akcan, E. (2012*). Architecture in translation: Germany, Turkey and the modern house*. Durham: Duke University Press.

Alexander C. (1966). A city is not a tree. *Design* 206:47–55

Alexander C., Neis H., Anninou A. & King I. (1987). A new theory of urban design. Oxford University Press, New York

Balamir, M. (1975). 'Kat Mülkiyeti ve Kentleşmemiz' ('The process of ownership fragmentation in Turkish urbanization'), *Middle East Technical University, Journal of the Faculty of Architecture* 1 (2), 295–319.

Barke, M. (2003). The lifespan of a typological form?. *Urban Morphology* 15:21–38

Barke, M. (2015). Further thoughts on research and practice in urban morphology: a British perspective. *Urban Morphology* 19(1):96-99.

Barke, M. (2018). The Importance of Urban Form as an Object of Study. In Oliveira V (ed) *Teaching Urban Morphology.* Springer, Cham, pp.11-30.

Barke, M. (2019). Why study urban morphology? The views of ISUF members, *Urban Morphology* 23(2):105-14

Bilgin, İ. (1999). 'Modernization', in Sey, Y. (ed.) Housing and settlement in Anatolia: a historical perspective (Tepe Architectural Culture Centre, İstanbul) 247–361.

Bobek, H. (1927). Grundfragen der Stadtgeographie, *Geogr. Anz*. 28, 213-24.

Booth, P. (1995). 'Zoning or Discretionary Action: Certainty and Responsiveness in Implementing Planning Policy', *Journal of Planning Education and Research* (14):103-112.

Borsi, K. (2015). Drawing the region: Hermann Jansen's vision of Greater Berlin in 1910. *The Journal of Architecture*, 20(1), 47-72.

Bozdoğan, S. (2001). *Modernism and Nation Building.* Seattle:University of Washington Press.

Bozdoğan, S. & Akcan, E. (2012). *Turkey: modern architects in history*. Reaktion, London

Cataldi, G. (2003) From Muratori to Caniggia: the origins and development of Italian school of design typology. *Urban Morphology* 1:96–99

Conzen, M.R.G. (1958) *The growth and character of Whitby*. In: Daysh GHJ (ed) A survey of Whitby and the surrounding area. Shakespeare Head Press, Eton, pp 49–89

Conzen, M. R. G. (1960). *Alnwick: Northumber- land: a study in town-plan analysis*. Institute of British Geographers Publication 27. George Philip, London.

Conzen MRG (1969) *Alnwick, Northumberland: a study in town-plan analysis*, 2nd edn. Institute of British Geograpers Publication 27. London: Institute of British Geographers.

Conzen, M.R.G. (1975). Geography and townscape conservation. In: Uhlig H, Lienau C (eds) *Anglo-German symposium in applied geography*. Lenz, Giessen, pp 95–102

Conzen, M. R. G. (2004). *Thinking about urban form: papers on urban morphology* (Conzen, M. P., ed.). Peter Lang, Bern.

Cullen G (1961). *Townscape*. Reinhold, New York

Gu K (2018). *Exploring Urban Morphology as Urban Design Pedagogy*. In Oliveira V (ed) Teaching Urban Morphology. Springer, Cham, pp.145-158.

Günay, B. (2005). *Türkiye mimarlığı: gelenek, yöre, doğu, batı (Architecture in Turkey: tradition, locality, east, west).* Şehir Plancıları Odası, Ankara.

Hall, T. (2008). The form-based development plan: bridging the gap between theory and practice in urban morphology. *Urban Morphology,* 12(1):77–95

Hedman, R. & Jaszenski, A. (1984). *Fundamentals of urban design*. APA Press, Chicago

Jacobs, A. & Appleyard, D. (1987). Toward an Urban Design Manifesto, *Journal of the American Planning Association*, 53:1, 112-120

Jacobs, J. (1961). *The death and life of great American cities*. Vintage Books, New York

Keskinok, Ç. (2006). *Şehirciliğimizin yüzyılını değerlendirirken (On the evaluation of a century of our urbanism).* In: Keskinok Ç (ed) Kentleşme siyasaları (Urbanization policies). Kaynak, Istanbul, pp 213–218

Kropf, K. (1996). Urban tissue and the character of towns. *Urban Design International* 1:247–263

Kropf, K. (2014). Ambiguity in the definition of built form. *Urban Morphology* 18(1):41–57

Kropf, K. (2017). *The handbook of urban morphology*. Chichester, Wiley

Kropf, K. & Ferguson, P. (2014). *City of Bath morphological study*. Built Form Resource, Oxford

Larkham, P.J. (2006). The study of urban form in Great Britain. *Urban Morphology* 10(2):117–141

Loius, H. (1936). *Die geographische Gliederung von Gross-Berlin’,* in Louis, H. and Panzer, W. (er.) Landerkundliche Forschung: Krebs-Festschrift içinde (s.146-171), Engelhorn, Stuttgart.

Lynch K (1960) *The image of the city*. MIT Press, Massachusetts

Lynch K (1981) *Good City Form*, MIT: Cambridge Massachusetts

Moudon, A.V. (1997). Urban morphology as an emerging interdisciplinary field. *Urban Morphology* 1(1):3–10

DOI: 10.15320/ICONARP.2019.82– E-ISSN: 2147-9380

Oliveira, V. (2006). The morphological dimension of municipal plans. *Urban Morphology* 10(2):101–113

Oliveira, V. (2016). *Urban morphology: an introduction to the study of the physical form of cities*. Springer, Dordrecht

Oliveira, V. & Sousa, S. (2012). Urban morphology in planning practice. *Urban Morphology* 16(1):80–82

Oliveira, V., Silva, M. & Samuels, I. (2014). Urban morphological research and planning practice: a Portuguese assessment. *Urban Morphology* 18(1):23–39

Öncel, A. D. (2010). *Apartman: Galata'da yeni bir konut tipi (Apartment: a new housing type in Galata).* Kitap, İstanbul.

Panerai P., Castex J., Depaule, J. C. & Samuels, I. (2004). *Urban forms: the death and life of the urban block. Oxford*: Architectural Press.

Rykwert, J. (2010). *The Seduction of Place. Oxford*: University of Oxford Press.

Saban Okesli, D. (2009). Hermann Jansen's planning principles and his urban legacy in Adana. *METU Journal of the Faculty of Architecture,* 26(2), 45-67.

Samuels, I. (1990). *Architectural practice and urban morphology*. In: Slater TR (ed) The built form of Western cities. Leicester University Press, Leicester, pp 415–435

Samuels, I. (1997). A typomorphological approach to design. *Urban Design International* 4:129–141

Samuels, I. (2019a). *Research and Practice*, in V. Oliveira (ed.), J.W.R. Whitehand and the Historico-geographical Approach to Urban Morphology, Springer, Cham, p. 115-131.

Samuels, I. (2019b). Mind the gap, *Urban Morphology* 23(2):169-70

Scheer, B.C. (2008). Urban morphology and urban design. *Urban Morphology* 12(2):131–133

Scheer, B.C. (2010). *Evolution of urban form: typology for planners and architects*. APA, Chicago

Schlüter, O. (1899). Bemerkungen zur Siedelungs-geographie, *Geographische Zeitschrift*, 5, 65– 84.

Sey, Y. (1998a). *'Cumhuriyet döneminde Türkiye'de mimarlık ve yapı' ('Production of architecture and building during the Republican period')*, in Sey, Y. (ed.) 75 yılda değişen kent ve mimarlık (75 years of urban and architectural change) (Tarih Vakfı, İstanbul) 25–40.

Sey, Y. (1998b). *'Cumhuriyet döneminde konut' ('Housing during the Republican period')*, in Sey, Y. (ed.) 75 yılda değişen kent ve mimarlık (75 years of urban and architectural change) (Tarih Vakfı, İstanbul) 273–300.

Tankut, G. (1993). *Bir başkentin imarı (Development of a capital city)*. Anahtar, istanbul

Tibbalds, F. (2001). *Making people-friendly towns*. Taylor & Francis, London

Trancik. R. (1986). *Finding Lost Space: Theories of Urban Design*. New York: Van Nostrand Reinhold.

Urban Task Force (1999). Towards an urban renaissance. DETR, London

Ünlü, T. & Baş, Y. (2017). Morphological processes and the making of residential forms: morphogenetic types in Turkish cities. *Urban Morphology* 21(2):105-122

Ward, S. (1992). *The Garden City introduced.* Ward, S. (Der.) The Garden City: Past, present and future içinde. Oxon: Spon.

Whitehand, J. W. R. (1981). *'Conzenian ideas: extension and development',* in Whitehand, J. W. R. (ed.) The urban landscape: historical development and management. Papers by M. R. G. Conzen Institute of British Geographers Special Publication 13 (Academic Press, London) 127-52.

Whitehand, J.W.R. (2001). British urban morphology: the Conzenian tradition. *Urban Morphology* 5(2):103–109

Whitehand, J.W.R. (2005). The problem of anglophone squint. *Area* 37:228–230

Whitehand, J.W.R. (2007). Conzenian urban morphology and urban landscapes. *In: Proceedings of the 6th international space syntax symposium,* Istanbul

Whitehand, J.W.R. (2009). The structure of urban landscapes: strengthening research and practice. *Urban Morphology* 13(1):5–27

Whitehand, J.W.R. (2012). Issues in urban morphology. *Urban Morphology* 16(1):55–65

Whitehand, J.W.R. (2019). ISUF and Urban Morphology: 25 years on and counting, *Urban Morphology* 23(2):103–4

Resume

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Research Article

Persistence, Inertia, Adaptation and Life Cycle: Applying Urban Morphological Ideas to Conceptualise Sustainable City-Centre Change

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David Adams**

Abstract

Consideration of the speed and scale of change of urban forms has a long history in urban morphological thought. Buildings and forms that persist in the urban landscape through inertia or, more positively, deliberate decisions to retain them create character and – a more recent argument – contribute to sustainability not least in their embedded energy. This paper explores issues of the persistence and adaptation of some urban forms, focusing on the central business district of Birmingham, UK. Much of this is now protected as a conservation area, and some of its forms have persisted for centuries. Yet there have been periods of rapid change, and we examine the extent of change following Second World War bomb damage. This allows discussion of the dynamics of change and the agents and agencies responsible for producing new urban forms or

Keywords: Urban form, sustainability, rate of urban change, reconstruction, Birmingham

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retaining existing ones; and this informs exploration of the potential contribution of longevity of form to sustainability. The rapid recycling of some structures, after only a couple of decades, may be very unsustainable – impracticable and unaffordable – in an urban context.

INTRODUCTION

Cities are being continuously shaped and reshaped by economic forces, architectural tastes, planning ordinances, building controls, changing public fashions and a myriad of public-private regulations governing the form and use of space. In some cases, structural obsolescence, damage, war or disaster also provide opportunities for change. It is common, therefore, for urbanists to consider that cities are palimpsests of successive layers of redevelopment over time (Martin, 1968). But, despite the scale and speed of urban change, particular structures, landscapes and morphologies persist. The urban morphologist and chartered town planner M. R. G. Conzen, for example, highlighted the persistence of street patterns in comparison to the faster change of plot patterns and buildings (Conzen, 1962). There is a link here to ecosystems theory: "the dynamics of the system will be dominated by the slow components, with the rapid components simply following along" (O'Neill, Deangelis, Waide, Allen, & Allen, 1986).

Persistence is often linked to retention, although sheer inertia, resistance to change, may play a role. Retention is often linked to heritage and conservation. Decisions about what to retain, and the sorts of designs that should be variously encouraged and discouraged through preservation practices, are often enmeshed in judgements about the value and meaning of different aspects of the past, present and future (Edensor, 2019; Graham, Ashworth, & Tunbridge, 2000). Even places that are recognised (or even branded) as 'historic' and spatially or temporally 'fixed' are invariably assemblages of urban interventions over time.

Three-quarters of a century after the damage inflicted by the Second World War, these factors are affecting management of the post-war reconstruction. Indeed, urban managers in many cities have been eager to rapidly remove or remodel what remains of post-war planning, perceiving it as being out of fashion with current design ideas. Yet lobbying attempts have sought to retain aspects of the post-war physical fabric, hence selected modern buildings, structures and landscapes are also being preserved and brought into the remit of state protection (While & Short, 2011).[1] In some cases, they are being re-worked to nestle within wider narratives of regeneration, place-marketing and gentrification, while serving the needs of elite interests (Harwood, 2015; Lees,

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2003; While, 2006, 2007). Despite concerted efforts to revive 'lost' ideas of architectural authenticity, community and hope associated with the post-war modern urban environment (Harwood, 2015; Hopkins, 2017), many urban managers, landowners and residents often prefer new structures which, they feel, help create economically functioning, socially vibrant city spaces. The popular perception of the poor quality of modern rebuilding, when substantial areas were rebuilt in a very short period, using new styles and materials to produce buildings and areas, is difficult to shift (Kynaston, 2015). But while there is already considerable debate around the barriers facing the preservation of post-war heritage, one under-explored issue relates to how the concepts and dynamics of urban change and the persistence of particular forms might contribute to the contemporary priority of sustainability through minimising resource use.

Taking forward these ideas of change, preservation and sustainability, therefore, this paper explores how the modernist built environment of the 1950s, 1960s and 1970s is being situated within urban development policy frameworks. By focusing on the post-war buildings and design narratives we raise wider questions about how this built form is produced and reproduced – changed or retained – within localities. Here, analysis focuses primarily on the fundamental question: which buildings persist through periods of urban change and why are they privileged in local design terms? This analysis includes a consideration of how the post-war built form might be integrated within urban redevelopment schemes that promote sustainability.

We begin by exploring the forces that shape change in the built environment. It moves on to examine how selected architecture and planning remnants from the 1950s / 1960s have been treated following the global economic recession. The initial empirical analysis highlights a series of potential conflicts and complementarities between the post-war legacy and the dominant design frameworks of 'post-industrial design' that have been an important element of pro-growth regeneration strategies for many cities since the late 1980s / early 1990s.

SHAPING CHANGE IN THE BUILT ENVIRONMENT

In recent decades, much of what was once valorised as 'modern' is being steadily replaced to generate for new urban forms and images, new patterns of use and mobility. In many ways, the "stock of buildings in a city" can come to represent "an ageing and declining asset", with supplementary investment needed to avoid both structural, economic and functional obsolescence (Larkham, 1996). Nevertheless, with the ebb and flow of urban change, traces of previous values, ways of life and material artefacts are embodied in official conservation and preservation efforts (Glendinning, 2013). Consequently, particular features may persist in urban landscapes for extended periods, sometimes as “relics” (Conzen, 1962) with little direct connection with contemporary values and meanings, as the city rapidly transforms (Edensor, 2019). This persistence may be through inertia, resistance to change, or through deliberate decisions to retain buildings and areas.

Of course, the protection or promotion of ‘heritage’ inevitably involves the selective (re)interpretation of certain aspects of the past, designed to suit “contemporary purposes, be that economic, cultural, political or social” (Graham, Ashworth, & Tunbridge, 2000). Nevertheless, despite recent detailed efforts to re-assess and celebrate aspects of everyday post-war modernist architecture (Harwood, 2015; Hopkins, 2017), many buildings and structures from this era evoke inaccessible architectural and cultural meanings that often conflict with the fast-paced, contemporary city, replete with its changing fashions, tastes and policy emphasis on sustainable urbanism (Benton-Short, Keeley, & Rowland, 2019). In some cases, the architectural and planning endeavours underpinning these buildings remain important concerns for certain groups and individuals. For example, with Goldfinger’s Balfron Tower, Sheffield’s Park Hill and other notable cases, some younger audiences warmly embrace planned attempts to revive post-war buildings: such structures offer a route to an unembellished and ‘authentically honest’ urban past (Harwood, 2015; Kynaston, 2015). And yet, concerted efforts to revive or promote goals and practices of post-war conservation / preservation in-line with an era of sustainable design face stiff challenges, despite a recent focus on low-carbon construction and developments that are resilient to climate change (Ministry of Housing, Communities & Local Government, 2018).

Indeed, notwithstanding attempts to resuscitate forgotten, over-looked and neglected urban histories of the post-war physical fabric, the public attitude, even among those who cannot directly recall the physical alteration of familiar landmarks and popular spaces, remains decidedly critical. Hence the spectre of lofty, yet ultimately ‘failed’ modern architectural ambitions continues to loom over many cities, often affecting strategies to demolish or remodel seemingly outmoded structures that might be repurposed in ways to minimize the impact on the built and natural environment. Similarly, there may not be a widespread

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rush to glamourize or revere the architectural intentions of post-war modernism, despite the best efforts of some (While, 2007). Regardless of changing tastes, styles, cultural values and a desire to 'move away' from the legacy of post-war rebuilding, elements of the modern physical fabric nevertheless persist. They may continue to shape the present-day everyday experiencing in unusual, unprovoked and sometimes positive ways that can align or collide with official renderings of the urban past (Adams & Larkham, 2019; Larkham, 1999). Being alert to how these traces continue to shape the everyday urban experience opens up important areas of inquiry relating not only to the possibility of assessing earlier, 'unreachable' socially progressive ideals attached to much post-war building, but they also offer a chance to look more carefully at how outmoded post-war structures might contribute to a wider sustainability discourse. In the following sections, these issues are explored through a case study of 1950s/1960s buildings and dominant heritage and design narratives in Birmingham, UK.

DYNAMICS OF URBAN CHANGE: THE LEGACY OF BIRMINGHAM'S POST-WAR HERITAGE

Birmingham is the country's "second city", located in the English Midlands about 110 miles north of London. It grew from a small local market town to be a world-class industrial centre during the nineteenth century. The city was badly bombed during the Second World War, with damage being scattered across the city, although there was a concentration in the city core. In the post-war period its fortunes have fluctuated as de-industrialisation removed much of its heavy industrial base. It now has a population of just over 1 million and still growing, with many young people and a strong policy emphasis on creating a thriving "post-industrial" city.

Birmingham began the process of post-war reconstruction very early (Adams & Larkham, 2019; Larkham, 2016). Its plans were well developed and, through the provisions of a private Act of Parliament in 1946 the relevant mechanisms were in place, before the majority of bomb-damaged towns. On several occasions, the City Engineer and Surveyor, Herbert Manzoni, asserted that Birmingham's redevelopment plans predated the wartime bombing raids and he felt that the relatively limited (in comparison to Germany, Italy and Japan) and scattered nature of the bomb damage ensured that there was no need for a city-wide reconstruction plan (Sutcliffe & Smith, 1974; Sutcliffe, 1967-9). Unlike the schemes that many other cities were producing at the time, on Manzoni's advice the deliberate decision was taken in the early 1940s not to proceed with an overall city centre redevelopment plan. The Council itself already owned much property in the city centre and additional sites had been acquired along the line of the proposed inner ring road, thus allowing the local authority considerable control over how to shape the modern city (Manzoni, 1968) (Figure 1).

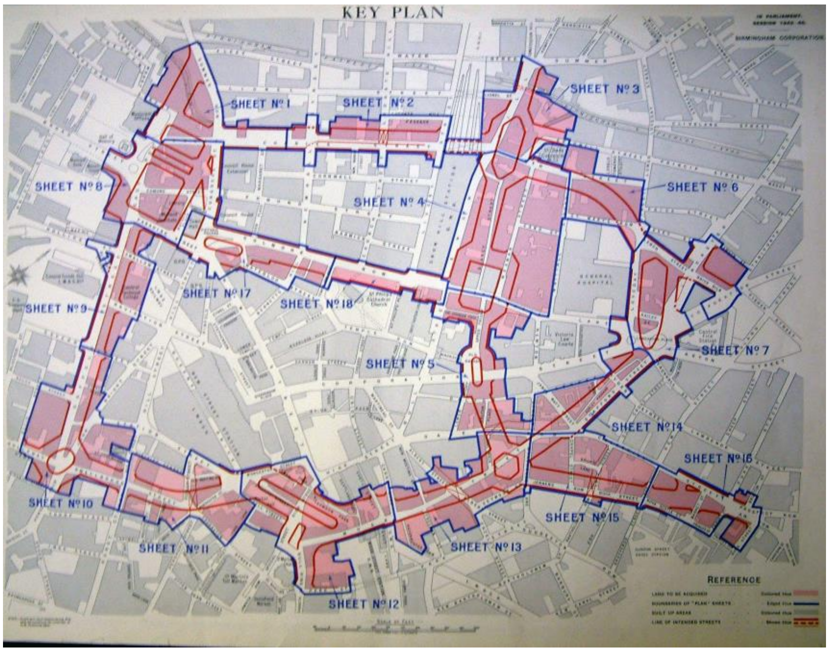

Figure 1. Inner Ring Road route and property to be purchased (darker shading) (Birmingham City Council).

Nevertheless, implementation was slow, owing largely to national governmental inability or unwillingness to sanction local expenditure or to allocate source materials (Larkham, 2016). From the early 1950s, however, there was a decade of significant activity, culminating in the Smallbrook Ringway (the first section of the ring road, a high-speed street though closely lined with shops and offices) and associated developments. From the election of the Conservative government in 1951 to the end of the office boom in the mid-1960s, however, the economy was de-regulated, building materials were no longer rationed from 1954-5, the 100% tax on land value increased by development ("betterment") was removed, and speculative developers forced the pace of change. This was certainly a period of intense development in the city and became prominently featured in the national and international press: "Birmingham's gleaming new buildings and roads ... its expressways, sprawling suburbs, tall buildings, and its air of hustle and bustle and enterprise make its Britain's most transatlantic city" (Sutcliffe & Smith, 1974). Despite the lack of an overall plan, with the ring road providing an armature the city's urban form changed very significantly in terms of street networks (Van Nes, 2001), plot patterns and building forms and uses (Figure 2).

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Figure 2. Post-war city-centre redevelopments (2A) including the Inner Ring Road (2B) (Base maps © Crown Copyright and Landmark Information Group Limited (2012). All rights reserved.

Development activity began to slow towards the end of the 1960s. By the early 1970s, substantial pockets of public anxiety emerged around the excesses and rate at which the comprehensive modernist redevelopments were taking place in the centre of the city (Adams, 2011). Foster, in a major architectural history of the city centre, suggests that the early 1970s public campaign against demolition of the Victorian Post Office on Victoria Square marked a significant change of attitudes, less supportive of the scale, pace and generally unsympathetic approach pursued during city's post-war development (Foster, 2005). Although some projects, including some very major ones such as the Central Library, were ongoing until the 1973 international oil crisis, development then virtually ceased (Larkham, 2016).

Parts of this story are familiar, of course, and resonate with wider arguments around the apparent failure of mid-twentieth century modernity. For Birmingham, though, the decline was felt particularly sharply: in the 1950s and 1960s the region underwent change on an unprecedented scale, as Birmingham reaped the benefits of manufacturing-related economic success. However, in retrospect, the specialized nature of the region made it increasingly susceptible to economic changes and so the protracted recession of the 1970s and 1980s had a dramatic effect on the region, with employment in the dominant manufacturing sector declining rapidly (Flynn & Taylor, 1986). Following the recession of the late 1970s and early 1980s, Birmingham City Council sought to engineer a new future for the city; one which carried the hallmarks of the modern, progressive ideals of the mid-twentieth century. Grand development projects and aggressive promotion initiatives emerged in an attempt to reverse the city's image of being centred on the primacy of the motor car (for a more in-depth review, see Loftman & Nevin, 2003). Efforts also centred on reversing the negative associations attached to the radical physical transformation that occurred between 1947 and 1973, characterised by the modern redevelopment and overpowering highway schemes. For example, in 1988 Birmingham City Council sought to drastically change the inner ring road. This was in part due to the perceived disadvantage of the pedestrian; but, perhaps more importantly, also because of its functioning as "a physical and psychological barrier inhibiting growth" of the commercial core (Birmingham City Council, 1989). Furthermore, in a decisive rejection of the post-war architecture, the 1990 *Birmingham Urban Design Study*, produced by a then-prominent urban design practice, suggested ways in which the city could overturn its image of an unfathomable concrete jungle by making it cleaner, safer, and more legible, by prioritising the pedestrian over the motorcar (Tibbalds, Colbourne, Karski, & Williams, 1990).

Attempts to reverse the negative associations of the city's post-war physical landscape were also accompanied by a strident 'pro-growth' attitude designed to bolster the city's role in a changing global economy (Barber & Hall, 2008). Hence the emergence of polices designed to attract new forms of foreign investment, while creating attractive, well-designed spaces where affluent, youthful urbanites can live, work and socialize (Hall & Hubbard, 2014). Clearly, more consensual, less sweeping and more sensitive approaches to development and conservation have also emerged in recent years. Enhancing the city's "historic environment and sense of place" (Birmingham City Council, 2017) are important policy considerations in creating a new, vibrant city image, as elements of the city's physical heritage are celebrated, preserved and marketed in a range of media. Rather less official weight is given to the preservation and promotion of the city's post-war physical legacy. Indeed, despite Foster's sympathetic reappraisal (2005) and more recent high-profile cases, the material legacy of post-war (e.g. 1950s and 1960s) modernist redevelopment remains a largely unacknowledged part of Birmingham's heritage and design identity. And the city's post-war structures (from the 1950s to the 2000s) are routinely castigated in surveys of the city's – even the country's – ugliest buildings (for example, BBC, 2008).

It is understandable, therefore, that much recent policy emphasis continues to stress the need for new, resiliently designed, sustainable buildings and land uses that support shopping, business tourism and major cultural events (Birmingham City Council, 2017).

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Just as some contemporary architects saw the Second World War bombing as an opportunity, so can the demolition of the reconstruction-era buildings be seen today. Batty (2007), for instance, notes of the late 2000s rebuilding boom in London that "what is so interesting about this renewal is that it is not generated simply by the fact that buildings have outlived their usefulness ... perfectly serviceable and even attractive buildings are being removed and rebuilt". Moreover, this leads to the crucial question of whether, for all the difference in their respective rhetorics, the ideas that influenced post-war redevelopment and contemporary approaches to rebuilding the city, can produce significantly different outcomes or whether we are witnessing a new series of contradictions that a future generation of planners need to assuage in the future? In the following section we explore various ways in which the post-war legacy has begun to be re-shaped.

THE FATE OF BIRMINGHAM'S POST-WAR BUILDINGS

Rapidity of change[2]

For a wide range of reasons Birmingham's post-war buildings have been seen as problematic and, in some cases, ephemeral. Of those falling into the latter category, the Bristol and West Building Society's building at the corner of St Philip's Place and Temple Row is significant (Figure 3A). Opened in 1975, this building was carefully designed to fit a neighbour and also the design of the reconstruction-era Rackhams department store. It faced a major heritage asset, the cathedral and churchyard, and was within the central conservation area.[3] This was a robust, serviceable building, yet in 1999 the decision was taken to demolish and rebuild rather than to refurbish (planning application 1999/00671/PA). By then the original owner had been taken over by the Bank of Ireland. The reasons given included that the heating and ventilation were integral to the concrete structure and could not be replaced; the new extensively-glazed building has a slightly bulkier form, and the windows jetty out over the pavement by a couple of feet (Figure 3B). So there is increased lettable floorspace, and finance won. The lifespan of the 1970s building was 25 years.

Figure 3. Corner of St Philip's Place and Temple Row (A) after 1970s redevelopment (by Patricia Frost, from the Bristol and West's promotional booklet, 1975) (B) after 2000s redevelopment.

Another ephemeral building was 35 Newhall Street (Figure 4A). Again, within the central conservation area, in the early 1990s, conservation officers spent much time and effort in negotiating a striking design to turn this corner. However, by 2005 there were proposals for a major change, virtually a replacement building (Figure 4B), again extensively glazed and jettying out slightly over the pavement (application 2005/01612/PA, for "erection of additional storey and new elevations"). Once more there was a significant increase in lettable floorspace. The lifespan of the 1990s building was a mere 15 years.

Figure 4. 35 Newhall Street (A) after 1990s redevelopment (B) after 2000s redevelopment.

Neither of these buildings was functionally obsolescent. The first was, arguably, structurally obsolete in terms of the difficulty and expense of retro-fitting new services. But the key driver in replacing/reconstructing both buildings after such short lives was the ready availability of finance and the relative rental income from the highest-quality office floorspace. These buildings will soon suffer from the structural obsolescence of key components: for example, the industry-estimated life of double-glazed sealed units such as are used here is only about 15-20 years, and IT infrastructure probably rather less.

These rather ephemeral buildings can be contrasted with one of the icons of the city's post-war reconstruction era, the Rotunda. Designed by local architect James A. Roberts and built by 1964, it survived an IRA bomb in 1974 although large amounts of external gazing had to be replaced, and the unpopularity of its segment-shaped offices. By 1986 there were proposals to redevelop it with

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another 'landmark' office building; instead it was listed. As part of the Bullring redevelopment of 2000-3 it was stripped back to the concrete structural frame and re-clad (Figure 5), the design receiving the approval of the original architect as being closer to his original design than what was originally built! This support was helpful in making the developer's case for planning consents from the local authority and English Heritage.[4] The developer Urban Splash converted the bank, offices and unused restaurant into flats, which sold out within a couple of hours of going on to the market. Its lifespan so far has been 55 years, it is now protected, and is still functioning well. The robustness of its structural core is crucial to its successful refurbishment and survival. Its status as a local icon, appearing on book covers and a range of marketing products, was also helpful in generating wider public support.

Figure 5. The Rotunda, stripped for refurbishment in August 2006.

The Mailbox, formerly one of the largest Royal Mail sorting offices, dating from 1970, likewise became redundant and was sold to a developer for £3 million in 1998. Instead of demolition, it too was stripped to the steel frame and rebuilt as 15,850 sq. m (170,000 sq. ft) of office space with the BBC a major tenant, 9,290 sq. m (100,000 sq. ft) of highest-quality retail space, plus restaurants and a health club, and apartments above (Bryson, 2003). It seemed easier to get planning permission for a major reconstruction than for a wholly new building, notwithstanding the radical reshaping of the interior structure and striking recladding of the exterior (Figure 6). This is part of a transition of this business/industrial urban quarter into a high-density residential area, with several new apartment blocks.

Figure 6. The Mailbox following conversion.

The Inner Ring Road itself is also an iconic morphological structure of this period. Its design spanned the period *c.*1944-71; its construction 1957-71. The detailed design was radically changed from a high-speed road lined with shops and offices to an urban motorway with tunnels, flyovers and extensive roundabouts. One of the cross-arms (see Figure 1) was never built, a casualty of the changing attitudes towards conservation by the early 1970s. But, as with other ring roads of the immediate post-war period, its route was extremely closely delineated around the CBD and it soon became known as a 'concrete collar', stifling outward business growth. It also hindered movement, especially of pedestrians, since the numerous pedestrian underpasses eventually became sites of graffiti and violence. Hence a series of campaigns from 1988 sought to 'break the concrete collar' at several points around the city core, filling underpasses, lowering the roadway, and giving priority to pedestrians (Figure 7). The road remains despite this surgery, still a major route around most of the city core: the radical new alignment and scale of the 1940s plan have persisted although elements of the built form have been equally radically changed.

However, work to the Inner Ring Road at one point (Figure 7) provided an opportunity to review another element of sustainability: the CO_2 cost of this redevelopment. Built between 1961-64, demolition of this raised section began in 2002: a lifespan of four decades. This part of the Ring Road redesign project alone cost £24.2 million (at 2002 prices) and involved

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recycling of 20,000 m^3 of concrete into 48,000 tonnes of construction aggregate: much was recycled on site, the lowest emissions option (Thomas, Lombardi, Hunt, & Gaterell, 2009). This example reinforces the wastefulness of the energy and CO_2 embodied in demolishing these large-scale structures after a short life.[5]

Figure 7. Radical change to the Ring Road at Masshouse Circus.

Conflict and contest: decision-making and urban form

In the UK, advocates for 1950s/1960s architecture – or post-war conservationists (While 2007) – have played a key role in promoting a reassessment of post-war modernism (Harwood, 2015). This includes national pressure groups such as the Twentieth Century Society, and individuals who write books and newspaper articles, stage exhibitions, organise study visits, make television programmes, oppose plans to redevelop important buildings, and generally lobby on behalf of post-war architecture. As a result of pressure the scope of national listed building protection in England was extended to cover the 1950s, 1960s and 1970s: the expansion of post-war listing offers a 'counterhegemonic' conservation approach in terms of its position within the national protection regime (While & Short, 2011). Searching questions regarding how the post-war heritage might be used are exposed when decisions are taken about whether to protect particular buildings and areas. The resulting battles are often hard-fought and time-consuming. It took years of pressure from Historic England and the Twentieth Century Society to persuade Plymouth City Council to designate its city core as a conservation area in 2019, although this is the most complete development of a key plan by the period's key planner, Professor Sir Patrick Abercrombie (Plymouth City Council, 2019).

In Birmingham there has also been some noticeable resistance to the recent rush to dispose of elements of the post-war city. Some of the city's leading post-war architects have been an important part of this lobbying movement – albeit that there is a degree of self-interest here, as they were campaigning for increased heritage validation for their own buildings. James Roberts's contribution to the Rotunda refurbishment has been mentioned, and John Madin was a passionate advocate for the protection of buildings such as Birmingham Central Library, one of the most startling examples of post-war architecture in the city (Figure 8). The Twentieth Century Society has played a key role in lobbying for protection for individual buildings, such as the Central Library. It is also noticeable that recent architectural histories, including several volumes on the publicly-unpopular "Brutalist" style (including Calder, 2016; Clement, 2018) have taken a mostly compassionate view of the 1950s and 1960s legacy, and Madin's own contributions have been subject to critical reappraisal even before his death (Clawley, 2011).

Figure 8. The Central Library, shortly before demolition

The saga of the Central Library exposes some key issues in the relationship between decision-making and urban form (Clawley, 2015; Larkham & Adams, 2016). Madin was asked in 1964 by the then City Architect J.R. Sheridan-Shedden to collaborate on a new civic centre master plan, combining an ensemble of civic buildings, including a new library, at the eastern end of Broad Street on the site known as Paradise Circus. Madin produced a large model, showing (amongst other buildings) the Town Hall of 1832-4 and the Hall of Memory war memorial, together with a bus station, student halls of residence, a concert hall and library. Madin's plans for Paradise Circus were approved by the council in 1968, and the original scheme was for a central library, with a bus

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terminus underneath, a school of music and physical sports institute – this was Madin's 'civic heart' of the city (Madin, 2009).

Construction of the library began in 1969 and the main shell of the building was completed in 1971. The outward form was simple and comprised a huge reference block and smaller lending block to its east, which also houses the first set of escalators leading to the upper floors of both libraries. Adopting a cantilevered design resulted in a distinctive inverted ziggurat form. It was adopted for civic purposes in the monumental Boston City Hall design by Kallmann, McKinnell and Knowles, in 1962 (also subject of very polarised views: Sirman, 2018). Madin's original vision of a building clad in Portland stone or travertine marble, set in landscaped gardens replete with fountains and waterfalls, was altered by the City Council for cost reasons, and pre-cast concrete with a stone aggregate was used instead, leading to some criticism that the library was a 'concrete monstrosity' (Foster, 2005; Gold, 2007; Parker & Long, 2004).

The Council also cited the failure of some of the concrete panels in 1999 as a reason to demolish the library and pass the site to a commercial developer – although the Council-appointed experts did not substantiate these claims (Dale, 2009). Despite some fresh visual attempts to understand and communicate the original architectural concepts to a wider audience – including a small photographic exhibition, 'Back to the Modern', held in 2006, which celebrated the library's history which weaved together a blend of archive and contemporary photographs – the City Council, and in particular its then Leader, decided to proceed with demolition to make way for a more commercial enterprise. Government Ministers supported the Council and overrode two recommendations from English Heritage that it should be listed. Writing for the *Birmingham Post*, Madin (2009) stridently argued that it is the definitive act of urban regeneration to take the library building and resuscitate it for a new life, all for a cost not dissimilar to that of a new building. Madin's library was demolished in 2015-6 and new offices are being constructed on its site; a replacement library costing approximately £190 million was opened nearby in 2013 (Mecanoo architecten, 2014).

In this case, efforts to protect the building faced stiff resistance from critics unwilling to see the value of preserving what was presented as an unpopular and dysfunctional building; a structure that for some became indelibly linked with the perceived failings of modern Birmingham. Of course, official protection does not necessarily guarantee protection in perpetuity, but it does establish a strong presumption in favour of conservation. Lobbying efforts to revivify and preserve a semblance of original architectural integrity run the risk of imposing the interests of a narrow architectural elite on landowners, local authorities and local residents. Ideas of political obsolescence together with a push for new, shiny structures and land uses that fit a wider narrative of post-industrial growth trumps deeper concerns over any desire to repurpose functional, architecturally distinctive buildings to fit wider sustainability goals.

PERSISTENCE AND NEW SUSTAINABLE OPPORTUNITIES FOR BIRMINGHAM'S POST-WAR URBAN FORM

Certain structures, such as the Rotunda and Mailbox, manage to contribute efficiently alongside newer buildings. In many ways, these examples fit comfortably within the broader narrative of rapid post-industrial urban renaissance and sustainability ambitions.

Furthermore, protection through listing has emphatically not prevented a very substantial modification and upgrading of the Rotunda, with the decision to install more energy-efficient electrical systems and insulation: the building is, in some ways, more environmentally friendly as a result. In this case, listing has been sufficiently flexible to allow for change, despite concerns that the major refurbishment has damaged the character of the building (Foster, 2005).

The design principles of some of Birmingham's post-war architecture resonate well with the wider narrative of sustainability. This is perhaps most notable in terms of offering flexible floorplates for residential or office accommodation mixed with a certain urban coolness, as reflected in the transformation of structures such as the Mailbox and the Rotunda, where apartments sold out within hours. In the 1990s, the developer Urban Splash was actively buying up 1960s 'outmoded' office and industrial buildings in Birmingham and elsewhere (Allen & Blandy, 2004). While elements of the original design aesthetic are retained, the Urban Splash approach tends to involve an exterior makeover of recladding or repainting stained concrete, and design alterations such as new entrances, but where possible window and other original features are retained for economic as much as design reasons. The UK Urban Task Force (UTF)[6] (Urban Task Force, 1999) praised the Urban Splash approach in bringing empty commercial property back into residential use – and indeed most of the Rotunda had stood empty for some years. However, Lees (2003) sounds a note of caution: this might be sustainable re-

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use, but "for the most part, because of the limited space, it is only attractive to wealthy professional singles or couples without children. The UTF promotes the kinds of gentrified enclaves familiar from US rust-belt cities such as New York, Boston and Baltimore". Conversely, some of the more recent buildings – of the 1970s and even 1990s rather than 1950s or 1960s – have led very brief lives. They have been redeveloped for largely financial reasons, rather than structural or functional obsolescence. The Central Library, however, was condemned more by 'political obsolescence'. The radical changes to the Rotunda and Mailbox have proved what can be done, and in cost-effective ways. Demolishing such relatively new buildings cannot be sustainable.

CONCLUSIONS

Like many places, the urban form of Birmingham city centre is a constantly changing assemblage of architecture, planning interventions, changing tastes, fashions and experiences. This paper explores the factors that are shaping decisions about what remains of the 1950s/1960s legacy in that city, focusing particularly on the connection between post-war conservation and the ongoing programme of urban renewal. As a starting point for consideration, the products of 1950s/1960s urbanism have tended to be seen by later urban leaders as "relic features", an unwanted interruption to the more recent design narratives of post-industrial cities, even despite the recent focus on sustainability. Although there is some appreciation of the architectural qualities of post-war urbanism, we have tentatively sketched out the possibility for alternative ways of interpreting how this apparently unwanted heritage could make positive contribution to a wider sustainable discourse. Two main conclusions arise from the analysis, with specific implications for the legacy of post-war modernism and more general resonance for sustainability and urban form.

Buildings can be changed very quickly and/or have relatively short lives. In the contemporary city centre, structural obsolescence is much less an issue than finance and the imperative for more attractive post-industrial structures and lettable floorspace, notwithstanding the design quality of a building to be replaced. The short-term financial interests of land and building owners dominate. Land ownership can also trigger change and building replacement even of apparently sound structures especially when as in Birmingham, many sites are held on relatively short-term leases. Powerful memories, meanings, and values attached to buildings, structures and artefacts may fade. But these memories also continue to hover in the background, ready to burst through the immediate context and provoking sometimes powerful, emotive and political responses among residents, developers, landowners and decision-makers (cf. Edensor, 2019). Hence political, rather than structural or financial, considerations may also trigger removal of buildings deemed unsightly, unpopular or in the way of development. More recently, awareness of the finite life of building components – glazing, roofing, services – as compared to the much longer life of steel or concrete frames has become an issue, while in the UK's system, retaining a frame might make the planning issues more straightforward. Consideration of sustainability costs and considerations – of embedded energy and CO_2, and of recycling - need to be more clearly incorporated in decision-making.

Emerging from this is the suggestion that the unloved ordinary buildings of the post-war reconstruction period need to be reappraised in the current concern for sustainable urban and built form. They can often be readily adapted to new uses; rebuilt or reclad. Extending their life promotes sustainability, especially considering the energy embedded in their original structure. The radical new urban forms proposed by some might be less of an issue if the best use is made of these under-appreciated assets. Rather than championing the importance of architectural integrity or authenticity, sustainable future urban forms should pay much greater heed to considerations of flexibility and adaptability of what currently exists, even of relatively unloved and vulnerable structures. A life of 15-40 years for major city-centre buildings or expensive infrastructure is not sustainable. This realisation will change the dominant dynamic of city-centre urban form in the industrial era: fast and large-scale change is unsustainable, unless caused by some catastrophe such as natural disaster or, in Birmingham's case, the destruction of war.

NOTES

1 A "Listed" building has been added to a Government list of buildings of special architectural or historic interest. Buildings are graded (I, II*, II) depending on their perceived architectural or historic importance.
2 Information for this section is sourced from Birmingham City Council archives and planning files, and from conversations with former professional planning staff.
3 A "conservation area" is designated by the local authority as "an area of special architectural or historic interest, the character or appearance of which it is desirable to preserve

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or enhance" (Planning [Listed Buildings and Conservation Areas] Act, 1990).

4 English Heritage was the Government's advisory body on heritage from 1983; in 2015 it was restructured and Historic England provides that function.

5 Producing a tonne of concrete liberates about a tonne of CO_2 and about 900 MJ of energy: the costs of concrete production are huge (Aïtcin & Minders, 2011), and thus the embodied costs of concrete structures are a serious consideration for sustainability.

6 The Urban Task Force was a Government initiative, chaired by the architect Lord Richard Rogers.

REFERENCES

Adams, D. (2011). Everyday experiences of the modern city: remembering the post-war reconstruction of Birmingham. *Planning Perspectives, 26*(2), 237-260.

Adams, D. & Larkham, P. J. (2019). *The Everyday Experiences of Reconstruction and Regeneration: From Vision to Reality in Birmingham and Coventry*: Routledge.

Aïtcin, P. C. & Minders, S. (2011). *Sustainability of Concrete*. Abdingdon, Spon.

Allen, C. & Blandy, S. (2004). *Fables of the reconstruction: Inner-urban regeneration, city centre living and the reinvention of urban space.* Paper presented at the international conference of the International Sociological Association, Research Committee.

Barber, A. & Hall, S. (2008). Birmingham: whose urban renaissance? Regeneration as a response to economic restructuring. *Policy Studies, 29*(3), 281-292.

Batty, M. (2007). The creative destruction of cities. *Environment & Planning B*, 24, 2-5.

BBC (British Broadcasting Corporation) (2008). Bullring 'UK's ugliest building. BBC News 14 October. http://bbc.co.uk/1/hi/uk/7668994.stm (accessed 6/9/ 2019).

Benton-Short, L., Keeley, M. & Rowland, J. (2019). Green infrastructure, green space, and sustainable urbanism: geography's important role. *Urban Geography, 40*(3), 330-351.

Birmingham City Council (1989). *The Highbury Initiative City Challenge Symposium.* Birmingham: City Council.

Birmingham City Council (2017) *Birmingham Plan 2031.* Birmingham: City Council.

Bryson, J. (2003) Reshaping and reinvesnting the city of Birmingham: planning for enterprise and the information society. In A. MacLaren (ed.) *Making Space: Property Development and Urban Planning* London: Arnold.

Calder, B. (2016). *Raw concrete: the beauty of brutalism*: Random House.

Clawley, A. (2011). *John Madin*. RIBA Publications.

Clawley, A. (2015). *Library Story*. Birmingham: author.

Clement, A. (2018). *Brutalism: post-war British architecture*: The Crowood Press.

Conzen, M.R.G. (1962). The plan analysis of an English city centre. In K. Norborg (ed.) *Proceedings of the I.G.U. Symposium in Urban Geography, Lund, 1960.* Lund Studies in Geography. Lund: Royal University of Lund, Department of Geography.

Dale, P. (2009). Experts cast doubt on Birmingham Central Library 'concrete cancer' claims. *Birmingham Post* 16 June. https://www.thefreelibrary.com/ (accessed 6/9/2019).

Edensor, T. (2019). The haunting presence of commemorative statues. *Ephemera, 19*(1), 53-76.

Flynn, N. & Taylor, A. (1986). Inside the rust belt: an analysis of the decline of the West Midlands economy. 1: International and national economic conditions. *Environment & Planning A, 18*(7), 865-900.

Foster, A. (2005). *Birmingham* (Buildings of Britain: Pevsner Architectural Guides). New Haven: Yale University Press.

Glendinning, M. (2013). *The Conservation Movement.* Abingdon: Routledge.

Gold, J. R. (2007). *The practice of modernism: modern architects and Urban Transformation, 1954–1972*: Routledge.

Graham, B., Ashworth, G. & Tunbridge, J. (2000). *A Geography of Heritage*. London: Edward Arnold.

Hall, T. & Hubbard, P. (2014). Birmingham needs you/you need Birmingham: Cities as Actors, Actors in Cities. In M. Conzen & P.J. Larkham (eds), *Shapers of Urban Form: Explorations in Morphological Agency* (pp. 285-300). Abingdon: Routledge.

Harwood, E. (2015). *Space, Hope, and Brutalism: English Architecture, 1945-1975*. London: Yale University Press.

Hopkins, O. (2017). *Lost Futures: The Disappearing Architecture of Post-war Britain*. London: Royal Academy of Arts.

Kynaston, D. (2015). A crushing case for brutalism — with the people left out. *The Spectator*, 10 October, https://www.spectator.co.uk/2015/10/big-is-beautiful-a-crushing-case-for-brutalism-with-the-people-left-out/ (accessed 19/9/2019).

Larkham, P.J. (1996). *Conservation and the City.* London: Routledge.

DOI: 10.15320/ICONARP.2019.78– E-ISSN: 2147-9380

Larkham, P.J. (1999). Tensions in managing the suburbs: conservation versus change. *Area, 31*(4), 359-371.

Larkham, P.J. (2016). Replanning post-war Birmingham. *Architectura, 46*(1), 2-26.

Larkham, P.J. & Adams, D. (2016). The un-necessary monument? The origins, impact and potential conservation of Birmingham Central Library. *Transactions of the Ancient Monuments Society, 60*, 94-127.

Lees, L. (2003). Visions of 'urban renaissance': the Urban Task Force report and the Urban White Paper. In R. Imrie & M. Raco (eds) *Urban Renaissance? New Labour, Community and Urban Policy.* Bristol: Policy Press.

Loftman, P. & Nevin, B. (2003). *Prestige projects, city centre restructuring and social exclusion: taking the long-term. view*. In M. Miles & T. Hall (eds) *Urban Futures.* London: Routledge.

Madin, J. (2009). Cutting the cultural and civic heart out of Birmingham. *Birmingham Post*, 9 October., http://www.BirminghamPost.net/comment (accessed 6/9/2019).

Manzoni, H.J. (1968). *The Development of Town Planning in Birmingham.* Unpublished notes from the History of Birmingham Seminar no. 2, School of History, University of Birmingham, copy in Birmingham Library, Local Studies, LP56.4.

Martin, G. H. (1968). The town as palimpsest. In H. J. Dyos (ed.), *The Study of Urban History*. London: Edward Arnold.

Mecanoo architecten (2014). *A People's Palace: the Library of Birmingham*. Berlin: Aedes Architecture Forum.

Ministry of Housing, Communities & Local Government (2018). *Revised National Planning Policy Framework*. London: Ministry of Housing, Communities & Local Government

O'Neill, R.V., DeAngelis, D.L., Wade, J.B., Allen, T.F.H. & Allen G.E. (1986). *A Hierarchical Concept of Ecosystems.* Princeton: Princeton University Press.

Parker, D. & Long, P. (2004). 'The mistakes of the past'? Visual narratives of urban decline and regeneration. *Visual Culture in Britain, 5*(1), 37-58.

Plymouth City Council (2019). Press release on new conservation area. http://plymouthnewsroom.co.uk/council-agrees-new-city-centre-conservation-area/(accessed 6/9/2019).

Sirman, B. (2018). *Concrete Changes: Architecture, Politics, and the Design of Boston City Hall*. Amherst: University of Massachusetts Press.

Sutcliffe, A.R. (1967-9). *Transcripts of Interviews with Prominent Birmingham People 1967-9.* Unpublished typescript, copy in Birmingham Library, Local Studies, LF71.

Sutcliffe, A., & Smith, R. (1974). *Birmingham 1939-1970/ (History of Birmingham Volume III)*: Oxford University Press.

Thomas, A., Lombardi, R., Hunt, D. & Gaterell, M. (2009). Estimating carbon dioxide emissions for aggregate use. *Proceedings of the Institution of Civil Engineers, 162,* 135-144.

Tibbalds, Colbourne, Karski, Williams (1990). *Birmingham Urban Design Strategy: City Centre Design Strategy.* Birmingham: City Council.

Urban Task Force (1999). *Towards an Urban Renaissance.* London: Department for Environment, Transport and the Regions.

van Nes, A. (2001) Road building and urban change. In *Proceedings of the 3rd International Space Syntax Symposium*. Atlanta.

While, A. (2006). Modernism vs urban renaissance: Negotiating post-war heritage in English city centres. *Urban Studies, 43*(13), 2399-2420.

While, A. (2007). The state and the controversial demands of cultural built heritage: the origins and evolution of post-war listing in England. *Environment & Planning B, 34,* 645-663.

While, A., & Short, M. (2011). Place narratives and heritage management: the modernist legacy in Manchester. *Area, 43*(1), 4-13.

Resume

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Exploring the Fringe-Belt Phenomenon in a Multi-Nuclear City: The Case of Istanbul

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Abstract

This paper examines historic land use changes to the fringe-belt zones of Istanbul, and in particular looks at the transformation of areas such as these into CBDs due to the effects of urban growth development cycles. The study is based on detailed research into the selected case study areas regarding changes in their land-uses within the overall urban development pattern of Istanbul. Once in the periphery, many of these areas now reflect CBD characteristics as a result of their development cycles. Urban fringe-belts are the urban peripheries of earlier periods that have become enveloped by the city through urban growth, and over time these areas adjust to the ever changing dynamics of urban land-use. In contrast to the dense urban texture of previously developed regions of the city, fringe-belts have a more loose texture and frequently retain the potential for the creation of public spaces. These include the open green areas, institutional areas, and industrial heritage sites that have connections with urban identity, and which are therefore essential for urban memory. Fringe-belts are both heritage areas and ecological corridors that create buffer zones to protect the natural landscape from urban sprawl. However, due to the requirements of rapid population

Keywords: Fringe belt, urban growth, CBD, urban morphology, Istanbul

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growth, they are often seen as potential development areas and those that remain become alienated. Understanding the formation and modification dynamics of fringe-belts is important for both the appreciation and management of cities, and also for the determination of urban areas' future development.

INTRODUCTION

Since the first cities were founded 10,000 years ago, they have undergone many changes in form. Most often, these changes have stemmed mainly from a city's unique economical, political and social dynamics. A comparative analysis of the changes that occur through history, and an examination of their components, allows a better understanding of the dynamics of different urban forms. A historico-geographical approach, therefore, becomes an important means by which to follow the evolution of a given urban form and to chart its spatial traces of change. Concepts such as fringe-belts, burgage cycles, and morphological regions are the products of this approach.

When they are mapped and studied systematically, it is evident that urban fringe-belts constitute major elements of the internal structure of cities, even though this may not be immediately apparent to those on the ground, and is most noticeable in places where a fixation line exerts a powerful constraining influence. In addition, once fringe-belts have been established, it is common for them to have a marked effect on subsequent developments, and for this reason their study is a particularly valuable means of structuring a historico-geographical account of the developing forms of cities (Whitehand, 2007).

As the CBD reflects centralizing forces that concentrate businesses and control functions at the urban core (Murphy 1966), fringe-belts are those portions of the urban area defined by the accumulation of larger space-using sites and structures that were originally located further at the periphery (Whitehand, 1967). The CBD is distinguished by the density and tight texture of its built form; residential districts by their general compactness; and fringe-belts by their significantly looser, more open patterns of land coverage and the availability of larger plots (Conzen 2009).

This study aims to identify the fringe-belt formation and modification processes that continue to occur during the urban growth cycle of Istanbul by identifying the city's substratum as well as the permanent structures that have shaped it so far. Istanbul is located at a key strategic geographical location (at the meeting point of the two continents, Europe and Asia) and it has

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had a long and magnificent history due to its being the capital of the Roman, Byzantine and Ottoman Empires (Kubat, 1999).

Urban morphologists and geographers have been studying the concept of the urban fringe-belt since the 1960s. Although previous studies have demonstrated the validity of the fringe in a variety of regions around the world (Conzen 2009), they have usually focused on small cities (Whithorn and Bromsgrove in Britain) or large cities that developed from a single center such as the Tyneside conurbation, Birmingham, Baghdad, Lusaka, and Auckland (Conzen, 2009). However, there has been little examination of Fringe Belt concept with regard to the multi-centered cities of the developing world. It is therefore timely to make an attempt to fill this void, particularly in the light of the challenges for urban planning facing the central areas of Istanbul, a multi-nuclear metropolitan city with a current population of around 15 million people.

Studies on the urban growth of Turkish cities from viewpoint of urban morphology are very limited but they have been increasing over last decade. Ünlü (2013) focuses on the formation and modification of the inner fringe belt of Mersin, which is furthered by Ünlü and Baş (2016) through an investigation of fringe belt development on a citywide scale. They examine the relationship between distinct fringe belts and provide an explanation of multi-nuclear urban growth with reference to fringe-belt development. Ünlü and Baş identified the development periods of Turkish cities to their fringe belts within the temporal framework, from 19th century until the present day (Ünlü, Baş, 2019).

This study seeks to fill this gap by giving special attention to Istanbul, and by examining the impact of urban growth and CBD transformation on the formation and modification processes of its fringe-belt areas. However, more explicit operational methods and examples are needed to reveal the benefits of the fringe-belt concept to the policy makers and urban planners.

FRINGE BELT CONCEPT

Conzen defined a fringe-belt as “a belt-like zone originating from the temporarily stationary or very slowly advancing fringe of a town and composed of a characteristic mixture of land-use units initially seeking a peripheral location” (Conzen, 1960). During periods of urban growth, the areas that best reflect fringe-belt characteristics are those urban units that were initially located in the periphery. These were later enveloped by the city, but still remain different from more densely structured areas in terms of their textures and functions.

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Fringe-belts were first identified by Herbert Louis in a study of Berlin published in 1936. "Louis formulated the basic concept and made the first attempt to delineate fringe-belt zones cartographically. His accomplishment was to differentiate Berlin's entire metropolitan area into zones that were legible in terms of their historico-geographical development and to map those zones in detail" (Conzen, 2009; Louis, 1936). He demarcated areas according to how densely formed they were, labeling them as: heterogeneous built-up zones, industrial belts, allotment garden districts, villa quarters, and absorbed former village centers. The fringe-belt phenomenon and the associated processes of urban growth were further explored in the early 1960s by M.R.G. Conzen, a student of Louis, who examined Alnwick and Newcastle-upon-Tyne (Conzen, 1960; 1962). Conzen also found three distinct belts in close association across what was, by comparison with Louis' Berlin case study, a very small built-up area (Whitehand, 1967).

After the studies of Conzen, the concept of the fringe-belt became a tool by which to explain urban growth (Whitehand, 1987). Building upon Conzen's studies, Jeremy Whitehand confirmed the utility of mapping fringe-belts in large urban settings such as the Tyneside conurbation and the cities of Glasgow and Birmingham. More importantly, however, he advanced the theoretical underpinnings of fringe-belt theory by using two major methods. First, he explored the relationship between fringe- belts and the pulses of urban building cycles, thereby proving statistically what Conzen had recognized intuitively. Second, he developed a mathematical model (the Building Cycle Model) that explains the generation of the belt area and site selection with respect to the economic cycles of the city/country (booms & slumps) and changes in land price (Whitehand, 1967, 1972, 1987). By using factors such as distance from the center, accessibility to the periphery, and distance to services, Whitehand found that institutional uses favored these regions, and that the formation of these areas continued during times of economic recession despite falls in housing production; this is largely due to the concurrent drop in land prices. However, it has been mentioned that the formation of fringe- belt areas can also be a cause of declines in housing production for reasons other than those that originate within the building cycle and the rings of construction (Whitehand, 1988).

The use of fringe-belts may vary for reasons such as the choice to locate in the periphery, the need for relatively cheap, large spaces, and the attractiveness of their geographical features. These areas are characterized by the ownership of large units and a high

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proportion of open spaces (Whitehand and Morton, 2004). Green areas, urban agricultural areas, industrial areas, institutional areas, sports areas, low-density residential areas, and recreation areas are all commonly found within fringe-belts (Barke, 1982).

In his primary analyses, Conzen identified three fringe-belts: an inner fringe-belt (IFB), a middle fringe-belt (MFB) and an outer fringe-belt (OFB). Inner fringe-belts generally form around historic city centers, thereby becoming the oldest fringe-belt formation, and are often limited by fixation lines. Middle fringe-belt areas are more distant from the center and are also associated with fixation lines. However, these can occur in areas closer to the centers of slow or under-growing cities. Compared to inner fringe-belt areas, they are less continuous, their parcels are larger, they have more open areas and more vegetation, and major road networks are rare (M.P. Conzen, 2009). Outer fringe-belt areas are the most independent and generally consist of large, scattered, and rarely adjacent parcels. Although OFBs tend to have more open areas, these are less likely to be the product of fixation lines. Despite their differences, all fringe-belt areas are products of centrifugal forces, and as such they are affected by the dynamics of the central business district (CBD), which is the product of centripetal forces (Whitehand, 1967). Conzen (2009) drew attention to the fact that the pressure from CBD expansion and transformation have brought major changes to the IFBs of older cities, and studies of MFBs have shown them to be subject to pressure arising from the need for additional housing (Birmingham being the best explored case).

Table 1. Formation and Modification Phases of Fringe-Belts (reproduced from Conzen, 2009)

Fringe-Belt Formation		**Fringe-Belt Modification**	
Fixation Phase	Incipient character	***FB Alienation***	Loss to residential or CBD
Expansion Phase	Pronounced character	***FB Reduction***	Ditto
Consolidation Phase	Dominant character	***FB Translation***	Transfer to another FB

Fringe-belt areas develop an internal history in parallel with the development dynamics of the city and pass through two grand stages, namely formation and modification (Table 1). In the *formation* stage, they progress from a *fixation* phase to an *expansion* phase, and then to a *consolidation* phase (Conzen, 2009). Over time these once peripheral but now embedded fringe-belts adjust to the ever- changing dynamics of urban growth and the CBD. After the formation stage, they can be perpetuated by attracting areas of similar character *(FB accretion).* However, if fringe-belt areas are located within a city, there will be greater pressure to change and they will be exposed to *modification or expansion.* Thus, fringe-belts may lose their size or coherence when radical or large scale redevelopment takes place *(FB alienation and reduction)* (Conzen, 2009). The different characterization of older fringe-belt areas (multi-storey office blocks and apartment buildings) and the allocation of parking spaces for redevelopment are some of the factors that cause the *alienation* of fringe-belts (Gu, 2010).

Michael Barke and Estelle Ducom have made two useful attempts to understand general fringe-belt dynamics. Barke (1990) schematized the permutations of land use change as fringe-belts multiply and mature. According to Barke (1990), the new land uses from these processes also affect the formation of new fringe-belts. Ducom (2005), on the other hand, examined the interrelationship between decision takers, contributing factors, and the processes of modification as fringe-belts evolve. In this latter model, the formation of the fringe-belt is shaped as a result of the decision-making processes of the primary actors, namely those public administrators and private entrepreneurs who are influential in urban development. According to Ducom (2005), if urban expansion accelerates and/or there is stagnation in the use of these areas, they run the risk of losing their fringe-belt characteristics.

Although these processes apply to fringe-belts, they might also be expected to occur in all urban areas. However, there are also significant regional differences that stem from differing historical, socioeconomic and cultural development to be considered. With regard to this point, studies investigating such differences are important.

METHODOLOGY

Comparative map analysis is the main research methodology to be used when there is a focus on historical maps, aerial photos and development plans. Accordingly, in order to define the fringe-belts of Istanbul, a comparative map analysis was conducted. The fringe-belt modification process of Istanbul was investigated by overlapping the city maps and development plans from different periods, and this was carried out in accordance with the work of Conzen and Whitehand. (Conzen, 2009, Whitehand, 2007). The current study is based on a method of data collection and analysis

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that concentrates on several land-use patterns linked to fringe-belt land utilization (according to Conzen). The study selects among several land-use patterns that reflect the fringe belt land utilization characteristics; cemeteries, military areas, college grounds, hospitals, industrial areas, market gardens, sports and recreation areas, vast squares, parks and gardens, train stations, and low density residential areas.

For the analysis of the fringe-belt areas of Istanbul, each priority area was determined according to the city's main growth axes. From the European side, the Historical Peninsula, the Golden Horn, and the regions of Maslak and Ayazağa were selected as case study areas; and from the Anatolian (Asian) side, the Kadıköy region was selected. As part of this ongoing research project, the Taksim-Pera region on the European side – the key area on the linearly developing CBD axis – and the Üsküdar region from the Anatolian side of the city will be added as additional cases for analysis for the future studies (see Figure 1).

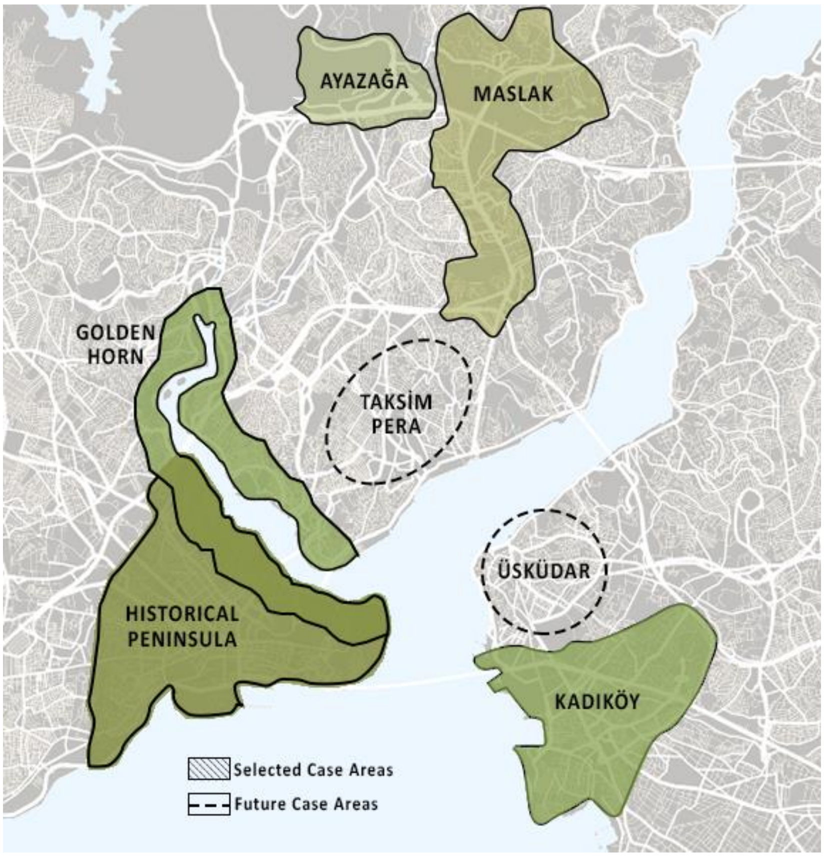

Figure 1. The selected case study areas of the Istanbul Fringe-Belt analysis

The research methodology for this study is a comparative analysis of various city plans that correspond to significant urban transformation periods (1764 – 2017). The historical maps obtained for the case study areas were categorized as Roman (330 – 476); Byzantine (476 – 1453); Ottoman (1453 – 1800); Westernized (1800 – 1923); and Republican (1923 – Present) as shown in Fig (2). The selected case study areas were then examined according to these historical periods.

The maps which reflect the urban growth and transformation patterns according to land utilization are listed in Table (2). By using these maps it is possible to better comprehend both the formation and the modification of the fringe-belts in the case study areas.

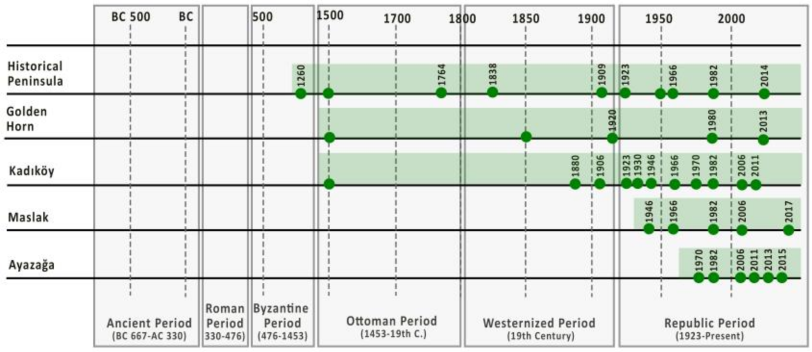

Figure 2. Selected historical maps of case areas and historical periods

Table 2. Selected historical maps related to the case study areas

Historical Peninsula	**Kadıköy**	**Golden Horn**	**Maslak**	**Ayazağa**
*1260 City Map *1400s (15th) City Map *1764 City Map *1838 City Map *1909 City Map *1923Pervettich Maps *1966 City Map *1982 City Map *2014 Satellite Map	*1400s (15th) City Map *1880 Stolpe Map *1906 Goad Map *1922 Gedik Pasha Map *1923 Pervettich Maps *1946 Kadıköy Satellite Map *1966 Kadıköy Satellite Map *1970 Kadıköy Satellite Map *1982 Kadıköy Satellite Map *2011 Kadıköy Satellite Map	*1400s (15th) City Map *1853 And 1860-1970 City Maps *1913 German Blues Map *1923Pervettich Maps *1978 Land Utilization Maps Of Golden Horn *2013 Land Utilization Map Of Golden Horn	*1946 Maslak Satellite Map *1966 Maslak Satellite Map *1982 Maslak Satellite Map *2006 Maslak Satellite Map *2017 Maslak Satellite Map	*1970 Ayazağa Satellite Map *1982 Ayazağa Satellite Map *2006 Ayazağa Satellite Map *2011 Ayazağa Satellite Map *2013 Ayazağa Satellite Map *2015 Ayazağa Satellite Map

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ISTANBUL: HISTORICAL EVOLUTION

The historic development of Istanbul consists of different phases and stratification from ancient times until today. (Kubat, 1999). The main periods of the city's development are its ancient Roman, Byzantine, Ottoman, Westernized and Republican phases. The city dates back 3 thousand years and for nearly 16 centuries it was consecutively the capital of the Roman, Byzantine, and Ottoman Empires.

Pre-Roman and Roman Periods: The first settlement where Istanbul now stands was established on a peninsula (the "Historical Peninsula" today) surrounded on three sides by the Marmara Sea, the Bosphorus, and the Golden Horn. Founded in the 7th century BC, the city was primarily Greek and was called "Byzantion". It developed over time and later fell under the rule of the Roman Empire. During this period, with the declaration of the east as the administrative center of the Empire, the city became a center of culture and politics. There is no numerical area size data for the pre-Roman period, however, it can be said that it remained as a small commercial city. Sources show that it occupied an area of approximately 140 hectares during the Roman period (Kuban, 1996). The first defensive wall was built by Septimius Severus; it stretched for about 5 km and had 27 towers. This wall was later demolished by Constantine I and another was built 3 km to the west to improve the security of the city (IBB, 2005).

Byzantine Period: The city of Byzantium became the center of the Byzantine Empire after the Roman Empire lost political and economic power and divided into two in 395. The eastern capital became known as "Nova Roma" (New Rome) and was officially renamed Constantinople in 330 Fig (3), in honor of the emperor (Kuban, 1996). This period saw the city flourish in terms of both a greater urbanism and major architectural works. Under the reign of Theodosius II, the population increased, its area expanded from 6 km^2 to 14 km^2, and it became necessary for it to be administratively divided into 14 regions and 322 sub-units.

Figure 3. Byzantine Constantinople Map, 1260 (Harvard Map Collection)

Ottoman Period: The city was conquered in 1453 by the Ottoman army under the command of Fatih Sultan Mehmet and became the capital of the Ottoman Empire in 1457. Following this, there were changes made to both its physical and social structures (Kuban, 1996). Renamed Istanbul, the city which had previously developed according to a typical Roman city form, now came under the influence of Islamic culture. The magnificent buildings and mosques (Topkapı Palace, Sultanahmet Mosque etc.) were built on the hills overlooking the Golden Horn, fundamentally changing the city's appearance. The 16th and 17th centuries under Ottoman rule were among the brightest periods of Istanbul. During these centuries, the city spread across both shores of the Golden Horn and the Bosphorus to Galata, Pera, Üsküdar, and Kadıköy Fig (4). As the 18th century progressed, however, it began to become impoverished, and its urban structure was later damaged and irrevocably changed by fires in the 19th century. The street patterns of many districts within the Historical Peninsula (Aksaray, Unkapanı, Fener, and Balat) lost their original structure. Following this, as mentioned by Kuban (Kuban, 1996), the size and number of green areas decreased as they were converted into residential districts.

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Figure 4. Constantinople in 15th Century (German Kartenwerkstatt Map)

Westernized Period: The 19th century was a period when the Ottoman economy became open to capitalist relationships and the first planning studies were carried out. Westernization brought great changes to the city; the Golden Horn was given over to industrialization processes, the transportation system was improved, and many major development activities were undertaken. With the construction of the Sirkeci-Edirne and Haydarpaşa-Izmit railways, commuter trains started to operate and suburban settlements began to grow outside the center (İBB, 2009).

Republican Period: In the first years of the Republican period, the growth rate of the city population decreased and several reconstruction initiatives were started in response. However, the plans prepared by European urban planners and architects had major effects on the spatial structure of the city. For instance, although Prost's plan (1937) had a conservative attitude toward the city’s cultural heritage and its natural landscape, it also intervened radically on its historical fabric. The most important aspect of this plan was the development of medium- and large-scale industries on the shores of the Golden Horn and the construction of state-owned factories and warehouses on the shores of the Bosphorus (Kubat&Hazar, 2018).

As a result of these initiatives, migration to the city increased once more, leading to the development of illegal housing areas. The first migration wave settled around the Golden Horn and the industrial areas outside the city walls. Thus, Kağıthane and Zeytinburnu became the nuclei of the first illegal housing areas (settlements and structures built without permission or land titles). The Istanbul Industrial Plan of 1955 froze some of the industrial development of the Golden Horn. The aim of this plan was to decentralize industries by relocating them to the periphery (Topkapı-Rami and Levent). However, this decision led to the creation of yet more illegal housing. In the 1950s, the Kağıthane illegal housing area had grown large enough for it to become the third-largest in the city, and the formation of new industrial areas caused other non-controlled areas such as Halkalı, Maltepe, and Kartal to also become sites for illegal housing. By the mid-1950s, Istanbul had spread over an area that extended to Yeşilköy (the location of Atatürk Airport) in the west, Levent (a high-density residential area) to the north, and Bostancı (another residential area) on the Anatolian side (İBB, 2009). Additionally, the development of new apartment buildings close to the illegal housing areas also became a problem during this period. In 1965, with the Law of Floor Ownership (condominium), primary empty spaces and later green spaces, parks and playgrounds were transformed into apartment buildings. Parallel to this, the acceleration of the industrialization process also continued the rise in unregulated and illegal housing, and by 1962, residents in illegal housing (squatter settlements) accounted for 40% of Istanbul's urban population.

In the 1970s, there were over 2 million people living in Istanbul, and in 1980, the population of the city had reached 3 million, mostly spread across three regions: the Historical Peninsula, Karaköy-Beyoğlu and Üsküdar-Kadıköy (Kubat &Hazar, 2018). In the 1980s, industries around the Golden Horn were moved to the periphery in a move toward decentralization, and expropriation projects and coastal arrangements were carried out in many districts of the city. In 1980, the first Istanbul Metropolitan Area Master Plan was prepared and approved by the Ministry of Reconstruction and Settlement. This was produced at a scale of 1 / 50,000 and was intended to be complete by 1995.

As a result of population movements and settlement tendencies in the city in the 1990s, it was observed that development was moving in the east-west direction. This was partly due to new and rapidly developing industrial areas which had led to the formation of more illegal settlements in their surrounding areas, and also because of increased reconstruction rights which resulted in further increases in population. In addition, the bridges built across the Bosphorus (Bosphorus Bridge-1973; Fatih Sultan Mehmet Bridge-1988; Yavuz Sultan Selim Bridge-2016) have each

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created new development axes, and one major result of this has been the movement of the CBD from the Historic Peninsula towards Maslak.

APPLICATION OF THE METHODOLOGY

The Fringe-Belts of Istanbul

The initial settlements within the region were established on the Historical Peninsula (European side) and in the Kadıköy region (Anatolian side) during the Roman period. The first fringe-belt formation and fixation lines occurred at the tip of the Historical Peninsula (where today's Topkapı Palace is located) during the Ottoman period (Fig 5a). While a study of the Chalcedon archeological site (where Kadıköy now stands) shows that it did not reflect the fixation characteristics of its historical period (Fig 5a-b), and disappeared over time. The fixation lines of the sea walls and land walls of the peninsula date back to before the Byzantine Empire (Fig 5b).

The Roman Severius walls and Byzantine Constantinian walls of the Historical Peninsula no longer exist, and both have long-since lost their fringe characteristics. However, these historical walls can be accepted as fossil or ghost fixation lines as major transportation axes have been built where they once stood (Ataturk Boulevard follows the route of the Constantinian wall and Ankara Street follows that of the Severius wall respectively). (Fig 5b)

Although the fringe-belts of Kadıköy and the Historical Peninsula were mostly consolidated during the Ottoman period, there are also alienated and expanded areas within the fringe areas of these districts (Fig 5c). During the Ottoman period, the settlement on the peninsula spread to the opposite shore of the Golden Horn after the construction of the Galata Bridge. (Fig 5c)

During the Westernization period, the Maslak and Ayazağa regions, which were in the urban periphery in the previous periods, were redeveloped from agricultural areas to industrial and military zones. On the Anatolian side, many of Kadıköy's fringe-belts were transformed from open spaces and low density residential areas to more intensive residential and commercial uses (Fig 5d).

Most of the fringe-belt areas in the Golden Horn district have been redeveloped during the current Republican period. However, characteristically fringe-belt areas have also been consolidated in both the Historical Peninsula and the Kadıköy district (Fig 5e). The Maslak region has also undergone a FB alienation process that started due to its subsequent redevelopment (transformation) from industrial use to a CBD Fig (5e).

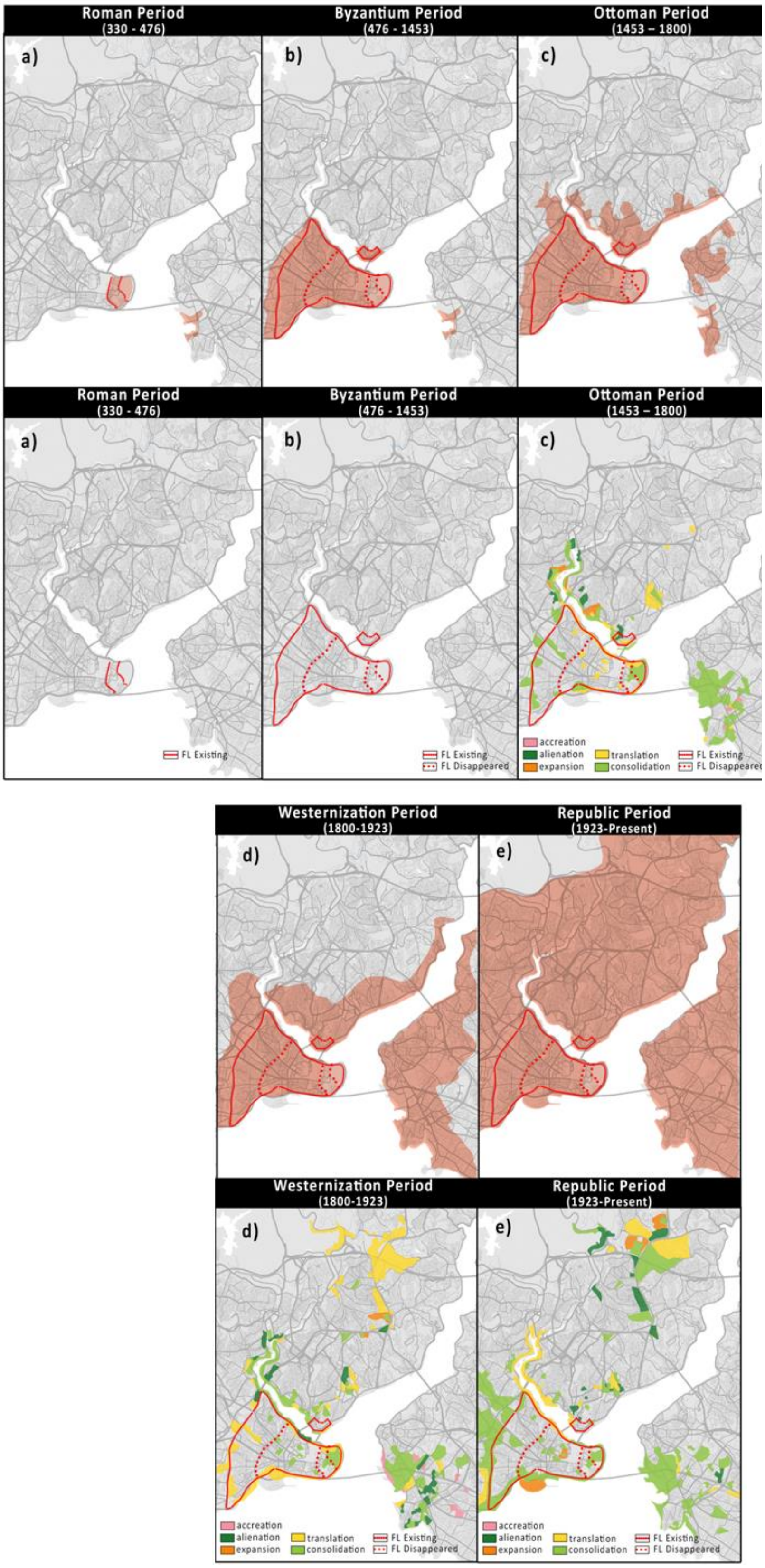

Figure 5. Fixation line formation and fringe belt modification process of İstanbul (prepared by authors; the historical maps mentioned in Table 2)

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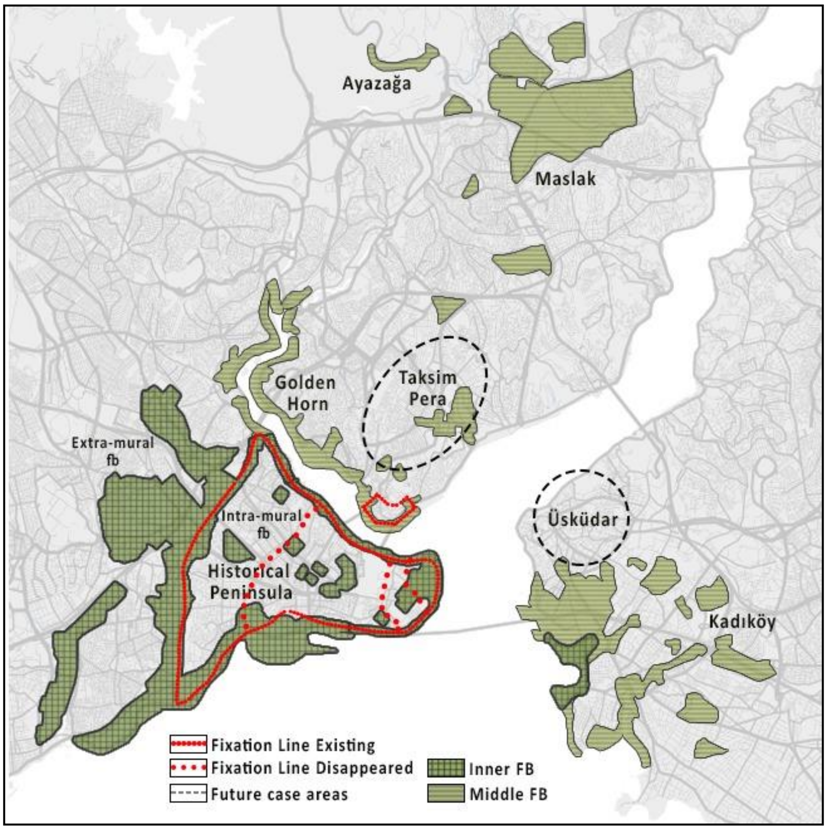

Figure 6. Inner and Middle Fringe-belt areas of Istanbul (prepared by the author; FB maps in Figure 5)

Inner Fringe Belts: Historical Peninsula

The Theodosius walls (land walls) and sea walls of the historical peninsula created a continuous fringe belt zone. These continuous green belts included agricultural areas, cemeteries and urban parks.

Figure 7. Fixation line formation process of the Historical Peninsula during the Roman period (330-476)

Figure 8. Fixation line formation process of the Historical Peninsula during the Byzantine phase (476-1453)

Detailed analyses of the maps reveal that the fixation line of the city Istanbul was developed throughout the Roman period and Byzantine periods. Firstly, the Severius wall and later the Constantinian and Theodosius II walls were constructed. The Constantinian wall was demolished during the Byzantine period Fig (7- 8).

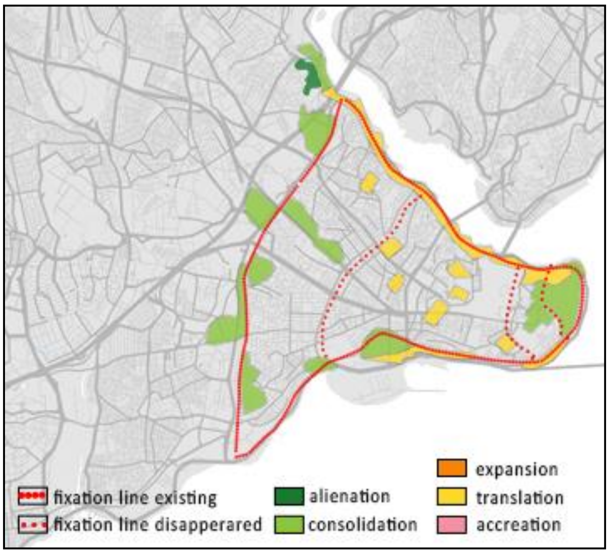

Figure 9. Fringe-belt modification process of the Historical Peninsula during the Ottoman period (1453 – 1800)

Modification	**Area (ha)**
Translation	226.1
Consolidation	339.1

During the Ottoman period; Open spaces, common entities and institutional areas were consolidated around the fixation line, however, the waterfront residential areas were given over to industrial and institutional functions. Many inland residential areas were also taken for institutional use, as in Fig (9).

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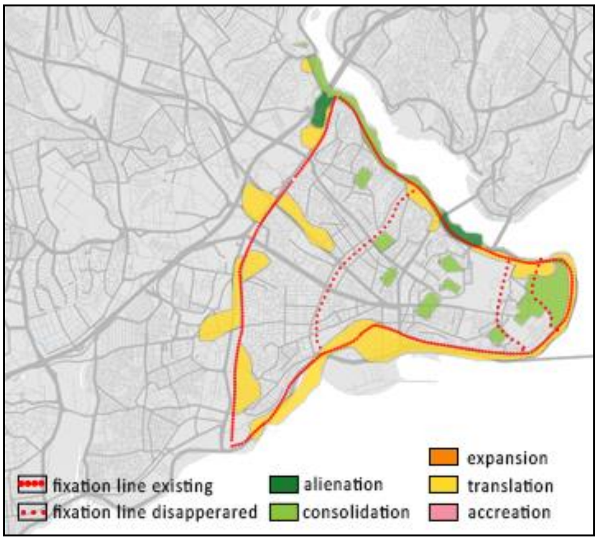
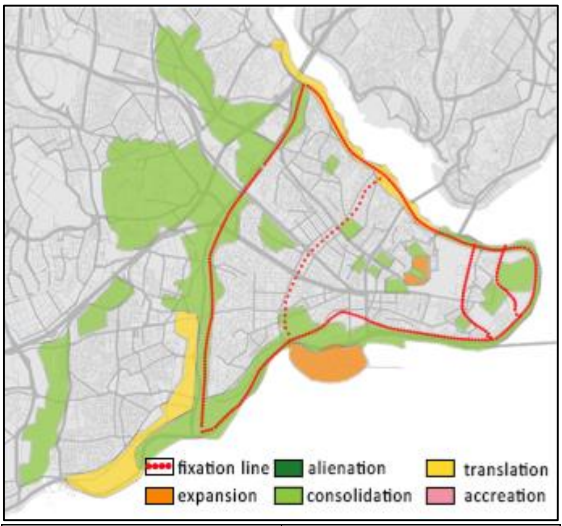


Modification	Area (ha)
Translation	428.2
Consolidation	175
Alienation	26.3

Figure 10. Fringe-belt modification process of Historical Peninsula during the Westernization period (1800-1923)

During the Westernization period, most Inner fringe-belt uses underwent processes of translation. In general, these areas were changed from open spaces to institutional and industrial areas (Fig. 10). While fringe-belt uses were consolidated in inland areas, and partly in waterfront areas, some of the industrial zones were given over to commercial use *(FB alienation).*



Modification	Area (ha)
Translation	259.8
Consolidation	1217.3
Expansion	108.5

Figure 11. Fringe-belt modification process of the Historical Peninsula during the Republican period (1923-Present)

During the current Republican period, fringe-belt usage around the fixation line, especially around the Theodosius II wall, has increased and has mostly been consolidated. Religious sites; such as the Süleymaniye Mosque, the Hagia Sophia, the Sultanahmet

Mosque and the İstanbul University Campus (which was ones an Ottoman Palace); were also consolidated within larger areas in the internal structure of the peninsula. At the waterfront, fringe-belt areas have been expanded due to the Yenikapı landfill project Fig (11).

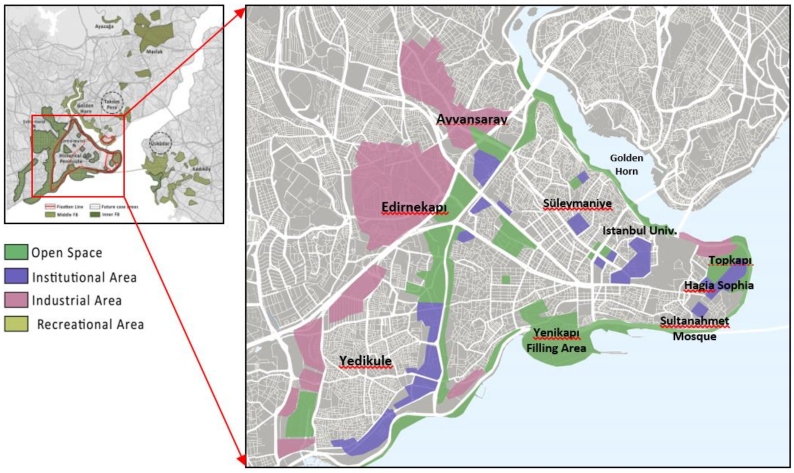


Figure 12. Land use of the current Inner Fringe Belt area on the Historical Peninsula (prepared by author)

From these observations, it can be determined that the land uses in the current inner fringe-belt area are; empty lots, green areas, cemeteries, farmlands, industrial areas, storage, institutional areas, religious and monumental buildings Fig (12). The fringe-belt change process of the Historical Peninsula and the elements of the fringe-belt are shown in Table (3).

Table 3. The fringe-belt development process of the Historical Peninsula and the elements of the fringe-belt (prepared by author)

INNER FRINGE BELTS		
Periods	**Historical Peninsula**	
	Change Process	***FB Elements***
B.C. 667 - A.C.330Byzantion/Chalcedon	Byzantion as a Greek city	Monumental structures, (Institutional areas), ports and first city walls **FB formation-fixation line(Ancient Wall)**
330 - 476 Roman Empire	The eastern administrative center of the Roman Empire	Harbors, aqueducts, new city walls, temples, forum, low density residential areas, monumental structures (Institutional areas) **FB formation-fixation line (Septimius Severius wall)**

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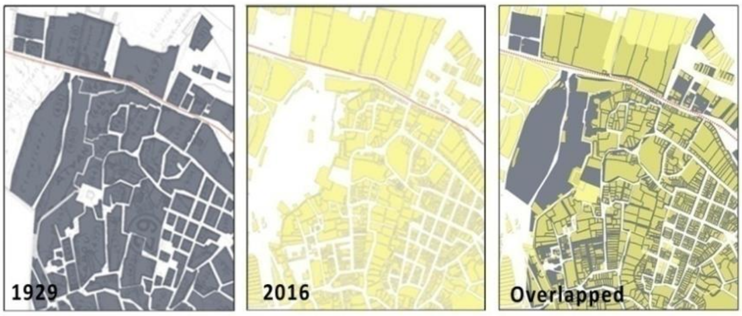
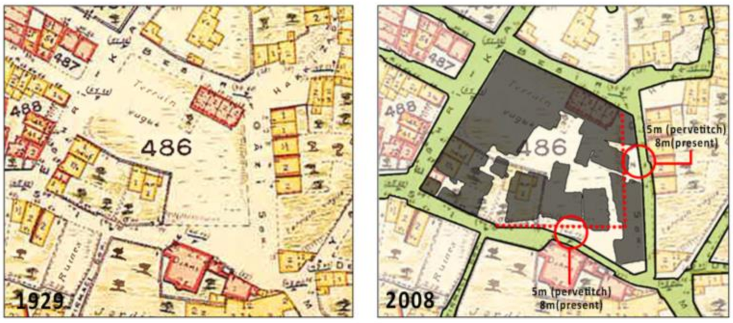
476 - 1453 The Byzantine Empire	Plague epidemic, occupation, looting, poverty, Ottoman siege, Reconstruction of Hagia Sophia	Monumental structures, a new wall system, forum, harbors **FB formation-fixation line (Constantine & Theodosius II walls)**
1453 – 19th c. Ottoman Empire	Islamic influence, population growth, spreading outside the city walls, new settlement arrangements, changes in the silhouette of the region	Monumental structures, recreation areas, cemeteries, farms and gardens, low density residential areas, religious areas **FB modification (translation)**
19th c. Ottoman Empire (Westernization)	Improvements in transportation, Fire disasters, new institutions, Moltke's plan	Barracks, railways, institutional areas, low-density residential areas, cemeteries, farms and gardens **FB modification (translation)**
The Republic and the 20th c. Modern City	Decrease in population after WW1, work of foreign planners and architects (1930s), demolition of historical monumental structures for new roads, increase in land values, apartmentization	Railways, stations, monumental structures, illegal housing areas, institutional areas, low-density residential areas, cemeteries, farms and gardens **FB modification (translation, alienation)**
Metropolitan city (After 2000)	Rapid population growth, reconstruction amnesties, increases in illegal housing areas, tramway, light metro, subway.	New institutional uses (universities, mosques), illegal housing areas, low density residential areas, cemeteries, farms and gardens **FB modification (translation, consolidation)**

For the inner fringe-belt analysis, three sample areas, Ayvansaray (at the northern part of the Theodosius walls), Edirnekapı (the gate of the Theodosius walls), and Yenikapı (at the southern tip of the Theodosius walls) were examined in detail. The plot-based changes over the years were investigated through the studies conducted in Ayvansaray (Fig. 13). The analysis revealed a remarkable increase in the number of buildings on empty lots in Edirnekapı Fig (14), and it was determined that farmland was transformed into residential areas during the urban growth process of the Yenikapı district (Fig. 15).



Plot Pattern		Number of Plot	Min. Plot Area	Max. Plot Area
1929		77	122 m²	22.400 m²
2016		1072	38 m²	12.460 m²

Figure 13. 1929-2016 plot-based change in Ayvansaray (prepared by author)



Change	Pervettich (1929)	Present (2008)
Blocks	2685	3211
Total building floor area	360	2256
FAR	0,10	0,70

Figure 14. 928-2016 plot change in Edirnekapı (prepared by author)

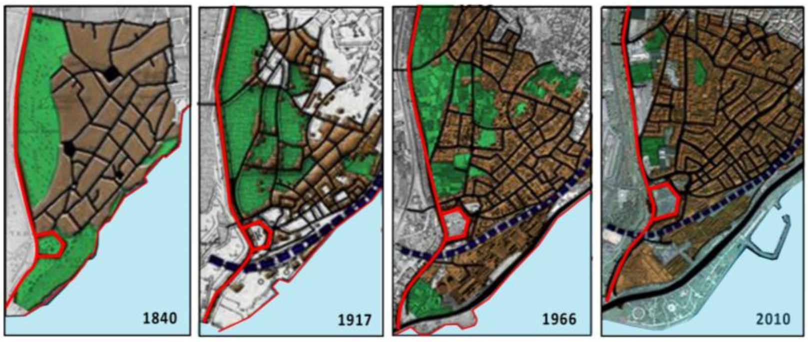


Figure 15. 1830-2010 transformation of the farmlands in Yedikule (prepared by author)

Middle Fringe Belts (MFB)

The conducted analysis of the inner fringe-belt around the historical city walls, and its transformation into the middle fringe-belt area of Istanbul can be determined by several common factors. For this reason, separate "district based" analyses are essential for middle fringe-belt studies of Istanbul as the city is a multi-centered metropolis and is therefore very different to its counterparts in Europe.

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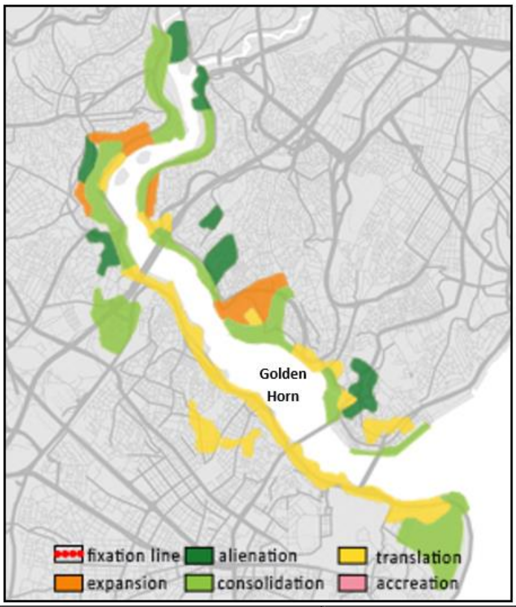
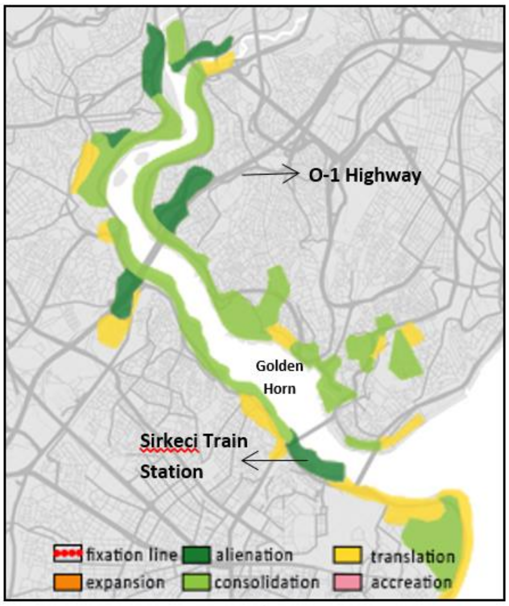
Golden Horn as a Middle Fringe Belt (MFB):

The open spaces, low density residential areas, and institutional areas were consolidated during the Ottoman period. However, some of these areas transformed into industrial zones following changes to planning policies (Fig. 16).



Modification	Area (ha)
Translation	259
Consolidation	298.6
Alienation	111
Expansion	63.5

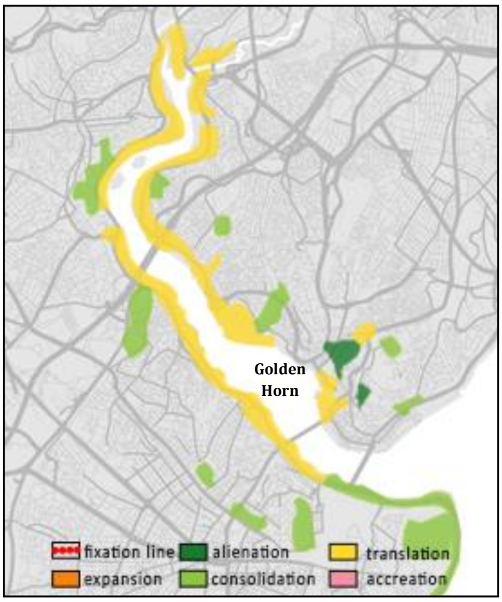
Figure 16. Fringe belt modification process of the Golden Horn during the Ottoman Period (1453 – 1800)



Modification	Area (ha)
Translation	171.3
Consolidation	387.2
Alienation	93

Figure 17. Fringe belt modification process of the Golden Horn during the Westernization Period (1800-1923)

Although the consolidation process can be seen in the Golden Horn, the reconstruction activities that were accelerated during the Westernization period also caused changes within these areas. Open spaces and low density residential areas were transformed into institutional areas (such as Sirkeci Railway Station) (Fig. 17). At the same time, the cemeteries and low density residential areas lost their character and became alienated after the construction of a major new road (the O-1 Highway).



Modification	Area (ha)
Translation	331.1
Consolidation	200.5
Alienation	25.8

Figure 18. Fringe belt modification process of the Golden Horn during the Republican period (1923-Present)

During the Republican period, the fringe-belt areas of the Golden Horn were redeveloped into recreational and/or cultural areas due to the policy of industrial decentralization (Fig. 18). In addition, cemeteries, institutional areas, recreational areas, and some industrial areas were consolidated during this period.

From these observations, it can be determined that the land use in the current middle fringe-belt area of the Golden Horn consists of recreational areas, cemeteries, industrial areas, ports, institutional areas, and cultural areas (Fig. 19). The fringe-belt change process in the Golden Horn and the elements of the fringe-belt are shown in Table 4.

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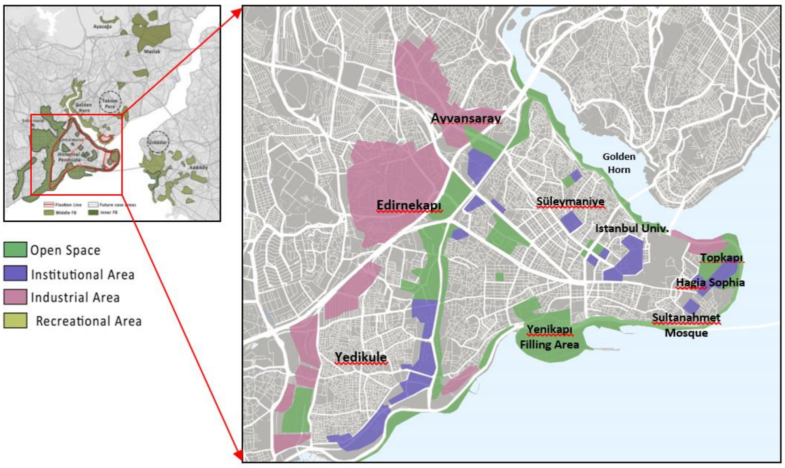

Figure 19. Land use of the current Fringe Belt area in Golden Horn (prepared by author)

Table 4. The fringe-belt development process of the Golden Horn and the elements of the fringe-belt

INNER AND MIDDLE FRINGE BELT		
Periods	**Golden Horn**	
	Change Process	***FB Elements***
B.C. 667 - A.C.330 Byzantion/Chalcedon		
330 - 476 Roman Empire	The eastern administrative center of the Roman Empire	Harbors, aqueducts, new city walls, temples, forum, baths, cemeteries **FB formation**
476 - 1453 The Byzantine Empire	Region has a new wall system, settlements spread North, developing sea trace, population of the region decreased	Two main ports, extra-mural fringes, out of wall settlements, summer house areas, cemeteries **FB formation**
1453 – 19th c. Ottoman Empire	Islamic influence, increasing Islamic building, improving Eyup and Beyoğlu settlements, coast areas as recreational use	Recreation areas, coastal palaces and mansions, extra-mural fringes, cemeteries **FB modification (consolidation, translation)**

19th c. Ottoman Empire (Westernization)	Developing sea transport and transportation system, institutional buildings, improved textile industry and shipyards,	New factories and shipyard buildings, railway stations, barracks and military facilities, cemeteries **FB modification (consolidation, alienation)**
The Republic and the 20th c. Modern City	New industrial areas, pollution in the region, illegal housing areas appeared, Building of coastal roads	port, illegal housing areas, new industrial building, cemeteries **FB modification (consolidation, alienation)**
Metropolitan city (After 2000)	Decentralization of industrial areas, Conservation & development projects, creating cultural zone, preservation of the historical and cultural values	Culture, cemeteries, tourism and recreation areas, education areas, low density residential areas **FB modification (translation, consolidation)**

Maslak as a Middle Fringe Belt (MFB):
The following analysis of the Maslak region is structured by overlapping the land-use maps from 1946 to 2017. Large empty lots and big parcels (plots) for hunting areas, palaces for Ottoman noble (sultan) family, farmlands and military barracks were all existing at Levent-Maslak-Sarıyer axis till 18th century. The CBD of the city shifted from the historical peninsula to the Şişli-Levent-Maslak axis (Kubat, Hazar, 2018) following the lines of the topography. By the attraction of the two bridges, increased the density and land prices, created alienation process and loss in these fringe uses of 18th century.

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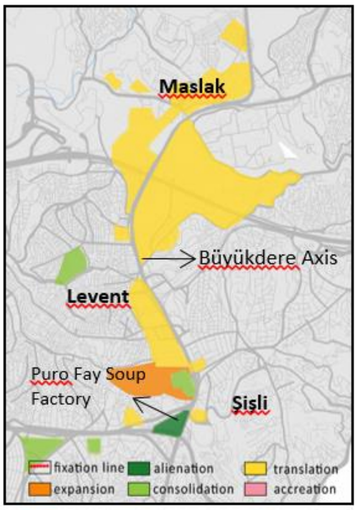
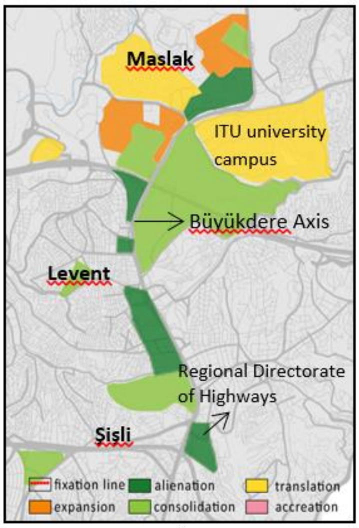
Within the scope of this study, and in order to comprehend the dynamics of urban transformation, it was essential to focus on the Büyükdere Boulevard which links Şişli, Levent and Maslak regions altogether. Open spaces and low-density (dense) residential areas were redeveloped into military and industrial zones during the Westernization period. However, some low-density residential areas were given over to commercial use and lost their fringe-belt characteristics, as shown in Fig (20).



Modification	Area (ha)
Translation	357.2
Alienation	11.7
Consolidation	21.3
Expansion	43.1

Figure 20. Fringe-belt modification process of Maslak during the Westernization period (1800-1923)



Modification	Area (ha)
Translation	313.3
Alienation	140.1
Consolidation	388.8
Expansion	114

Figure 21. Fringe belt modification process of Maslak during the Republican period (1923-Present)

During the current Republican period, the military areas have been consolidated and expanded, and the low density residential areas have been transformed into new military and educational areas (The Istanbul Technical University campus). After the construction of the Bosphorus Bridge (1973) and the Fatih Sultan Mehmet Bridge (1988), the CBD moved towards north along the main transportation arteries and the two bridges connecting Europe to Anatolia. Increasing density and land values have caused these areas to lose their fringe-belt characteristics with the result that the Maslak region has become alienated (Fig. 21).

The most remarkable transformation - alienation process (loss to residential or CBD) occurred on the Büyükdere axis of the Levent-Maslak area during Republican period (1923 to present). These are; Puro Soap factory (1952) is transformed to TAT Tower Commercial and office uses, Eczacıbaşı Medicine Factory (1942) to Kanyon shopping center & residential uses (2006), Transformation from Industrial uses and Emergence of two Shopping Malls next to Kanyon: Metrocity and Özdilek Park Shopping malls & Residences (2003), TC Regional Directorate of Highways Office Building Complex (1970) -former glacis fringe areas/green space of the city- to Zorlu Shopping Center (2013)

From these observations, it can be determined that the land use in the current Middle fringe-belt area in Maslak are cemeteries, industrial areas, educational areas, and sports grounds (Fig. 22). The fringe-belt change process in the Maslak and the elements of the fringe-belt are shown in Table (5).

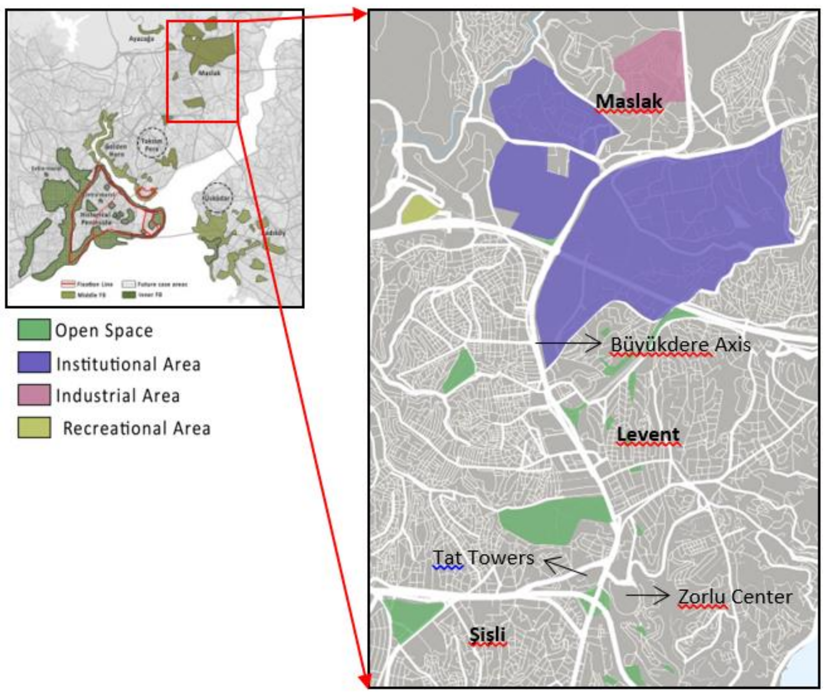


Figure 22. Land use of current Fringe Belt area in Maslak (prepared by author)

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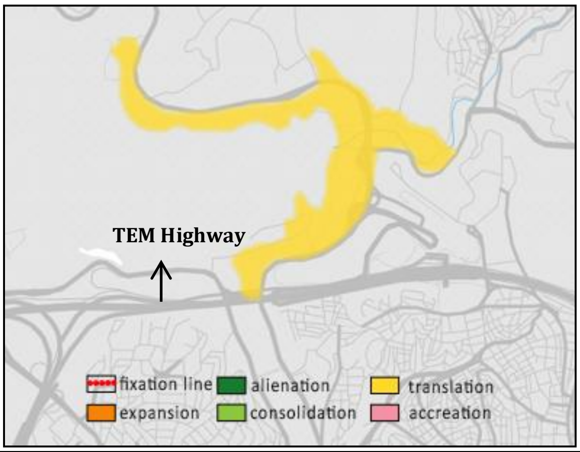
Table 5. The fringe-belt development process of the Maslak and the elements of the fringe-belt

MIDDLE FRINGE BELTS		
Periods	**Maslak**	
	Change Process	***FB Elements***
B.C. 667 - A.C.330Byzantion/Chalcedon		
330 - 476 Roman Empire		
476 - 1453 The Byzantine Empire		
1453 – 19th c. Ottoman Empire	First settlement is the Levent Farm in the city periphery	Farms, military complexes, hunting lodges, huts, waterways, cemeteries **FB formation**
19th c. Ottoman Empire (Westernization)	New planning decisions, pharmaceutical factories, increase in industrial areas, a new industry master plan designated, the construction of a new boulevard: Büyükdere axis	low density residential area, industrial areas, sport facilities, cemeteries, factories **FB formation**
The Republic and the 20th c. Modern City	Increase in motor usage, sub-centers, obtain world bank financing, construction of the first Bosphorus bridge (1973), transportation activities increased the	cemeteries, military zones, sport facilities, low density residential areas, educational campus, industrial areas **FB modification**

	accessibility in macro scale	**(expansion, translation)**
Metropolitan city (After 2000)	Construction of FSM bridge(1988), The underground system put into service, industrial areas transformed to CBD usage, migration, increase in population	cemeteries, military facilities, sports areas, low density residential areas, educational campus, industrial areas **FB modification (expansion, translation)**

Ayazağa as a Middle Fringe belt (MFB):
The following analyses were structured by overlapping land-use maps of 1970 and 2015 of Ayazağa. From this, it can be seen that agricultural areas were transformed into industrial areas during the Westernization period. The first phase of the change can be defined as fringe-belt translation (Fig. 23).



Modification	Area (ha)
Translation	96.7

Figure 23. Fringe-belt modification process of Ayazağa during the Westernization period (1800-1923)

The changes within the fringe-belt area of the Ayazağa region during the Republican period are defined as alienation. This is because the industrial areas were transformed into high density residential and commercial areas. In addition, empty lots and open spaces became sports grounds and industrial areas were consolidated (Fig. 24).

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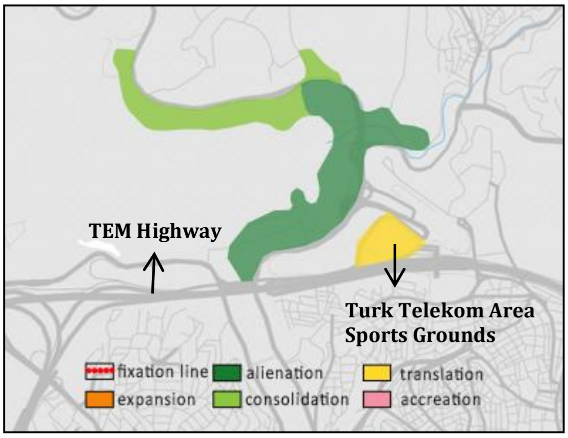

Modification	Area (ha)
Translation	12.3
Alienation	65.2
Consolidation	31.5

Figure 24. Fringe-belt modification process of Ayazağa during the Republican period (1923- Present)

These observations show that, the land uses of currently developed Middle Fringe Belt area in Ayazağa are industrial areas and sports grounds as in Fig (25). The fringe-belt change process in the Ayazağa and the elements of the Fringe Belt are shown in Table (6).

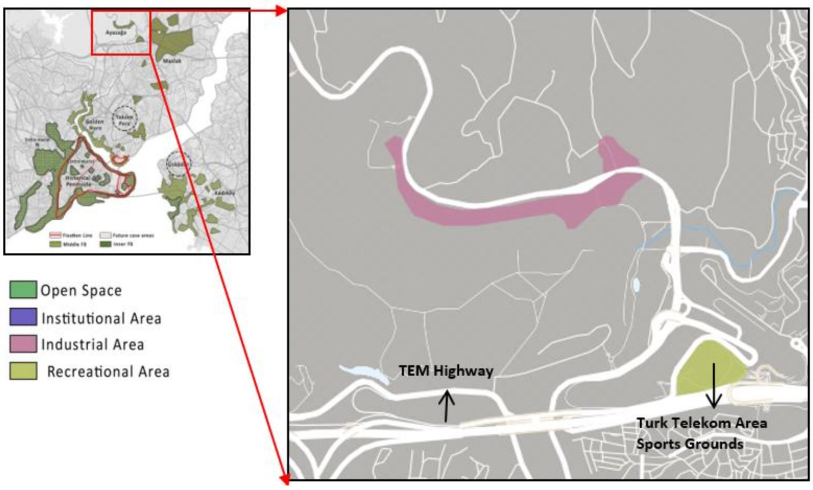

Figure 25. Land use of current Fringe Belt area in Ayazağa (prepared by author)

Table 6. The fringe-belt development process of Ayazağa and the elements of the fringe-belt (prepared by author)

MIDDLE FRINGE BELTS		
Periods	**Ayazağa**	
	Change Process	***FB Elements***
B.C. 667 - A.C.330Byzantion/Chalcedon		
330 - 476 Roman Empire		
476 - 1453 The Byzantine Empire		
1453 – 19th c. Ottoman Empire		
19th c. Ottoman Empire (Westernization)	Low-density developments, agricultural activities occurred near the water source, surrounded by dense forest.	Low density residential areas, agricultural areas **FB formation**
The Republic and the 20th c. Modern City	Industrial areas developed, factories, agricultural areas transformed to industrial areas, settlements expanded, the destruction of green areas	Industrial areas, factories, low density residential areas, **FB modification (translation)**
Metropolitan city (After 2000)	FSM bridge and TEM highway built, settlement density increased, new residential and commercial areas, relocated industries, surrounded by the construction of many luxury brand residences.	Sports areas, industrial areas **FB modification (alienation)**

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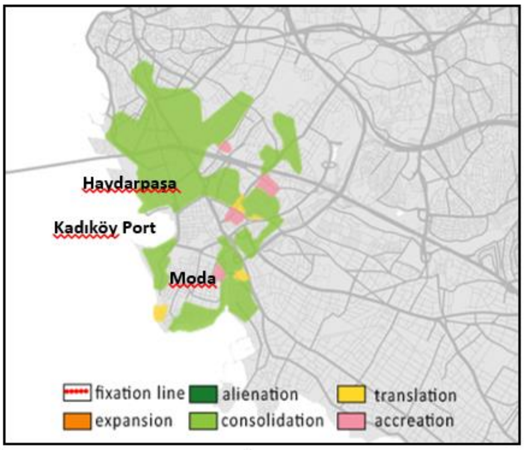
Kadıköy as a Middle Fringe Belt (MFB):

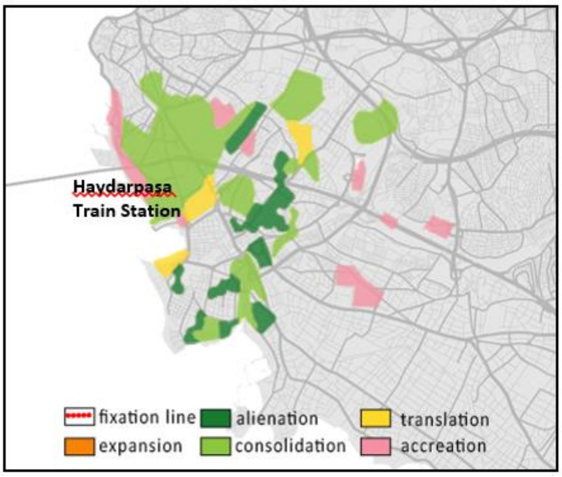
Kadıköy is a major commercial and business center as well as the transportation hub (with its port, train station and underground connection) for the Anatolian side of the city. It was first established in ancient times as the city of "Chalcedon", and was later was used as a summer resort and site for summer residences during the Ottoman period. However, the inner fringe belt observed in Kadıköy does not reflect any similar characteristics to that of the historical peninsula when considering to the whole structure and development cycles of the city. Although the history of the Chalcedon settlement is older than the primary settlement of the historical peninsula, its development remained constant. The fringe-belt formation of Kadıköy can therefore be accepted as the Middle Fringe Belt of metropolitan Istanbul for the purposes of this study.



Modification	Area (ha)
Accretion	28.5
Translation	22.9
Alienation	2.1
Consolidation	678.8

Figure 26. Fringe-belt modification process of Kadıköy during the Ottoman period (1453 – 1800)

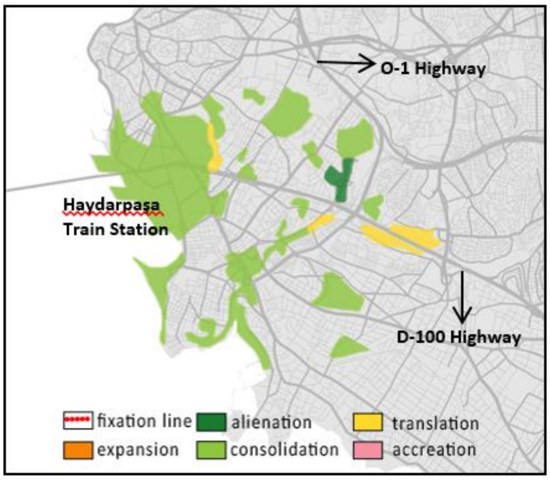
The fringe-belt areas of Kadıköy were in phases of consolidation and accretion during the Ottoman period. Military, educational, industrial, and low density residential areas, as well as gardens were consolidated. However, part of the fringe-belt's open spaces were developed for low density residential housing Fig (26).



Modification	Area (ha)
Accretion	136.3
Translation	72
Alienation	156.9
Consolidation	593.8

Figure 27. Fringe-belt modification process of Kadıköy during the Westernization period (1800-1923)

Population increases and initiatives by the municipality caused land use in many fringe-belt areas to be given over for residential and commercial purposes during the Westernization period. At the same time, the construction of the railway and the Haydarpaşa train station in 1908 caused changes to the fringe areas Fig (27).



Modification	Area (ha)
Translation	69.6
Alienation	27.2
Consolidation	889.3

Figure 28. Fringe-belt modification process of Kadıköy during the Republican period (1923-Present)

Cultural, commercial and recreational uses increased during the Republican period. This is due to the fact that Kadıköy became the center of transportation and transition of the Anatolian side. Although part of the fringe belt area alienated and translated during this period, most areas were consolidated as shown in Fig (28).

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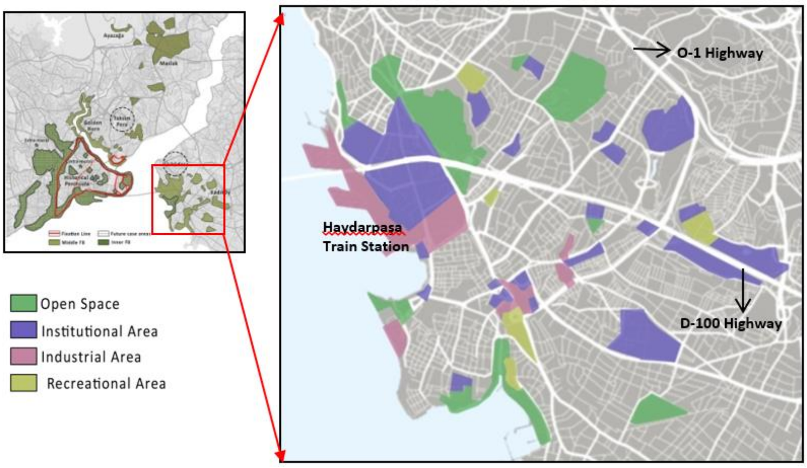

Figure 29. Land use of current Fringe Belt area in Kadıköy (prepared by author)

From these observations, it can be determined that the land use in the current inner and Middle Fringe-Belt area in Kadıköy were cemeteries, military zones, educational areas, institutional areas, industrial area, religious area, sports grounds, hospitals and the train station Fig (29). The fringe-belt change process in Kadıköy and the elements of the fringe-belt are shown in Table 7.

Table 7. The fringe-belt development process of Kadıköy and the elements of the fringe-belt (prepared by author)

INNER AND MIDDLE FRINGE BELTS		
Periods	**Kadıköy**	
	Change Process	***FB Elements***
B.C. 667 - A.C.330 Byzantion/Chalcedon	Chalcedon as a Greek city	Institutional areas (Monumental structures), **FB formation**
330 - 476 Roman Empire	Although the city did not develop during this period, it remained stable.	Institutional areas (Monumental structures), **FB formation**
476 - 1453 The Byzantine Empire	Low density residential areas and low population	Institutional areas (Monumental structures), gardens and vineyards **FB formation**
1453 – 19th c. Ottoman Empire	Chalcedon was endeavored with gardens, Kadıköy became popular excursion spot, Usage of seashores in the district for second residences	Recreational gardens, summer house areas, low density residential areas **FB modification (translation, alienation)**

19th c. Ottoman Empire (Westernization)	First attempts of municipal evolution in Kadıköy in the sense of modernity, population increased, establishment of the railway station, construction of a hospital, military facilities and barracks	Railway station, military facilities, cemeteries, education, recreational area, low density residential areas, hospital, barracks **FB modification (consolidation, alienation)**
The Republic and the 20th c. Modern City	a center for mosques, churches and various official buildings, commercial activity and residential areas intensified, educational areas increased, apartmentization	Cemeteries, military facilities, educational areas, hospital, low density residential areas, sport facilities, parks and gardens, religious facilities **FB modification (consolidation, alienation)**
Metropolitan city (After 2000)	The transit center of the Anatolian side, become a center of social, cultural and sportive life, high-density settlement texture	Cemeteries, military facilities, educational areas, institutional areas, industrial areas, religious area, sport areas, hospitals, train station **FB modification (consolidation, translation)**

CONCLUSION & DISCUSSION

Although the suitability of fringe-belt studies to planning practice has previously been discussed, their importance in implementation projects has not yet been understood sufficiently. Nevertheless, in recent years these areas have attracted

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considerable interest in the field of urban morphology. "Though not necessarily immediately apparent on the ground, when mapped and studied developmentally, it is evident that urban fringe belts constitute a major element in the internal structure of cities. They are most apparent where the fixation line has had a powerful constraining influence. Once established they have in many cases had a marked effect on subsequent developments; so that they provide a particularly valuable means of structuring historico-geographical accounts of developing form of cities". (Whitehand, 2007)

Like all urban areas, fringe-belts come by their identities as a result of many interactions and changes. However, very few of these interactions reflect the real characteristics of fringe-belts. From an objective point of view, while fringe-belts can give clues about the growth direction of the physical development of an urban area, they should also be evaluated in a deeper sense and on their own terms. This is because they can provide a valuable frame of reference when attempting to explain the phases of development of the periphery, and also when evaluating the physical evidence left by previous historical periods. Both of these reflect the necessity to focus on studies which examine the historical and geographical structures of cities and which are intended to raise awareness and increase understanding.

When projects are carried out in urban environments and the associated literature is examined, it can be seen that fringe-belt studies have been developed with an emphasis on small-scale cities that still contain their original regions or structures, or on those which have special meaning (Pereira & Meneguetti, 2011). However, despite the analysis of fringe-belts in smaller, slow-growth rate cities, it is also a fact that more holistic and comprehensive studies are needed for a multi-center metropolis such as Istanbul.

The inner fringe-belts of Istanbul are in a state of almost continuous change and metamorphosis that is a result of both their economic and historical pasts and the social changes they are currently undergoing. The inner fringe-belts of Istanbul developed an internal history as they were enveloped by the city in an ongoing process that started during the Byzantine Empire. These former inner fringe-belts remain as urban fossils as the built up area spread outward beyond them. During its formative stage, the city progressed from this early fixation phase and expanded until it became strongly tied to its Theodosia walls, leaving the Constantine wall behind as a fossil fringe-belt in the inner part of the Historical Peninsula. Later, an extension phase started towards the north; to Istiklal Street and Pera after the construction of the Galata Bridge; and to Taksim, Şişli and Maslak; following the topography and making connections to transportation arteries that give access to the three Bosphorus bridges.

These findings also indicate that during the development stage of Istanbul, the CBD could not be enlarged within the dense structure of the old core. In response to this restriction, it found a corridor by which to supply its needs, and eventually became a new CBD in a different location. Over time, these once peripheral but now embedded fringe-belts adjust to the ever changing dynamic of urban land-use and CBD development. The reduction in the extent of the inner fringe-belt, resulting from the implementation of large development projects in the past decade, has posed a substantial threat to the historical identity of the city.

In addition to the inner fringe-belt's development around the historical walls, Istanbul has a multi-centered and linearly developing characteristic, and the analyses in this study also cover middle fringe-belt regions such as Kadıköy on the Anatolian side and the Golden Horn, Maslak and Sarıyer sub-centers on the European side of the city. Furthermore, it is believed that the fringe-belt analyses of districts/neighborhoods that have peculiar characteristics should be considered separately. In particular, this study of fringe-belts illustrates how Istanbul is very different from its counterparts in Europe and cannot be analyzed in the same manner.

As a result of rapid urbanization and migration, fringe-belt areas within a city may be exposed to "FB Alienation" unless they are protected by strategic plans, conservation zoning plans, and landscape and urban design projects. In the Istanbul case, it is important to preserve the historical and urban identity of the city walls and their surroundings for future generations. As with all ancient structures, the land walls require maintenance and restoration. In addition, for an area with such aesthetic and urban qualities, any green areas should be well designed, pedestrian access should be increased, agriculture should be protected, and landmark viewing corridors should be constructed. It is important to consider fringe-belt areas in terms of their public interest, their common usage potential, and their positive effects on urban ecological sustainability.

This study is an attempt to codify the results from 10 years of academic research and analyses using fringe-belt concepts specifically adapted for the city of Istanbul (Kubat, Gümru,

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Kürkçüoğlu, Sungur, 2013), (Kubat, Gümru, 2014), (Hazar, Kubat, 2015, 2016), (Kubat, Hazar, 2018), (Karaulan, Kubat 2018), (Kubat, 2018). However, it is important to mark and differentiate the fringe-belt concept when it is applied to a multi-nuclear city such as Istanbul from other studies conducted in other countries. The most distinctive feature that arises from the study of this city would be the linear development axis of the CBD that started on the Historical Peninsula and which progressed according to the changing dynamics of the city.

It should be noted that a study of this kind, namely one that attempts to deal with a vast urban structure like Istanbul, could be considered only a beginning as each neighborhood unit and urban project needs to be surveyed separately and requires detailed analysis for it to provide precise data.

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REFERENCES

Barke, M. (1982). Beyond the urban growth map: suggestions for more analytical work in urban morphology. *Teaching Geography*, 7, 111-15.

Barke, M. (1990). Morphogenesis, fringe belts and urban size: an exploratory essay, in Slater. T. R. (ed.) The built form of Western cities, Leicester University Press, 279-97.

Conzen, M.R.G. (1960). Alnwick, Northumberland: a study in town-plan analysis. *The Institute Of British Geographers*, 27.

Conzen, M.R. G. (1962). The plan analysis of an English city centre, in Norborg, K. (ed.) Proceedings of the International Geographical Union Symposium in Urban Geography, Lund 1960 (Gleerup, Lund).

Conzen, M.P. (2009). How cities internalize their former urban fringes: a cross cultural comparison. *Urban Morphology*, 13, 29-54.

Ducom, E. (2005). Fringe belts in French cities: a comparative study of Rennes, Nantes and Tours, in Barke, M. (ed.) *Approaches in urban morphology* (Division of Geography, University of Northumbria, Newcastle upon Tyne), 34-43.

Gu, K. (2010). Exploring the fringe belt concept in Auckland: an urban morphological idea and planning practice. *New Zealand Geographer*, 66, 44-60.

Hazar, D., Kubat, A.S. (2012). Fringe belts in the process of urban planning and design: comparative analyses of Istanbul and Barcelona, *Journal of A/Z*, Istanbul Technical University, 12/1, 53-65

Hazar, D. & Kubat, A.S. (2015). The fringe belt development process of Istanbul. In Ding W. (ed) *Conference proceedings of the 23rd International Seminar on Urban Form (ISUF) 2015*, 423-436, Nanjing, China.

Istanbul Metropolitan Municipality (IBB) (2005), Tarihi Yarımada koruma amaçlı nazım imar planı raporu, Department of Reconstruction and Urbanism, Directorate of City Planning.

Istanbul Metropolitan Municipality (IBB) (2009), 1/100.000 ölçekli Istanbul çevre düzeni planı raporu, Department of Reconstruction and Urbanism, Directorate of City Planning.

Karaulan, D. & Kubat, A.S. (2018). Analyzing Fringe belt phenomenon in the historico-geographical structure of Milan, Italy. *ICONARP-International Journal of Architecture & Planning*, 6, Issue 2, 304-332.

Kuban, D. (1996). İstanbul Bir Kent Tarihi, Bizantion, Konstantinopolis, İstanbul. *Türkiye Ekonomik ve Toplumsal Tarih Vakfı*, İstanbul.

Kubat, A. S, (1999) "Morphological History of Istanbul", *Urban Morphology*, 3 (1), 28-41.

Kubat, A.S. & Gümru, B. & Kürkçüoğlu, E. & Sungur, C. (2013). Landwalls of Istanbul: morphological approach. *Presented in the Summer School: Theodosian Land Walls and Urban Agriculture*, Kadir Has University. (unpublished)

Kubat, A.S. & Hazar, D. (2018). İstanbul'un Çeper Kuşak Gelişim Süreci. in Kubat et al (eds) Proceeding Local ISUF Congress in Urban Morphology (II TNUM), Istanbul Technical University, 693-711.

Kubat A.S. (2018). Exploring the fringe belt phenomenon in the case of Istanbul. *CYNUM 2018*, Cyprus Network of Urban Morphology, Plenary section (invited speech, unpublished).

Louis, H. (1936). "Die geographische Gliederung von Gross-Berlin", in Louis, H. and Panzer, W. (eds) *Länderkundliche Forschung: Festschrift zur Vollendung des sechzigsten Lebensjahres Norbert Krebs* 146-71, Engelhorn, Stuttgart.

Pereira, J.A. & Meneguetti K.S. (2011). Urban fringe belts in planned new towns: the case of Maringa, Brazil. *In*

DOI: 10.15320/ICONARP.2019.83– E-ISSN: 2147-9380

published paper presented to the 18th ISUF Congress, Montreal, Canada.

Murphy, R.E. (1966). The American city, and Urban Geography, *Mac Grew Hill Company*, 292.

Ünlü T. (2013) Thinking about fringe belts: a Mediterranean perspective. *Urban Morphology,* 17(1):5-20.

Ünlü T., Baş Y. (2016) Multi-nuclear growth patterns in a rapidly changing Turkish city: a fringe belt perspective, *Urban Morphology* 20(2):107-121.

Ünlü T., Baş Y. (2019) The Urban growth and development periods of Turkish cities: a fringe belt perspective, in eds: Ö.B. Özdemir et al, *Urban and Regional Planning in Turkey*, The Urban Book series, Springer.

Whitehand, J.W.R. (1967). Fringe belts: a neglected aspect of urban geography. *Transactions of the Institute of British Geographers*, 41, 223-33.

Whitehand, J.W.R. (1972). Building cycles and the spatial pattern of urban growth. *Transactions of the Institute of British Geographers*, 56, 39-55.

Whitehand, J.W.R. (1987). The changing face of cities: a study of development cycles and urban form. *Institute of British Geographers Special Publication*, 21 (Blackwell, Oxford).

Whitehand, J.W.R. (1988-2007). Urban fringe belts: development of an idea. *Planning Perspectives*, 3, 47-58.

Whitehand, J.W.R. & Morton, N.J. (2003). Fringe belts and the recycling of urban land: an academic concept and planning practice, *Environment and Planning B: Planning and Design*, 30, 819-39.

Whitehand, J.W.R. & Morton, N.J. (2004). Urban morphology and planning: the case of fringe belts. *Cities*, 21, 275-89.

Whitehand, J.W.R. & Morton, N.J. (2006). The fringe belt phenomenon and socioeconomic change, *Urban Studies*, 43, 2047-66.

1260-1764-1838-1860-1909-1970 City Maps, Courtesy of The Harvard Map Collection, Harvard College Library

15th City Map, German Kartenwerkstatt Map: (https://tr.wikipedia.org/wiki/Dosya:Constantinople_map_German.png)

1880-1882 Stolpe Map: Stolpe, C. Plan de Constantinople, avec ses faubourgs, le port et une partie du Bosphore. (https://gallica.bnf.fr/)

1906 Goad Maps: Goad, C.E. Plan d'assurance de Constantinople (https://archnet.org/collections/1569/details)

1922 Gedik Pasha Map: Na, S. H. (1922). Map of Constantinople. Harvard Map Collection, Harvard College Library.

1923-1944 Pervititch Maps: Istanbul in the insurance maps of Jacques Pervititch, İstanbul, 2000

1913-1914 German Blues Map: German Blues, 1: 1913-1914 Before World War I. Maps of İstanbul / Source: Istanbul Metropolitan Municipality Directorate of Libraries and Museums.

1978 Land Utilization Maps of Golden Horn: G.Tezcan, S. Durgunoğlu, T. Ersen G. Çubuk, M. Tuğcu, N. Anadol, K. Karabey, H.(1978). Haliç ve Çevresi Düzenleme Çalışması, Mimarlık 78/4, 28-41.

2013 Land Utilization Map of Golden Horn: Istanbul Metropolitan Municipality

1946-1966-1970-1982-2006-2011-2013-2014-2015-2017 Aerial Maps: (https://sehirharitasi.ibb.gov.tr)

Resume

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Research Article

Swedish Typo-Morphology-Morphological Conceptualizations and Implication for Urban Design

Todor Stojanovski*

Abstract

Typo-morphology is a branch of urban morphology that understands physical form, formation and transformation in cities with use of types and typologies. This paper describes three Swedish typo-morphological approaches and discusses urban morphology and typologies in a context of urban design and planning practices. One approach describes architectural styles and typical buildings for different historical periods. The second focuses on classifying neighborhood types and their physical attributes. The third complements the second and argues that the Swedish neighborhood typology describes not only physical spaces, but also social structure.

Keywords: urban morphology, typo-morphology; building type, neighborhood type, urban design, Sweden

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INTRODUCTION

Cities are complex and there are many ways to describe and understand them morphologically (Kropf, 2009). The typo-morphological tradition looks at urban history and emergence of architecture and urban forms as a process of creating types. The spatial practices of any society both structure and are structured by the activity of creating and classifying types (Franck & Schneekloth, 1994). Society creates types (of streets, buildings, neighbourhoods and so on) to simplify communication and promote values (Franck 1994, p.345). Urban morphologists recognize and identify types of buildings, streets, neighbourhoods to build theory of inform architectural and urban design practices (Moudon, 1997). The process of urban design can be guided by typologies (of buildings, streets, neighborhoods and so on) as a theory or doctrine of types (Steadman, 2014).

Swedish typo-morphology has a long tradition (Abarkan, 2009; 2013). Many architects and geographers have created urban models of typical cities and typologies of buildings, streets and neighborhoods. This paper focuses on three Swedish typo-morphological approaches and discusses morphology and typologies in a context of urban design and planning practices. It is structured in the following manner. The following section describes the theoretical framework of typo-morphology and how it links to architectural and urban design practices. The third section describes three typo-morphological approaches in Sweden. The fourth presents application of these approaches in Swedish urban planning and design practices. Many municipalities like Stockholm, Malmö and the Region Gotland with historic Visby use building and neighborhood typologies as a background for design codes or building regulations. A new workshop method for participatory planning based on building and neighborhood types was also proposed by Swedish architects and urban designers. The fifth section discusses typo-morphology and typologies in a context of urban design. The last section presents conclusions concerning typo-morphological conceptualizations and implication for urban design.

Theoretical Foundations of Typo-Morphology and Its Urban Design Application

Typo-morphology is a branch on urban morphology that focuses on types and typological processes (referred to as typo-processual and historico-geographical approaches in Kropf, 2009). Creation of type is an act of abstraction to identify what is same about a buildings, street or neighborhoods and disregard what varies (paraphrased from Mitchell, 1990, p.87). Goethe wrote that is important to postulate a prototype against which all forms could be compared as to points of agreement or divergence. It is an archetypal form, in essence, the concept or idea of the form (Goethe, 1988 [1817]).

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Type and typology are commonly used among architects, urbanists and historians (Rossi, 1982 [1966]; Vidler, 1977; Panerai et al., 2004 [1977]; 1980; Caniggia & Maffei, 2001 [1979]; Steadman, 1979; 2014; Cataldi et al., 2002; Cataldi, 2003). The earliest references to type is done by Quatremère de Quincy in the Encyclopédie méthodique. Architecture and Dictionnaire Historique D'architecture (translated as Historical Dictionary of Architecture) from 1825 and 1832. Gianfranco Caniggia, a student of Severio Muratori and one of the pioneers of the Italian typo-morphological approach (referred as Muratorian School among morphologists, Cataldi et al., 2002; Cataldi, 2003), argues that cities grow incrementally with many elements being juxtaposed. An understanding of the formation and transformation of cities needs analysis of the mutation of the elements through both time and space (Moudon, 1994).

Types are abstractions about city elements (e.g. of apartment block). Similar to concepts in linguistic terms, a type packs much information into one icon: a set of architectural or environmental attributes; a set of rules for construction and for organisation of space; a set of behaviours and defined roles that take place within it; and a set of qualities it should exhibit (Schön, 1988; Robinson, 1994). The types have history and they tell histories (Southworth, 2005). Types are not static. They change over time and vary considerably between cultures and between different groups within the same cultures. Even though the typologies vary across cultures, the activity of creating types lives within all societies (Schneekloth & Franck, 1994).

Typology is inventory of different types of buildings, streets, neighbourhoods, cities, etc. including processes and rules to create types. There is no right or wrong way to create a typology. The types can derive from societal conceptualizations about spatial knowledge. They become words with very specific meaning in the language and they can vary even within a same language (e.g. “terrace or terraced houses” in the UK and “townhouses” in the USA). Types can be created by architectural professionals and geographers to emphasize relationships between elements. When making building typologies, architects conventionally focus on the building elements and their configurations e.g. types of windows and doors and their configurations, design of the façades and organization of the rooms, orientations of the building and its relation with surrounding spaces, and so on (e.g. Caniggia & Maffei, 2001 [1979]). On a neighborhood scale, geographers have focused on the morphological structure of cities and the relationships between streets, lots and buildings (Conzen 1960). The typical morphological structure of neighborhood types includes: plan elements (streets, lots and buildings); historical layering of the urban fabric; and building and land utilization (Conzen, 1960; Moudon, 1997; Whitehand, 2001; Kropf, 2011; 2018). Even though there are many possible combinations, only few building, street and neighborhood types are preferred, emerge and proliferate in specific historical eras.

Urban design can be regarded as an art to create assemblies of design elements (streets, lots, buildings, open spaces and so on) in urban space (Taylor, 1999). There are many typologies (Panerai et al. (2004 [1977]; Southworth & Ben-Joseph, 1995; 1997; Southworth, 2005). The urban design can be guided by typologies of design elements as a theory or doctrine of types (Steadman, 2014). Many architects and urban morphologists have argued for critical application of typologies in morphologically-informed urban design (Samuels, 1990; 1999; 2008; McGlynn & Samuels, 2000; Marshall & Caliskan, 2011; Hall & Sanders, 2011; Sanders & Woodward, 2015; Sanders & Baker, 2016). Cities are the result of the interaction over often long periods by many actors with their own interests, sets of values and objectives. Urban design is an art that enables this complexity and does not looks for quick aestetic fixes (Talen & Ellis, 2004; Marshall, 2016).

Swedish Urban Morphology and Typo-Morphological Approaches

The geographers started the Swedish typo-morphology tradition in the beginning of the 20th century by classifying neighbourhoods and cities. Inspired by the French, German, British and American schools of geography and sociology (particularly the Chicago school), the city was defined geographically as "agglomeration of neighbourhoods clearly differentiated by their character/type" (bebyggelseagglomeration med tydlig inre differentiering" in Swedish, Ahlmann at al., 1934, p.7). The Geographical Institute at Stockholm's University under professor Hans Ahlmann, made extensive geographical studies of Stockholm's morphology (e.g. William-Olsson, 1984 [1937]; 1940). Gregor Paulsson (1950) later wrote two tomes of *Swedish city* (or *Svensk stad*) describing in detail the development of Swedish cities in the XIX century. Paulsson illustrated "idealtypisk" or typical cities, social groups, household structures and urban lifestyles. Elias Cornell (1970; 1977) continued this tradition focusing on building technologies.

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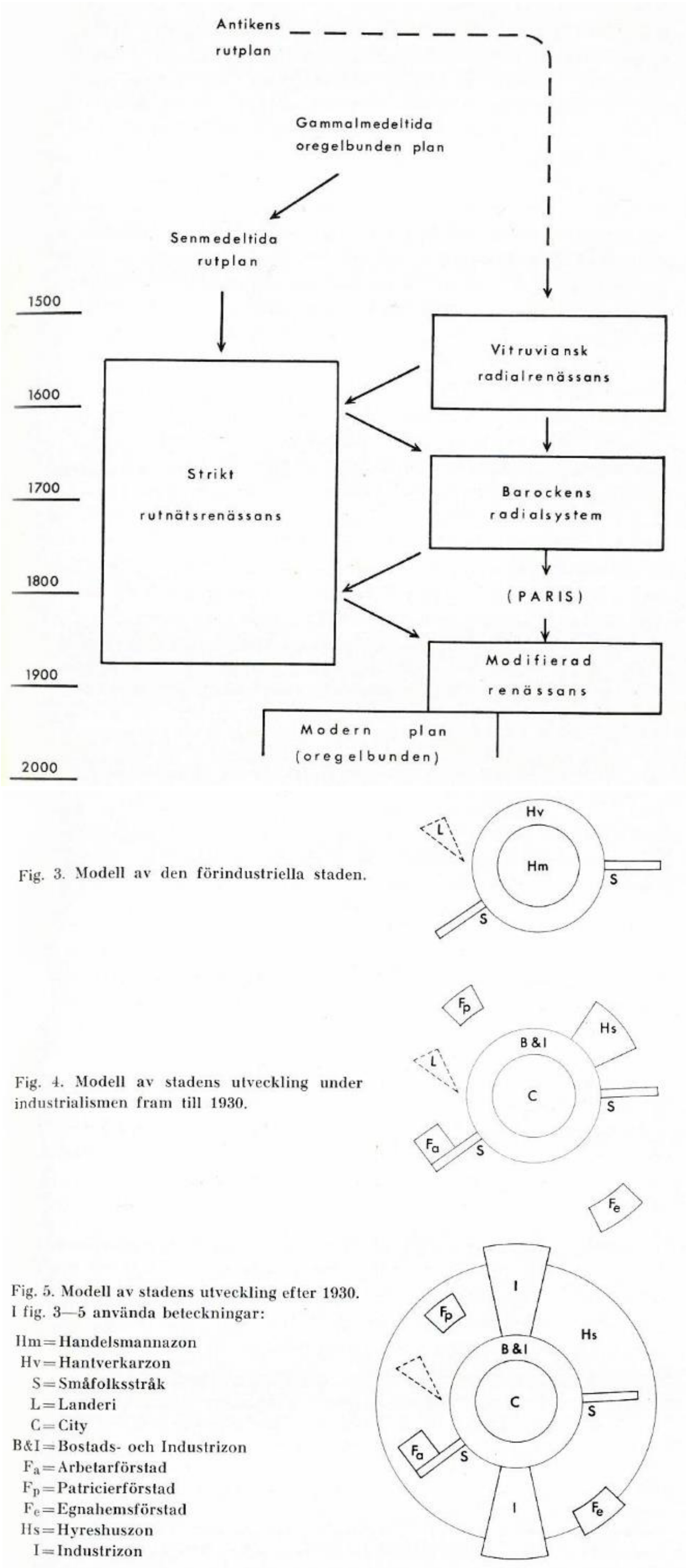

Figure 1. Historical epochs in Swedish urbanization (source Ameén, 1964, p. 43) and a hypothetical urban model of a Swedish city (ibid, p.47)

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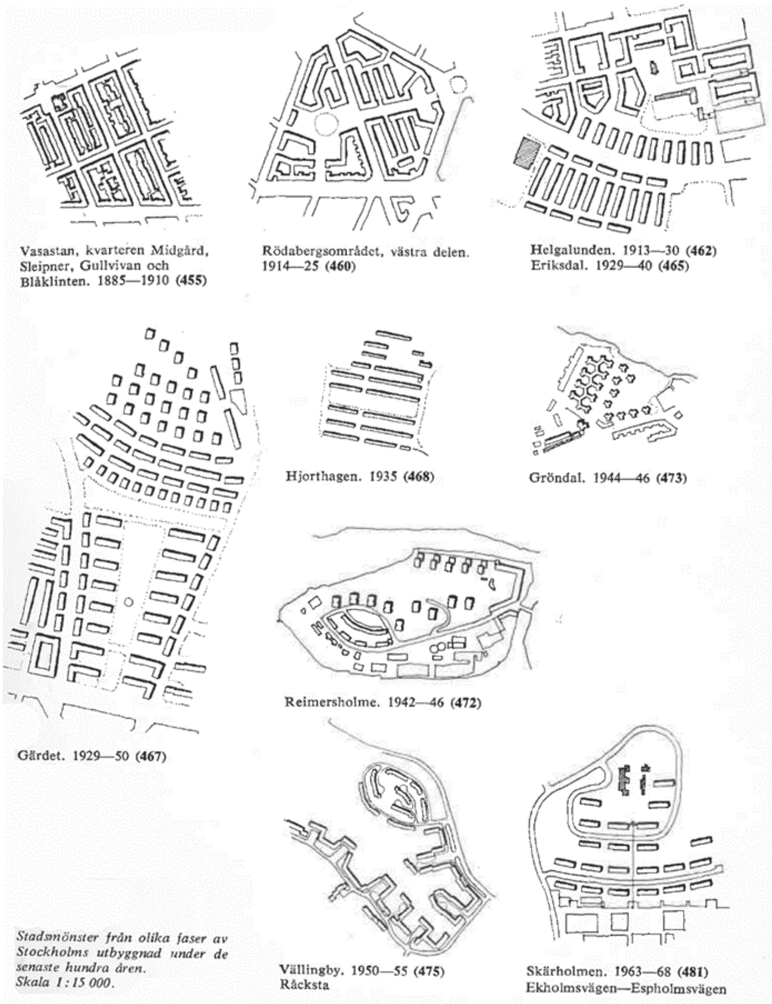

Figure 2. Typical neighborhoods in specific historical periods (Andersson & Bedoire, 1973, p.35).

Björn Linn was an architect who used morphological and historical analyses to understand the emergence, inspirations and proliferation of a specific neighborhood type (“storgårdkvarter” or translated in English “enclosed urban block with a large courtyard/inner garden”) in Sweden and other European countries (see Linn, 1974). Linn used the term “bebyggelsemönster” (translated as “pattern of settlements”) to describe a typical spatial structure in a formation of city. The spatial structure starts with a typical building, but the pattern includes relationships of the building with the surrounding spaces (Figure 2). The surrounding spaces include public streets and semi-private courtyards (such as the inner garden in a typical “storgårdkvarter”). The typical building can stand alone, it can create an open of enclosed city block assembly or can be part of a neighborhood with similar or different city blocks. Linn particularly emphasizes the relational structure between the elements of patterns (the typical building and surrounding spaces). Additionally, the pattern is recognized and experienced as spatial structure of elements (the typical building and its relations). These experiential qualities of the pattern as relational

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symbolism are more important than the geometry of the physical space (Linn, 1991).

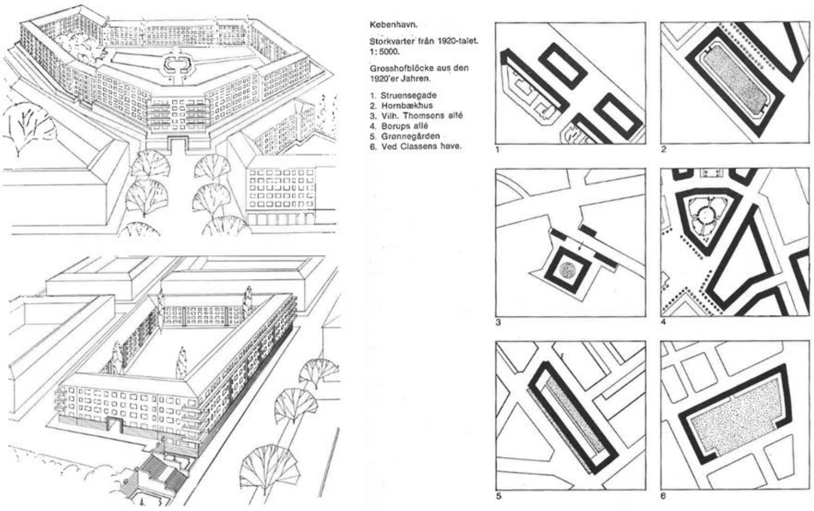

Figure 3. The building as leitmotif in the "bebyggelsemönster" (translated as "pattern of settlements") of typical "storgårdkvarter" or translated in English "enclosed urban block with a large courtyard/inner garden" and variations on a scale of a city block as perspective, cases in Stockholm on the left and on the city plan, cases in Copenhagen on the right (source Linn, 1974; 1991).

The writings of Björn Lynn and the urban models and typologies of Lennart Ameén and Henrik O. Andersson inspired new typo-morphological research and conceptualizations in the 1980s aimed not only to contribute to urban history, but also to understand and guide urban planning and design practices. Terms such as, "typområde" ("typical places" or "place types", in Engström et al., 1988), "stadstyper" ("urban types" in Rådberg, 1988; Rådberg and Friberg, 1996; Arken Arkitekter m fl., 2011), "stadskaraktär" ("urban characterss" in SSBK, 1997; 2000; SLL, 2009; MSK, 2001) were used to describe types of neighborhoods or city blocks (as configurations of buildings). Since the 1980s, typologies have been developed according to building types and architecture styles specific for historical periods (Björk et al., 2003 [1983]; 2009; 2018 [2000]); planning and development paradigms (Rådberg, 1988; Rådberg & Friberg, 1996); and industrialization epochs (Engström et al., 1988). The following subsections describe these three approaches.

Building Types and Architecture Styles Specific for Historical Periods

The trilogy Så byggdes (translates Thus was built in English) includes books that focus on apartment buildings, villas and cities (Björk et al., 2003 [1983]; 2009; 2018 [2000]) focuses. These books aimed to illustrate typical Swedish architecture and present it as part of the urban history. The authors argue that historical period affects the whole society and causes many people to be interested in and enjoy same things and lifestyles at the same time. The architectural style is usually established through innovative architecture. As a prototype it becomes popular among other architects in specific historical periods that last around ten years. The architectural style remains for a longer period, though on a more modest scale as new styles become more fashionable. The books illustrate the dominant architectural styles for apartment buildings and villas for every decade in from the end of 19th century until today (Figure 4). The first two books on apartment buildings and single or multi-family villas have a strong focus on architectural design, building materials, construction technology and details, but also on illustration of hypothetical neighborhoods that would correspond to the building type (Björk et al., 2003 [1983]). The last book puts the architecture into a planning perspective (Björk et al., 2018 [2000]).

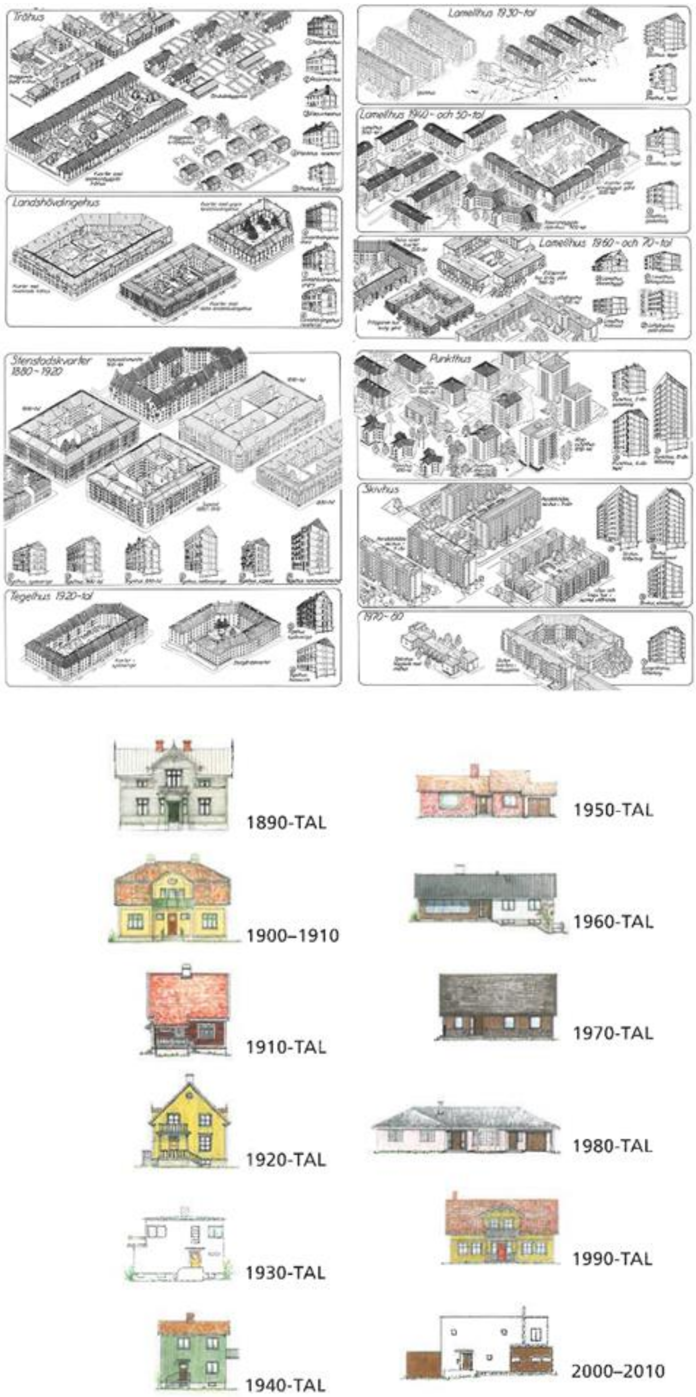

Figure 4. Typical apartment buildings presented as representative exemplars and in city blocks (Björk et al., 2003 [1983]) on the top and typical villas for each decade (Björk et al., 2003) on the bottom.

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Swedish Planning Paradigms and Urban Types

Inspired by the writings by architects Uno Åhren and Björn Lynn, and particularly the architectural historian François Choay, Johan Rådberg (1988) proposed a Swedish urban typology based on three major planning doctrines: the regularism (represented by Baron Haussmann's 19th century renewal of Paris), the Garden City (promoted by Ebenezer Howard on the end of the 19th century) and the functionalism (urbanism proposed by Le Corbusier and the modernists in the 20th century). Rådberg argued that "urban types" ("stadstyper" in Swedish) emerge during these periods that are consistent in terms of density, Floor Space Indexes (FSI), Open Space Indexes (OSI, in Sweden an inverse measure of building coverage (100% - OSI) is commonly used instead of OSI) and building heights (Figure 5).

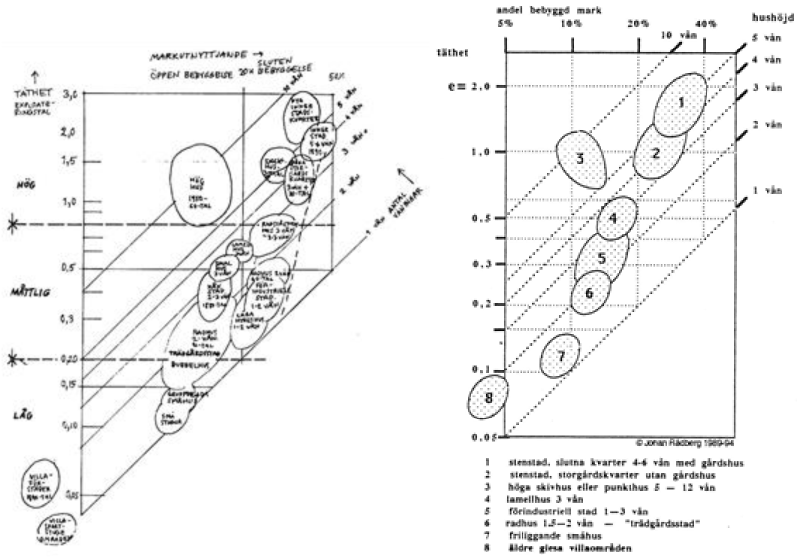

Figure 5. Johan Rådberg's (1988; Rådberg & Friberg, 1996) hypothesis about density: urban types emerged under specific planning doctrines are consistent in terms of density, Floor Space Indexes (FSI) and building heights

Subsequent research drew upon typo-morphological theories from Britain, Italy and France, (e.g. Conzen 1960; Panerai et al., 2004 [1977]; 1980; Moudon, 1986). Rådberg and his associates proposed a detailed classification of Swedish neighborhoods (Figure 6) that consists of forty urban types showing representative examples and minor variations in plans, FSIs, OSIs and building heights (Rådberg & Friberg, 1996). In the consecutive studies, e.g. in the city of Vasteras (Västerås), Rådberg and his associates explored the relationship between the proposed urban typology and urban quality as housing preferences (Rådberg & Johannsson, 1997; Rådberg, 2000).

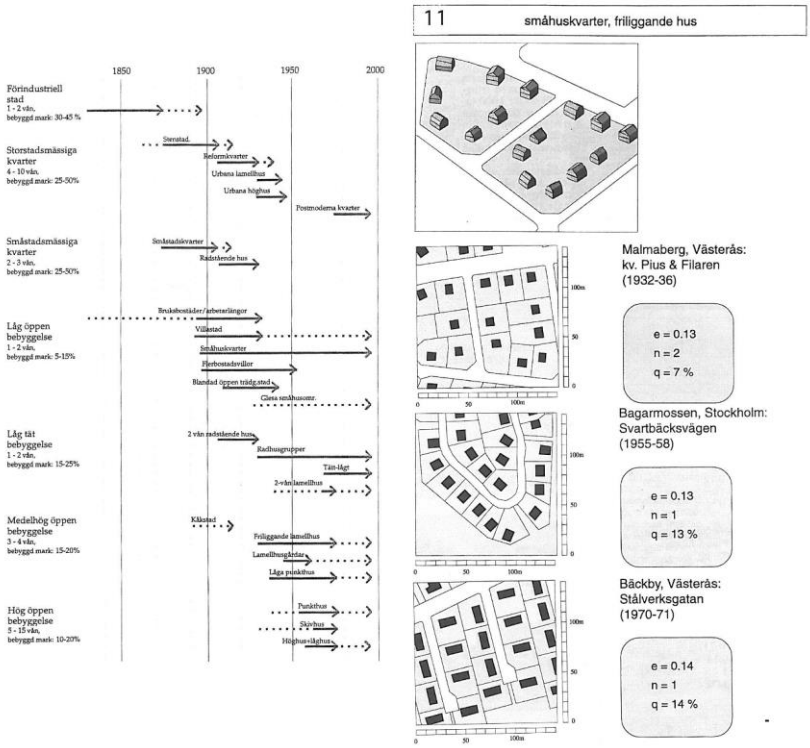

Figure 6. Periods of Swedish urbanization and typical neighborhoods (Rådberg & Friberg, 1996, p. 46) and neighborhood type 11 defined in terms of density, Floor Space Indexes (FSI), building coverage (100% - OSI) and building heights (n).

Place Types and the Typical Swedish City

Carl-Johan Engström, inspired by the work of Greger Paulsson, Elias Cornell and Björn Linn, proposed a typo-morphological urban model based on "place types" ("typområde" in Swedish), urbanization and industrialization in the book Swedish city (Svensk tätort in Swedish, see Engström et al., 1988). Engström's analysis starting points are technology and economy. The transportations technology improves accessibility while economical conditions create specialization of labor. Together they create new urban forms and reshape the existing city and lifestyles. Table 1 presents the epochs in Swedish urbanization from the pre-industrial city, the city during the industrialization, the modern/industrial city to the postmodern/post-industrial city. These cities had specific requirements in terms of accessibility, communication and transportation technology and urban structure.

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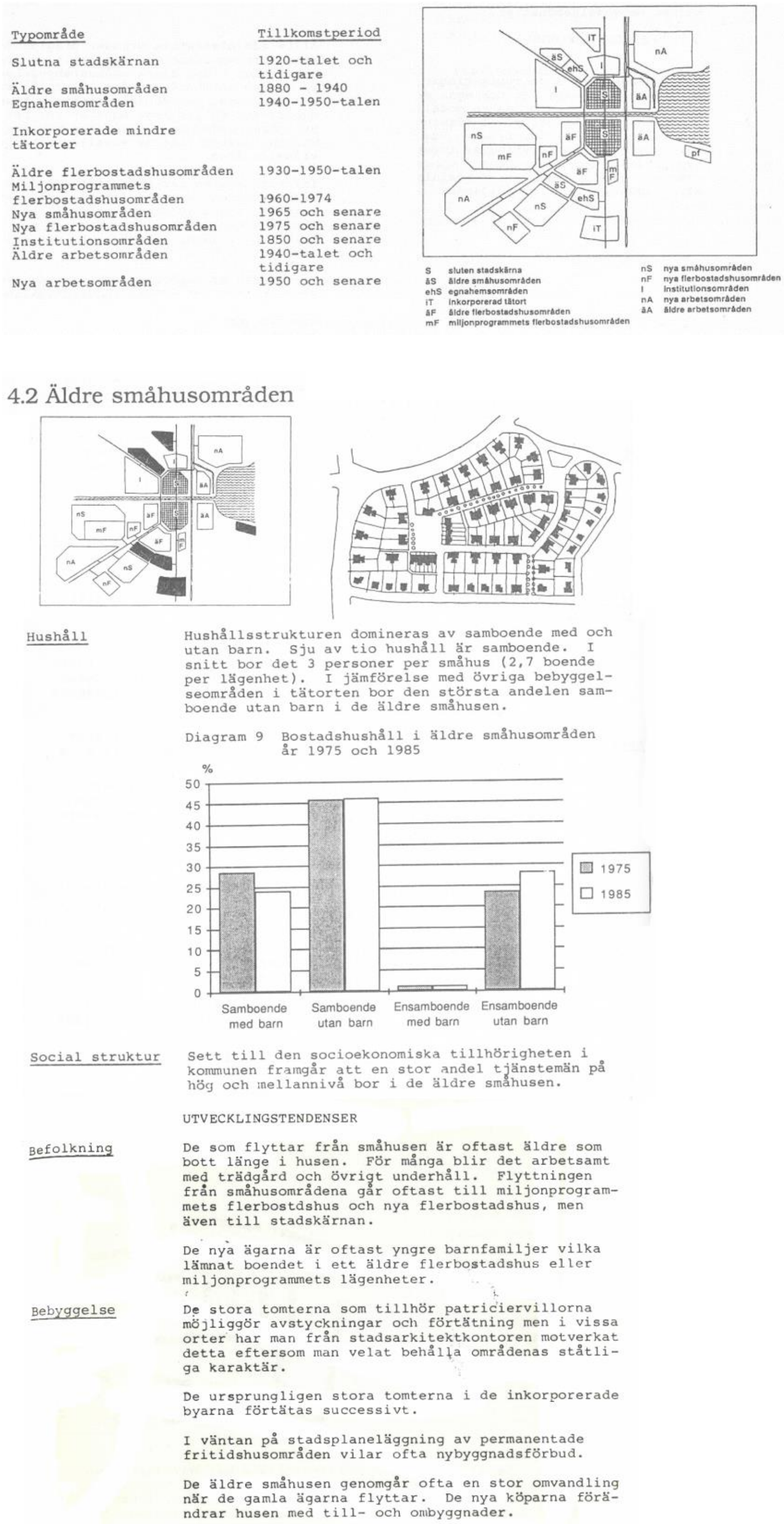
Table 1. Epochs of the Swedish urbanization in respect to development of the economy, industrialization and society (expanded from Cars & Engström, 2008; Engström 2018)

Epoch	Economy and industry	Need of access	Communication and transportation technology	Urban structure
Traditional society	Labor division	Spatial proximity	Narratives and stories, private carts and carriages	City and villages
Industrial society	Mechanization of labor	Spatial proximity	Newspapers and telegraph, public omnibuses, trams and trains	City and region
Welfare society	Specialization of processes and automation	Temporal proximity	Television, radio and telephone, private cars and public buses and trains	Urban region
Knowledge society	Specialization of services	Proximity to a network	World wide web, private and public cars and jets and high speed buses and trains	Urban network with global reach

Historical periods in Swedish urbanization, changes in economy and society reflect on the emergence and spread of neighbourhood types in Swedish cities. Carl-Jöhan Engström argues that place types or typical neighborhoods that emerge in these periods do not only explain variables such as FSI, OSI and building heights (Rådberg 1988; Rådberg & Friberg 1996), but also social structure in the neighbourhoods, residential and employment densities and urban development tendencies that change over time (Figure 7). Subsequent research shows that social structure in the neighbourhoods, residential and employment densities changed consistently over time especially in the historical cores of Swedish cities following changes in economy and society presented in Table 1 (Engström & Legeby, 2001; Engström, 2008; 2018).



Typområde	Tillkomstperiod
Slutna stadskärnan	1920-talet och tidigare
Äldre småhusområden	1880 - 1940
Egnahemsområden	1940-1950-talen
Inkorporerade mindre tätorter	
Äldre flerbostadshusområden	1930-1950-talen
Miljonprogrammets flerbostadshusområden	1960-1974
Nya småhusområden	1965 och senare
Nya flerbostadshusområden	1975 och senare
Institutionsområden	1850 och senare
Äldre arbetsområden	1940-talet och tidigare
Nya arbetsområden	1950 och senare

4.2 Äldre småhusområden

Hushåll — Hushållsstrukturen domineras av samboende med och utan barn. Sju av tio hushåll är samboende. I snitt bor det 3 personer per småhus (2,7 boende per lägenhet). I jämförelse med övriga bebyggelseområden i tätorten bor den största andelen samboende utan barn i de äldre småhusen.

Diagram 9 Bostadshushåll i äldre småhusområden år 1975 och 1985

Social struktur — Sett till den socioekonomiska tillhörigheten i kommunen framgår att en stor andel tjänstemän på hög och mellannivå bor i de äldre småhusen.

UTVECKLINGSTENDENSER

Befolkning — De som flyttar från småhusen är oftast äldre som bott länge i husen. För många blir det arbetsamt med trädgård och övrigt underhåll. Flyttningen från småhusområdena går oftast till miljonprogrammets flerbostdshus och nya flerbostadshus, men även till stadskärnan.

De nya ägarna är oftast yngre barnfamiljer vilka lämnat boendet i ett äldre flerbostadshus eller miljonprogrammets lägenheter.

Bebyggelse — De stora tomterna som tillhör patricierviIlorna möjliggör avstyckningar och förtätning men i vissa orter har man från stadsarkitektkontoren motverkat detta eftersom man velat behålla områdenas ståtliga karaktär.

De ursprungligen stora tomterna i de inkorporerade byarna förtätas successivt.

I väntan på stadsplaneläggning av permanentade fritidshusområden vilar ofta nybyggnadsförbud.

De äldre småhusen genomgår ofta en stor omvandling när de gamla ägarna flyttar. De nya köparna förändrar husen med till- och ombyggnader.

Figure 7. Urban model of a Swedish city showing periods of urbanization and typical neighborhoods (Engström et al., 1988, p. 46) and neighborhood type 4.2 (similar as on Figure 6) defined as location in the urban model, physical form, household and social structure, and development tendencies.

Application of Typo-Morphology in Swedish Urban Planning and Design

The Swedish typo-morphological conceptualizations presented in the previous section found its application in urban planning and

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design firstly as part of municipal building ordinances on the end of the 1990s. Building ordinances and codes are commonly used by municipalities for conservation purposes, especially in the historical cores of cities that want to preserve the urban character. Inspired by the typo-morphological research from the 1980s and early 1990s, the City of Stockholm proposed "building ordnances" ("byggnadsordning" in Swedish) to understand and discuss the future development of the municipality (the City of Stockholm is a municipality and part of a larger Stockholm Region). Twelve "stadskaraktärer" ("urban characters") were identified that served as background for urban planning, design and development in the 2000. Figure 8 shows a map of the comprehensive development plan for Stockholm. It presents "stadskaraktärer" ("urban characters") on the left side and street types on the bottom. The urban characters served as background and inspiration to preserve the morphological character of these neighborhoods as a part of densification effort with infill developments.

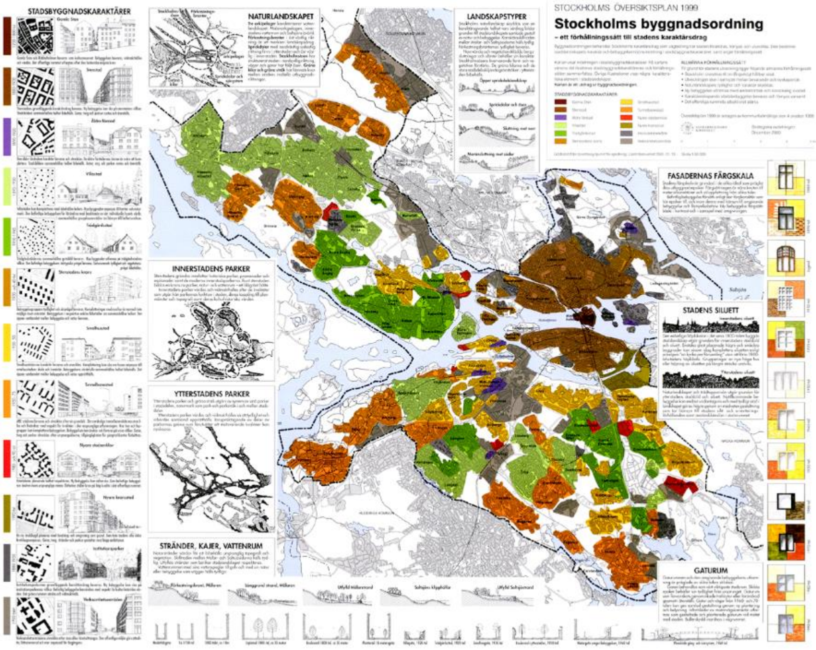

Figure 8. The map of Stockholm including neighborhood types or "stadskaraktärer" (urban characters) on the left and street types (City of Stockholm, 1999)

The City of Malmö created an urban typology with ten urban characters. The urban typologies in Malmö and Stockholm are very similar. Some variations in wording occurs with "stad" or "city" (preferred in Stocholm) and more general "bebyggelse" or "settlement" or "område" or "area" (favored in Malmö) e.g. villastad in Stockholm is referred to as villabebyggelse in Malmö (Figure 9). Region Gotland also established building ordnances for the historical core of Visby on a more detailed scale describing buildings and architectural details. The methodology more closely resembles the architectural elements in the Så byggdes trilogy, particularly the tomes on apartment buildings and villas (Björk et al., 2003 [1983]; 2009)

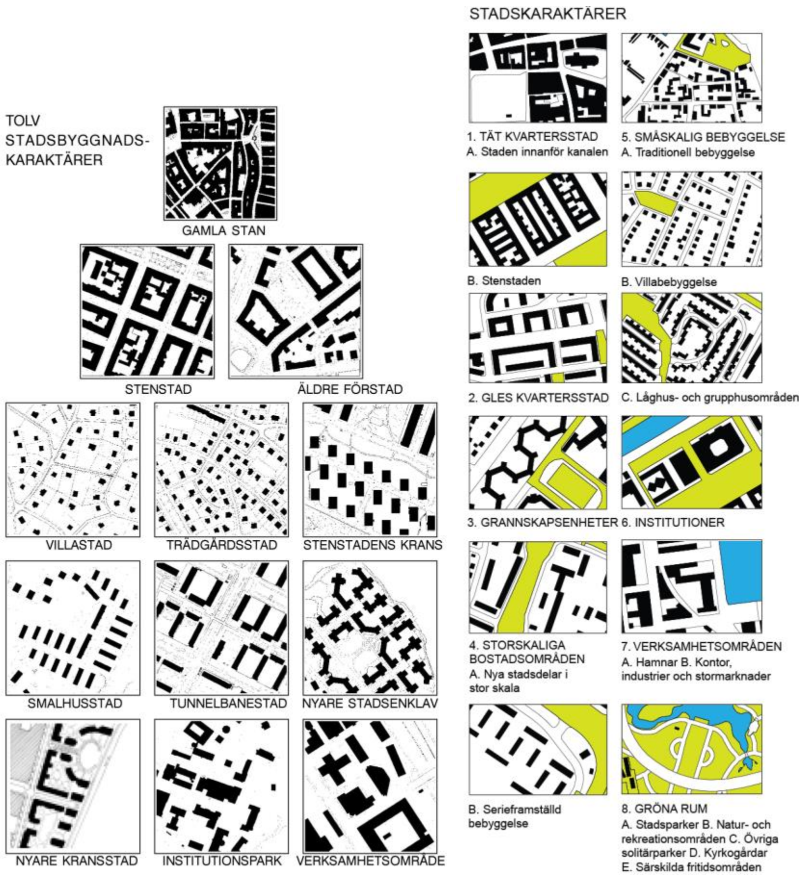

Figure 9. The neighborhood types or stadskaraktärer in Stockholm (twelve on the left) and Malmö (ten on the right).

The research on urban typologies also influenced architectural practices and urban design consultancies in the 2000s. URBAN STEP is a participatory method for urban design and planning based on "stadstyper" ("urban types") developed by Ekologigruppen AB, Arken SE Arkitekter in cooperation with Jerker Söderlind and Håkan Jersenius (Einarsson, 2012). It includes a workshop with a round table with a map, matrix of urban types and value rose diagrams that assesses sustainability of the historical and newly proposed urban types (Figure 10). One of the aim of the workshop to create understanding of the historical development of the city and collaboratively discuss new sustainable urban designs.

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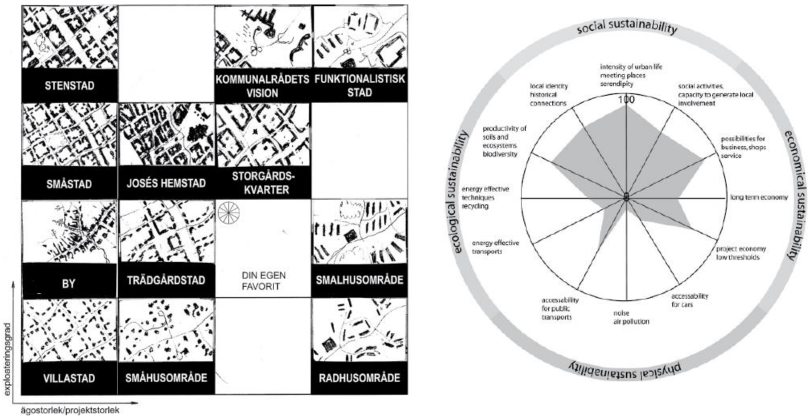

Figure 10. The "urban type" ("stadstyp") matrix and the value roses describing different aspects of sustainability used in the workshops organized by Ekologigruppen and Arken Arkitekter.

DISCUSSIONS

Building upon the typological conceptualization of Greger Paulsson, Lennart Ameén and Björn Lynn, Swedish morphologists developed three complementing typo-morphological approaches in the 1980s and 1990s. These approaches were accepted by municipalities like Stockholm and Malmö and also Region Gotland and the historic Visby. A group of architects and urban designers also developed a participatory method to assess sustainable urban designs by considering urban typologies. The typo-morphological research continued on the academy in two directions. Meta Berghauser-Pont following upon the work on Uno Åhren and Johan Rådberg presented a Spacematrix model (Berghauser-Pont & Haupt, 2010; 2013). Berghauser-Pont proposes generic urban typology that it based on standard morphological elements in English and urban form variables (e.g. building heights, FSIs, OSIs). An urban type as "low-rise buildings" can translate to several Swedish neighborhoods with houses e.g. "villastäder" or "neighborhoods with villas" that designate late 19th and early 20th century neighborhoods with small houses or "småhusområde" or "neighborhoods with small houses" that will refer to late 20th century neighborhoods with small houses that were oriented to the automobile (the term "suburban sprawl" can also be used). As generalist model, Spacematrix model has been widely accepted in morphological research and used to analyze urban elements e.g. lots (Bobkova, et al., 2019a; 2019b). Todor Stojanovski used the Swedish urban typologies proposed by Carl-Johan Engström and Johan Rådberg to analyze the effect of urban form as neighborhood type on travel (Stojanovski, 2018). He used the typology as background for future transformation of Swedish cities (Stojanovski, 2012; 2013; 2019a) together with a typology of public transportation systems (Stojanovski; 2019b).

Typo-morphology and typologies can be very useful to understand urban history. The building and neighbourhood types can be identified and recognized the general public (as argued by the creators of URBAN STEP). They can be compiled in a typology and described by architectural and urban historians or new types of buildings and neighborhoods can be proposed by architects and urban designers. The types consist of elements and rules to combine these elements in space (discussed by Christopher Alexander and Björn Linn, Figure 2 illustrates how a building type is applied to create different city blocks). Architects and urban designers solve urban problems by entering design worlds and playing with elements, rules and types that characterize design worlds (Schön, 1988; Mitchell, 1990). As such that are appealing to urban design practitioners. The types, elements and rules can easily be turned into building ordinances and codes because typo-morphological conceptualization directly link to design toolboxes and worlds (Talen, 2002; 2009; Marshall & Çalişkan, 2011; Marshall, 2011).

However, there are limitations in using typo-morphology in practice that requires critical understanding and application of typologies. Firstly, the Swedish typologies presented in this paper developed over a century and they are specific for Sweden. Words such "vilastäder", "stenstad" and so on were specifically coined in Swedish language to describe these types of neighborhoods. The typologies cannot be directly transcribed, but it is possible to use the method to create building and neighborhood typologies capturing cultural and linguistic uniqueness. Secondly, the typologies are predominantly historical. The retrograde disposition and nostalgic attachment to specific neighbourhood types can result in repetitiveness and stereotypes. Typologies are usually historical facts, whereas the future is here to be invented. If a historical pattern of a neighbourhood (e.g. a railway suburb of the early 20th century) is replicated as a new Transit-Oriented Development (TOD) today, the neighbourhood type will be different in the historical context and will affect age groups, social grouping, and so on, despite similarities in neighbourhood design, residential and employment densities (as discussed by Engström, 1988; 2018).

In the end, this paper focuses only on the typo-morphological approaches in Sweden. There are other morphological approaches with long tradition in Sweden. Abdellah Abarkan has a research group that focuses on urban history. Lars Marcus, one of the prominent Swedish morphologists, leads a Space Syntax group in Chalmers University. There is a long tradition in urban geography and regional science. The work of Torsten Hägerstrand is highly influential and KTH Royal Institute of Technology has a

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group that works with regional planning and urban modelling. These morphological approaches are not reviewed in this paper.

CONCLUSIONS

Swedish morphologists in the 1980s and 1990s developed three distinctive, but complementing typo-morphological approaches to understand Swedish architecture and cities. These approaches were accepted by municipalities like Stockholm and Malmö, but also Region Gotland and the historic Visby. These municipalities have used these building and neighborhood typologies as a background for urban codes or building regulations. A new workshop STEP method for participatory planning based on neighborhood types was also proposed by Swedish architects and urban designers to assess sustainable urban designs.

Urban morphology and design are intertwined and many morphologist have argued for using typo-morphological approach in architectural and design practices. The typologies can help in understanding urban history. The elements, rules and types that characterize various building and neighbourhood types can be easily applied by practicing architects and urban designers. They can be turned into building ordinances and codes. The building and neighbourhood types can be identified and recognized the general public which makes possible to organize participatory workshops and charrettes as argued by Swedish architects and urban designers who created the URBAN STEP method. However the typologies have to be applied critically. The presented Swedish typologies are deeply embedded in Swedish culture and language and they cannot be transcribed directly to other contexts. The typologies are furthermore historical. The historicity and multiplication of typical designs can result in repetitiveness and stereotypes. Typo-morphology emphasize the importance of morphological information to urban planning, design and development practices, but not replication. Typologies are historical facts, whereas the future can be invented. The typologies are urban visions in dynamic processes of urban morphogenesis or evolutionary incremental processes in achieving good urban forms (Scheer, 2010). The future can be invented without replicating historical urban patterns.

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REFERENCES

Abarkan, A. (2009). The study of urban form in Sweden. *Urban Morphology, 13*(2), 121-7.

Abarkan, A. (2013). Typo-morfologi: Metoden och dess tillämpning på bebyggelsesmönster. *The Nordic Journal of Architectural Research, 13* (1-2).

Ahlmann, H.W. (ed.) (1934). *Ekonomisk-geografisk undersökning av nutida Stockholm med förorter D. 1 Stockholms inre differentiering.* Stockholm: Geografiska institutet vid Stockholms högskola.

Améen, L. (1964). *Stadsbebyggelse och domänstruktur: svensk stadsutveckling i relation till ägoförhållanden och administrativa gränser.* Lund: Carl Bloms Boktrykeri.

Améen, L. (1973). *Stadens gator och kvarter: stadsmiljöns geografiska grunddrag.* Lund: CWK Gleerup.

Andersson, H.O. & Bedoire, F. (1973). *Stockholms byggnader: en bok om arkitektur och stadsbild i Stockholm*. Stockholm: Prisma.

Berghauser-Pont, M. Y. & Haupt, P. (2010). *Spacematrix: space, density and urban form.* Rotterdam: NAi Publishers.

Berghauser-Pont, M. B. & Haupt, P. (2013). The Spacemate - Density and the Typomorphology of the Urban Fabric. *Nordic Journal of Architectural Research, 18*(4).

Björk, C., Kallstenius, P. & Reppen, L. (2003 [1983]). *Så byggdes husen 1880-2000: arkitektur, konstruktion och material i våra flerbostadshus under 120 år (5th edition).* Stockholm: Formas.

Björk, C., Reppen, L. & Nordling, L. (2009). *Så byggdes villan: svensk villaarkitektur från 1890 till 2010.* Stockholm: Formas.

Björk, C., Nordling, L. & Reppen, L. (2018 [2000]). *Så byggdes staden. (Fjärde uppdaterade utgåvan) (5th updated edition).* Stockholm: Svensk Byggtjänst.

Bobkova, E., Marcus, L., Berghauser Pont, M., Stavroulaki, I., & Bolin, D. (2019). Structure of plot systems and economic activity in cities: Linking plot types to retail and food services in London, Amsterdam and Stockholm. *Urban Science, 3*(3), 66.

Bobkova, E., Berghauser Pont, M., & Marcus, L. (2019). Towards analytical typologies of plot systems: Quantitative profile of five European cities. Environment and Planning B: Urban Analytics and City Science, 2399808319880902.

DOI: 10.15320/ICONARP.2019.81– E-ISSN: 2147-9380

Caniggia, G. & Maffei, G. L. 2001 [1979]. *Architectural Composition and Building Typology: Interpreting Basic Building.* Firenze: Alinea.

Cataldi, G., Maffei, G. L., & Vaccaro, P. (2002) 'Saverio Muratori and the Italian school of planning typology', *Urban Morphology 6*(1), 3-14.

Cataldi, G. (2003) 'From Muratori to Caniggia: the origins and development of the Italian school of design typology', *Urban Morphology, 7*(1), 19-34.

Conzen, M. R. G. (1960). Alnwick, Northumberland: a study in town-plan analysis. Transactions and Papers (Institute of British Geographers), (27), iii-122.

Cornell, E. (1970). Byggnadstekniken: metoder och idéer genom tiderna. Stockholm: Byggförl.

Cornell, E. (1977). Bygge av stad och land. Stockholm: PAN/Norstedt.

Einarsson, T. (2012). In Haas, T. (ed.) *Sustainable urbanism and beyond: rethinking cities for the future.* New York: Rizzoli.

Engström C.J, Lindqvist A., Lagbo E. & Landahl, G. (1988). *Svensk tätort.* Stockholm: Svenskakommunförbundet.

Engstrom C.J, & Legeby F. (2001). *Scenariostudie om framtidsstaden*. Göteborg: Chalmers tekniska högskola.

Engstrom C.J. (2008). Kunskapsdriven näringsutveckling och stadsomvandling. in Cars, G., & Engström, C. J. (eds.). *Stadsregioners utvecklingskraft-trender och nya perspektiv.* Stockholm: Kungliga tekniska högskola.

Engström C.J. (2018). Kunskapsunderlag till betänkande om transportplaner inom Kommittén Samordning för bostadsbyggande. Available at; http://www.sou.gov.se/wp-content/uploads/2018/04/Kunskapsunderlag-om-transportplaner.pdf

Franck, K.A. (1994). Types are us. In Franck, K.A. and Schneekloth, L.H. (eds.). *Ordering space: types in architecture and design.* New York: Van Nostrand Reinhold, 345-372

Franck, K.A. & Schneekloth, L.H. (1994). *Ordering space: types in architecture and design.* New York: Van Nostrand Reinhold.

Goethe, J.W.V. (1988 [1817]). *Scientific studies.* New York: Suhrkamp.

Hall, A.C. & Sanders, P. (2011). Morphological design control for large-scale city development: a new proposal. *Built Environment, 37*, 427-444.

Kropf, K. (2009). Aspects of urban form. *Urban Morphology, 13*(2), 105-120.

Kropf, K. (2011). Morphological investigations: Cutting into the substance of urban form. *Built Environment, 37*(4), 393-408.

Kropf, K. (2018). *Handbook of urban morphology*. Chichester: John Wiley & Sons.

Linn, B. (1974). *Storgårdskvarteret: ett bebyggelsemönsters bakgrund och karaktär*. Stockholm: Statens institut för byggnadsforskning.

Linn, B. (1991). Bebyggelsemönstret som analysmodel. In Hall T. (ed.) *Perspektiv på planering.* Uppsala: HSFR.

Marshall, S. (2011). *Urban coding and planning.* Abingdon, Oxon: Routledge.

Marshall, S., & Çalişkan, O. (2011). A joint framework for urban morphology and design. *Built Environment, 37* (4): 409-426.

Marshall, S. (2016). The kind of art urban design is. *Journal of Urban Design, 21*(4), 399-423.

McGlynn, S., & Samuels, I. (2000). The funnel, the sieve and the template: towards an operational urban morphology. *Urban morphology, 4*(2), 79–89.

Mitchell, W.J. (1990). *The logic of architecture: design, computation and cognition. Cambridge*, Mass.: MIT Press.

Moudon, (1994). Getting to Know the Built Landscape: Typomorphology. in Franck, K.A. and Franck, K.A. and Schneekloth, L.H. (ed.). *Ordering space: types in architecture and design.* New York: Van Nostrand Reinhold. 289-314.

Moudon, A. V. (1997). Urban morphology as an emerging interdisciplinary field. *Urban morphology, 1*(1), 3-10.

MSBK (Malmö Stadsbyggnadskontoret). (2001) Översiktsplan för Malmö 2000 (Öp 2020). Malmö: MSBK.

Panerai, P. Castex, J., Depaule, J. C. & Samuels, I. (2004 [1977]). *Urban forms: the death and life of the urban block*. Oxford: Architectural Press

Panerai, P., Depaule, J., Demorgon., M., & Veyrenche., M. (1980), *Elements D'analyse Urbaine.* Bruxelles: Archives d'Architecturc Moderne.

Paulsson, G. (1950). *Svensk stad I-III. Liv och stil i svenska städer under 1800-talet*, Stockholm: Albert Bonniers förlag.

Robinson, J.W. (1994). The Question of Type, in Franck, K.A. and Schneekloth, L.H. (ed.). *Ordering space: types in architecture and design*. New York: Van Nostrand Reinhold. 179-194.

Rossi, A. (1982 [1966]). *The architecture of the city.* Cambridge, Mass.: MIT Press.

Rådberg, J. (1988). *Doktrin och täthet i svenskt stadsbyggande 1875-1975.* Stockholm: Statens råd för byggnadsforskning.

Rådberg, J. (2000). *Attraktiva kvarterstyper: en undersökning av bebyggelse, befolkning och attraktivitet i Stockholm Söderort.* Stockholm: Kungliga Tekniska högskolan.

DOI: 10.15320/ICONARP.2019.81– E-ISSN: 2147-9380

Rådberg, J. & Friberg, A. (1996). *Svenska stadstyper: historik, exempel, klassificering.* Stockholm: Kungliga Tekniska högskolan.

Rådberg, J. & Johansson, R. (1997). *Stadstyp och kvalitet.* Stockholm: Kungliga Tekniska högskolan

Sanders, P. S., & Woodward, S. A. (2015). Morphogenetic analysis of architectural elements within the townscape. *Urban Morphology, 19*(1), 5–24.

Sanders, P., & Baker, D. (2016). Applying urban morphology theory to design practice*. Journal of Urban Design, 21*(2), 213–233.

Samuels, I. (1990). Architectural practice and urban morphology. In: Slater, T. R. (ed.) *The Built Form of Western Cities: essays for M.R.G. Conzen on the occasion of his 80th birthday.* Leicester: Leicester University Press.

Samuels, I. (1999). A typomorphological approach to design: the plan for St Gervais. *Urban Design International, 4*(3-4), 129-141.

Samuels, I. (2008). Typomorphology and urban design practice. *Journal of Urban Morphology, 12*(1), 58-62

Scheer, B. C. (2010). *The evolution of urban form: typology for planners and architects.* Chicago: American Planning Association.

Schneekloth I.H and Franck, K.A. (1994). Prison or Promise?, in Franck, K.A. and Schneekloth, L.H. (ed.). Ordering space: types in architecture and design. New York: Van Nostrand Reinhold. 15-40.

Schön, D. A. (1988). Designing: Rules, types and words. *Design studies, 9*(3), 181-190.

SLL (Stockholms Läns Landsting). (2009). *Tätare Stockholm.* Stockholm: SLL.

Southworth, M. (2005). Reinventing main street: From mall to townscape mall. *Journal of Urban Design, 10*(2):151-170.

Southworth, M., & Ben-Joseph, E. (1995). Street standards and the shaping of suburbia. Journal of the American Planning Association, 61(1), 65-81.

Southworth, M. & Ben-Joseph, E. (1997). Streets and the shaping of towns and cities. New York: McGraw-Hill.

SSBK (Stockholms Stadsbyggnadskontoret). (1997). Stockholms byggnadsordning. Stockholm: SBK

SSBK. (2000). ÖP99. Stockholm: SBK

Steadman, P. (1979). *The evolution of designs: biological analogy in architecture and the applied arts*. Cambridge: Cambridge University Press.

Steadman, P. (2014). *Building types and built forms. Kibworth* Beauchamp: Matador.

Stojanovski, T. (2012). The Swedish urban typologies in the city of Karlstad: neighbourhood conceptualizations and typologies for urban development and transformation in the 21st century. In 3rd International Conference on Degrowth for Ecological Sustainability and Social Equity, Venice, Italy.

Stojanovski, T. (2013). "Bus rapid transit (BRT) and transit-oriented development" (TOD) (Licentiate thesis, KTH Royal Institute of Technology).

Stojanovski, T. (2018). How density, diversity, land use and neighborhood type influences bus mobility in the Swedish city of Karlstad. *Journal of Transport and Land Use, 11*(1), 769-789.

Stojanovski, T. (2019a). "Urban Form and Mobility-Analysis and Information to Catalyse Sustainable Development" (Doctoral thesis, KTH Royal Institute of Technology).

Stojanovski, T. (2019b). Urban design and public transportation–public spaces, visual proximity and Transit-Oriented Development (TOD). *Journal of Urban Design*, 1-21.

Talen, E. (2002). Help for urban planning: the transect strategy. *Journal of Urban Design, 7*(3), 293-312.

Talen, E. (2009). Design by the rules: The historical underpinnings of form-based codes. *Journal of the American Planning Association*, *75*(2), 144-160.

Taylor, N. (1999). The elements of townscape and the art of urban design. *Journal of Urban Design*, *4*(2), 195-209.

Talen, E. & Ellis, C. (2004). Cities as art: Exploring the possibility of an aesthetic dimension in planning. Planning Theory & Practice, 5(1), 11-32.

Vidler, A. (1977). The Idea of Type: The Transformation of the Academic Idea, 1750-1830, Oppositions 8, 95-113.

Whitehand, J.W.R. (2001) British urban morphology: the Conzenion tradition. *Urban Morphology 5*(2), 103-109.

William-Olsson, W. (1984 [1937]). *Stockholms framtida utveckling: Bilaga: huvuddragen av Stockholms geografiska utveckling 1850-1930: bilaga.* Stockholm: LiberFörlag.

William-Olsson, W. (1940). Stockholm: Its structure and development. *Geographical Review*, *30*(3), 420-438.

Resume

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Research Article

Design for Mitigating Urban Heat Island: Proposal of a Parametric Model

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Abstract

Urban areas dramatically affect the microclimatic conditions of cities, and induce the 'Urban Heat Island' (UHI) effect, which generates many undesirable conditions in the living environment. In recent years, several studies have been examined a strong correlation between the morphology of urban areas and the development of heat island intensity. Then the increasing need for climate responsive design approaches calls for the development of new methodical approaches and tools to control the planned (trans)formation of the urban fabrics. Computational modelling techniques, in this context, suggest relevant methodologies to provide an evidence-based design approach to the issue. This research, in this regard, aims to propose a parametric model for analyzing the key morphological components of urban tissues with regards to the UHI intensity on the basis of 'Sky View Factor' (SVF) while testing the alternatives in generative manner. The proposed (parametric) model, therefore, stands on the close-correlation between the algorithmic simulation based on the selected parameters and morphological analysis. By the model, SVF values of the different building settings are calculated with reference to the basic building codes of the development planning system in Turkey (i.e. FAR, building height and setback) in an actual context. Then the proposed model is tested in the case of one of

Keywords: Evidence-based urban design, parametric modelling, urban heat island, urban morphology

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the transformation areas in Ankara, Turkey. Eventually, a methodical framework is aimed for a climate responsive urban design process to mitigate urban heat island.

INTRODUCTION

Urban climate is a key factor of urban livability which is influenced by the complexity of morphological characteristics (form and geometry) which, in turn, condition the thermal properties of urban surfaces. The intrinsic physical nature of the cities as the cumulative outcome of long-term (trans)formation, results in the emergence of the particular urban microclimatic conditions in the cities. Defined as the measured differentiation in the air temperature between urban areas and its surroundings, the phenomenon of Urban Heat Island (UHI) is considered one of the major issues on the spatial performance of urban morphology. Emerging environmental problems due to an increase in the UHI effect in urban areas call for a specification of the influential factors on the change in the thermal balance of the environment as an outcome of urban development.

Urban geometry as the main factor in the development of heat island intensity, in this regard, has been evaluated by several studies by which its critical effects have been proved for recent years. Accordingly, the variation on the main parameters of urban geometry, (i.e. location, orientation, height of the buildings and spaces between them) has been specified to define the correlation between urban form and the ambient air temperature. In those studies, sky view factor (SVF), which is based on the degree of visibility of sky from the ground level, is used to simulate urban canyons, which are characterized by horizontal (street) and vertical (building surfaces) elements of the urban fabric.

To specify the real effect of the indicators of urban geometry on UHI, many studies have been conducted on the actual urban areas by using certain computational tools. Since those models have largely focused on measuring various conditions of UHI in different urban contexts, the lack of predictive tools for the simulation of UHI intensity has emerged in the research field. Need for the test-scenarios, estimations based on the specific urban areas, and the practical restrictions on form generation by computational design tools, so far, call for the development of new tools and techniques that would enable designers and planners to build a proactive perspective on the climate-responsive urban design.

Since the development of parametric modeling tools, designers have equipped with a serious capability to generate numerous

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spatial configurations and design alternatives which, in turn, would be analyzed within the same algorithmic setting, to guide better solutions. Since parametric modeling provides a large universe of possibilities for searching, analyzing and operating distinct design settings, it has gained a wide practical ground in the field of architectural and urban design. Nevertheless, despite its increasing use in design practice, its use in spatial analysis and research has fallen limited. Considering its current computational capacity, the existing research argues that parametric modeling can be employed in 'generative spatial research' that would ensure an efficient integration between analysis and design specifically on the issue of the urban heat island. Since urban geometry-based UHI studies are generally specialized either on measurement or on simulation techniques, the current analytical models do not suggest an integrated framework. Therefore, following the measures on specific urban areas, possible alternative formations are not generated in response to the given contextual constraints. Therefore, there exists a lack between morphological analysis and design from a context-sensitive perspective. To overcome such a shortcoming, the paper suggests an alternative model combining spatial analysis and form-generation to mitigate UHI intensity.

This research aims to investigate the potentials of parametric modeling for analyzing morphological indicators of urban areas, and testing the alternative forms with regards to Urban Heat Island (UHI) effect, accordingly. By developing a parametric approach, following the calculation of UHI intensity in urban areas, a new (evidence-based) design control approach could be possible based on generating and testing alternative spatial patterns in the same operational framework. Eventually, opening up a methodical discussion on the problematic issue of urban heat island (UHI) is aimed.

To test the applicability of the proposed parametric model, an actual urban context in Ankara, Turkey is selected for the analysis and form generation. As one of the most rapidly transformed urban areas in the city, the selected neighborhood provides an opportunity to compare different morphologies while testing some hypothetical ones in the same planning context. That means alternative urban configurations will be tested based on the same development rights in the site. Then the possibility of mitigating UHI intensity in the given planning conditions will be discussed.
With the model proposal, the effect of urban geometry on UHI development is to be revealed. The parametric model, in this framework, is aimed to perform as a design-support system

informing urban design processes targeting for the mitigation of heat island intensity in the planned urban fabrics.

URBAN HEAT ISLAND (UHI) AND URBAN GEOMETRY

Definition of Urban Heat Island

Urban microclimate, which is formed by the complexity of morphological conditions of urban areas, basically influences temperature, air pressure, wind, humidity and precipitation of any regional climate (Yılmaz, 2013). Due to its negative impacts on thermal comfort, the dramatic differentiation in air temperature observed with higher values in the urban areas has been the subject of many spatial studies on the issue.

On the phenomenon of UHI, much of the progress in a robust understanding of heat island formation has been suggested by the researches of T.R. Oke. (1988) linked the magnitude of heat island effect to the energy balance of urban areas and improved the knowledge of urban microclimate. Energy balance, in this regard, is the main driver behind the ambient air and surface temperature differences in the context of the built and natural environment. Impermeable surface materials with low reflectance, the limited sky view due to the urban geometry, lack of vegetation and water surfaces in the built-up areas cause serious disparities in the heating and cooling capacity of the cities. As a result of the energy flux, when the thermal balance of the environment turns into a positive (heat storage), the heat of the environment increases and it conduces the development of the UHI effect (Oke, 1988; Santamouris et al., 2001; Erell et al., 2011). T.R. Oke has also conducted several studies about physical factors in the formation of UHI while correlating them to the issues of the urban population, weather conditions, thermal properties of surface materials and urban canyon geometry.

The magnitude of the heat island intensity may vary to the climate, geographic location and urban layout of the cities. Particularly, densification of the built-up areas, increased human activities due to population growth, anthropogenic heat release via energy consumption, the replacement of natural ground coverages by low reflective surfaces, demolition of moist surfaces or vegetation areas, and reduced wind speed within the streets cause temperature increase and make cities warmer than their natural surroundings. Such transformations in urban areas can create complex radiation exchange between the surfaces and the atmosphere, and thus contribute to a more intensive UHI effect (Oke et al., 1991; Santamouris et al., 2001; EPA, 2008).

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Following T.R. Oke's footsteps, several researchers have contributed to the field by providing an estimation of heat island intensity and mitigation strategies for that. As a result of all these studies, warmth characteristics of the surface areas and air temperatures in the built environment are examined. In urban areas, the mean air temperature is determined to be a minimum of 1 to 3°C warmer than suburban or rural areas, and it can reach up to 10 - 12 degrees (EPA 2008; Oke, 1973). Then the temperature difference between them is called as Urban Heat Island (UHI) intensity.

The development of larger heat island intensity, due to increase in density, and release of heat by basic human activities (i.e. transportation and industry), and greenhouse gas emissions in the urban areas cause serious climate change from local to the global scale. At least 1°C rise in air temperature of cities has a knock-on effect on global warming. The trend of warming has negative effects on human health, as well. High-temperature increases by extreme heat waves result in mortality risks in the cities (Santamouris et al., 2001; Wong and Chen, 2009). Therefore, mitigation of the UHI effect should be taken into consideration for the well-being of urban communities (Erell et al., 2011; Shahmohamadi et al., 2010).

The Relationship between UHI and Urban Geometry

Urban geometry has a certain effect on urban microclimate, and, specifically, on the development of the UHI intensity. During a day, incoming short-wave radiation is absorbed by the buildings, and stored as heat, internally. After the sunset, the urban surfaces that were warmed up during the day start to emit long-wave radiation and release heat during the night. However, urban geometry has a crucial role in the heat loss rate of the gained heat. When an urban geometry (i.e. building heights and street widths) involves deep canyons, the average sky view in the given fabric falls limited, thus radiation loss occurs lower than open spaces. In other words, as a result of restricted long-wave radiation and heat loss by the geometrical configuration of the urban fabric, residual heat contributes to the formation of heat island (Hammerle et al., 2011; Lopez et al., 2016; Oke, 1981; Unger, 2009). Therefore, these energy exchanges can be linked to the variables of urban canyons, and canyon geometry characterized by three main indicators: aspect ratio, sky view factor, and building orientation. These indicators have been demonstrated to have a significant impact on the UHI by several studies.

The aspect ratio of a canyon, or in other words, building height to street width (H/W) ratio has been found to be a significant factor contributing to UHI intensity (Oke, 1981; Bakarman and Chang, 2015; Takkanon, 2016). In general, an increase in the H/W ratio as a result of created deep canyons in urban areas contributes to the development of the UHI effect. In heat island studies, three-dimensional urban geometry data are transformed to the two-dimensional sections to calculate the H/W ratio. The role of the urban geometry indicators on the heat island effect is also controlled by the building orientation, or in other words, canyon axis orientation. The level of the solar access to the canyon, especially to the building facades, is highly determined by the orientation. In addition, street orientation has a significant impact on temperature reduction through airflow (Nunez and Oke, 1977; Lau et al., 2015). Even if these indicators have an enormous impact on the magnitude of the UHI effect, this study focuses on the three-dimensional representation of urban geometry and neglects some factors such as airflow patterns and insolation. Therefore, the Sky View Factor (SVF) calculation for the estimation of heat island intensity is determined as a measure.

Sky View Factor (SVF)

The Sky View Factor (SVF) is widely used as an important measure of urban geometry for the measurement of the UHI effect. The SVF is defined as the fraction of the visible sky. In other words, the SVF value represents the ratio of radiation from a given point to received from the entire hemispheric radiant (Johnson & Watson, 1984). SVF basically conditions the ratio of emitted long-wave radiation from urban surfaces to the atmosphere. Therefore, the fraction of the visibility of the sky from a point on the urban surfaces depending on the interception of the near located urban structures is indicated by a SVF value, which is within a range between the values, 0 and 1. The SVF value of 1 means that the sky is unobstructed and completely visible, whereas if it gets the value of 0, that means the sky is completely blocked from the ground level. When the SVF value decreases due to high-rise buildings and narrow streets, in addition to the multiple reflections, long-wave radiation loss is restricted, heat is trapped, and thus heat island effect is increased in urban canyons (Hammerle et al., 2011; Unger, 2009). (see: Figure 1)

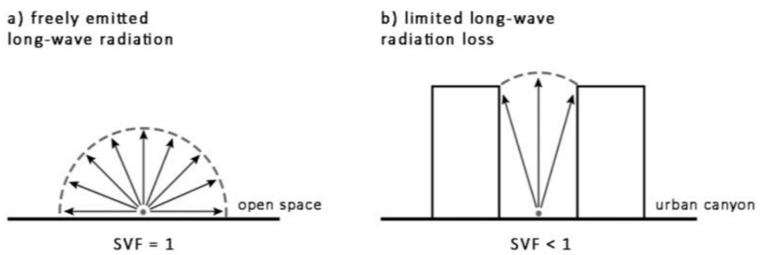

Figure 1. The relation between SVF values and emitted long-wave radiation

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The basic calculation method of the SVF is based on the projection of each building surfaces which are seen from the point as an obstruction to a hypothetically set hemisphere (sky vault) from a specific point in an urban area. This illustrates the interrupted portion of the sky seen from a certain point of the observer. The ratio of the remaining part is considered as the SVF value, and it is formulated by subtracting the sum of all view factor values of building surfaces from 1 (Unger, 2009). (see: Figure 2)

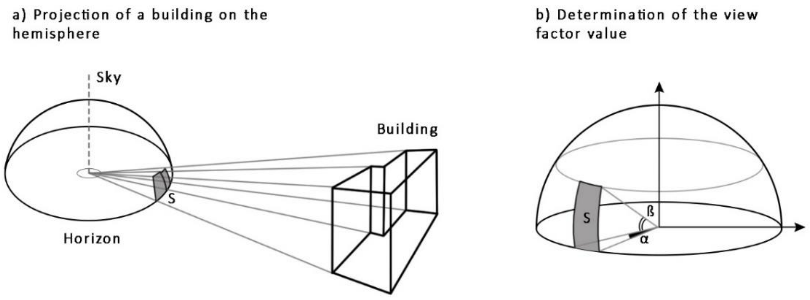

Figure 2. Schematic depiction of the SVF calculation (Unger, 2009)

Many studies have proved a strong correlation between the SVF value and the UHI effect in urban areas. Comparisons of measured air temperatures at different urban sites and calculated SVF values show that urban geometry had a significant impact on the distribution of the average air temperature (Svenson, 2004). To demonstrate the correlation between them and to calculate UHI intensity ($\Delta Tu{-}(max)$), Oke (1987) formulated a new equation using the SVF (ψsky) as a measure:

$$\Delta T_{u-r(max)} = 15.27 - 13.88\, \psi_{sky}$$

According to the equation, the measured SVF value is be multiplied by 13.88, then the obtained value is be subtracted from 15.27. For this mathematical operation, Oke (1981) made a series of SVF measurements in the central urban areas of Australian, European and North American cities where urban heat island intensity data was available. Comparing the measurement results, he came up with a strong inverse correlation between maximum heat island intensity and the sky view factor observed. The resulting relationship provided the equation of linear regression with r^2=0.88 and a standard error of the estimate of $\Delta T_{u-r(max)}$ of ±0.92°C.

METHOD OF THE RESEARCH: A MODEL PROPOSAL

The methodical approach of this study stands on the systemic combination of analysis and simulation processes. To mitigate UHI intensity in urban areas, the proposed model provides the combination of the SVF calculation by analyzing the morphology of urban fabric, and form-generation through maximizing the obtained SVF values at the same algorithmic setting. Then, in the first stage, the layout of the selected area is to be analyzed to calculate the SVF value and UHI intensity on the base of the formulation of Oke's (1987). In the second phase, the alternative urban compositions will be simulated in the search for minimizing heat island intensity through maximum levels of the SVF. By the simulation based on the parametric modeling, a set of alternative form typologies ensuring maximized SVF values are aimed to be provided. For the parametric modeling, Grasshopper®, a graphical algorithm editor integrated with Rhino's 3-D modeling tools has been used.

Algorithmic Definitions of the Morphological Indicators of UHI

To analyze the effect of urban geometry on heat island intensity regarding SVF value while reproducing the test case during the generation of alternative fabrics, parametrically, the algorithmic framework of the model has to be defined. To that end, the key morphological components as the major inputs of the algorithmic setting are specified along with the related parameters. In this context, the block, the plot, and the building are considered as the elements of urban form that would be parameterized to define the main morphological indicators of UHI.

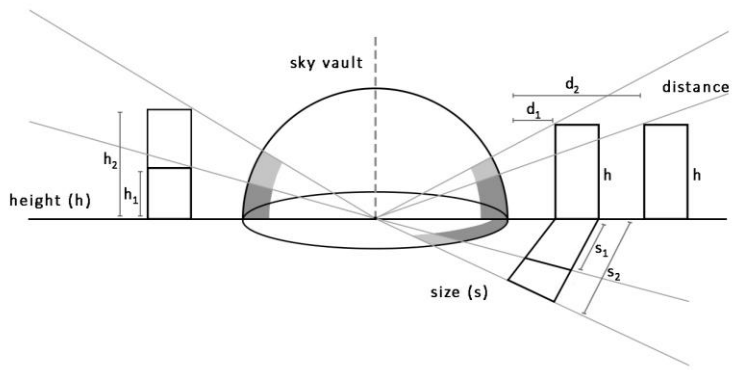

Figure 3. Schematic illustration of the effect of major parameters on the visibility of the sky

Previous studies on the issue show that main morphological factors on the relationship between SVF and heat island intensity are as follows:

- the height of the buildings,
- the distance between the buildings,
- the distance between the measurement point and buildings,
- and the size of the buildings.

As shown in Figure 3, the variation in the main parameters of urban geometry (height, distance, and size) induces an obstruction of the sky view in different sizes. When the average

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height of the building increases in a certain direction ($h2>h1$), the obstructed field in the given direction also increases. However, an increase in the distance between the test point and the buildings ($d2>d1$) results in a decrease in the obstruction of the visibility within the condition of the same building heights. Moreover, the more the building coverage -with the same floor area ratio (FAR)-, the higher the value of the SVF is obtained.

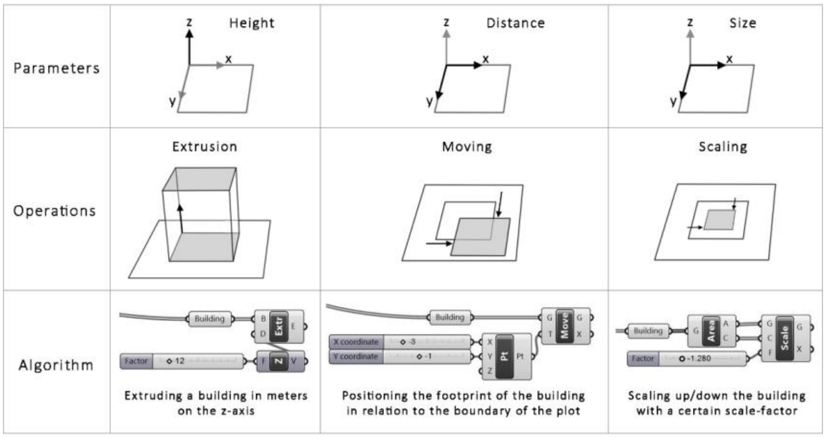

Figure 4. Schematic depiction of algorithmic attributions

To generate alternative fabrics for the test case, the basic morphological operations have to be defined, as well. In this context, extrusion, moving, and scaling are specified as the main parametric operations involved in the generative algorithm. (see: Figure 4)

In the search for alternative configurations to mitigate heat island intensity effect in the built fabric, the key morphological indicators are determined regarding the legislative framework of the Turkish spatial planning system that regulates the development of the urban form. In the development plans in Turkey, building coverage, floor area ratio (FAR) and a maximum height of the buildings (Hmax) within the given planning context are the three basic form indicators involved in the development plans. In the current study, coverage and FAR are determined as the basic indicators controlling the simulation process in the generation of hypothetical alternative urban fabrics.

Algorithmic Setting for the Analysis

To calculate SVF value in urban areas, a new technique that is based on the algorithmic calculation of geometric features is suggested. Geometric components of urban areas were quantified by a special algorithm based on the specified viewpoints computing the SVF values through the hemispheric projection of the buildings. With the use of the algorithmic model, the distribution of SVF values in an urban fabric, and the magnitude of UHI intensities at those areas can be calculated and compared. This proposed model, in this framework, calculates the SVF values in three steps, *positioning* (the measurement points and the fields of analysis), *projection* (of the hypothetical hemisphere) and extraction (of the obstructed fields).

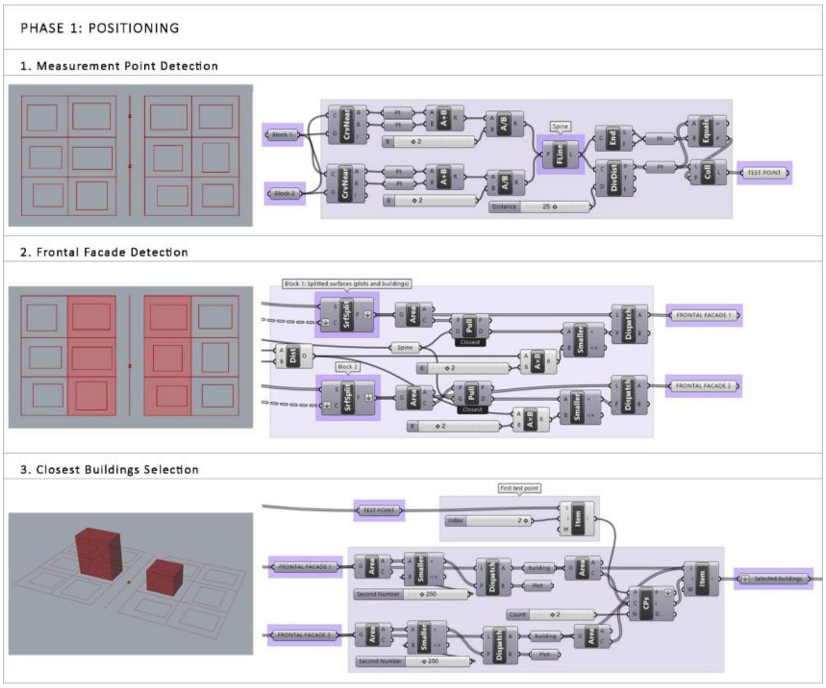

Figure 5. Phase 1: The consecutive steps to position the measurement point and the fields of analysis

The first phase of *positioning* is run by the decision-making algorithm for selecting the measurement points, the plots and the buildings that are visible from the point where the SVF calculation is to be made, accordingly. Then in the first phase, the measurement point is specified, the plots facing the specified point are classified, and the closest buildings to the point in the given segment are selected, respectively. (see: Figure 5).

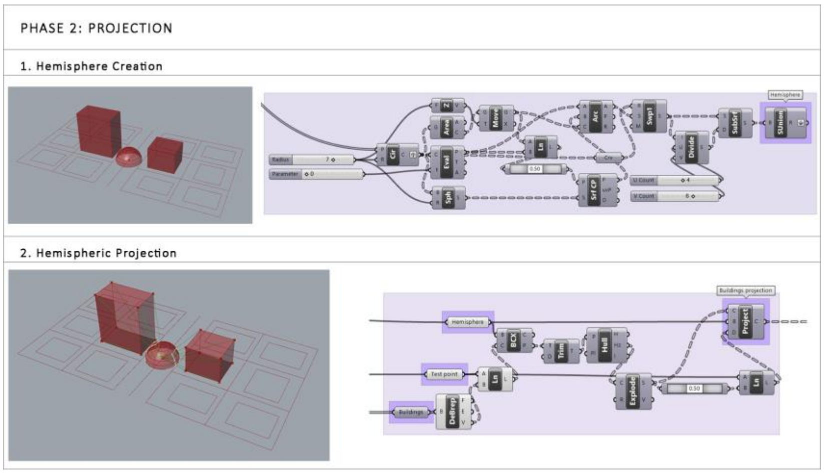

Figure 6. Phase 2: Projection of the buildings on the hemisphere

In the second phase called projection, first, a hypothetical hemisphere is generated at the center of the urban canyon. To cover the street section, completely, the radius of the hemisphere is set as half of the street width. Then, with the use of buildings,

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the test point, and the hemisphere, the projection lines are generated from the measurement point to the edge of buildings. As a result of that operation, the obstructed area on the sky vault by buildings is detected. (see: Figure 6)

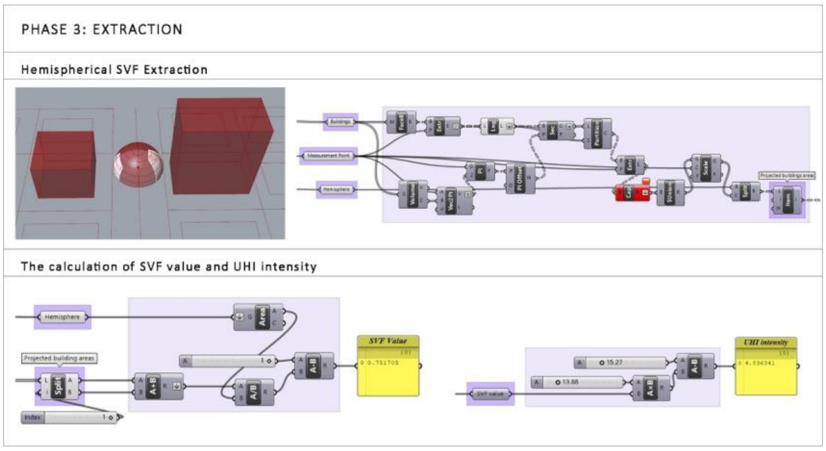

Figure 7. Phase 3: Extraction of the SVF from the hemispherical projection model

After the projection process, in the third phase of setting the analytical algorithm, extraction is made to calculate the SVF value and UHI intensity. The SVF value was computed by the subtraction of the ratio of the total projected buildings area to the surface area of the hemisphere from 1. Then, the UHI intensity was calculated with the use of Oke's (1987) formulation, accordingly. (see: Figure 7)

Algorithmic Setting for the Simulation

Proposing a parametric model to simulate the alternative form compositions ensuring higher SVF values for the mitigation of UHI intensity, requires a generative algorithmic setting. For this purpose, Galapagos®, an evolutionary computing tool operating within the parametric model to test the input parameters within the automatic generation of alternative geometries is used. The algorithmic framework is designed to evaluate the given parameters (i.e. height, distance, size) via Galapagos®. Then the simulation is run for testing the impact of any change in the value of the parameters on the visibility of the sky represented by SVF. Therefore, a set of alternative configurations are to be obtained following the changes in the parameters of the urban geometry. In this context, the morphological indicators of coverage and floor area ratio (FAR) are introduced as a constraining factor characterizing the simulation of alternative urban tissues by the generative algorithm.

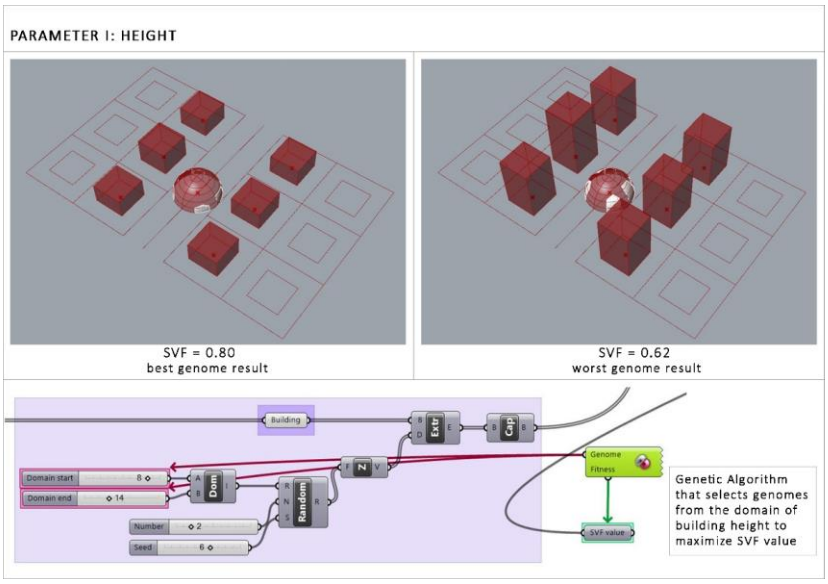

Figure 8. The SVF simulation based on the parameter, *building height*

The involvement of the morphological parameters in the simulation is set separately from to reveal their specific influence on the SVF. For instance, in consideration of the changing parameter of height, Galapagos® tends to simulate the optimum form-compositions maximizing the SVF value within the given range of building heights.

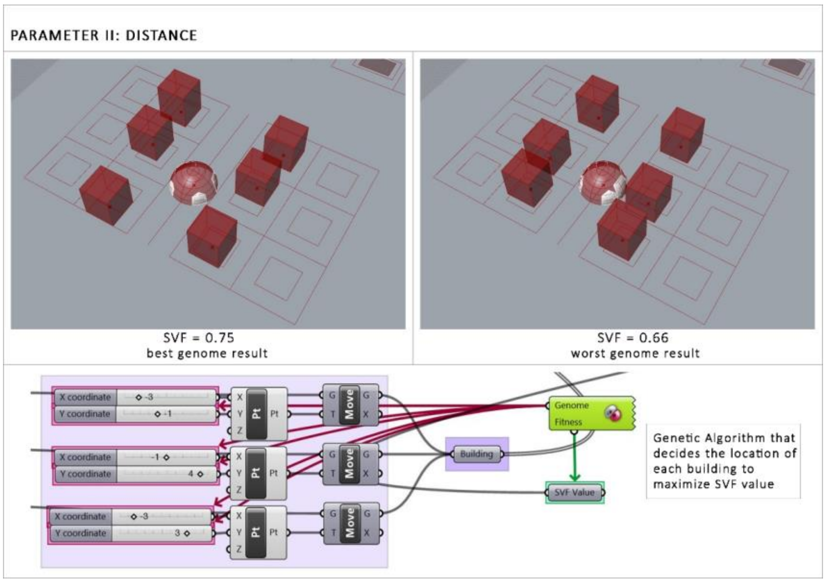

Figure 9. The SVF simulation based on the parameter, *distance*

As another key parameter for the simulation, the distance between the measurement point and the buildings is varied via the movements of the buildings on x and y coordinates. The alteration in each building location results in different SVF values, which is optimized by a series of iterations via Galapagos®. The simulation results show that even small differences in the distance of buildings to the test point cause significant changes in the SVF value. (see: Figure 9)

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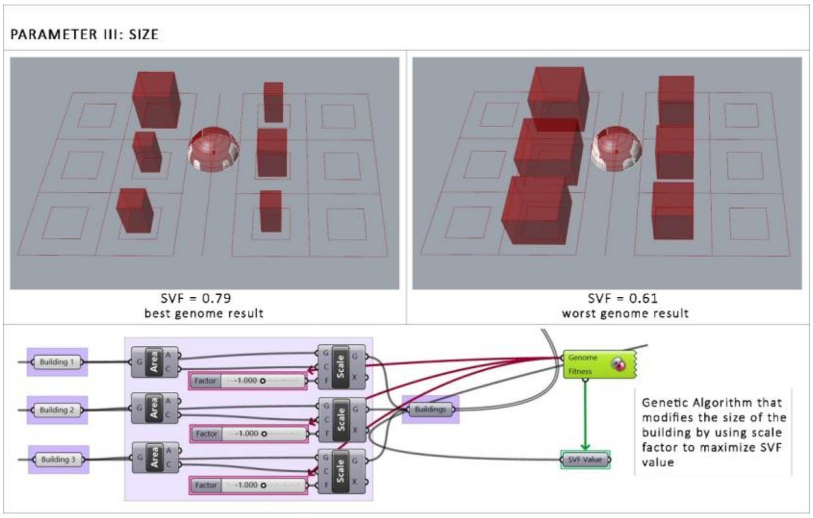

Figure 10. The SVF simulation based on the parameter, *building size*

Changes in the building coverage area conditioned by the parameter of size are also simulated for getting a range of SV results. Since the height of the buildings within a given area is fixated in a certain value, any increase in the coverage of the buildings directly affects their volume, which, in turn, would change the average SVF value in the given fabric. The simulation run by the scaling tool that controls the size of the building by a specific scale-factor constrained by coverage of the building. (see: Figure 10)

APPLICATION OF THE MODEL IN THE ACTUAL URBAN CONTEXT

For the demonstration of the proposed parametric model that aims for the integration of parametric modeling with design control in planning, this model is applied in an actual urban context. For this purpose, an urban transformation area has been selected to make a comparative analysis of the fabric before and after the redevelopment process. Then the alternative urban fabrics are to be generated with the same (re)development codes provided by the new plan of the site. In this way, the effects of urban geometry on the intensity of UHI would be tested against the actual and hypothetical morphologies.

Case Study Area

The selected site for the application of the model locates in one of the rapidly transforming districts in Ankara. By the mid-2000s, the land use pattern in the area got highly diverse in a fragmented manner. At that period, Ankara Metropolitan Municipality enacted a new master plan envisaging a planned renewal in the form of redevelopment within the area. From that year on, a significant spatial transformation has taken place in the area. (see: Figure 11)

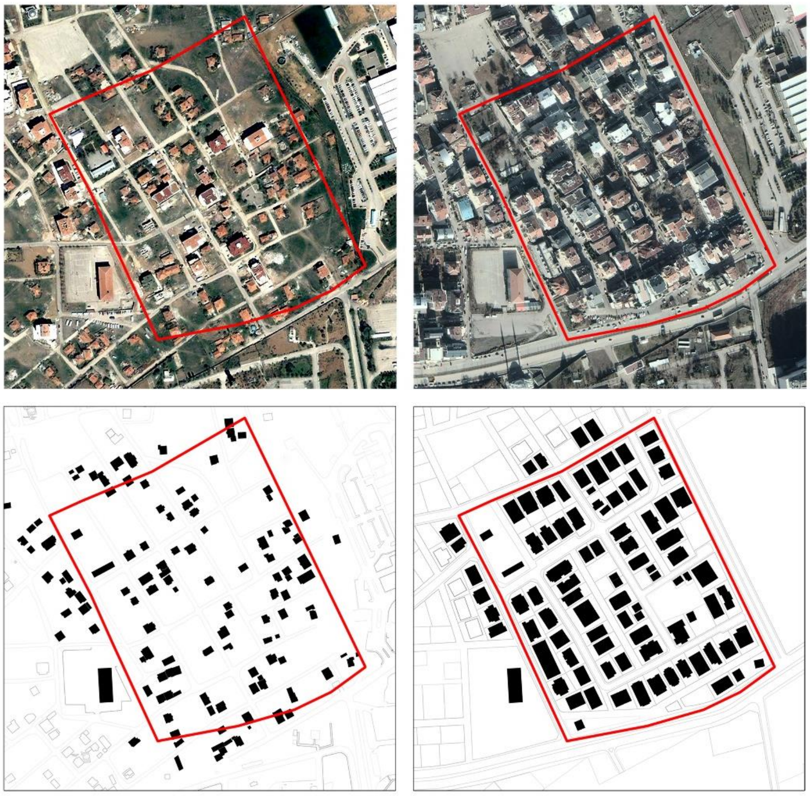

Figure 11. Satellite images of the case study area before and after the transformation (above), and figure-ground map of the area with that of the new fabric after the redevelopment (below) -dated in 2005 and 2018 respectively

The case study area represents a very common example of the typical spatial pattern redeveloped upon the existing pattern of the informal urban fabric. Keeping the layout of the old tissue intact, the plan transforms the old fabric by a radical increase in development rights through coverage, FAR and maximum building height. To have a consistent typological framework, the area of the model application has been specified as a representative section that was comprised of the homogenous collective fabric.

Case Study Analysis: *SVF Calculation*

In the first stage of the model application, the points of the SVF calculation are generated by the algorithm. To ensure a homogenous measuring point distribution, the distance between each measurement point is specified according to the length of the street. Then, the distance between the measurement point and buildings' centroids are defined for the selection of the buildings to be projected on the hypothetic hemisphere. (see: Figure 12)

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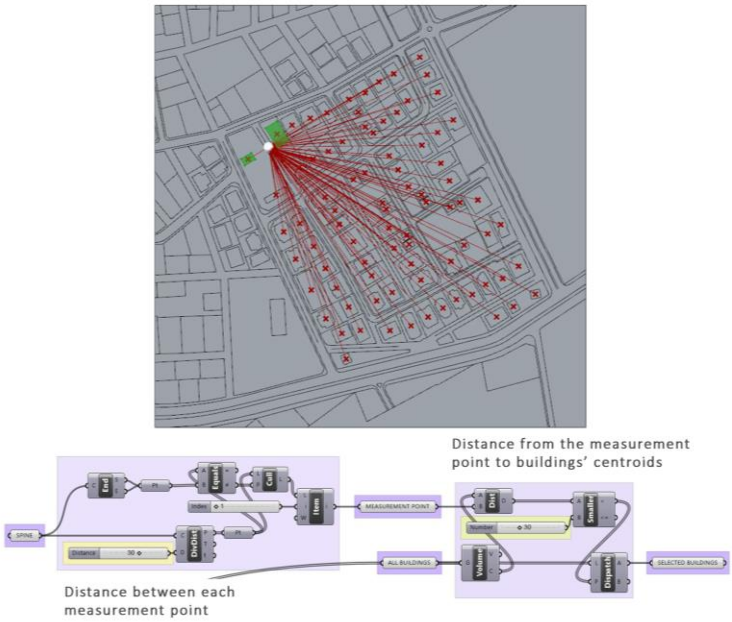


Figure 13. Application of the algorithmic set of analysis on the area

By multiplying this sub-algorithm, the selection of all buildings to be used for SVF calculation is provided. The positioning of the points and the hemispheres attached accordingly are aimed to configure a homogenous distribution throughout the area. (see: Figure 13)

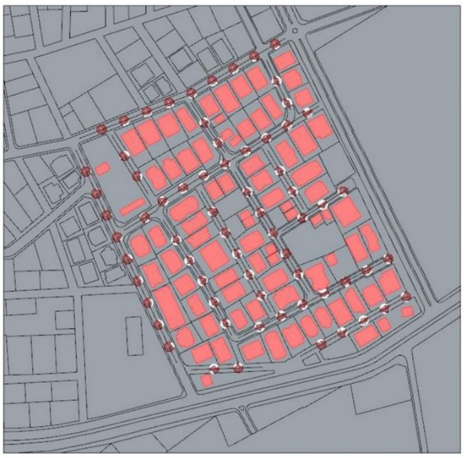


Figure 12. Algorithmic setting of the building selection for measurement points

In the SVF calculation, to compare the current state of the art in the study area with the condition before the transformation took place, the analysis has been applied to the two fabrics. With the analysis, it is found that the informal housing area with 1-2 storey buildings has a higher mean SVF value (0.91) than that of the planned fabric (0.75). Then the heat island intensity is calculated lower (2.48°C) in the loose fabric of the transformed area than that in the redeveloped new fabric (4.75°C). Higher building density introduced by the (re)development plan ends up with a serious increase in the magnitude of the UHI effect. This actually provides the initial demonstration of the actual effect of urban geometry on the condition of heat island intensity in the built fabrics.

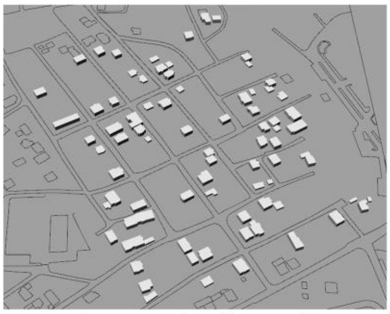
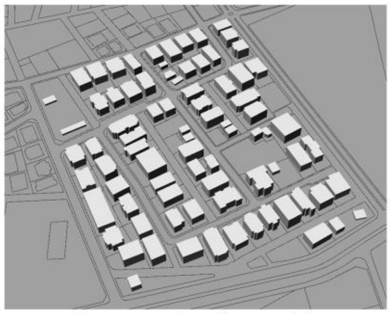
The urban fabric before the planned transformation	The urban fabric after the planned transformation
 Average number of storey: 1-2	 Average number of storey: 4-5
Floor Area Ratio: 0.3	Floor Area Ratio: 1.3
Average SVF value= 0.91	Average SVF value= 0.75
UHI intensity = 2.48°C	UHI intensity = 4.75°C

Figure 14. Comparison of measurement results (SVF and UHI intensity)

Testing the Hypothetical: Generation of Alternative Fabrics

In the second stage of the model application, alternative compositions are simulated on the same layout to reveal more about the actual effect of urban geometry on heat island intensity on a hypothetical basis. In this context, the floor area ratio (1.3), the actual development right which is specified by the development plan of the area is taken as the basic constraining factor of the form-variation in the simulation process. That ensures the total building volume remaining constant in each alternative layouts by the simulation. This would also enable the authors to compare the hypothetical models with the actual conditions before and after transformation. By the generative phase of the proposed model, the relative thermal performance of the formal variations within the same typology is aimed to discuss. That means, rather than addressing a specific typology as the so-called 'good urban form', the intrinsic effect of subtle morphological variations on the heat island intensity is aimed to reveal by the analysis of the simulated models. Then, the behaviors of the form-variations within the specified typologies, point-block, row housing, and perimeter block wıll be discussed, respectively, as follows.

In this framework, the first variation is searched on the point-block typology. Within the same building density, the change in building heights that inevitably manipulates the coverage of the buildings, seemingly, results in variations in the mean SVF values, and thus influences the magnitude of heat island intensity. Accordingly, for instance, the 3-storey point blocks with the average building footprint of 380 m^2 tend to generate 4.78°C heat island intensity through the whole fabric. When the building height increases from 9 meters to 15 meters, the UHI intensity has reached up to 4.87°C. Whereas, when the average building height

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increases to 30 meters, we can see a significant decrease in UHI intensity, as well. (see: Figure 15)

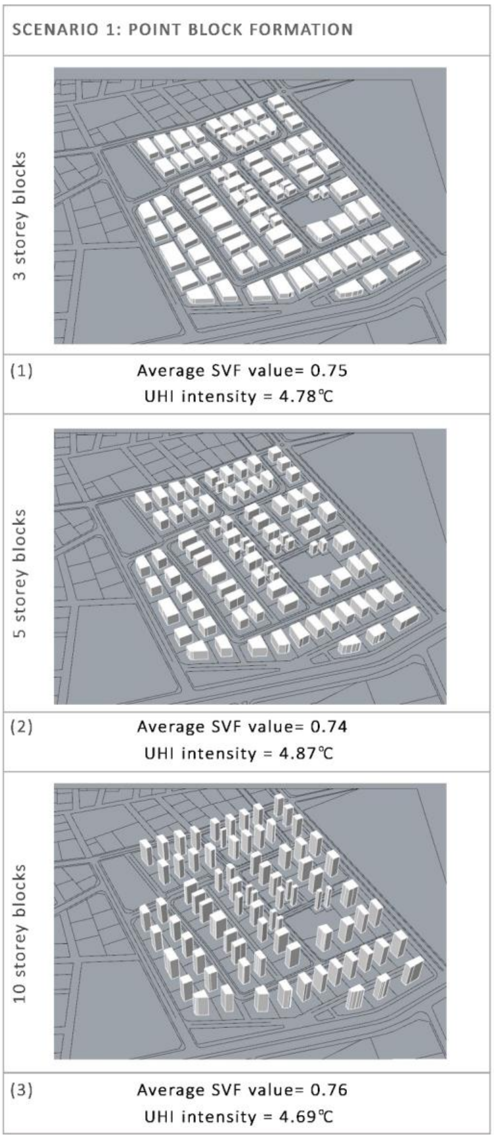

Figure 15. Compositional variations of the point-block typology, and the average SVF values of the fabrics generating a certain level of UHI intensity

Table 1. Parametric variations of the simulated morphologies and their relative performances on the UHI intensity (point-block typology)

Variations	FAR	Coverage	Building Height (m)	Average Footprint Area (m^2)	Average SVF Value	UHI Intensity
1	1.3	0.42	9	379	0.7553	4.78 °C
2	1.3	0.25	15	224	0.7492	4.87 °C
3	1.3	0.12	30	110	0.7617	4.69 °C

This implies the subtle relationship between the parameters of building height and ground coverage on UHI intensity. The simulation results show that increased building sizes on the vertical plane have a greater effect on the rise in the air temperature than the horizontal one. In other words, the UHI effect tends to increase as the building height increases. Though it seems that low-rise buildings have an advantage in heat loss up to a certain height, the increased level of porosity generated by the decreasing footprints (along with the increase in building heights within the same density) leads to a decrease in heat island intensity (see Table 1). Increased open spaces between buildings providing a high level of visibility of the sky help to reduce ambient air temperature by increasing the emittance of long-wave radiation. Then an increase in the building height can be interpreted as an influential factor, more open spaces between buildings (via increased setbacks) may gain priority for the mitigation of the heat island intensity.

In the second typological variation, three forms of row-housing fabric are simulated along with their corresponding average SVF values and UHI intensity. (see: Figure 16)

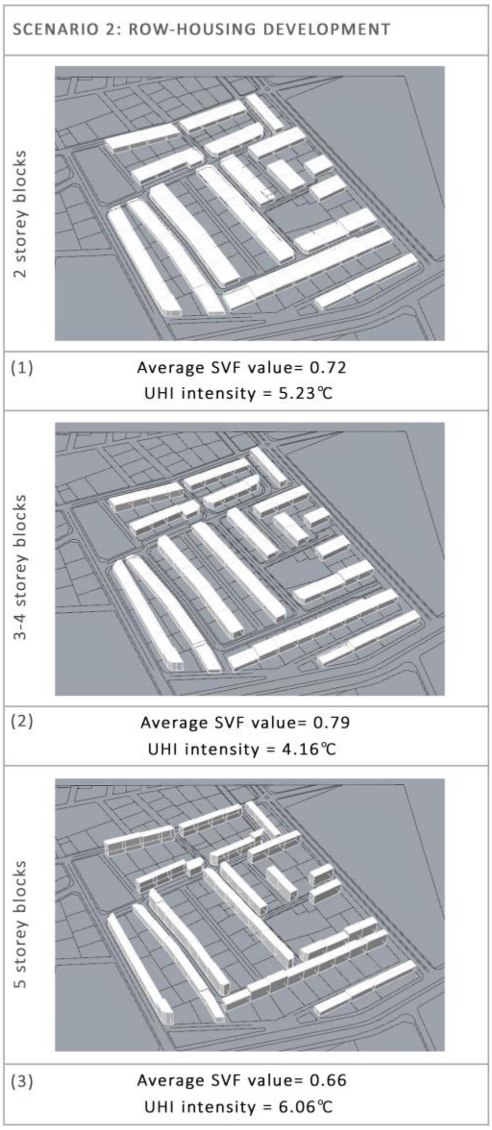

Figure 16. Compositional variations of the row housing typology, and the average SVF values of the fabrics generating a certain level of UHI intensity

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Table 2. Parametric variations of the simulated morphologies and their relative performances on the UHI intensity *(row-housing typology)*

Variations	FAR	Coverage	Building Height (m)	Average Footprint Area (m^2)	Average SVF Value	UHI Intensity
1	1.3	0.55	6	571	0.7229	5.23 °C
2	1.3	0.40	9-12	417	0.7997	4.16 °C
3	1.3	0.27	15	276	0.6629	6.06 °C

Simulation results show that an increase in the building height causes an increase in the air temperature. To illustrate, the highest UHI intensity (6.06°C) with the lowest mean SVF value (0.66) is calculated for the fabric comprised of the highest building configuration. (see: Table 2) Since the row-housing fabric consists of narrow canyons with the long facade facing streets, building height becomes one of the most important factors for this formation. However, the simulation results also show that the UHI effect can be reduced by modifying setbacks to increase the open spaces between buildings, and to promote heat loss within those spaces. For instance, when the front yard setbacks are set to by putting a larger distance between the facing facades of the row-houses, the heat island intensity would be manipulated to 4.16°C. This basically displays the critical relationship between the building height and the setbacks in mitigation of UHI intensity.

Finally, the third simulation enables to illustrate the relative performance of the different urban compositions within the typology of the perimeter block. In this framework, without changing the setback distances of the outer peripheries of the blocks, giving different values to coverage ends up with observed differences in height while still keeping FAR the same. This eventually generated different behaviors of the fabric with regards to the development of the UHI effect. (see: Figure 17)

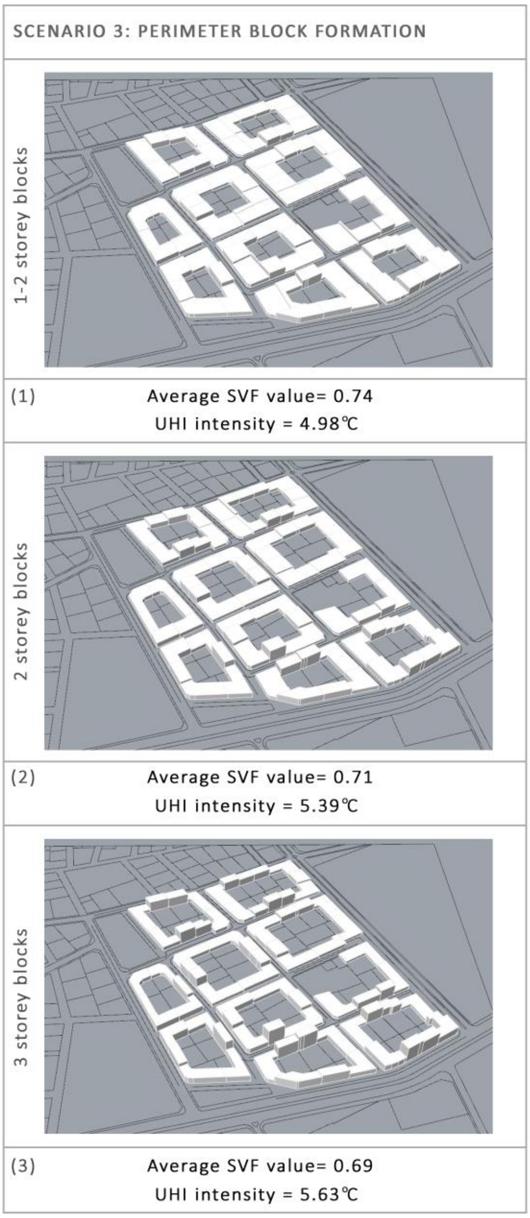

Figure 17. Compositional variations of the perimeter block typology, and the average SVF values of the fabrics generating a certain level of UHI intensity

Table 3. Parametric variations of the simulated morphologies and their relative performances on the UHI intensity *(perimeter block typology)*

Variations	FAR	Coverage	Building Height (m)	Average Footprint Area (m^2)	Average SVF Value	UHI Intensity
1	1.3	0.79	3-6	770	0.7408	4.98 °C
2	1.3	0.68	6	657	0.7116	5.39 °C
3	1.3	0.54	9	524	0.6941	5.63 °C

Parametric variations in the given typology shows that, the highest UHI intensity (5.63°C) with the lowest SVF value (0.6941) along the streets was observed in the third alternative which comprises of the highest average building height, while the fabric with the lowest average level of building height (1-2 storey)

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reveals the maximum performance on UHI effect. Nevertheless, it should also be noted that when the building height decreases, the building blocks tend to get more compact in form, thus, that might cause a rise in the ambient temperature in the inner courtyards of those areas.

CONCLUSION

This paper discusses the potentiality of parametric modeling in the analysis of the actual urban fabrics in terms of their intrinsic performance on urban heat island (UHI), as well as the possibility to integrate such an analytical framework into the generative capacity of parametric design. In this way, a combinatoric model would be suggested to test both the old and existing fabrics and the new ones simulated based on certain morphological parameters. Suggesting a performative tool for analysis and design, the model is believed to provide urban designers and planners with a proactive perspective on the issue of urban climate with a particular focus on UHI.

Even though evaluations on the form variations are limited to generalize the future design solutions, the research would contribute to the development of an operational basis of evidence-based urban design regarding urban heat island intensity as one of the crucial climatic problems for urban areas. Since it is based on the processes of 'learning by doing' by which multiple design solutions are simultaneously generated and tested against certain performance criteria (Sailer et al., 2008), the evidence-based design pursued by the computational methods in is potentially enhancing the already emerging performative design approach in urbanism. Such an approach would also ensure systemic research in the formulation of responsive strategies and tactics to achieve better design solutions (Karimi and Vaughan, 2014). In this regard, the proposed parametric model can be considered as a kind of 'decision support system' (DSS) that informs the designing of collective urban from the specific perspective of the UHI effect in urbanism.

It is important to note that since the research mainly aims to design an operational model for climate-responsive urban design, the model application does not tend to come up with a normative framework idealizing certain typologies as the optimum and universal design solution in the name of 'good urban form' with regards to the issue of UHI. Instead, the relative performances of different urban geometries within the same typology are aimed to discuss. This basically enabled us to focus the discussion on the parametric variation of urban form and its climatic performance within the specified constraints.

At this point, one should address the certain limitations of the model proposal of the research. First of all, the analytical setting of the model is constructed on the calculation of SVF to reveal the UHI effect in the fabric. The main intention behind such specification is to improve the already established perspective in the existing literature on the issue. Nevertheless, it should be noted that an improved version of analysis considering the internal spaces of urban blocks (in addition to those on the streets) would suggest a more comprehensive analytical framework for the mitigation of UHI in urban fabrics. Moreover, future studies taking the other factors such as orientation pattern, wind behavior of the context and vegetation in consideration of the analysis would potentially provide robust modeling techniques for better practice in climate-sensitive urban design and morphology.

REFERENCES

Bakarman, M. A., & Chang, J. D. (2015). The influence of height/width ratio on urban heat island in hot-arid climates. *Procedia Engineering*, *118*, 101-108.

Erell, E., Pearlmutter, D. & Williamson, T. (2011). *Urban microclimate: Designing the spaces between buildings.* Earthscan: London.

Hammerle, M., Gál, T. M., Unger, J. & Matzarakis, A. (2011). Introducing a script for calculating the sky view factor used for urban climate investigations. *Acta Climatologica et Chorologica*, *44*, 83-92.

Johnson, G. T. & Watson, I. D. (1984). The determination of view-factors in urban canyons. *Journal of Applied Meteorology and Climatology*, 23, 329-335.

Karimi, K. & Vaughan, L. (2014). An evidence-based approach to designing new cities: The English New Towns revisited, *Chapter 22 in explorations in urban design: An urban design research primer*, 261-276.

Lau, K. K. L., Thorsson, S., Lindberg, F. & Holmer, B. (2015). Street geometry design and its effect on mean radiant temperature: A parametric study based on numerical modelling. 9th International Conference on Urban Climate jointly with 12th Symposium on the Urban Environment, Toulouse.

Lopez, C. S. P., Sala, M., Tagliabue, L. C., Frontini, F. & Bouziri, S. (2016). Solar radiation and daylighting assessment using the Sky-View Factor (SVF) analysis as method to evaluate

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urban planning densification policies impacts. *Energy Procedia*, 91, 989-996.

Nunez, M. & Oke, T. R. (1977). The energy balance of an urban canyon. *Journal of Applied Meteorology*, 16, 11-19.

Oke, T. R. (1973). City size and the urban heat island. *Atmospheric Environment*, 7, 769-779.

Oke, T.R. (1981). Canyon geometry and the nocturnal urban heat island: Comparison of scale model and field observations. *Journal of Climatology*, 1, 237-254.

Oke, T. R. (1987). *Boundary layer climates*, 2nd edition. Routledge: London.

Oke, T. R. (1988). The urban energy balance. *Progress in Physical Geography*, 12, 471-508.

Oke, T. R., Johnson, G. T., Steyn, D. G. & Watson, I. D. (1991). Simulation of surface urban heat islands under ideal conditions at night: Diagnosis and causation. *Boundary Layer Meteorology*, 56, 339-358.

Sailer, K., Budgen, A., Losdale, N., Turner, A. & Penn, A. (2008). Evidence-based design: Theoretical and practical reflections of an emerging approach in office architecture. In: The 4th Design Research Society Conference, Sheffield, UK.

Santamouris, M., Asimakopoulos, D. N., Assimakopoulos, V. D., Chrisomallidou, N., Klitsikas, N., Mangold, D., et al. (2001). *Energy and climate in the urban built environment*. James & James: London.

Shahmohamadi, P., Che-Ani, A. I., Ramly, A., Maulud, K. N. A. & Mohd-Nor, M. F. I. (2010). Reducing urban heat island effects: A systematic review to achieve energy consumption balance. *International Journal of Physical Sciences*, 5, 626-636.

Svensson, M. (2004). Sky view factor analysis - implications for urban air temperature differences. *Meteorology Applications*, 11, 201–211.

Takkanon, P. (2016). A study of height to width ratios and urban heat island intensity of Bangkok. *4th International Conference on Countermeasures to Urban Heat Island, Singapore.*

U.S. Environmental Protection Agency (EPA). (2008). Urban heat island basics. In: Reducing urban heat islands: Compendium of strategies. Draft. https://www.epa.gov /heat-islands/heat-island-compendium.

Unger, J. (2009). Connection between urban heat island and sky view factor approximated by a software tool on a 3D urban database. *International Journal of Environment and Pollution*, 363, 1-3.

Wong N. H. & Chen, Y. (2009). *Tropical urban heat islands: Climate, buildings and greenery*. Taylor & Francis: New York.

Yılmaz, E. (2013). Ankara şehrinde ısı adası oluşumu. Unpublished doctoral dissertation, Graduate School of Social Sciences, Ankara University, Ankara.

Resume

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Research Article

An Interstitial Reading of Istanbul

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Abstract

As palimpsests of multiple layers of historic, geo-political, and socio-economic complexity, contemporary cities demand innovative methods of deciphering and unraveling their development. Typically referred to as reading the city, these methods of delayering and synthesizing urban complexity have, for long, pre-occupied urban planners and decisionmakers. Drawing from its interdisciplinary literature, this paper explores a comprehensive model of reading the city. Using a qualitative approach from both the archival and visual data sources, this study provides a better understanding of complex layers of urbanism that guide urban planners, policy makers and decisionmakers in developing more convenient solutions to urban problems. With multiple layers of its urbanism, Istanbul makes a suitable case study for this purpose. Identifying three types of developments (controlled or top-down, partially controlled and outlawed, bottom-up), different interactive networks provide sufficient grounds for reading Istanbul. Reading these intricate layers of Istanbul's 'closed' and 'open' city (Sennett, 2017) in close proximity to a main transportation artery (D 100 highway) against the broader backdrop of its long history intertwined with geographic and socioeconomic push and pull forces provides a comprehensive tool for adopting similar methods for reading other cities.

Keywords: Interstices, Istanbul, reading the city, urbanism, urban complexity

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INTRODUCTION

Reading the city allows planners, scholars and policymakers to "understand how [the city] works, why people behave the way they do, live where they live, choose what they choose" (Rybczynski, 2010), and captures the dynamics of understanding the seen and unseen attributes of the built environment. It also helps make long-term decisions for the future of cities (Mahyar Arefi, 2004; Clay, 1973). Based on this working definition, this paper offers a reading of Istanbul's intersecting and interstitial layers, the constitutive features of urban space, and the impacts of the urban development process.

Interstices comprise the layers of planned and unplanned, formal and informal, and fragmented and integrated urban tissues. Reading the city combines these layers as multiple narratives and stories providing a comprehensive understanding of their interrelationships. This reading unfolds contradictions, uneven infrastructure developments, defects and deficiencies, which in turn, stimulate spatial and social segregation, and how salient actors and stakeholders engage in the urban transformation process.

Defined as "the residual spatial products of contemporary urban planning," interstices lie between planned and unplanned parts of the city (Tonnelat, 2008), and "infrastructural forms" particularly suitable for informal activities and marginal groups (Wall, 2011). Interstitial spaces, then, emerge as outcomes of distinct development activities, and responses to global or local forces, processes, and factors, which holistically represent "continued reproduction of the capitalist economic systems" (Scott, 2008a). "Found between, under and over" (Wall, 2011), they compete on many levels, and give rise to developments and urban forms for different purposes.

These spaces vary widely in terms of social, cultural, and spatial qualities. While some interstitial layers characterize non-places (Webber, 1964) or placelessness (Relph, 1976), they represent continuous tensions and conflicts between "figured and disfigured spaces" (Boyer, 1995), and affect consequences of public or private planning decisions (i.e., infill or piecemeal developments), that might weaken potential connectivity among places (Boyer, 1995).

These types of developments could also stem from ill-conceived, defective or "splintered" (Graham & Marvin, 2001), and separate development patterns and policies, representing tensions between prosperity and poverty, exclusion and inclusion, legality and illegality or planned and unplanned, ultimately posing serious

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challenges to citizens and plans. Understanding the transformation process in today's fractured metropolises, therefore, requires reading these "interstices" that represent the city's historic, geographic, and socio-economic layers.

A comprehensive reading of the city may help better understand how interstitial spaces may become transitional instead of fragmented. Different disciplines propose different ways of reading the city where disguised interstices ultimately impact social and spatial layers and reveal lingering problems in polycentric cities. Providing a comprehensive model of reading the city demonstrates how adjacent urban layers or zones influence each other. This study seeks to apply this method of reading to Istanbul, posits how actors, different historical layers, and architectural traditions affect each other, and defines the elements of reading the city.

To provide a compelling reading of the city, this study seeks to offer three urban typologies. By reading the urban interstices, one bounces back and forth within and between cultural, political, historical and spatial associations; thereby hoping to get a glimpse of the larger picture. Reading Istanbul and an overview of the literature capture its dynamics through a typological classification approach.

Thus, looking at the interconnectedness of different parts of the city explains how interstitial spaces operate. Studies on recent developments of Istanbul (Dinçer, 2011; Enlil, 2011; Kurtuluş, 2005; Terzi & Kaya, 2011), do not, however, explain how different layers, approaches and ideas create a comprehensive picture of the city. Also, little is known about how interstices alter the citizens' daily routine activities. Therefore, such a reading of Istanbul displays the juxtaposition of intricate urban issues against one another.

This paper is organized into four parts. The next section explores the literature on reading the city, and discusses how different approaches and methods of reading the city vary with respect to its scope and scale; what they cover or miss out. The next section represents the research methodology, and then outlines the interstitial reading of Istanbul, representing three types of developments, and discusses how the proposed model helps understand and analyze Istanbul's development types. The last section discusses how three interstitial types of developments in Istanbul emerged and their policy implications.

WHY READ THE CITY?

An overview of the literature provides an interdisciplinary approach in reading the city, and shows how different disciplines address certain urban questions while exclude others. It ideally integrates the spatial, geographic, historic, morphological, and political layers of Istanbul. A comprehensive reading of the city, which according to (Rybczynski, 2010), helps planners and policymakers to "understand how [it] works," unravels how people behave the way they do and combines "market forces, user demands and design intentions," (ibid: xiv), that at times demonstrate conflicting interests and intentions.

Therefore, reading the tangible (i.e., telecommunications) and hidden (i.e., sewer lines) interstitial and overlapping layers of the urban environment examines the dynamics of the city that shape urban identity. This perspective exposes urban practitioners to look below the surface and analyze the contemporary built environment, and reveals how hidden networks and infrastructures may segregate urban spaces (Graham & Marvin, 2001). Others have also shown how unraveling problematic juxtapositions highlight spatial segregation as one way of reading the city (Banerjee & Verma, 2005).

Rapid changes in the late nineteenth century America made Ebenezer Howard conscious of thinking differently about building new towns, especially compared to those of the past (Rybczynski, 2010). As a "symbol of collective purposes" in Mumford's seminal work "Culture of Cities" (Lewis Mumford, 1938), urban settings develop agendas for future plans, and their purposeful transformation. Identifying the roots of the urban form (Kostof, 1991, 1992) urban scholars typically analyze cities historically, and through evolutionary planning perspectives (Hall, 2002). Mumford's Culture of Cities (1938) shows how cities undergo social transformation, focus on factors affecting urban growth, and the historic evolution of their streetscapes. Cities characterize the physical outcomes of collective purpose, symbols of human experience, by-products of time, and accumulation of social conditions (Lewis Mumford, 1938; L. Mumford, 1961).

Criticizing this approach, however, (Clay, 1973) considers these practices narrow, "tunnel-vision" methods of the past seen as business-as-usual, boilerplate, and stereotypical. An alternative approach incorporates nuances of urban space by coming "down below," enabling urban practitioners to read the city from the street level (de Certeau, 1984). Rather than a place with "freestanding objects," the city may be seen as ordinary, but with characteristic elements and places of daily lives (Clay, 1973).

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In addition to the tunnel vision critique, parochial views, remote, and stereotypical readings, which ignore people's everyday lives and urban encounters, practitioners recommend to "make use of seen and visible spaces" (de Certeau, 1984). Cullen (1961) also emphasizes the eye level street view of the city as a form of self-discovery and serial vision; where pedestrians walk through and experience the spaces of the city at a "uniform speed." This experiential recognizes three impacts: "exposure," "enclosure," and "consciousness," to grasp both entangled relationships and the spontaneity of urban life in city environments (ibid.).

Concentrating on human scale, revealing the daily routines, and spontaneous solutions in the public realm, "everyday urbanism" also looks at the city in a similar way (Chase, Crawford, & Kaliski, 1999)Alternatively, Graham and Marvin (2001) see infrastructure as an important element of the city and as a prime mover of complex interactions in the local and global networks that could help scholars and practitioners to deal with spatial and social segregation. Some of these interactions include the role of transportation in urban growth (Fogelson, 1967; Fulton, 1997), accessibility and modification of urban patterns (Banham, 1971; Blumenfeld, 1967), and the narrative disguised behind infrastructure (Banham, 1971). While Blumenfeld (1967) and Banham (1971) note that the transportation networks reflect the financial and geographical divide among different income groups, (Fulton, 1997) attributes the growth of Los Angeles to the interrelationships between the networks of capital, power, structure, and land.

Apart from these approaches, growth politics explores the historic transformation through stakeholders' (i.e., developers, policy makers, urban planners, and architects) involvement in the development process. (Fulton, 1997) stresses how the powers that be help developers in changing or circumventing zoning and construction ordinances. He also notes that transportation projects accelerate urban growth and change, and new developments intensify social segregation. The role of the marketplace in creating a rustic life style in Los Angeles' urban sprawl is a case in point. Investigating the role of land use and density in urban sprawl, Banerjee and Verma (2005) explore how spatial segregation has exacerbated social segregation in Los Angeles.

Actors and processes impact urban growth in Los Angeles, and separate activities, where polycentricity arises from creating distinct topographical characteristics. Polycentricity, in turn, modifies transportation policies, particularly given the natural resource limitations on one hand, and their impacts on urban form, architecture and culture on the other (Banham, 1971). Macro-level planning decisions of rapid growth in Los Angeles during the 1950s and 1960s expanded the transportation and transit system (Fogelson, 1967), and increased the economic benefits of population growth. Besides geographic segregation caused by transportation and market-based decisions, the ecological dimension of urban sprawl brought piped water from greater distances, and drained coastal wetlands (Barnett, 1995).

(Edward W Soja, 2000) and (Scott & Soja, 1996) multi-tiered spatial geography framework allows observers to explore conflicting and interdependent relationships of place against the broader political, natural, social and spatial backdrops of the metropolis. (Scott, 2008b) also focuses on the human-space interactions in carrying out various activities from production and transportation to consumption. He sees the land use pattern and urban form as the outcomes of intersecting layers, actions, and physical and non-physical activities. He suggests “focusing on [a] peculiar form of spatial integration instead of aliquot parts, to discover the urban characteristic” (ibid.: 756).

Politicians and academics alike, recognize interpretation of the multidimensional nature of the urban environment as a crucial planning tool. The call for a holistic understanding of the city reflects the increasing complexity of urban problems seeking more effective solutions. The nexus between space and society or the social production of space has always engaged scholars and professionals (Lefebvre, 1991; Scott & Soja, 1996) in exploring people’s roles in creating robust and lively spaces (Alexander, 1977). Barthes (Hassenpflug, Giersig, & Stratmann, 2011) sees the city as “a place of communication,” whereas for Lefebvre (1991), the city is an outcome of overlapping ideologies. However, depending on collective cultural values and individual idiosyncrasies (Mahyar Arefi, 2013; Lynch, 1960; Rapoport, 1982), the perception of the urban environment varies widely.

Reading the city means different things to different people. Historians often seek to evaluate the roots of cities and urbanization over time. Urban geographers tend to explore the role of location on urban development while urban sociologists focus on human interactions in urban space. While those differences certainly define disciplinary boundaries, a comprehensive reading of the city, mainly requires delayering or decoupling such boundaries first and then integrating them. The recent surge in different types of urbanisms reflects such disciplinary loyalties on one hand, and the need for a common understanding on the other. The next section addresses research

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methodology and operationalizing the interstitial reading of Istanbul.

AN INTERSTITIAL READING OF ISTANBUL

Despite growing research on understanding the urban process following ground- breaking studies on reading Los Angeles, planning approaches to urban problems are still fairly generic, fragmented, and monolithic in scope. An inter-related and interstitial focus on urban issues requires not only a more engaged and multidimensional approach, but also a comprehensive and holistic one. Although the extant literature provides insights into large or small scaled market-led and consumerist neoliberal developments, it adds little to the inter-relatedness and relevance of urban tissues.

Long debates show how the dominance of the private sector in the production of space triggers micro and macro scale segregation and socio-spatial disparities. The relational ties between "urban splintering and infrastructural unbundling" and how they feed into each other, exemplify the uneven infrastructural development process and solutions such as "toll highways, enclosed quasi-private streets, malls, and skywalks," deepening segregation (Graham & Marvin, 2001). Consistent with Graham and Marvin (2001) work, research on gecekondus in Istanbul shows insufficient infrastructural provisions that deepen the exclusion and weaken the integration of the urban poor into urban life (Baharoglu & Leitmann, 1998; Pınarcıoğlu & Işık, 2007).

Enlil (2011) notes how new transportation investments and uneven infrastructure provisions relocate upper-middle income groups to peripheral gated communities. Her studies followed affluent citizens to show evidence of dramatic redistribution of socio-economic classes in the city. Capturing the interdependence of "site and function" and their procedural impact on urban form, Blumenfeld (1967) underlined the interactions of the physical and socio-economic urban conditions. The process of building "disconnected hypermodern buildings and shopping malls" or post-urbanism (Kelbaugh, 2001) and "proto-postmodern urbanism" (Dear & Flusty, 1998) exemplify these trends. Subject to agglomeration economies, (Sassen, 1991), however, considers "spatially dispersed yet globally integrated organization of economic activity," part of the globalization process. Postmodern urbanism defines how "human and non-human ecologies," transform citizens into consumers, traditional neighborhoods into monitored and gated communities, moving them into privately owned themed, controlled malls and segregating marginal groups (Dear & Flusty, 1998)

Different disciplines describe urban settings with their unique perspectives. Using a holistic approach, this study views the city as a phenomenon that showcases the outcomes of human activity, where stakeholders set in motion conflicting ideas and actions. To interpret and examine these activities, planners experience "wicked" problems (Rittel & Webber, 1973) that do not necessarily lend themselves to straightforward planning solutions. These problems interfere with a holistic reading of the city, because the recent "phase of capitalist development" (Scott, 2008b) sees the city as a combination of fractured pockets instead of a "total entity" (Boyer, 1995). These landscapes represent social and physical fragments and create the so-called "interstitial" opportunities. Reading the city exposes the interstitial and overlapping layers as well as the hidden features by looking at the interconnected dynamics that shape the urban identity. The infrastructure, i.e., sewer lines, telecommunications, subway lines and also superstructures such as residential and commercial land uses include various layers of these readings.

The historic evolution of the urban form (Kostof, 1991, 1992) within the socio-economic, geographic and global dimensions (Sassen, 2007; Scott & Soja, 1996) unravels a multi-scaled approach including observing people's daily lives (de Certeau, 1984), their spontaneous solutions to urban problems (Chase, Crawford, & Kaliski, 1999), and nuances (Clay, 1973), where 'going up' to remote urban spaces of sprawl, new developments, contradicting patterns, effects of globalization and neoliberalism (Brenner & Theodore, 2012), social segregation (Banerjee & Verma, 2005; Scott, 2008a), and infrastructural networks and fragmented urban pockets (Graham & Marvin, 2001), all underline profound changes in Istanbul. With its dynamic and robust spatial structure and rich historic legacies and remnants of three distinct civilizations, Istanbul serves as an appropriate case study. Its physical, social, economic, political, and bureaucratic layers provide strong dynamic, multi-layers of analysis of reading the city, which contribute to better and more relevant policies.

Istanbul constitutes a leading city in Turkey both demographically and economically with unique geographical features, unprecedented historical background and a modern infrastructure. The city connects Europe and Asia, and is also the capital of the Roman, Byzantium and Ottoman empires, shaped by varied planning approaches (Bilsel, 2011; Çelik, 1993; Dokmeci & Ciraci, 1999; Kuban, 1996; Ayataç, 2007). These rich historical and architectural layers (Çelik, 1993; Kuban, 1996), in turn, combine local and global flows of human interaction and capital accumulation (Keyder, 2005; Kurtuluş, 2005). The liberal policies

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of the 1950s', however, reversed the demographic and economic recession that occurred between 1923 and 1930. The rural-urban migration, modernization, and increased regional accessibility following the construction of two bridges (built in 1973 and 1988) over the Bosphorus Strait, bear similarities between Istanbul and Los Angeles, where land speculation plays a major role in their expansion. With these transformations, Istanbul experienced a phenomenal population growth from 2.78 million in 1970 to 13.96 million in 2014 (World Urbanization Prospects, 2015). Istanbul's globalization process, adoption of liberalization policies (Keyder, 2005), integration into the free market, and the ongoing European Union accession process (Uzun, 2010) since the 1980s, have also altered state-led planning mechanisms, aiming to promote the private sector and giving impetus to market-oriented developments. Since early 2000s, neoliberal policies have changed the pace of Istanbul's development. Besides new malls, and mixed-used towers, the privatization of public land and the urban transformation on pre-gecekondu settlements have accelerated. Furthermore, by 2011 the process surged with the central government's decision on urban transformation and the city has experienced a state-led transformation process with the goal of marketing Istanbul as a global city (Karaman, 2013).

Table 1 displays the steps taken to synthesize a new framework for reading the city of Istanbul. By looking at archival resources and the visual data, a two-step mixed approach minimizes the limitations and weaknesses of a singular method, and provides a more coherent and holistic view of the research apparatus. The proposed method gleans from different urban layers (natural and man-made), conduct an evaluative comparison, and analyze the interaction between stakeholders, inhabitants, policymakers and market forces in creating new urban tissues.

Table 1. A 2-step process for reading the city

(1)	archival (literature review:) - secondary data
•	1: holistic readings on approaches, elements, limitations
•	2: readings on actors, processes, outcomes in Istanbul
(2)	empirical: comprehensive, qualitative, inductive - primary data
•	combine and minimize limitations of existing models
•	develop a new framework in analyzing of Istanbul (control mechanisms / stakeholders)

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The research method contains an overview of the literature, particularly on ways of obtaining secondary data on meanings, approaches and components of reading the city in general (Table 2); and focusing on Istanbul's historic evolution along with new technologies that help show the emerging phenomena, such as urban sprawl, gentrification, gated communities, informal settlements, social and physical fragmentations. Against the broader backdrop of both the natural and manmade elements, this approach examines various means of development control (i.e., government, market and citizens as stakeholders) as a basis for conceptualizing the urban typologies in Istanbul.

Table 2. The macro- and micro-scale attributes of the case studies

Site	**Type**	**Land use**	**Urban Pattern**	**Outcome**	**Pre-Socio-Economic Class**
Macro scale					
Tarlabaşı (Historic)	Renewal	Residential vs. commercial and touristic	Planned	Dislocation Gentrification Economic upgrading	Migrants and immigrants
Sulukule (Squatter)	Renewal	Low income Residential vs. high income residential	Organic vs. Planned	Dislocation Gentrification	Roma Low income
Fikirtepe (Squatter)	Renewal	Low income Residential vs. middle and high income residential	Organic vs. Planned	Dislocation Gentrification	Migrants Middle and low income
Micro scale					
Ali Sami Yen Stadium	Redevelopment	Public facility vs. mixed use complex for high income group	Designed	Privatization of public domain	All citizens
Haydarpasa Train Station	Adaptive reuse	Public facility vs. tourism/hotel	Designed	Privatization of public domain	All citizens
Cercil D'Orient	Redevelopment	Registered historic building vs. shopping mall	Designed	Loss of historic identity	All citizens

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Examining Istanbul brings to bear infill planned developments surrounded by unplanned, left over and/or dead spaces, which not only keep the unwanted out (Öncü & Weyland, 1997), but also stir up "interstices" between "figured and disfigured spaces" (Boyer, 1995). This "coexistence as a problematic of non-integration" (Auge (1995) from Arefi, 1999) practically relates governance and market orientation (Erkip, 2000). Collaborations and interrelationships between politics and development, global and neoliberal policies and processes generate new land use configurations (Fulton, 1997). Global capital flows, the rise of the new economic class and new consumption habits, profit-oriented urban governance, market-led and piecemeal reproduction of space as reasons of spatial fragmentation and social segregation in Istanbul "[fill] up every piece of vacant land left between buildings" (Blumenfeld, 1967), inducing privatization of the public realm, reluctant relocation of aged and middle income families, and the imperious displacement of low-income groups, (prone to earthquake vulnerability) (Erkip, 2000; Keyder, 2005; Kurtuluş, 2005). This process is conducive to the introversion of low-income groups (Pınarcıoğlu & Işık, 2007), and "voluntary ghettoization and self-segregation" (McLaughlin & Muncie, 1999) of prosperous (upper and middle) citizens isolating themselves in gentrified neighborhoods, and within the walls of rapidly increasing malls, gated communities, gated apartment complexes, and mixed-use towers (Akgün & Baycan, 2011; Erkip, 2000; Keyder, 2005; Kurtuluş, 2005).

The urban transformation of Istanbul encompasses wiping out the urban memory (Emek Theatre, Ataturk Cultural Center, Inci Patisserie etc.), and loss of identity in historic districts (Aksoy, 2012; Aksoy & Robins, 1996), while also deepening the rich-poor gap (Pınarcıoğlu & Işık, 2007). The proposed framework in aims to decipher vague urban layers with their interstitial issues by utilizing Edward W Soja (2000)'s geohistorical approach requiring an examination of culture, nature and society, Cullen (1961)'s, de Certeau's (1984), and Chase et. al.'s (1999)everyday life, Blumenfeld (1967)'s progressive, (Banham, 1971)'s architectural history oriented, Barnett (1995)'s socio-spatial, Fulton's (Fulton, 1997) planning policy, and Banerjee and Verma (2005)'s quantitative approach. This comprehensive model minimizes potential limitations and provides a better understanding of the urban environment.

To engage in a more holistic reading, examining these interstitial or in-between layers requires a mixed-methods approach. Qualitative methods include ethnographic, participant observational interpretations, whereas the quantitative methods emphasize remote sensing and demographic analytical methods of reading; both are used to study Istanbul so that theory may be applied to discover the varied approaches the city presents.

What follows operationalizes the interstitial reading of Istanbul and deciphers its development typologies by using visual data including maps, satellite images and aerial photos, research and technical reports from the Istanbul Chamber of Planning, urban policy reports, development plans, urban transformation projects and parcel-based plan decisions from Istanbul metro municipality.

DETECTING THREE READINGS

The selected interstices occur between "fragmented" parcels and "homogenized" landscapes (Lefebvre, 2009), where "overlays and articulations [are] becoming thicker and denser" (E W Soja, 2010). Bearing little identical visual or physical attributes, these transitional spaces connect different socio-economic groups to the rest of the city more so than to each other. These transitional spaces comprise three types. Type A includes controlled, Type B partially controlled, and Type C uncontrolled or ignored developments. The categories emerge from the historical, political and social development accounts of reading Istanbul. 'Remote sensing' of urban sprawl and development phases from 1946, 1966, 1970, 1982, satellite images of the 2000s, and 'coming down below' with serial visions', observing and photographing the city in a uniformed speed provided the basis for this reading. The political, social and economic plans and policies from Istanbul Metropolitan Municipality and Central Government provided additional layers of analyses. An overview of the literature on Istanbul added the final layer of information. Site visits and observations conducted between 2014 and 2016 in Istanbul adjusted possible pitfalls and helped obtains a more realistic reading of the emergent typologies. This analysis identifies a number of mechanisms for understanding Type A, the controlled (e.g., market led, urban transformation projects), Type B, the partially-controlled (e.g., the Metrobus), and Type C, the ignored, or uncontrolled (e.g., the illegal / informal settlements) types of urban development patterns (Figure 1).

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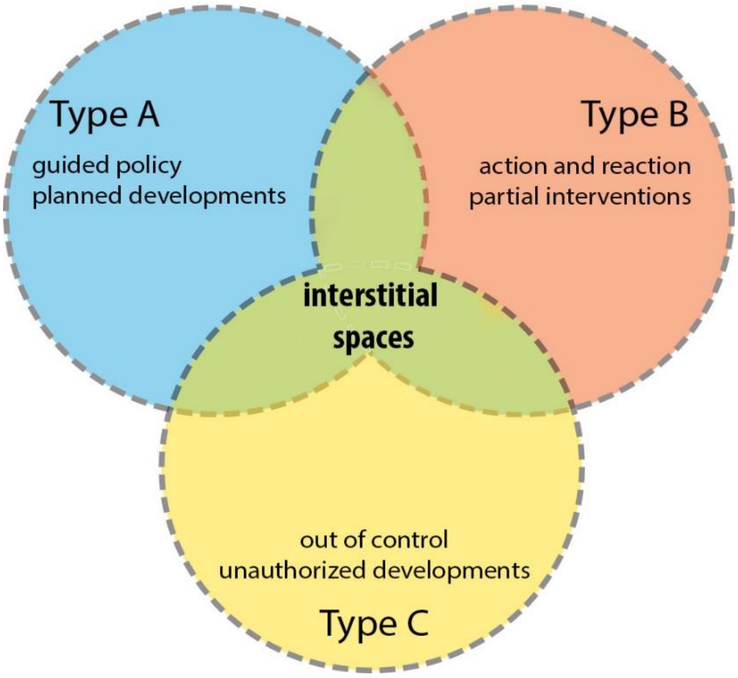

Figure 1. Conceptual framework summarizing interstitial spaces in three types

The juxtaposition or co-existence of these development typologies or patterns form complex landscapes and spatial interstices comprise historical and contemporary layers, highlighting the contradictions between the stakeholders and actors, and the public and private interests. As opposed to stasis, the typologies introduce vivid and dynamic aspects of Istanbul including gated communities with parcel-based development plans under Type A while a gated community illegally developed on forest land (2B) falls under Type C. Gecekondus while legalized since 1980s, go under Type C too. The main classification criteria involve the stakeholders' aims including the public officials, the private sector, and possible partnerships. They also materialize the interesting but fairly rare juxtaposition of closed and open city (Sennett, 2017). What is rare about these interstices is as Sennett argues, closed cities envisage top-down command and control and predictable planning while open cities constitute unpredictable settings that do not necessarily comply with the regulatory mechanisms and norms of the formal city. These potential juxtapositions, according to Sennett, creates potentially interesting opportunities for mutual dialogs between the open and the closed city. Finally, while historic settlements and buildings that constitute and define unique urban identity in Istanbul were excluded, more recent interventions such as urban retrofits, small or large-scale redevelopment projects on historic sites were included.

Type A Controlled Development:
Type A features the politics of growth where the role of marketplace, and collaboration between urban authorities and developers are prominent (Fulton, 1997) and designates small or large scale planned interventions at the metropolitan scale, i.e., industrial relocations, infrastructural investments, brownfields, and historic neighborhood redevelopment projects. 'Planned' developments refer to top-down developments (i.e. Istanbul Third Bridge and New Airport) or market-led megaprojects, including shopping malls, gated communities, mixed-use towers that target consumption-dependent middle to upper income social groups with high economic impact (Zukin, 1995, 2010) Financially viable market-oriented flagship projects and infills, mixed-use towers and shopping malls in the city center operate independently from the surrounding areas, and create infrastructural shortcomings, traffic jams, and noise. This type of urban redevelopment mainly includes industrial decentralization, infrastructural investments preceding peripheral urban growth, and infills. Examples include gated towers in the city center, state-led public housing, urban renewal and redevelopment projects on publicly-owned land, squatters and historic neighborhoods, high-end residential complexes and malls. Characterized by top-down decision-making process, in most cases, little consideration is given to international historical preservation (UNESCO), and most ensue irreversible outcomes disconnected from the rest of the city. Type A developments eliminate such barriers and clear the way for urban growth where active urban authority does not yield to opposition.

While these developments pursue economic growth, improve mobility and accessibility, and create a high impact/high profile for iconic projects, they may also cause loss of historic identity, environmental degradation, or a loss of natural resources, and involve unintended social inequality and adverse environmental consequences by inadvertently displacing low-income people, or a combination of both. Type A developments like Fener-Balat, Zeyrek, Süleymaniye, Sulukule and Tarlabaδı redevelopment projects result in gentrification, socio-spatial segregation, displacing original inhabitants and loss of cultural identity because of the urban renewal and transformation projects in historic neighborhoods.

Type A differentiates from Type B and Type C in terms of purpose, function, methods in use and collaboration among stakeholders, and features top-down command and control planning. They also disregard opposing opinions and do not seek to promote public participation or consensus building among stakeholders—be it

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NGOs (e.g. UCTEA), social activists, or government agencies. The central government's reconstructing of the Taksim Military Barracks as a shopping mall in Taksim Gezi Park that faced mass public opposition and protests (Gezi Park Protests have been held in May 2013) exemplifies this type of development.

Other state-led, financed infrastructural initiatives include the Third Bosphorus Bridge, Canal Istanbul, Galata Port, Istanbul New Airport, Marmaray (the subway crossing at the Bosphorus, Istanbul's strait), and the Euroasia Tunnel (the road crossing at the Bosphorus) (Akin, 1998). Planning these projects requires thorough cost-benefit analysis and environmental impact assessments. Bringing piped drinking water from greater distances, which cause the loss of wildlife, flora and fauna, exerting pressure on water basins and forests, in Istanbul, exemplify some of the negative ecological outcomes of these infrastructural megaprojects, which have increased vulnerability and the likelihood of flooding, and decreased resilience and protection against natural hazards, such as earthquakes.

Type B Partially-Controlled Developments:
Initiated by actions and reactions, type B developments characterize partially-controlled projects as solutions or reactions to unintended consequences and outcomes of planned (or unplanned) developments. Outcomes of large-scale plans result from long-term planning decisions, infill projects, and their short-term consequences, which in turn might trigger social engineering for unanticipated urban growth problems such as squatter developments. Unexpected infrastructure pressure demands from planned or unplanned developments (i.e., parking lots, upgrading the infrastructure or sewage, or public transportation systems) also typically emerge.

Reaction to the rural-urban migration and unauthorized developments, and setting up the dolmus (minibus) system as a self-induced transportation solution in the 1980s is a case in point. While the system mainly served squatter settlements, it became a major public transportation option particularly in Istanbul (Tekeli, Gülöksüz, & Okyay, 1976)., an intercontinental rapid transit system of Metrobus (i.e., bus priority lanes), is another instance of undetermined infrastructural demands stimulated by increased residential densities and uneven land use diffusion (Alpkokin & Ergun, 2012). It also aims to solve an interstitial problem created by previous plans which unintentionally caused urban sprawl.

Spontaneous gentrification of inner city neighborhoods, such as Cihangir, which depend on the agglomeration of the film and arts sector and income groups (college students, creative workers, artists etc.), also serves as another example of partially-controlled developments. Type B developments feature action-reaction chains and find ways of urban authority mediation.

Type C Uncontrolled / Ignored Developments:
Type C conceptualizes the temporality-permanence, integration-disintegration, and necessity-opportunity dualisms and includes unauthorized squatter and informal settlements (gecekondus) as yet another pent-up or untapped demand that meets the needs of rural-urban migrants. The user-centered illegal growth of squatter settlements, were flexible and adaptive, and most commonly bottom-up driven. Although squatter settlements in Istanbul have mostly legalized since 1980s, they fit snugly into Type C with a bottom-up development process.

This type of development mostly subsumes opportunities, such as -informally developed- gated luxurious communities and light industries on naturally vulnerable and topographically-isolated lands. Although the emergence of squatter settlements relies on the basic need for shelter—a temporal solution to housing problems for low-income migrants becomes gradually permanent; a part of the urban fabric turned into profitable investments for gecekondu owners (building multi-storey buildings, inhabiting in one and renting others). Unauthorized developments result in part from upgrading or expanding the urban infrastructure, i.e., the transportation network which enhances mobility and access, or according to Banham (1971) allows/increases "freedom of movement," thereby attracting rural-urban migrants who previously concentrated along freeways and manufacturing plants.

Squatter settlements are viewed as temporary solutions to long-standing housing problems in developing countries. These bottom-up, grassroots spontaneous attempts to home ownership and tenure constitute deep-seated problems. While informal settlements reflect the illegal occupation of land, they typically point to larger structural macroeconomic problems, ranging from uneven development and squatting in vulnerable and hazardous areas, to social inequality. Even though many of these settlements, over time, attain *de facto* status, or legalize and establish their identity, they use local knowledge innovatively to solve endemic problems. However, these squatters remain socially and physically detached and isolated from the mainstream society (Akbulut & Başlik, 2011; Mahyar Arefi, 2011; Pınarcıoğlu & Işık, 2007). The challenge in Type C is to make urban authorities active (rather than inactive) so they differentiate between necessity versus opportunity, and transform temporary place-making to

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permanent settlements. Table 3 synthesizes the three types of spaces comparatively to better illustrate each type, their characteristics, and outcomes.

Table 3. Distinctive features of three types of case studies

Control mechanisms, development characteristics, and outcomes in Istanbul		
Type A: Command & Control	Type B: Partially-Controlled	Type C: Uncontrolled or Outlawed
Urban re/development guided by policymakers Market-led Organized industrial areas in urban peripheries Gated communities in urban edge and gated blocks in city center Privatization of public domain Adaptive reuse, redevelopment of historical buildings	**Action and reaction Cycle** Action. Relocation of low and middle income population as a result of market-led Inner-city transformation and new settlements on urban periphery. Reaction. Intercontinental public transportation solutions as an indicator of polycentric development of Istanbul: Metrobus (bus priority lanes)	**Unauthorized growth** privately designed (unauthorized luxury gated communities) and/or unplanned (ad hoc) (squatter settlements); opportunity-based developments (Gecekondus) Ignored housing or industrial developments in urban periphery as a result of opportunity
Actors		
Central government/ state, market	Local government, planning authorities	Citizens, local authorities, market
Typologies		
Infill design Local developments ignoring		Parcel based or infill: gated communities, Undesigned/unplanned: gecekondu settlements,

environmental, sustainability; Profit making, triggering urban growth and population increase		topographically integrated organic growth; Starts as temporal housing for low income migrants.
Approach/Process		
Top-down	Combination	Bottom-up
Purpose		
Profit making	Problem solving / demand cover	Make use of opportunity
Outcomes		
Positive environmental impact of industrial decentralization in city center Economic gain for developers Spatial and social segregation Loss of public domain. Negative environmental impact of mass development. Private car dependent travels. Loss of urban identity	Increased public transportation for low and middle income groups, Positive impact on commutes Gentrification of inner city neighborhoods	Political gain for government, economic gain (opportunities) for people illegally settled on public/private property inadequate infrastructure Vulnerable Sites Loss of natural resources

Several case studies throughout Istanbul serve to provide a better understanding of the proposed typologies. Considering the role of transportation and accessibility in urban growth (Fogelson, 1967; Fulton, 1997) and their modifying patterns (Banham, 1971; Blumenfeld, 1967)different types of developments along and around D-100 highway, constituted the case study selection criteria. As a long-lasting transportation corridor, the D100 highway strikingly reflects the financial and spatial divide among different income groups (Banham, 1971; Blumenfeld, 1967), and

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connects urban peripheries to the city center, thereby manifesting urban transformation (from agricultural land to squatter, gated community, light industry, retail) during the 20th and 21st centuries. Figure 2 displays the locations of the examined interstitial cases in Istanbul. Points 1-6 illustrate the aerial photographs of the selected interstices, and their proximate streetscapes in Istanbul (Figure 3).

Figure 2. Case study locations along the D-100 transportation artery

Figure 3. Case study locations along the D-100 transportation artery

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Table 4. Examples of Interstitial Spaces in Istanbul

Figure	Location	Vicinity/Land use	Method
1	Gazi Osman Pasa	Mixed used	Type A + Type B + Type C
2	Levent	Mainly Residential	Type A + Type C
3	Sisli	Mainly Residential	Type A + Type C
4	Ferikoy	Mixed used (in CBD)	Type A + Type B + Type C
5	Sulukule	Mixed used (in CBD)	Type A + Type B + Type C
6	Beylukduzu	Mainly Residential	Type A + Type C

Table 4 executes critical examples of privatization, urban renewal and redevelopment in Istanbul. In order to see the urban interstices, a profound look is taken of the city, including informal developments, infill, renewal/redevelopment projects, infrastructural forms, and in what circumstances they bind together in space.

Figure 3 shows a number of developments in different Istanbul neighborhoods including the Metrobus station, a mixed-used tower with office, retail and residential uses surrounded by low and middle income neighborhoods in Sisli-Mecidiyekoy. An infill luxury gated community project in a low-income development Ferikoy comes next, followed by a gated community development in Sulukule showcasing the public (TOKI) and private consortium /partnership in state-led urban transformation project. The common ground in all those cases is creating new interfaces, physical and social borders in the city space.

These interstitial layers mostly act as transitional open spaces. For example, an interstitial solution, or a built infrastructural form, between Talatpasa Avenue in Levent had high rise residential and office towers on Büyükdere Avenue (Type A) when designed by Kemal Ahmet Aru in the 1950s. But the Gültepe neighborhood (gecekondu/squatter development) (Type C) in its close proximity started to develop since the 1970s. Due to globalization and the liberalization of the Turkish government and the Istanbul Metropolitan Municipality, the area experienced rapid transformation. Levent developed as the first suburban social housing project by the Turkish government during the 1950s. Light industries followed by a gecekondu (Gultepe) developed on the west side of Levent. The construction of Bosphrous bridge in the 1970s triggered rural-urban migration, and squatter settlements as well. Consumerist liberal economic policies and building the Istanbul metro Levent station in the 2000s led to building several shopping malls on Buyukdere Avenue (Levent metro station 2000, Metrocity Mall 2003, Kanyon Mall 2006, Sapphire Mall 2010). Furthermore, Levent's public housing status for the middle-income people experienced spontaneous gentrification, and the upper income class replaced the original residents.

Designed as a transportation solution, Sisli Metrobüs Station (2007), is another mixed-use example of interstitial space between the Trump Tower-Type A (2010), the metrobus-Type B, and Kustepe neighborhood (pre-gecekondu development)-Type C. The Trump tower was built on a formerly recreational and educational land with an infill redevelopment plan. The direct pedestrian subway connecting the Metrobus Station to Trump Tower came on board in 2014.

New urban peripheries also show that the piecemeal development of a gated community (Type A), and a gecekondu (Type C) face each other in Ferikoy, Sisli—an infill development where a luxury walled community faces a middle to low income neighborhood. Personal observation in 2013 showed that the gated community dwellers mostly drive instead of walk through the neighborhood for daily needs.

The urban transformation project in traditional Romani neighborhood Sulukule, replaced original inhabitants with high income residents, causing a price-boom where only 20 Romani families bought houses out of the 620 original homes. A public-private partnership venture initiated this project as an urban transformation site in 2006. Although Sulukule's previous inhabitants were relocated in Kayabasi TOKI public housing, most families moved back due to commute costs (URL-1, 2016).

Beylikdüzü and Esenyurt boroughs have also witnessed multiple projects (Figure 5) including a theme mall/park, an unplanned neighborhood, a Metrobus station, a connecting concrete surface crossing over a six-lane highway, acting as a pedestrian flyover. These projects connect the station to the city and bridges on two sides of the highway. Cooperative housing complemented the squatter settlements that rapidly popped-up around the village area by the 1980s. The Metrobus connection increased accessibility to the area, property prices and the new malls in 2012 (Bauhaus 2000, Marmara park 2012).

The last case study located in the Asian side of Istanbul includes different developments: Type A (luxury gated communities i.e.

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Almondhill 2008), Type B (Uzuncayir metrobus station in 2009), and the Istanbul metro Unalan station, Type C gecekondu settlements (legalized) (Fikirtepe), Type A Akasya tower including residential, office and retail uses (2014). An urban transformation project on a 134-hectare land has started through a public and private partnership in 2010 in Fikirtepe gecekondu. With a discourse to redevelop earthquake vulnerable buildings, and to redevelop housing stock in the area (Karaman, 2013) the proposed project increased the building height and population density (from 47,000 to 150,000) without additional new public space.

Research on Istanbul views state and market-led strategies (Terzi & Bolen, 2009) as causes of accelerating rates of sprawl, its polycentric spatial structure, and how new suburban settlements morph into peripheral centers (Dökmeci & Berköz, 1994; Terzi & Kaya, 2011). The increased traffic between the outer and inner city areas, however, mainly stems from insufficient employment opportunities and predominant residential land use (Aysan, Demir, Altan, & Dökmeci, 1997; Özüş, Sence Türk, & Dökmeci, 2011), creating a greater demand on rapid public transit systems. As the "freedom of movement" (Banham, 1971) accelerates urban sprawl, partially planned developments increase the edge city density, thereby creating more demand for rapid public transit. Developed due to high demand and insufficient supply, the intercontinental public transit system, Metrobus has become a familiar cyclical action-reaction (Alpkokin & Ergun, 2012; Banham, 1971; Jacobs, 1961) case of social and spatial isolation of middle and low income groups from the city center.

The market-led / public private partnership urban transformation projects from infill to neighborhood scale not only increased density without considering infrastructural demand/capacity, but also deepened the social inequality. Table 6 illustrates macro and micro views of sites and how planning or the lack thereof has changed land use, social mix, and the stakeholders involved.

Since physical and non-physical forces both matter in the production of space (Scott & Soja, 1996), capturing the causes and dynamics of interstices, along with their characteristics and reflections help discern the challenges people face in their everyday life. Drawing from reading the city, this study proposes recommendations for policymakers, developers, decision makers, and the other stakeholders to make informed decisions. Regardless of the potential tensions, interstitial spaces encompass regular and irregular urban forms with definitive or, at times, undefined spatial boundaries, thereby, accommodating to heterogeneous or even contradicting juxtapositions of socio-economic and spatial patterns. These spaces neither create human scale public spaces nor integrate them into the existing urban fabric, but instead mainly showcase fragmented urbanisms based on the logics and necessities of the neoliberal orthodoxy (M Arefi, 1999).

DISCUSSION AND CONCLUSION

Cities characterize complex forms of interconnections. (Rittel & Webber, 1973) notion of “wicked” problems owes much of this complexity to the interdisciplinary nature of forces acting on them. While governments initiate urban management policies, social and spatial divides seem to have widened. Interstitial spaces continue to pop up as proofs of widening socio-economic conflicts and divides.

Reading the city unravels the spatial complexity and engages academics in ongoing interdisciplinary debates by focusing on specific elements of the urban form, albeit with their inherent biases and “fixes” (Clay, 1973). This paper sought to develop a more holistic modus operandi for reading the city. Limited methods of reading the city have prompted new approaches of capturing interpretive nuances (Mahyar Arefi, 2004) based on the elements of the city and their interrelationships.

Istanbul’s historic, geographic, and socio-economic layers of interpretation coupled with episodes of planned and unplanned developments provided its holistic and interstitial reading. Istanbul has a rich inventory of “complex and interconnected whole” ((Jacobs, 1961) in Rybczynski, 2010 p.60-66), where conflicting ideas and interests intersect and create interstitial spaces. These layers, in turn reflect:

- global and neoliberal ties of reproductive spaces of urban development and redevelopment;
- controlled and uncontrolled growth;
- conflicting interests of actors and the marketplace.

These interactions operate in three different typologies. Type A represents the first degree of government control covering planned (including infill) developments, i.e., land use changes, privatization of the public space, urban transformation and mass housing, decentralization of industries from the city center, and large-scale transportation and infrastructure plans. Type B signifies the second degree of control partially driven by supply and demand under, increasing land values as a consequence of increased accessibility. Type C includes undetermined and unexpected developments, i.e., squatter settlements or

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undesirable migrations. This framework helps evaluate relational and contextual interstitial problems, layers and actors, and varied urban forms.

Two interrelated observations warrant attention: first, parochial decisions and policies, which by nature serve short-term goals and purposes, might by default, ensue detrimental long-term consequences; second, these activities enable a holistic approach toward reading the city.

The Istanbul case study revealed a complex palimpsest of geographic, historic and socio-economic overlays. New ways of reading the city helps planners to explore resilient solutions for diverse urban problems, and grapple with formidable challenges in the face of the globalization process. Interstitial spaces epitomize varied approaches and conflicting interests that eventually form new landscapes of contestation and equilibrium. These readings, in turn, unravel the increasing fragmentation and segregation, and how high and low income settlements stand side by side, while not quite intruding upon each other. Interstitial spaces in Istanbul pervade throughout the city, between, under and around, figured and disfigured, temporary and permanent, informal and formal spaces, with both short-term and long-term planning implications of 'glocal' decisions.

REFERENCES

Akbulut M R, Başlık S, 2011, "Transformation of Perception of The Gecekondu Phenomenon" *Metu Journal of Faculty of Architecture* **28** (2) 1-44

Akgün A A, Baycan T, 2012, "Gated communities in Istanbul: the new walls of the city" *TPR* **83** (1) 87-109

Akin N, 1998 *19. Yuzyilin Ikinci Yarisinda Galata ve Pera* (Istanbul Literatur) [Galata nad Pera in the Second Half of the 19th Century]

Aksoy A, Robins K, 1996, "Istanbul between civilization and discontent" *City* **5** (6) 6–33

Aksoy A, 2012, "Riding the storm: 'new Istanbul'" *City: analysis of urban trends, culture, theory, policy, action*, **16 (**1-2) 93-111

Alexander C, Ishikawa S, Silverstein M, Jacobson M, Fiksdahl-King I, Angel S, 1977. *A pattern language: Towns, Buildings, Construction* (Oxford University Press, New York)

Alpkokin P, Ergun M, 2012, "Istanbul Metrobüs: first intercontinental bus rapid transit" *Journal of Transport Geography* **24** 58–66

Arefi M, 1999, “Crisis of local identity in a metropolitan area under neoliberal influences” Journal of Urban Design, **4**(2) 175-194

Arefi M, 2004, “The pedagogy of the American city: revisiting the concepts of place, non-place, and placelessness” *URBAN DESIGN International* **9** 103–117

Arefi M, 2011, Order in Informal Settlements: A Case Study of Pinar, Istanbul,” *Built Environment,* 37 (1): 42-56.

Arefi M, 2013. “The structure of visual difference: A comparative case study of Mariemont and Lebanon, Ohio” *URBAN DESIGN International* 1-17

Auge M, 1995 *Non-Places: Introduction to an Anthropology of Supermodernity* (New York, Verso).

Ayataç H, 2007, “The International Diffusion of Planning Ideas: The Case of Istanbul, Turkey” *Journal of Planning History,* **6** 114 – 137

Aysan M, Demir O, Altan Z, Dökmeci V, 1997, “Industrial Decentralization in Istanbul & its Impact on Transport” *Journal of Urban Planning & Development* 123 (3)

Baharoglu D, Leitmann J, 1998, “Coping Strategies for Infrastructure: How Turkey's Spontaneous Settlements Operate in the Absence of Formal Rules” *HABITATITNL* **22** (2) 115-135

Banerjee T and Verma N, 2005, “Sprawl and Segregation: Another Side of the Los Angeles Debate”, in *Desegregating the City* Ed. D Varady (State University of New York Press), pp 200 – 212.

Banham R, 1971 *Los Angeles: The Architecture of Four Ecologies* (Harper and Row, New York)

Barnett J, 1995 *The Fractured Metropolis: Improving The New City, Restoring The Old City, Reshaping The Region* (HarperCollins, New York)

Bilsel C, 2011 “Les Transformations d’Istanbul”: Henri Prost’s planning of Istanbul (1936-1951), *ITU A/Z* **8** (1) 100-116

Blumenfeld, H.(1967). *The Modern Metropolis: Its Origins, Growth, Characteristics, and Planning-Selected Essays by Hans Blumenfeld*: Cambridge: MIT Press [cl967].

Boyer C, 1995 The great frame-up. Fantastic Appearances in contemporary politics in *Spatial Practices* Ed. Liggett, H and Perry, D C (Sage Publications)

Brenner N. and Theodore, N 2012 *Spaces of Neoliberalism: Urban Restructuring in North America and Western Europe* (Blackwell)

Celik Z, 1993 *The Remarking of Istanbul: Portrait of an Ottoman City in the Nineteenth Century* (Berkeley, CA: University of California Press)

DOI: 10.15320/ICONARP.2019.85– E-ISSN: 2147-9380

Chase J. L Crawford M Kaliski, 1999 *Everyday Urbanism* (The Monacelli Press, New York)

Clay G, 1973 *Reading the American city* (University of Chicago Press)

Cullen G, 1961 *Townscape* (Architectural Press, GB)

Dear M, & Flusty S, 1998, "Postmodern Urbanism" Annals of the Association of American Geographers, **88** (1), 50-72

de Certeau M, 1984 *The Practice of Everyday Life*. (University of California Press, Berkeley).

Dinçer I, 2011, "The Impact of Neoliberal Policies on Historic Urban Space: Areas of Urban Renewal in Istanbul" *International Planning Studies* **16** (1), 43-60

Dokmeci V, Berkoz L, 1994, "Transformation of Istanbul from a monocentric to a polycentric city" *European Planning Studies*, **2** (2), 193–205.

Dokmeci V, Ciraci H 1999, "From Westernization to globalization: An old district of Istanbul", *Planning History*, **21** (3), 13–23.

Elden S, 2004 *Understanding Henri Lefebvre (*Continuum Books, Great Britain)

Enlil Z M, 2011, "The Neoliberal Agenda and the Changing Urban Form of Istanbul" *International Planning Studies*, **16** (1) 5-25

Erkip F, 2000, "Global transformations versus local dynamics in Istanbul" *Cities* 17 (5) 371-377

Fogelson R M, 1967 *Fragmented metropolis* (Harvard University Press, Cambridge)

Fulton W, 1997 *The Reluctant Metropolis: The Politics of Urban Growth in Los Angeles* (Solano Press Books, California)

Graham S, Marvin S 2001 *Splintering Urbanism* (Routledge, New York)

Hall P, 2002 *Cities of Tomorrow* (Blackwell Publishing)

Hassenpflug D, Giersig N, Stratmann B, (Ed.) 2011 *Reading the City: Developing Urban Hermeneutics* [Stadt lesen: Beiträge zu einer urbanen Hermeneutik] (Verlag der Bauhaus-Universitat Weimar).

Jacobs J, 1961 *Death and Life of Great American Cities* (New York, Random House)

Karaman O, 2013 Urban Renewal in Istanbul: Reconfigured Spaces, Robotic Lives International *Journal of Urban & Regional Research* **37** (2) 715-733

Kelbough D, 2001, "Three Urbanisms and the Public Realm", Proceedings of 3rd International Space Syntax Symposium Atlanta.

Keyder C, 2005 "Globalization and Social Exclusion in Istanbul", *International Journal of Urban and Regional Research*, **29** (1) 124–134

Kostof S, 1991 The *City shaped: Urban Patterns and Meanings Through History* (Bulfinch Press)

Kostof S, 1992 The *City assembled: The Elements of Urban Form Through History* (Bulfinch Press)

Kuban D, 1996 *Istanbul: An Urban History: Byzantion, Constantinopolis, Istanbul* (Istanbul: Economic and Social History Foundation of Turkey).

Kurtuluş H, 2005 *İstanbul'da Kentsel Ayrışma: Mekansal Dönüşümde Farklı Boyutlar* (Bağlam, Istanbul) [Urban Segregation in Istanbul: Varied Dimensions in Spatial Transformation]

Lefebvre H, 1991 *The production of space* (Blackwell, Oxford)

Lefebvre H, 2009 Space and Mode of Production. In N. Brenner & S. Elden (eds.), Henri Lefebvre: *State, Space World*, (Minneapolis, University of Minnesota Press)

Lynch K, 1960 *The Image of the City*. MIT Press: Massachussetts.

Mclaughlin E, Muncie J, 1999 "Walled Cities: Surveillance, Regulation and Segregation", in Pile, S., Brook, C. and Mooney, G. (ed.) *Unruly Cities, Order/Disorder,* London; New York: Routledge in Association with the Open University.

Mumford L, 1938 *The Culture of Cities* (Harcourt, Brace and World Inc., New York)

Mumford L, 1961 *The City in History: Its Origins, Its Transformations, and Its Prospects* (Harcourt, Brace and World Inc., New York)

Öncü A and Weyland P 1997 *Space, Culture & Power: New Identities in a Globalizing World* (Zed Books).

Özüş, E.; Sence Türk, S.; Dökmeci, V. 2011 "Urban Restructuring of Istanbul." *Eur. Plan. Stud*. 19, 331-356.

Pınarcıoğlu M, Işık O, 2007 "Not Only Helpless but also Hopeless: Changing Dynamics of Urban Poverty in Turkey, the Case of Sultanbeyli, Istanbul" *European Planning Studies* **16** **(**10).

Rapoport, A 1982 *The Meaning of the Built Environment: A Nonverbal Communication Approach* (California: Sage Publication)

Relph E, 1976 *Place and Placelessness* (London: Pion)

Rybczynski W, 2010 *Makeshift Metropolis* (Scribner, New York)

Sassen S, 1991 *The Global City: New York, London, Tokyo* (Princeton University Press)

Sassen S, 2007 *Sociology of Globalisation* (W.W. Norton and Company, New York)

DOI: 10.15320/ICONARP.2019.85– E-ISSN: 2147-9380

Sassen S, 2010, "The Global City: introducing a concept" in *Blackwell City Reader* Ed. G Bridge and S Watson (Wiley-Blackwell) pp 126 - 132

Scott A J and Soja E, 1996 *The city: Los Angeles and Urban Theory at the end of Twentieth Century* (University of California Press)

Scott A J 2008, *Social economy of metropolis*. (Oxford University Press, Oxford)

Scott A J 2008, "Inside the City: On Urbanisation, Public Policy and Planning", *Urban Studies* 2008; **45**; 755-772

Sennett, R 2017, The Open City, in Haas & Westlund (eds), In *The Post-Urban World: Emergent Transformation of Cities & Regions in the Innovative Global Economy* (London, Teylor & Francis)

Soja E, 2000 *Postmetropolis: Critical Studies of Cities and Regions* (Blackwell Publishing, Great Britain)

Soja E, 2010 "Six discourse on postmetropolis" in *Blackwell City Reader* Ed. G Bridge and S Watson (Wiley-Blackwell) pp 374 – 381

Tekeli I, Gülöksüz Y, Okyay T, 1976 *Gecekondulu, Dolmuşlu işportalı Şehir · Gecekondulu, Dolmuşlu işportalı Şehir* (Cem Yayinevi)

Terzi F, Bolen F, 2009, "Urban Sprawl Measurement of Istanbul", *European Planning Studies*, **17** (10), 1559-1569

Terzi F, Kaya S, 2011, "Dynamic spatial analysis of urban sprawl through fractal geometry: the case of Istanbul", *Environment and Planning B: Planning and Design*, **38**, 175 - 190

Tonnelat S, 2008, "`Out of frame': The (in)visible life of urban interstices - a case study in Charenton-le-Pont, Paris, France", *Ethnography,* **9**, 291-324

UCTEA Chamber of Urban Planning Istanbul Branch 2010. *3rd Bridge Project Evaluation Report*, 25 September 2013 retrieved from www.spoist.com

URL-1.(2016). Retrieved.from http://www.arkitera.com/haber/26594/sulukulede-hukuksuzluk

Uzun N, 2010, "Urban governance in Istanbul", *Análise Social,* **197**, 757-770

Wall E, 2011 "Infrastructural Form, Interstitial Spaces and Informal Acts" in *Infrastructural Urbanism: Addressing The In-between*. Ed. T. R. Hauck, R Keller, V Kleinekort (DOM Publishers, The UK)

Rittel H W J, Webber M W, 1973, "Dilemmas in a General Theory of Planning", *Policy Sciences* **4**, 155-169

Webber, M. 1964. The urban place and non-place urban realm. In M.M. Webber and J.W. Dyckman, and D.L. Foley et al., Explorations into Urban Structure, pp. 79-153 (Philadelphia, PA, University of Pennsylvania Press).

World Urbanization Prospects: The 2014 Revision, 2015, United Nations

Zukin S 1995 *The Culture of Cities*. (Massachussetts, Blackwell)

Zukin S 2010 *Nake City: The Death and Life of Authentic Urban Places* (Oxford, Oxford University Press)

Resume

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Research Article

Morphological Structures of Historical Turkish Cities

Mehmet Topçu*

Abstract

In this study, morphological structures of the traditional fabrics of cities in Turkey, which have been shaped under the influence of various different cultures and geographical and climatic conditions in the historical process are presented via a mathematical interpretation. In this scope, spatial configuration and morphological structures of the historical cores of a total of fourteen cities selected from the seven geographical regions of Turkey, two cities from each (from the Marmara Region, *Edirne* and *Bursa;* from the Black Sea Region, *Kastamonu* and *Trabzon;* from the Central Anatolia Region, *Sivas* and *Kayseri;* from the Eastern Anatolia Region, *Kars* and *Erzurum; from the Aegean Region, Muğla* and *Kütahya;* from the South Eastern Anatolia Region, *Urfa, Mardin* and lastly from the Mediterranean Region, *Tarsus* and *Antakya)* region were analyzed comparatively using the Space Syntax method. In this method, the cities were analyzed in three main categories using eleven different parameters. These categories are convex space, axial space and syntactic space. Convex space analyzes were made using the paramters of convex articulation, convex deformation of the grid, grid convexity and convex ringness; axial space analyses were made using the paramters of axial articulation, axial integration of convex space, grid axiality and axial ringness; finally, syntactic space analyses were made using the parameters of integration, intelligibility and synergy. In

Keywords: urban morphology, space syntax, convex space, historical cities, Turkey

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conclusion, it could be said that historical fabrics of the cities in Turkey have synchronous structures, manifest regular reflections, have organic systems compared with the grid systems, and constitute higher intellibility and synergy.

INTRODUCTION

Hillier and Hanson describe societies as spatial formations (Hillier & Hanson, 1984). Societies have settled in different regions on earth. People meet each other and convey information as a consequence of communication that has arisen within and between these regions. The concept that we name space, on the other hand, is an attestation of the existence of the society inhabiting that space. However, a society does more than existing in a space.

The field of urban morphology, a branch of science born in the first half of the twentieth century, investigates, through deeper analyses, processes of formation and transformation as well as characteristics of urban spaces created by societies in the course of history (Conzen, 1960; Whitehand, 1986). Urban morphology has been explored by numerous scholars in England, Italy and France, and indeed instead of being restricted to these countries, it has been further studied by many independent scholars in other countries (Moudon, 1997). The afore mentioned three countries have come up with their own approaches to urban morphology and established schools of morphology to enable furthering of these approaches. The work in England in this regard was initiated by M.R.G. Conzen and continued by Whitehand. Their endeavors were on the whole on an urban scale. In Italy, on the other hand, studies pioneered by Muratori were conducted predominantly at the building level aimed at preserving historical and architectural heritage. Work undertaken by these two schools added a new dimension to urban morphology in subsequent years, and as a result social dimension in urban morphology was investigated when architects Panerani and Castex and sociologist De Paule combined their efforts. This school, like the other two schools, was founded as a reaction to the disregard shown to history (Moudon, 1997). Urban morphology is an in determining the transformation processes of urban fabrics, making sense of the historical roots of spatial and functional structures and bringing them to the present day (Larkham, 2002). In addition, Urban morphology has become a common and important research method for the analysis of the physical structures of cities through quantitative analysis. In this context, Hillier and Hanson, (1984) with the support of technological developments, combined this morphological concept with quantitative analysis of city patterns and called it 'space syntax'. According to Hillier,

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space syntax is a method that can be used for morphological analyses of buildings, architectural plans, urban areas and urban plans. It is possible to give quantitative descriptions of built spaces by using this method (Hillier & Hanson, 1984). At this point, the space syntax method has become an effective method in studies on urban morphology as it allows comparative analyses of obtained quantitative data and intepretation of the transformations that cities have undergone in the historical process as well as revealing the relationship between these transformations and the social structure (Kubat, 1997). The purpose of this study is to be able to understand, at a deeper level via comparative analyses, the present forms of the historical cores of the cities in Turkey, which took shape in the course of time, through the space syntax method according to their geographical distribution. In this scope, fourteen cities in Turkey were selected to be included in the sample for analysis on the basis of their geographical locations and historical processes. The geography where the greater part of Turkey is located is named Anatolia, which serves as a bridge between Asia and Europe.

HISTORY OF ANATOLIA IN BRIEF

Anatolia is rich in architecture and urban structure, reflecting its geographical location and the influence of several civilizations (Kubat, 2010).

When we take a look at the structure of Anatolia before the common era, we see that small communities that lived in caves or rock coves 12.000 years ago during the Old Neolithic Age had to adopt a sedentary life style during the Neolithic Age between the years 8.000 and 5.000 A.D. years as their food stuffs were now obtained from the soil; then, these productive communities transformed into kingdoms and cities when agriculture and animal farming developed in the Bronze Age (Kejanlı, 2005).

Following these periods, migration and conquests became important factors affecting the structure of the cities in Anatolia. The Hittite State, which was established in the 16th century B.C.E, was destroyed in the 12th century B.C.E. as a result of immigration from the Agean Sea, and subsequently Greek states emerged.

The era of Roman Empire in Anatolia began in 30 B.C.E. and was replaced by the Byzantine State, also called the Eastern Roman Empire, in 330 B.C.E. During the Roman Empire, the Anatolian cities were designated as cities that did not possess the rights enjoyed by the Roman citizens and were used as sources to obtain mercenaries (Kaya, 2003). The cities of the Byzantine State, on the other hand, were initially under the influence of this approach and demonstrated a physically complex and varied structure chacaterized by detachment from each other, serving military purposes and based on an agricultural lifestyle (Tanyeli, 1987). The Turks, who began to settle in Anatolia after the Battle of Manzikert, became the founders of the Anatolian Seljuk State, which reigned between 1075 and 1272. When the urban structure of this state is examined, it is seen that the Turks reflected on the Byzantine cities they conquered the experiences they had gained during the migrations before their settlement in Anatolia. These migrations, which took place from Central Asia to Anatolia betwen the 9th and 11th centuries, had ethnic, religious, socio-cultural, military and political impacts on the Turkish society as a consequence of the influence of the Central Asian urban culture, the interactions between Iran and Islam and the Greek and Roman civilization in Anatolia (Özcan, 2006).

These influences on Anatolian cities have been, in a sense, indicators of how different communities and cultures have affected each other and how the cities have been shaped based on culture. Immigrations from the east moved further into inland and as a result cities located in these areas shrank physically and were confined within the boundaries of the city walls. Byzantine cities assumed an urban fabric dominated by Turkish populace when old cities grew and a new urban structure emerged; new cities were founded and nomadic people became urban dwellers. (Kuban, 1968).

The Ottoman Principality, which was one of the principalities scattered across Anatolia in 1300, declared its independence from the Ilkhanidsin 1299 as a consequence of policies based on diplomatic skills and aimed at improving economic potential rather than military conquests. Subsequently, making efficient use of the conflicts afflicting the Byzantine State, it brought an end to the Byzantine State by conquering Istanbul (Fierro, 2011).

At the height of its power in the 16th century, the Ottoman State secured its domination in Anatolia and the Balkans and was deemed a world power in terms of both its economy and military force. Undergoing a process of decline from that period on and failing to overcome ethnic conflicts and internal strife, the empire came to a point of disintegration as a result of the defeat it suffered in World War I. However, the War of Liberation fought in its wake led to the foundation of the Turkish Republic as a new Turkish state in Anatolia in the contemporary world.

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SELECTION OF SAMPLE AREAS

In this study, the classification of seven geographical regions (*Marmara, Black Sea, Central Anatolia, East Anatolia, Aegean, Southeast Anatolia and Mediterranean*) adopted by geographers was used as a criterion in the selection of the study sample to investigate the morphological structure of historical cities in Turkey (Figure 1). For instance, there are various different housing types in different regions that are totally different from one another, reflected in the way the cities were established to their urban fabric and transportation systems, because climatic conditions, natural vegetation and distribution of agricultural products are extremely varied (Aru, 1998). Two cities were chosen from each of the seven geographical regions in Turkey and thus a comparative analysis was made of the spatial setup and morphological structures of the historical cores of the fourteen cities in total. These cities reflect, in addition to their geograpical differences, traces of rich cultural transformations they have undergone in the historical process of Anatolia.

The selected cities involve *Edirne* and *Bursa* in the Marmara Region, *Kastamonu* and *Trabzon* in the Black Sea Region, *Sivas* and *Kayseri* in the Central Anatolia Region, *Kars* and *Erzurum* in the Eastern Anatolia Region, *Muğla* and *Kütahya* in the Aegean Region, *Urfa* and *Mardin* in the South Eastern Anatolia Region and finally *Tarsus* and *Antakya* in the Mediterranean Region (Figure 1). The boundaries determined in a study conducted by Aru (Aru, 1998) on Turkish cities were taken as a reference in determining the boundaries of the historical urban patterns of the selected cities.

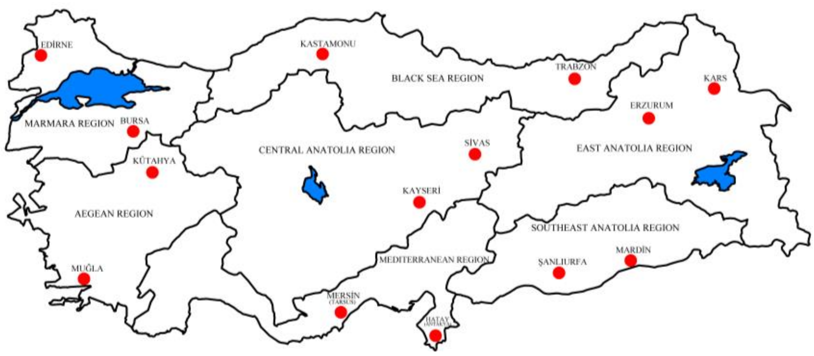

Figure 1. Locations of the selected sample areas on a map of Turkey.

The Marmara Region;

Edirne; Geographically, it is located in the north eastern most tip of Turkey. Its winters are warm while its summers are extremely hot and dry (Bölük, 2016). Throughout its history, it has come under *Roman, Byzantine 395 C.E., Ottoman 1362 C.E.,* and *Turkish 1922 C.E.* rule. It bears marks of predominantly Roman and Ottoman impact. It was built, for defense purposes, within a rectangular castle on a flatland during the Roman era. Being the capital city of the Ottoman era, Edirne spread radially to the plains around the center to the east of the castle (Aru, 1998). The historical center of the city of Edirne is composed of two parts. These could be termed inner castle and outer castle. Accordingly, we can observe a grid-like road pattern inside the castle while we can see an organic road pattern outside the castle (Figure2).

Bursa; Geographically, this city is located in the interior of north east of Turkey. Its winters are warm whereas its summers are very hot and dry (Bölük, 2016). The city was built within a castle belonging to the Roman period on a slope at the foothills of Uludag. In the historical process, the city has come under *Roman, Byzantine 395 C.E., Seljuk 1080 C.E., Ottoman 1362 C.E.* and *Turkish Republic 1922 C.E.* rule. Although it has come under the influence of various civilizations, the Ottoman impact makes itself manifested more predominantly (Aru, 1998). Patterns belonging to the Ottoman period that are in parallel with the topography are visible. The city failed to maintain the grid-like road pattern of the Byzantine period. The organic urban pattern is dominant (Figure2).

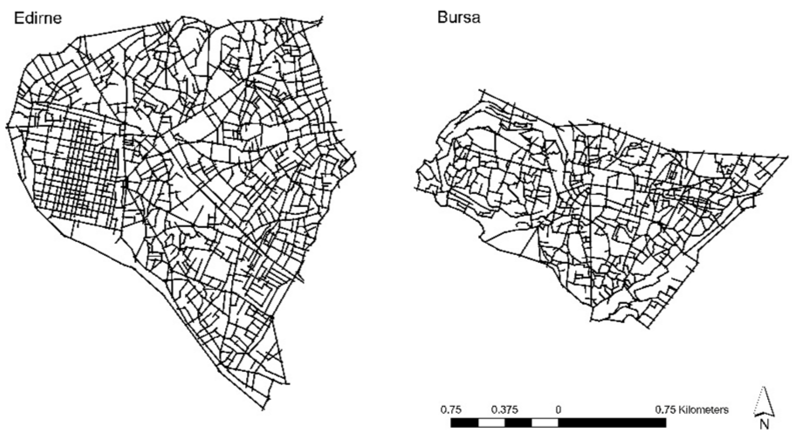

Figure 2. The road patterns of the cities of Edirne and Bursa.

The Black Sea Region;

Kastamonu; Geographically, this city is situated in the Karaçomak valley at the foothills of the Ilgaz Montains in the North-central part of Turkey. It enjoys warm winters and summers and has precipitation at all seasons (Bölük, 2016). It was located initially on the western slopes of a creek that divided the city into two but then extended from the flatlands on both banks to the steep slopes (Aru, 1998). In the historical process, it has come under *Roman 100 B.C.E., Byzantine 395 C.E., Çobanoğulları principality 1295 C.E., Candaroğulları principality 1039 C.E., Ottoman1461 C.E., and Turkish Republic 1922 C.E.* rule. However, the city created its present visible settlement pattern during the Ottoman period. Therefore, the visible form is an organic pattern (Figure 3).

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Trabzon; Geographically, the city is located inthe north-eastern part of Turkey. It enjoys warm winters and very hot summers, with a climate characterized by precipitation at all seasons (Bölük, 2016). In the historical process, the city has come under *Greek 756 B.C.E., Roman 100 B.C.E., Byzantine 395 C.E., Greek-Pontic 1204 C.E., Ottoman 1461 C.E.* and *Turkish Republic 1922 C.E.* rule (Aru, 1998). One can see spatial traces of all periods of the city, which has been under the influence of various civilizations. This situation results from the topographic structure of the city and the fact that it has been seen as a safe settlement due to the relationship this topography has established with the sea. The most obvious indication of this is the fact that the area where the city was first founded was between two deep valleys, which rendered it defensible and suitable for settlement (Dursun, 2002). The city displays an urban configuration that is squeezed between the sea and the mountains in the north-south axis and the flatlands betwen two deep valleys in the east-west axis (Figure3).

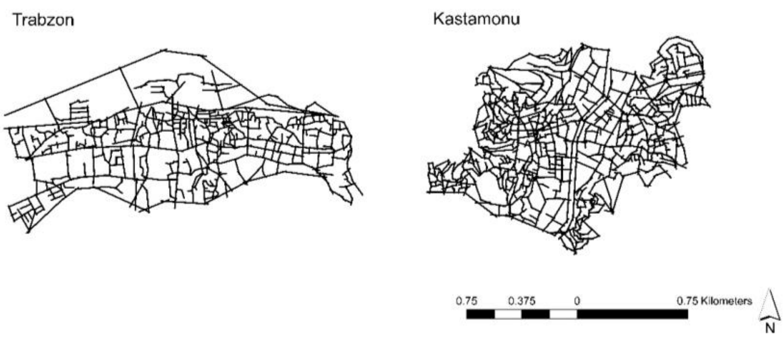

Figure 3. Road patterns of the cities of Trabzon and Kastamonu

The Central Anatolia Region;

Kayseri; Geographically, the city is located in central Turkey. It enjoys warm winters and very hot and dry summers (Bölük, 2016). It was founded on the edge of a plain at the foothills of Erciyes Mountain in the Hittite period. It has been under the influence of numerous civilizations up to the present time. In the historical process, it has been ruled by *the Greeks 756 B.C.E., Romans 100 B.C., Byzantines 395 C.E., Arabs 7th century, Ilkhanids 11th century, Eretna principality 14th century, Karamanids 1419, Ottomans 1515 C.E. and Turkish Republic 1922 C.E.* (Aru, 1998). The historical pattern of the city reflects a radial growth. Its growth pattern begins with the castle at its center and expands in the form of concentric rings (Figure 4).

Sivas; The city is located on a slight slope to the north of the Kizilirmak valley. It is at an elevation of 1285 meters and has a rather harsh and cold climate. It enjoys extreme winters and dry and cool summers (Bölük, 2016). Its history dates back to the period of the Hittites. In the historical process, the city has come under *Hittite, Urartean, Median, Byzantine 395 C.E., Umayyid 7th century, Danişment principality 1080 C.E., Seljuk 1175 C.E., Ottoman1398 C.E. and Turkish Republic 1922 C.E.* rule (Aru, 1998). Having been ruled by various civilizations, the city of Sivas bears marks of Roman, Seljuk and Ottoman periods (Figure 4).

Figure 4. The road patterns of the cities of Kayseri and Sivas

The Eastern Anatolia Region;

Kars; Geographically, it is located in the northern most tip of East Anatolia. Its winters are extreme and it enjoys a cool climate characterized by precipitation at all seasons (Bölük, 2016). The foundation of the city dates back to the Urartean times. The first settlement took place inside the Kars castle, but then the city grew in the vicinity of the castle. In the historical process, the city has come under the domination of *Urarteans, Hurris, Sycthians, Sasanids 410 C.E., Seljuks 1064 C.E., Moguls 1239 C.E., Karakoyunlus 1406 C.E., Akkoyunlus 1467 C.E., Ottomans 1535 C.E., Russians 1877 C.E., and Turkish Republic 1922*. Although it has come under the domination of many states, the city manifests impact of Ottoman (1535-1877) and Russian (1877-1922) periods. However, the grid-like pattern of the Russian period is observed more predominantly (Figure 5).

Erzurum; Located in the north eastern part of Turkey, the city was built inside and around a castle belonging to the Roman period. In the historical process, it has come under the rule of *Romans 1st century B.C.E., Arabs 633 C.E., Seljuks 1048 C.E., Ilkhanids 1242 C.E., Karakoyunlus, Akkoyunlus 1335, Ottomans 1514 C.E.* and *the Turkish Republic 1922 C.E.* (Aru, 1998). It exhibits a concentric development imposed by its topographic structure (Figure 5). Situated on a slope, the city is surrounded by mountains to its south and a flat plain to its north. An organic pattern is observed in the city. It has extreme winters and dry and cool summers (Bölük, 2016).

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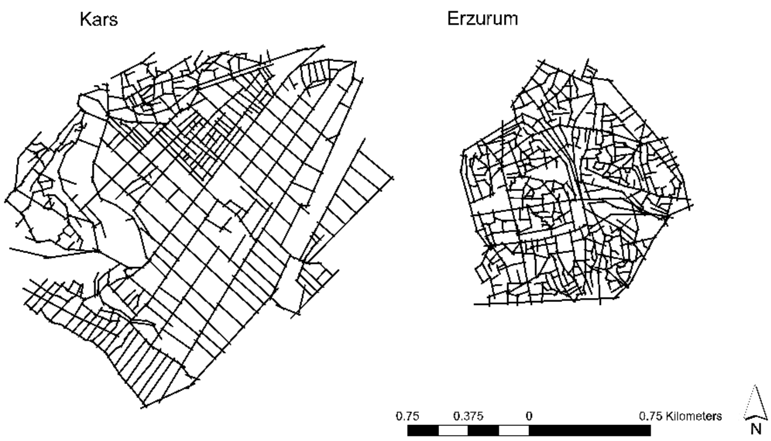

Figure 5. The road patterns of the cities of Kars and Erzurum.

The Aegean Region;

Kütahya; The city is located in the interior of western Anatolia. It enjoys warm winters and warm and dry summers (Bölük, 2016). In the historical process, it has come under the rule of *Romans 2nd century B.C.E., Byzantines 395 C.E., Seljuks 1080 C.E., Germiyanoglus 1285 C.E., Ottomans 1381 C.E. and the Turkish Republic 1922 C.E.* (Aru, 1998). The city bears marks of Romans, Byzantines, Seljuks, Germiyanoglus and Ottomans. The city was built in an arrow-shaped manner in line with its topography on the slopes of a steep hill where the Byzantine castle was located. The city exhibits a radial system, Ulucami (The Grand Mosque) being at its center (Figure 6).

Muğla; Geographically, the city is located in the southwest of Anatolia. It was built on a slope at the foothills of Oyluk mountain. Two streams divide the city into three sections. The road system was not formed in parallel with the topography. It enjoys warm winters and very hot and dry summers (Bölük, 2016). In the historical process, the city has come under *Roman 2nd century C.E., Byzantine 395 C.E., Arab 639 C.E., Seljuk 1069 C.E., Menteşeoğulları 1280 C.E., Ottoman 1390 C.E. and Turkish Republic 1922 C.E.* rule (Aru, 1998). Although it has come under the influence of various civilizations, organic Ottoman pattern is felt in the urban form (Figure 6).

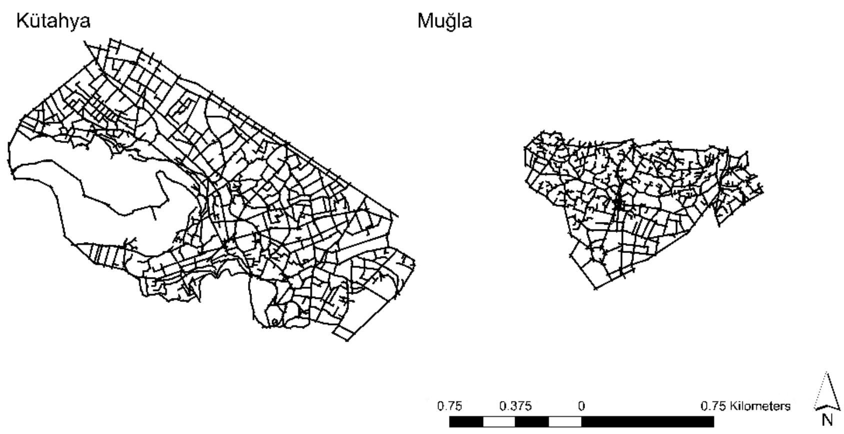

Figure 6. The road patterns of the cities of Kütahya and Muğla

The Mediterranean Region;

Tarsus; Tarsus is located in the central south section of the country. It enjoys warm winters and very hot and dry summers (Bölük, 2016). The historical center of Tarsus has a long-standing history dating back to thousands of years. The city was built at an intersection of important commercial roads in Cilician Plains to the south of the Taurus Mauntains and has maintained its existence from ancient times to the present. Because it has been a settlement since ancient times, it is rich in terms of cultural heritage. In subsequent periods, various different civilizations such as the Hittites, Assyrians, Egyptians, Persians, Greeks, Romans, Byzantines, Abbasids, Umayyids, Anatolian Seljuks and Ottomans ruled the city. The period whose marks are most clearly seen in the city center is the Ottoman period by virtue of the fact that it was the last state dominating the city before the declaration of the Republic (Figure 7)(Tüter & Ökesli, 2015).

Antakya; Geographically, the city is located in the southernmost tip of Turkey. It enjoys warm winters and very hot and dry summers (Bölük, 2016). In the historical process, the city of Antakya has come under the rule of *Seleucids 312 B.C.E., Romans 64 B.C.E., Arabs 638 C.E., Crusaders 1098 C.E., Mameluks 1268 C.E., Ottomans 1516 C.E., The French 1918 C.E.* and *the Turkish Republic 1938 C.E.* The historical core of the city was built on a slope between the terraces created by the River Asi and Mount Habibi Neccar. The city earned its importance during the Roman Empire. It was the third biggest city in the Roman Empire. In subsequent periods, the spatial configuration of the Roman period changed under the influence of various cultures (Demir, 1996). The city acquired an Islamic pattern especially after it came under Arab domination. It maintained this pattern during the subsequent Ottoman period. The pattern of Antakya still bears the marks of its early Hellenistic and Roman structures, especially in the formation of geometrical grids. The configuration of the streets reinforces Islamic

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characteristics; culde-sacs mean privacy and street structure is narrow (Figure 7).

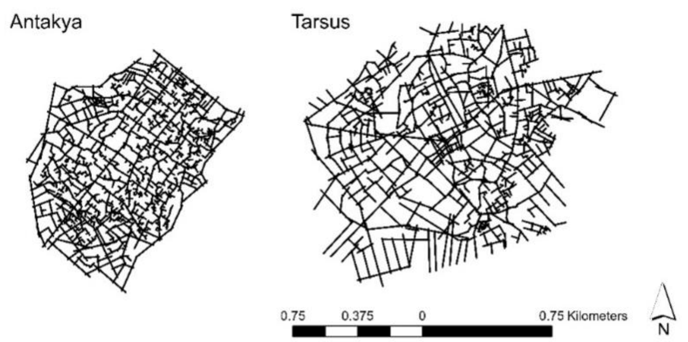

Figure 7. The road patterns of the cities of Tarsus and Antakya

The South Eastern Anatolia Region;

Urfa; Urfa is one of the oldest centers of civilization on earth. Natural conditions that are conducive to settlement and its position at the intersection of roads led to the emergence of various cultures. In the historical process, it has come under the domination of *Assyrians, Persians 6th century B.C.E, Seleucids 3rd century B.C.E., Romans 1st century C.E., Byzantines 395 C.E., Arabs 638 C.E., Hamdanis 873 C.E., Seljuks 11th century C.E., Karakoyunlus, Crusaders 1098 C.E., Ottomans 1516 C.E.* and the *Turkish Republic 1922 C.E.*. In addition to housing the oldest civilizations of Anatolia, the cultural legacy left by Persians and Romans, who came to the area for purposes of invasion and settlement, was passed on to the Arabs and Turks, who later occupied the region, thereby contributing to the shaping of the unique culture of the city in the historical process (Figure 8). The city enjoys warm winters and very hot and dry summers (Bölük, 2016).

Mardin; Possessing an organic pattern, Mardin is a slope settlement and exhibited a linear growth along the slope for long periods due to its topographic characteristics (Yekbun & Çırak, 2018). In the historical process, the city has come under the domination of *Romans 1st century, Byzantines 395 C.E., Arabs 638 C.E., Hamdanis 873 C.E., Seljuks 11th century, Karakoyunlus, Artuklus 1408 C.E., Ottomans 1517 C.E.,* and the *Turkish Republic 1922 C.E.* (Aru, 1998). It displays a settlement fabric where each layer in the historical process is built upon the other. The urban conservation site of Mardin expanded when the settlement pattern began to extend from within the fortress to the outer city walls (Figure 8). A unique organic pattern emerged when, in harmony with the topography, this traditional fabric gave way to terraced housing that did not block each other's façades. The building-backyard-garden-street interaction, which was compatible with the city's natural topographic characteristics and cultural life, created an unprecendented landscape. The city enjoys warm winters and very hot and dry summers (Bölük, 2016).

Figure 8. The road patterns of the cities of Urfa and Mardin

METHODOLOGY

According to Hillier and Hanson (1984), the space syntax approach bases urban structure on generation of a spatial culture (Hillier & Hanson, 1984). Studies conducted on urban morphology investigating especially historical cores of cities attributed the characteristics of the historical spaces to civilizations they hosted (Cutini, 2001; Hillier, 1989; Kubat, 1999; Peponis, Hadjinikolaou, Livieratos, & Fatouros, 1989).

Therefore, concepts related to history and culture such as Roman city, Hellenistic city or Turkish city emerged in the evaluation of urban structures (Eskidemir, 2016). The space syntax method, which approaches urban morphology from a scientific perspective, plays an active role in process-based investigation of transformations of historical cores. In this way, historical developments of cities are analyzed, and the harmony between spatial structure and social structure is revealed. The process of morphological evolution of the city is analyzed via this method, but other factors such as functions within the city are also incorporated into these analyses, thereby helping obtain data based on different factors. Space syntax explains morphological development of cities on the basis of spatial configuration and interprets the relationships among the factors involved in the formation of spatial configuration of the city. It interprets these spatial analyses through numerical values and thus provides verifiable data (Kubat, 1997). This methodology contributes greatly to the understanding of the physical structure of the cases in this study.

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It is possible to give quantitative descriptions of built spaces. Some definitions of the methodology used in the study are as follows: The axial map is the basis of settlement layout analysis. This represents the distance up to which observers can have an uninterrupted impression of visibility and permeability as they move about the town and look in various directions. The map is derived by drawing the fewest and the longest lines of uninterrupted permeability necessary to cover the public open space of an area.

The size of a settlement system is measured in terms of the number of lines. The convex map of a settlement is the set of widest spaces that covers the open space structure of that settlement. It is a map of the open space broken up into the widest possible convex spaces. If the system is regular, many axial lines may pass through a series of convex spaces. From these maps, it is easy to see that urban space structures differ from one another according to the degree of axial and convex extensions of their parts and according to the relation between these two forms of extension (Batty & Rana, 2002; Hillier & Hanson, 1984; Osmond, 2011).

In this context, first, the concept of syntactic analysis developed by Hillier was implemented in this study on the basis of a methodological approach proposed by Kubat (Hillier & Hanson, 1984; Kubat, 1997). In this framework, parameteres were grouped into three main categories. These categories were convex space analyses, axial space analyses and syntactic space analyses. Convex space analyses were measured through the parameters of convex articulation, convex deformation of the grid, grid convexity and convex ringness. The second category, namely axial space analyses involve the parameters of axial articulation, axial integration of convex space, grid axiality and axial ringness. The syntactic parameters in the last category, on the other hand, involve the parameters of integration, intelligibility and synergy. The study compared the historical cores of the selected sample cities on the basis of eleven parameters.

Measures of Convexity:

Convex articulation can be measured by dividing the number of convex spaces by the number of buildings. The degree to which the open space of an urban system is broken up into convex space is indicated by the convex articulation value. Lower values indicate lesser break up and therefore more synchrony (Figure 9). *Convex articulation = C*/number of buildings, *C* is the number of convex spaces (Kubat, 1997).

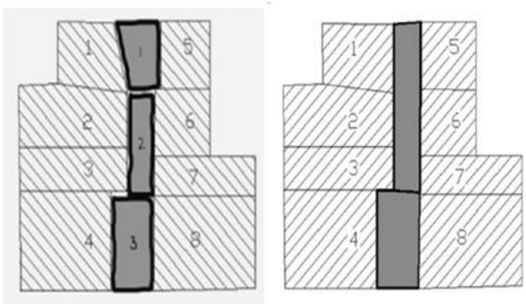

Figure 9. Convex articulation (Thilagam & Banerjee, 2016).

<u>*Convex deformation of the grid*</u> can be measured by dividing the number of convex spaces (C) by the number of islands (I) (Figure 10). Wherein an island is defined as a block of continuously connected buildings completely surrounded by open space. *Convex deformation = C/I,* (Kubat, 1997).

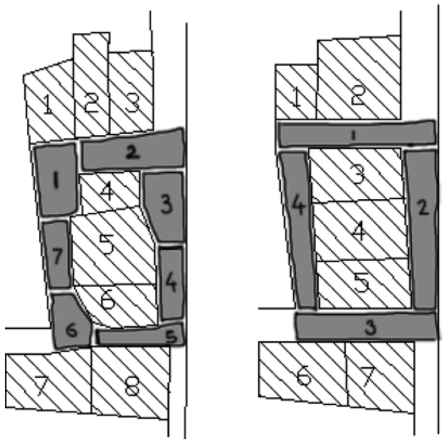

Figure 10. Convex deformation of grid (Thilagam & Banerjee, 2016).

<u>*Grid convexity (Gconvex)*</u> of the system is measured by the formula *Grid convexity* = $(I^{1/2} + 1)^{2/c}$, where *I* is the number of islands and *C* is the number of convex spaces. It is possible to make a comparison of a convex map with an orthogonal grid in which convex spaces extend across the system in one direction, and in the other direction fit ladder fashion into the interstices (Figure 11). High values indicate little deformation of the grid and low values indicate higher deformations of the grid (Kubat, 1997).

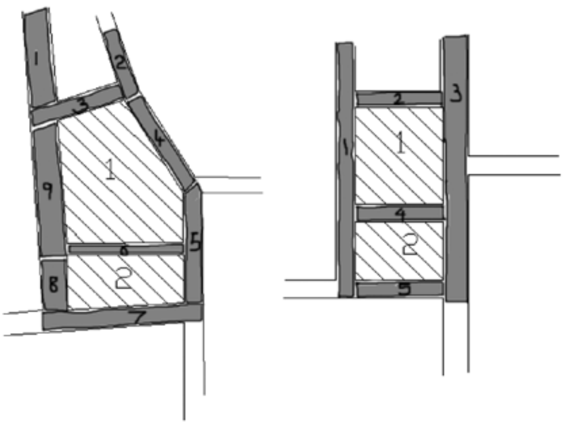

Figure 11. Grid convexity (Thilagam & Banerjee, 2016).

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<u>*Convex ringiness;*</u> The ringiness of the convex system, (**R**convex) is the number of the rings in the system as a proportion of the maximum possible planar rings for that number of spaces. $R\ convex = I/2C{-}5$, where I is the number of islands and C is the number of convex spaces.

Measures of Axiality

<u>*Axial articulation*</u> can be measured by dividing the number of axial lines by the number of buildings. Low values indicate a high degree of axiality and high values indicate a greater break up(Figure 12)(Kubat, 1997). *Axial articulation* = $L/$ the number of buildings, where L is the number of axial lines.

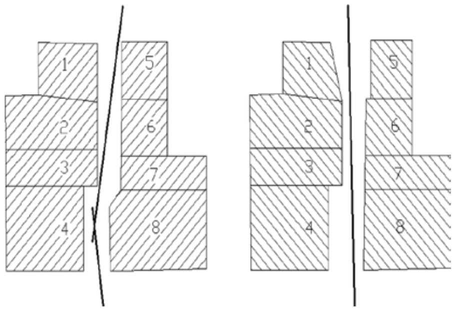

Figure 12. Axial articulation (Thilagam & Banerjee, 2016).

<u>*Axial integration of convex spaces*</u> can be measured by dividing the number of axial lines by convex spaces (Figure 13). Low values indicate a higher degree of axial integration of convex spaces (Kubat, 1997). *Axial integration* = L/C, where L is the number of axial lines and C is the number of convex spaces.

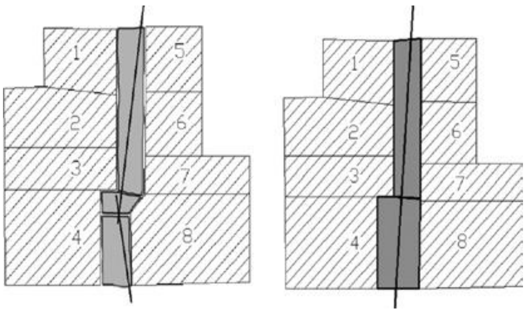

Figure 13. Axial integration of convex spaces (Thilagam & Banerjee, 2016).

<u>*The grid axiality (Gaxial)*</u> of the system gives a measure of the comparison of an orthogonal grid with the number of islands (Figure 14). The value is between 0 and 1, and a high value indicates a strong approximation to a grid and a low value a greater degree of axial deformation (Kubat, 1997). *Grid axiality* $=2I^{1/2} + 2/L$, where I is the number of islands and L is the number of axial lines

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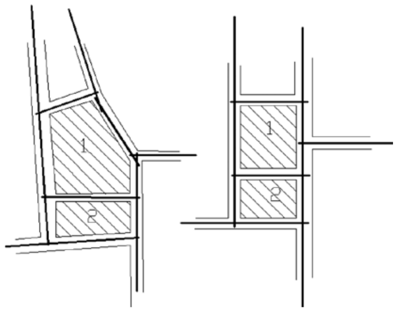

Figure 14. The grid axiality (Thilagam & Banerjee, 2016).

*<u>The ringiness of the axial map (**R**axial)</u>* can be measured by the formula $R\ axial = I/2L - 5$, where I is the number of islands and L is the number of axial lines. As the axial map is nonplanar, this value will be higher than the convex value. From the relation between convexity and axiality in a space, we obtain two kinds of information about the space: through the convex organization, we are given complete local information about the space we are in, and through the axial organization, we are given partial global information about the spaces we might go to. In urban space, we are in effect given information about two scales at once.

<u>Syntactic Measures</u>

The central concept of space syntax is integration. The technique allows one to express integration in numerical values. As is the case with many other measures of spatial structure, these values are dependent upon the urban area. The integration of space is a function of the mean number of lines and changes of direction that need to be taken to go from that space to all other spaces in the settlement system. Integration is therefore about syntactic not metric accessibility, and the word 'depth' rather than 'distance' is used to describe how far a space lies. Every line in a settlement layout has a certain depth from every other line. The integration value of a line is a mathematical way of expressing the depth of that line from all other lines in the system. It is assumed that the distribution of integration across an urban area correlates with the movement pattern of an area. Urban areas can be distinguished by and compared in terms of different levels of integration. Integration has is used as a measure of quality for urban areas. By calculating integrated and segregated parts of a settlement, it is also possible to know whether a new design proposal fits into the existing structure of an area.

The syntactic intelligibility of an urban system is defined as the degree of correlation between the connectivity and integration values in the system. The term intelligibility is used because the stronger the correlation, the easier it is to infer the global position of a space from its directly observable local connections (Bafna, 2003; Hillier, 1999; Hillier & Hanson, 1984; Penn, Hillier, Banister,

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& Xu, 1998). This makes it possible to capture the way people can learn about large patterns from their experience of small parts or fail to do so when the correlation is weak (Hillier & Hanson, 1984).

The concept of synergy, like the parameter of intelligebility, has been defined as a second-degree value emerging as a result of correlation. It is obtained as a consequence of the correlation between global integration (Rn) and local integration (R3) parameters where the city is assessed at the local scale dimension. The synergy value measures the degree of an area or a space within the urban system and to what extent it is correlated with this system (Hillier, 1996, 1999). The higher the correlation, the more the local areas in the system make themselves available as a well-structured local aggregation of the urban grid. In other words, the whole system tends to be made up of powerful local centers (Asami, Kubat, & Istek, 2001).

If the values which these two parameters, i.e. intelligebility and synergy, have are between 1 and 0.45, then the settlement is interpreted to be intelligible or effective in the settlement fabric of a local scale; if it is between 0.45 and 0.2, then it is interpreted to be an average value and if it is lower than 0.2, then it is interpreted to be unintelligible (Choudhary & Adane, 2012; Kubat, 1997; Mohareb, 2009).

FINDINGS OF THE STUDY

The data collection stage occupies a significant place in the study in order to be able to implement the analyses mentioned in the methodology section. For the purpose of our this study, the map of urban space is converted into two types of maps: an axial map whose basic unit is the axial line and a convex map whose basic unit is a two-dimensional polygon-shaped convex space. The base maps are digitized using Qgis software program and converted into dxf output files which are loaded into Depthmap software version x 0.30 (Varoudis, 2012) to conduct the axial and convex analysis. The axial analysis method was used in the study, because axial analysis needs to be used in the convex space relationship since convex space analyses and axial space analyses are made comparatively in the study. Numbers of convex spaces, numbers of axial lines, numbers of building and numbers of building islands were calculated in each of the fourteen cities selected to make the specified analyses and, in the areas, covering the boundaries of historical urban cores (Table 1). In the next stage, each of the parameters were analyzed separately.

Table 1. Characteristic measures for comparison of the morphology of the selected cities

Selected Cities	*Urban form data*			
	Number of C=Convex Space	***Number of L=Axial Line***	***Number of B=Building***	***Number of I=Island***
Edirne	1132	1237	18690	602
Bursa	1214	1183	12700	318
Katsamonu	913	943	3564	310
Trabzon	565	702	3761	173
Sivas	1694	980	8327	**672**
Kayseri	415	446	5197	165
Kars	778	455	7826	352
Erzurum	1188	553	9113	300
Kütahya	1037	1158	2259	345
Mugla	648	786	3987	392
Urfa	1739	**2413**	**14571**	315
Mardin	**2159**	1476	13254	268
Antakya	1224	1089	1880	256
Tarsus	960	811	3056	304
Mean	**1119**	**1017**	**7728**	**341**

Convex Space Analysis

When the fourteen selected cities ara analyzed according to the convex space parameters (Figure 15), low values in convex articulation indicate less breakup**,** which in turn indicates a more synchronous system. When convex articulation values of the historical cores of the selected cities are compared, it is observed that *Edirne, Bursa, Trabzon, Sivas, Kayseri, Kars, Erzurum, Muğla, Urfa and Mardin* have lower convex articulation values than the average compared with *Kastamonu, Antakya, Kütahya and Tarsus* (0,210), which means that they are more synchronous cities. It can be said that the historical urban core of Edirne has the lowest value (0,061) and therefore it is the city that possesses the most synchronous structure. Likewise, Antakya has the highest value (0,651) and therefore it could be said to be the least synchronous city among the sample cities (Table 2).

When values of convex deformation of the grid, which is another parameter, are examined, it is seen that the cities of *Bursa, Erzurum, Urfa, Mardin and Antakya* are above the average (3.521), whereas the cities of *Edirne, Kastamonu, Trabzon, Sivas, Kayseri, Kars, Kütahya, Muğla and Tarsus* possess lower grid deformation (Table 2). High convex deformation values of the grid system indicate a more irregular open space system. It could be said that the historical core of the city of Mardin has the highest value and therefore possesses the most irregular open space system. In contrast, the historical urban core of the city of Muğla, which has

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the lowest value, exhibits a more regular pattern compared with the other cities. When viewed from a regional perspective, it could be said that while the cities in the Aegean, Central Anatolian and Black Sea Regions exhibit a more regular form, the cities in the East Anatolia and Marmara Regions have values closer to the average, and the cities in the South Eastern Anatolia Region have a more irregular form than the average.

High values in the grid convexity parameter indicate low deformation in the grid structure. When the cities of the sample are examined in terms of grid convexity, it is seen that grid convexity values of the cities of *Edirne, Kastamonu, Sivas, Kayseri, Kars and Muğla* are above the average, whereas grid convexity values of *Bursa, Trabzon, Erzurum, Kütahya, Urfa, Mardin, Antakya and Tarsus* are below the average (Table 2). Grid convexity values in *Muğla, Edirne and Kars* are higher when compared with the values in the other cities. This indicates that the grid structure is less broken. When the matter is examined from a regional perspective, it could be said that grid structure is the least broken in the Central Anatolia Region, wheras grid structure is the most broken in the South eastern Anatolia Region.

High values in the convex ringness parameter indicate a more grid-like system than the organic pattern in terms of the open space system. At this point, when the grid ringness values are examined, it is seen that, proportionately, they exhibit the same values as grid convexity values. The results indicate that grid structure is higher in the historical urban patterns of *Edirne, Kars and Muğla* (Table 2).

Table 2. Measures of Convexity Parameters of selected cities' historical cores

Cities	***Convex Articulation*** *(Num. of C / Num. of B)*	***Convex Deformation of Grid*** *(Num. of C / Num. of I)*	***Grid Convexity*** *((I1/2+1)2/C)*	***Convex Ringness*** *I/2C-5*
Edirne	***0.061***	1.880	0.576	0.266
Bursa	0.096	3.818	0.292	0.131
Kastamonu	0.256	2.945	0.379	0.170
Trabzon	0.150	3.266	0.355	0.154
Sivas	0.203	2.521	0.428	0.199
Kayseri	0.080	2.515	0.462	0.200
Kars	0.099	2.210	0.502	0.227
Erzurum	0.130	3.960	0.283	0.127
Kütahya	0.459	3.006	0.369	0.167
Mugla	0.163	1.653	***0.668***	0.304
Urfa	0.119	5.521	0.202	0.091
Mardin	0.163	***8.056***	0.140	0.062
Antakya	*0.651*	4.781	0.236	0.105
Tarsus	0.314	3.158	0.354	0.159
MeanValues	***0.210***	***3.521***	***0.375***	***0.169***

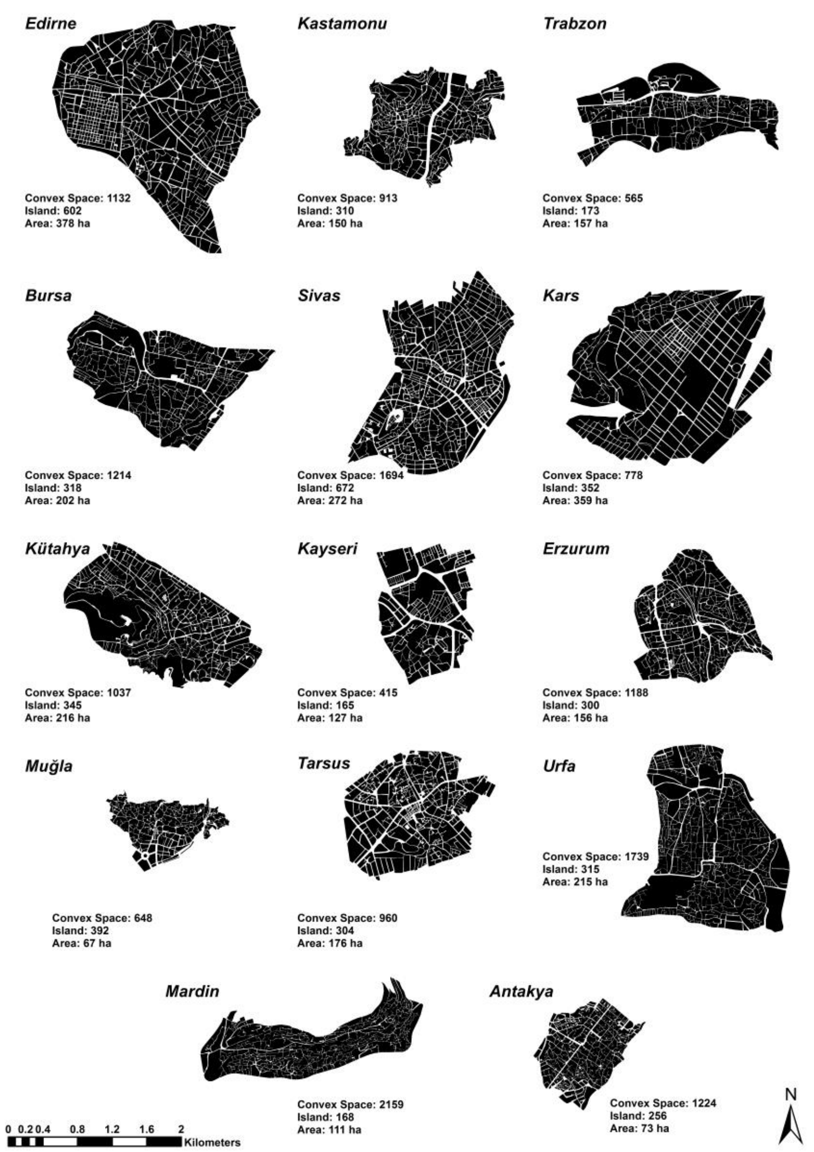

Figure 15. Convex maps of the selected cities' historical cores

Axial Space Analysis

When the fourteen selected cities are analyzed according to the parameters of axial space (Figue 16), it is seen that *Kastamonu, Kütahya, Antakya and Tarsus* are above the average in terms of axial articulation. In contrast, when compared with these cities, *Edirne, Bursa, Trabzon, Sivas, Kayseri, Muğla, Kars, Erzurum, Urfa and Mardin* have lower articulation values than the average (0.197). High axial articulation values indicate high axial breakup. *Kars, Erzurum and Edirne* stand out as the historical cities where proportionately axial breakup is the lowest. Antakya, on the other hand, is the city with the highest axial breakup. When viewed from a regional perspective, it can be said that open space systems of

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historical cores of the cities chosen from the Marmara, Central Anatolia and Southeastern Anatolia Regions exhibit a more axial structure. Likewise, breakups were higher in number in the historical cores of the cities chosen from the Mediterranean Region (Table 3).

When values of axial integration of convexity, which is another parameter, are examined, it is observed that *Edirne, Bursa, Kastamonu, Trabzon, Kayseri, Kütahya, Muğla and Urfa* are above the average, whereas *Sivas, Kars, Erzurum, Mardin, Antakya and Tarsus* are below the average in this respect. This parameter makes a comparison between the number of axial lines and the number of convex spaces, and here *low values* indicate a high level of integration of convex space. When looked in detail, proportionately, the highest level of axial integration is observed in the cities of *Urfa, Trabzon and Muğla*. It is also seen that the lowest axial integration is in the cities of *Erzurum, Kars and Sivas*. When viewed from a regional perspective, it can be said that historical fabrics of the cities in the Marmara, Black Sea and Aegean Regions have low axiality, whereas the historical fabrics of the cities in the Mediterranean and Eastern Anatolia Regions have high levels of axiality (Table 3).

The grid axiality value enables us to compare the same number of building islands as the orthogonal grid in the urban system. Here, high values point to a stronger grid structure. When the cities in the sample are examined in terms of the grid axiality parameter, it is seen that the grid axiality values of the cities of *Sivas, Kayseri, Kars, Erzurum, Muğla and Tarsus* are above the average, while grid axiality values of *Bursa, Kastamonu, Trabzon, Kütahya, Muğla, Urfa, Mardin and Antakya* are below the average (Table 2). However, given that these values are between 0 and 1, if they are near 1, they begin to express a grid system. Since the values in the sample are 0.1 and below, they can be deemed as systems whose grid axiality has been deformed (Table 3).

High values in the axial ringiness parameter indicate a more grid-like system compared with organic pattern in terms of open space system. At this point, when axial ringiness values are examined, it is seen that values of the cities of *Edirne, Sivas, Kars and Erzurum* are above the average value. This indicates that grid structure is higher in these cities than that in the other cities (Table 3).

Table 3. Measures of Axiality Parameters of selected cities' historical cores

Cities	AxialArticulation (Num. of L / Num. of B)	Axial Integration of Convexity (Num. of L / Num. of C)	Grid Axiality ($2I^{1/2}+2/L$)	Axial Ringness (I/2L-5)
Edirne	0.066	1.093	0.041	0.244
Bursa	0.093	0.974	0.032	0.135
Kastamonu	0.265	1.033	0.039	0.165
Trabzon	0.187	1.242	0.040	0.124
Sivas	0.118	0.579	0.055	0.344
Kayseri	0.086	1.075	0.062	0.186
Kars	0.058	0.585	***0.087***	***0.389***
Erzurum	0.061	0.465	0.066	0.272
Kütahya	0.513	1.117	0.034	0.149
Muğla	0.197	1.213	0.053	0.250
Urfa	0.166	***1.388***	0.016	0.065
Mardin	0.111	0.684	0.024	0.091
Antakya	***0.579***	0.890	0.031	0.118
Tarsus	0.265	0.845	0.045	0.188
Mean Values	***0.197***	***0.942***	***0.045***	***0.194***

Above average
Under average

Figure 16. Axial maps of the selected cities' historical cores

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Syntactic Measures of the Cities

When the fourteen selected cities are analyzed according to syntactic parameters (Figue 17), it is seen that *Sivas, Kayseri, Kars, Erzurum, Antakya and Tarsus* have values above the average when integration values are assessed on a global scale (Rn) in terms of the selected cities. In contrast, the cities of *Edirne, Bursa, Kastamonu, Trabzon, Kütahya, Muğla, Urfa and Mardin* are below the average. High integration values indicate existence of a more accessible system within an urban system. It is observed that among the sample cities, the historical core ofthe city of Kars has the highest integration value with 1.117, whereas the historical core of the city of Mardin has the lowest integration value with 0.51. When a comparison is made among the regions, it is seen that the mean integration values of the sample cities selected from the Marmara, Black Sea, Aegean and South Eastern Anatolia Regions are lower than the mean integration values of the cities selected from the Central Anatolia, Mediterranean and Eastern Anatolia Regions (Table 4).

When the cities are assessed in terms of intelligibility, which is another parameter, it is seen that *Trabzon, Sivas, Kayseri, Kars, Erzurum, Kütahya, Muğla* and *Tarsus* are above the average value of 0.453, whereas *Edirne, Bursa, Kastamonu, Urfa, Mardin and Antakya* are below this average value. High values of the intelligibility parameter indicate that spatial configuration is more intelligible and easily predictable by users. At this point, it could be said that the highest syntactic intelligibility value belongs tothe city of Tarsus with 0.621. When the intelligibility parameter is compared in terms of the regions, it is observed that the values of the cities inthe Central Anatolia and Eastern Anatolia Regions are higher, whereas the values of the cities in the Marmara and South Eastern Anatolia Regions are lower (Table 4).

When the parameter of synergy, which is a correlation of local and global integration values, is examined, it is seen that values concerning the cities of *Bursa, Trabzon, Sivas, Kayseri, Kars, Erzurum, Antakya and Tarsus* are above the average value of 0.698, whereas the cities of *Edirne, Kastamonu, Kütahya, Muğla, Urfa are Mardin* are below the average. It is observed that the highest value is in Kars, while the lowest value is in Mardin (Table 4).

Table 4. Space Syntax Parameters of selected cities' historical cores

Cities	*Integration (Global)*	*Integration (Local R3)*	*Connectivity*	*Intelligibility* (Correlation between Integration Global and Connectivity)	*Sinergy* (Correlation between Integration Global and Integration Local R3)
Edirne	0.782	1.681	3.515	0.327	0.540
Bursa	0.810	1.507	3.072	0.381	0.721
Kastamonu	0.728	1.529	3.249	0.441	0.654
Trabzon	0.812	1.431	2.932	0.469	0.714
Sivas	0.994	1.701	3.465	0.478	0.723
Kayseri	1.096	1.621	3.318	0.539	0.815
Kars	***1.117***	***1.794***	***3.635***	0.521	***0.834***
Erzurum	1.080	1.721	3.588	0.555	0.796
Kütahya	0.663	1.432	3.054	0.465	0.683
Muğla	0.555	1.324	2.863	0.490	0.659
Urfa	0.594	1.283	2.629	0.307	0.553
Mardin	0.510	1.346	2.847	0.335	0.496
Antakya	0.854	1.393	2.714	0.409	0.748
Tarsus	1.109	1.686	3.531	***0.621***	0.830
Mean Values	***0.836***	***1.532***	***3.172***	***0.453***	***0.698***

Above average (dark shading)

Below average (light shading)

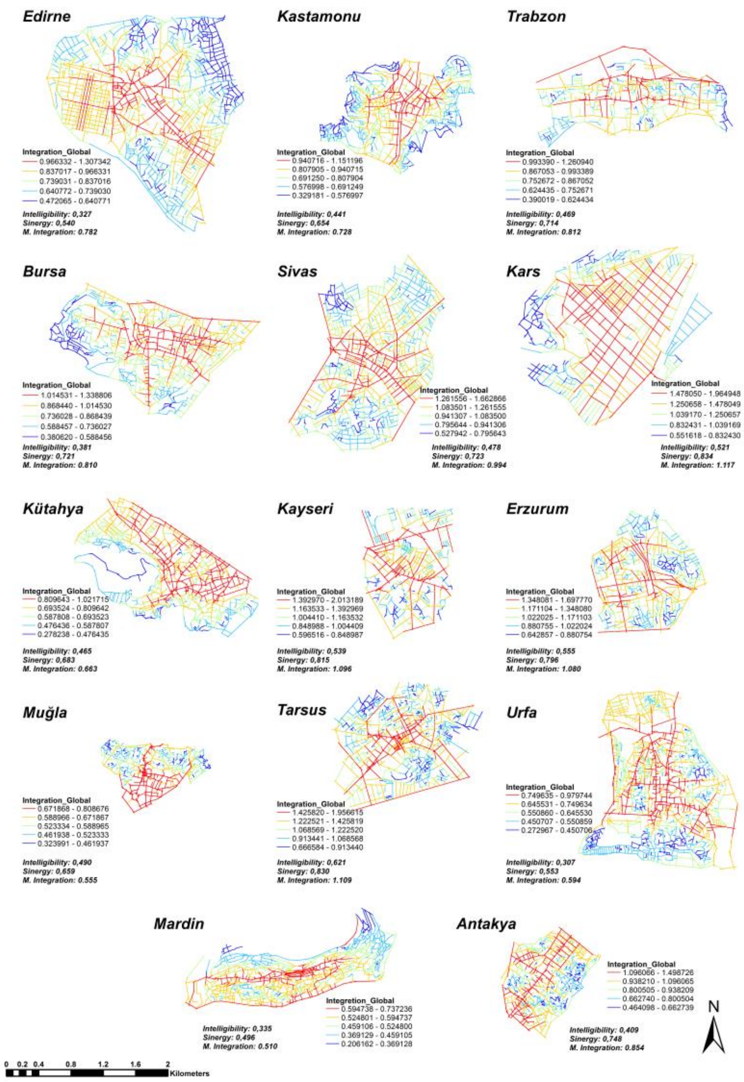

Figure 17. Integration maps of the selected cities' historical cores

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CONCLUSION

In this study, morphological structures of historical urban fabrics of settlements in Anatolia, which have been shaped up under the influence of various cultures and different geographic and climatic conditions through the historical process, are presented comparatively using a mathematical interpretation.

In the study, comparative, quantitative and morphological analyses were made on traditional urban patters of fourteen cities selected from the seven different geographical regions of Turkey, two from each of the regions. As a result of these analyses, detailed information was presented about the morphological structures of the urban forms on an urban scale as well as on a regional scale. In this context, the folowing conclusions have been reached within the framework of the specified methodological approach.

Table 5. Comparative morphological characteristics of the cities

Urban characteristics	*Edirne*	*Bursa*	*Kastamonu*	*Trabzon*	*Sivas*	*Kayseri*	*Kars*	*Erzurum*	*Kütahya*	*Muğla*	*Urfa*	*Mardin*	*Antakya*	*Tarsus*
Synchronous	■	■		■	■	■	■	■		■	■	■		
Asynchronous			■						■				■	■
Lower convex articulation value indicates less breakup and more spatial synchrony														
Regular	■		■	■	■	■	■		■	■				■
İrregular		■						■			■	■	■	
Lower convex deformation value indicates regular settlement layout														
Angular blocks	■		■		■	■	■			■				
Organic blocks		■		■				■	■		■	■	■	■
High grid-convexity values indicate less deformation of the grid and angular blocks.														
Axial	■	■		■	■	■	■	■			■	■		
Nonaxial			■						■	■			■	■
Low axial-articulation value indicates high axiality.														
Grid-like	■	■	■	■					■					■
Nongrid-like					■	■	■	■		■	■	■	■	
High grid-axiality values indicate a high approximation to a grid														
Distributedness	■		■		■	■	■		■	■				
Nondistributedness		■		■				■			■	■	■	■
High convex-ringiness and axial-ringiness measures indicate distributedness in the open space system.														
Intelligible				■	■	■	■	■	■	■				■
Unintelligible	■	■	■								■	■	■	
Values of ≥ 0.45 for correlation between global integration and connectivity indicate an intelligible system.														

When an assessment is made in terms of synchrony of the fourteen cities, it is seen that ten have a more synchronous open space system. If we are to make a generalization based on this, we could say that the cities in Turkey have a synchronous structure. If we go into more detail, we could say that the cities selected from the Mediterranean Region are more asynchronous compared with the other cities. When an assessment is made in terms of regularity or irregularity, it is observed that nine of the fourteen cities reflect regular forms with values above the average. The remaining five cities, on the other hand, have more irregular forms than the other cities with values below the average. In conclusion, if we are to make a generalization, we could say that the cities in Turkey exhibit regular forms. When the degree of grid deformation is examined, it is observed that organic form is more predominant. Though eight cities exhibit below-the-average organic structure, a grid-like structure is too weak to be felt among the other cities with the exception of Edirne and Kars. When an assessment is made in terms of axiality, it is observed that nine of the fourteen historical urban cores selected for the sample have high levels of axiality. It should be stated that the cities chosen from the Aegean and Mediterranean Regions are among the other five historical urban cores that have lower axiality than the average. When the issue is examined in terms of distributedness, it could be stated that high values in the parameters of Convex Ringiness and Axial Ringiness indicate more grid-like structure than organic pattern in terms of the open space system.While it is possible to make an interpretation on an urban level, no data appeared that could allow for making a more generalized interpretation. High intelligibility values indicate that spatial configuration is more intelligible and easily predictable by users. It could be said at this point that Tarsus has the highest syntactic intelligibility value with 0.621. When an interregional comparison is made in terms of the intelligibility parameter, it is seen that the cities in the Central Anatolia and Eastern Anatolia Regions have higher values, whereas the cities in the Marmara and SouthEastern Anatolia Regions have lower values (Table 5).

It could be stated that the results obtained from this study indicate that the analytical techniques offered by the Space Syntax method have made a significant contribution to the concretized formulation of spatial models and therefore could be designated as a means in demonstrating differences and resemblances of different built environments.

Anatolia, which is at a point where Asia and Europe meet, is a geography that has hosted many culture since the earliest civilizations of history were established. Anatolian cities, in particular, enjoy a historical legacy where spatial structures of Roman, Byzantine, Ottoman and Turkish cultures can be observed. In addition, the fact that geographically it enjoys different climatic conditions and topographic features seems to have a major influence on the spatial configuration of the cultures as well as on morphological formation of the geography. It is belived that a comparative analysis attempted in this study of the historical cores of the cities, which have been shaped up under the impact of rich historical and cultural heritage and geographical conditions, within the framework of a quantitative model will make a significant contribution to studies conducted on urban morphology, urban design, urban planning and architecture.

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REFERENCES

Aru, K. A. (1998). *Türk Kenti [Turkish city]*.

Asami, Y., Kubat, A. S., & Istek, C. (2001). Characterization of the street networks in the traditional Turkish urban form. *Environment and Planning B: Planning and Design, 28*(5), 777-795.

Bafna, S. (2003). Space syntax: A brief introduction to its logic and analytical techniques. *Environment and Behavior, 35*(1), 17-29.

Batty, M., & Rana, S. (2002). Reformulating space syntax: the automatic definition and generation of axial lines and axial maps. *Centre for Advanced Spatial Analysis Working Paper, 58*.

Bölük, E. (2016). *Köppen İklim Sınıflandırmasına Göre Türkiye İklimi*. Retrieved from Ankara:

Choudhary, P., & Adane, V. (2012). *Spatial configurations of the urban cores in central India.* Paper presented at the Proc. 8 Int. Sp. syntax Symp. Santiago de Chile.

Conzen, M. R. G. (1960). Alnwick, Northumberland: a study in town-plan analysis. *Transactions and Papers (Institute of British Geographers)*(27), iii-122.

Cutini, V. (2001). *Configuration and Centrality-Some evidence from two Italian case studies.* Paper presented at the Space Syntax 3rd International Symposium Proceedings, 2001.

Demir, A. (1996). *Through the Ages Antakya*. İstanbul: İstanbul Akbank Culture and Art Publication.

Dursun, P. (2002). *Trabzon kentsel dokusunda morfolojik analiz.* Fen Bilimleri Enstitüsü,

Eskidemir, K. (2016). *Kent Morfolojisi ve Kültür: Anadolu ve İtalya Kentleri Karşılaştırmalı Analizleri.* Fen Bilimleri Enstitüsü, İstanbul Teknik Üniversitesi,

Fierro, M. I. (2011). *The Western Islamic World, Eleventh to Eighteenth Centuries* (Vol. 3). Cambridge: Cambridge University Press.

Hillier, B. (1989). The architecture of the urban object. *Ekistics*, 5-21.

Hillier, B. (1996). *Space is the machine: a configurational theory of Architecture*: Cambridge University Press.

Hillier, B. (1999). The hidden geometry of deformed grids: or, why space syntax works, when it looks as though it shouldn't. *Environment and Planning B: Planning and Design, 26*(2), 169-191.

Hillier, B., & Hanson, J. (1984). The social logic of space, 1984. *Cambridge: Press syndicate of the University of Cambridge*.

Kaya, M. A. (2003). Anadolu'daki Roma Garnizonları. *Tarih İncelemeleri Dergisi, 18*(2), 83-94.

Kejanlı, T. (2005). Anadolu'da İlk Yerleşmeler ve Kentleşme Eğilimleri. *Fırat Üniversitesi Doğu Araştırmaları Dergisi, 4*(1), 89-97.

Kuban, D. (1968). Anadolu-Türk Şehri: Tarihî Gelişmesi, Sosyal ve Fizikî Özellikleri Üzerinde Bazı Gelişmeler. *Vakıflar*(3), 53-73.

Kubat, A. S. (1997). The morphological characteristics of Anatolian fortified towns. *Environment and Planning B: Planning and Design, 24*(1), 95-123.
Kubat, A. S. (1999). The morphological history of Istanbul. *Urban Morphology, 3*, 28-40.
Kubat, A. S. (2010). The study of urban form in Turkey. *Urban Morphology, 14*(1), 31-48.
Larkham, P. J. (2002). Misusing'morphology'?(Urban form). *Urban Morphology, 6*(2), 95-98.
Mohareb, N. I. (2009). Street morphology and its effect on pedestrian movement in historical Cairo. *Cognitive processing, 10*(2), 253-256.
Moudon, A. V. (1997). Urban morphology as an emerging interdisciplinary field. *Urban Morphology, 1*(1), 3-10.
Osmond, P. (2011). The convex space as the'atom'of urban analysis. *The Journal of Space Syntax, 2*(1), 97-114.
Özcan, K. (2006). Anadolu-Türk Kent Tarihinden Bir Kesit: Selçuklu Döneminde Anadolu-Türk Kent Modelleri. *Bilig*(38), 161-184.
Penn, A., Hillier, B., Banister, D., & Xu, J. (1998). Configurational modelling of urban movement networks. *Environment and Planning B: Planning and Design, 25*(1), 59-84.
Peponis, J., Hadjinikolaou, E., Livieratos, C., & Fatouros, D. A. (1989). The spatial core of urban culture. *Ekistics*, 43-55.
Tanyeli, U. (1987). *Anadolu-Türk kentinde fiziksel yapının evrim süreci (11-15. yy).* İstanbul Teknik Üniversitesi, Fen Bilimleri Enstitüsü, İstanbul.
Thilagam, N. L., & Banerjee, U. K. (2016). The morphological characteristics of medieval temple towns of Tamilnadu. *Environment and Planning B: planning and Design, 43*(1), 7-33.
Tüter, R., & Ökesli, D. S. (2015). *Geleneksel Kent Merkezi Çeperinde Dönüşüm Tarsus Örneği.* Paper presented at the Türkiye Kentsel Morfoloji Sempozyumu Temel Yaklaşımlar ve Teknikler, Mersin.
Varoudis, T. (2012). DepthmapX multi-platform spatial network analysis software. *Version 0.30 OpenSource, http://varoudis.github.io/depthmapX*.
Whitehand, J. (1986). Taking stock of urban geography. *Area*, 147-151.
Yekbun, A. E., & Çırak, A. A. (2018). *Mardin Tarihi Kent Dokusunda Form Değişiminin İncelenmesi.* Paper presented at the Türkiye Kentsel Morfoloji Araştırma Ağı II. Kentsel Morfoloji Sempozyumu "DeğişKent" Değişen Kent, Mekân ve Biçim", İstanbul.

Resume

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Viewpoint

Measuring Intensity – Describing and Analysing the "Urban Buzz"**

Tim Stonor*

Density or Intensity?

There is much debate about how to measure density – dwellings per hectare, bedrooms per hectare or people per hectare; including or excluding major highways, parks and open spaces; the permanent population only or the transient one too?

While this gives urban planners something to disagree about it risks missing the point: great urban places are not created by density; they are created by *intensity*.

And the difference matters. When people describe the buzz of a marketplace (figure 1.) they do not say, "Wow - it was so *dense*!". They are much more likely to say how *intense* it was. *Density* is a word used by planners. *Intensity* is a word that real people use, and perhaps because it describes the outcomes that people experience rather than the inputs that have gone in to creating them. It is the outcomes that are ultimately more important.

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**Morphology, Plenary section (invited speech, unpublished).

Figure 1. Trafalgar Square Central Steps, London, UK, redesigned following careful observation of human behaviour and computer modelling of future pedestrian movement flows that prioritise people over the movement of vehicles. (Space Syntax Limited © 2019) (Stonor, 2019)

But planning professionals like density. Even though density fails to capture the essence of what it feels like to be somewhere, the term appeals to professional instincts. It describes the raw ingredients that planners have to handle and, once you choose which version of the formula you are going to use, density is easy to measure. It involves a simple calculation of straightforward urban quantities such as the number of people, the number of houses or the number of bedrooms, all divided by the geographic area over which those ingredients occur. Easy.

In contrast, intensity seems more difficult to pin down, not least because it appears to have a subjectively emotional dimension; it speaks of feelings, of responses, of stimuli, and this raises problems about how it can be effectively measured. But intensity is also a response to context, to place and above all to people - and here we can find clues to its measurement.

Observing Intensity

So what are the factors that people are responding to when they instinctively feel the intensity of a great place? For a start, they can not be calculating a planner's measure of urban density because, even if they were so minded, they could not possibly know about populations and geographic areas when they are walking along a street or sitting at a café table on a public space.

What people can respond to though is what is happening around them in the public realm: they can see how many other people there are, and they can see what these people are up to. In other words, intensity is obvious, immediate and instinctively calculable to the person in the street: not only the mobile population of walkers, drivers and cyclists but also the *immobile* population of sitters, leaners and pausers. Intensity has a static as well as a kinetic dimension. Indeed the stationary people are the essential

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ingredient of intensity. They are the people who have chosen to be there, to add to the place through their semi-permanence and not simply to pass through on the way to somewhere else. Intensity is not therefore about the population density of an area but the population that is participating in the public realm of an area. And this should be obvious. And everyday. But any attempt to emphasise the benefits of static participation runs counter to the mindset of the traffic engineer and counter to the still-persuasive, kinetic legacy of Le Corbusier, who described "grinding gears and burning gasoline" as the pleasurable objectives of the Plan Voisin.

Nevertheless, intense places are sticky places and especially so when people are not only co-present in space but when they are also interacting: talking to each other, sharing thoughts, ideas, opinions. This is the essence of intensity; there is an exchange - a *transaction* – be it economic, social, cultural, intellectual, factual or simply facile. It is the daily public life of every thriving village, town and city. It is so apparently unremarkable as to go unnoticed, unobserved and unmeasured. Until it is not there. And that is when you feel it most clearly.

A number of years ago my colleagues at Space Syntax were working on a sample of towns across the UK, some historic and some new. The towns had similar residential populations and similar retail floorspace provisions across similar geographical areas; in other words, similar densities. But what the team had also done was to count the numbers of people using the centres of each town: how many were walking and sitting in public space. They had counted over several days, from morning until evening. What they found was that the historic towns consistently had many more people using their centres than the new ones - and they knew from other evidence that the historic towns had stronger economic performances. Here then were places with similar urban densities but different intensities of human activity.

What seemed to explain the differences between historic and new towns were first, the spatial layout and second, the street design of each place. The historic towns were laid out around radial streets that were designed to carry cars as well as vehicles and which met at the centre of the town in a public space. Behind these radial streets were more or less continuously connected grids of residential streets, interrupted by the occasional large open space. Both cars and pedestrians could use the residential streets, while the open spaces were generally for pedestrians only. There was some limited pedestrianisation in the very centre of each town.

In contrast, the new towns often had separate street networks for vehicles and pedestrians, no high street or central public space and usually one or two enclosed shopping malls. Their central areas were typically pedestrianised and spatially separated from the surrounding residential areas by a vehicle-only ring road; these residential areas were separated from each other by large swathes of open space.

To summarise, the key differences were first in the intensity of the human experience and second in the design of the street network. Intensity, it seems, is facilitated by an alignment of physical and spatial factors: having the movement-sensitive land uses on sufficiently well-connected streets that are, in the main, shared by vehicles and pedestrians.

Measuring Intensity

Importantly, both the amount of human activity and the degree of street connectivity are measurable commodities – if you know how. This is the professional specialism of my practice, Space Syntax, and it has two key parts: one part that takes place in the studio, using purpose-designed software that measures the amount of connectivity in street grids (figure 2.), and the other part that happens on site using some form of counting device. This device may be a camera strapped to a lamp post or, in recent years, a drone flight. Or it may simply be a set of human eyes, a pencil and a notepad.

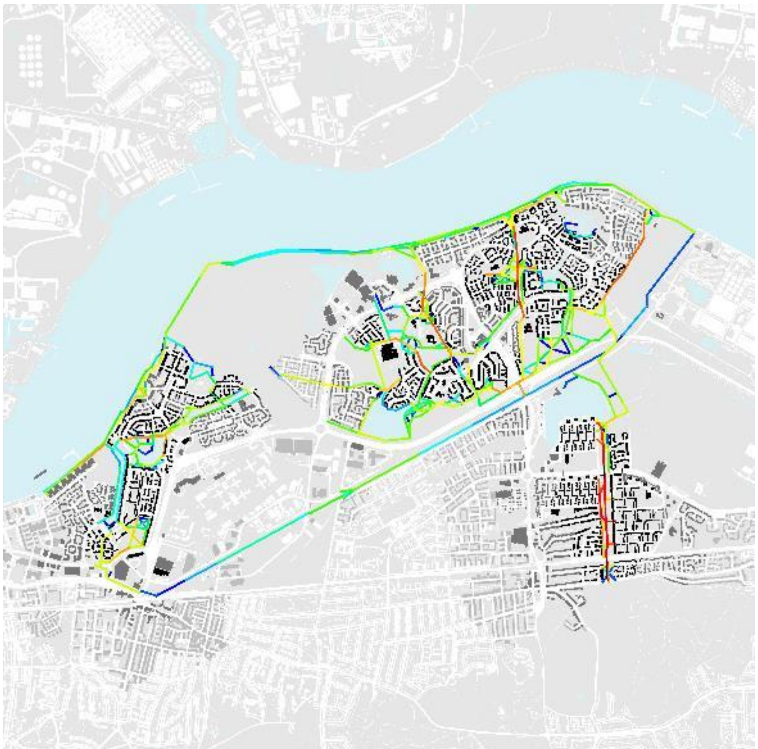

Figure 2. Spatial Accessibility Model of Thamesmead, UK, showing the hierarchy of street connections from most accessible in red, then orange through yellow and green to least accessible in blue. Practice demonstrates that spatial accessibility is a robust proxy for movement, land use vitality, land value and other key urban performance indicators. (Space Syntax Limited © 2019)

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Onto these ‘foundational’ datasets are added other information, which might be about air quality, land value, crime rates or health outcomes. Statistical software is employed to explore relations between the datasets: how is health or wealth or educational achievement related to spatial connectivity or isolation? The product of this process is an *Integrated Urban Model*: a quantitative record of urban form and urban performance (figure 3.). A Geographical Information System is used to hold the datasets in one place and a basic form of artificial intelligence is run to explore the links between the data.

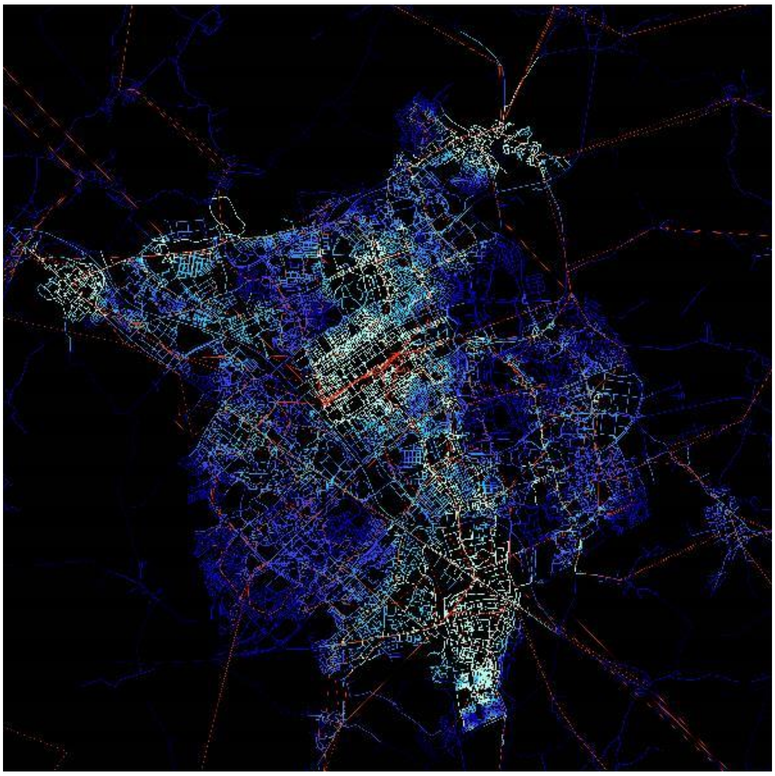

Figure 3. Integrated Urban Model of Milton Keynes, UK, combining data on spatial layout, land use and public transport accessibility to address car-dependence and social isolation. (Space Syntax Limited © 2019) (Parham, 2017)

However it is possible to create a primitive version of a data platform using only PowerPoint and Excel. After all, Space Syntax began its work before the Macintosh, before colour screens, before the internet, before CAD, before GIS and long before BIM. Its observations of pedestrian movements around Trafalgar Square were done with pen and paper, the results coded manually into a simple drawing programme.

What matters today is what mattered then: to bring data to life using maps and colours rather than spreadsheets and charts (figure 4.). To make it accessible to the audiences that will be making judgments about the future of places: investors, planning officers, politicians and local communities. Measures of intensity therefore need to speak to multiple audiences and not least to the design community, into whose creative hands is entrusted the responsibility for shaping the aspirations of stakeholders. An

Integrated Urban Model must be nimble, capable of responding again and again to the short and intensive programme of a rapid design process. Beware the Smart City "Control Room" stuffed with technicians; eintegratedmbrace instead a portable platform that can respond to the timescale of a creative whim.

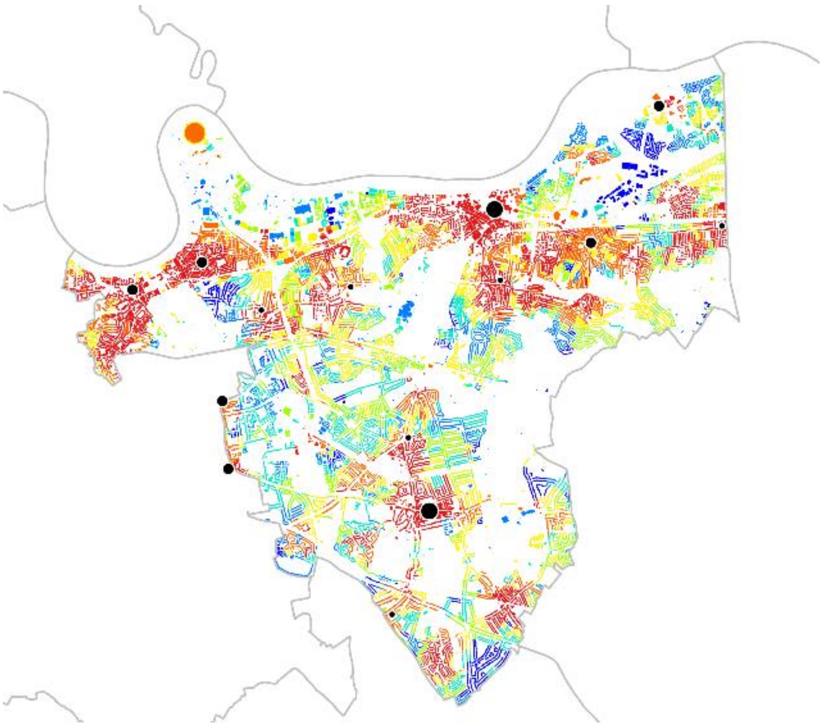

Figure 4. Land use catchment analysis of the Royal Borough of Greenwich, UK. The degree of access to different amenities and their mix defines the character of an area by creating a more walkable and vibrant urban context, 2019. (Space Syntax Limited © 2019) (Hillier & Stonor, 2017)

Creating a Profession of "Urban Intensity Surveyors"

So why do we not measure towns and cities in such a systematic way? Why is there not a profession of urban intensity surveyors? And a culture among architects and urban planners of designing for intense human interactions?

The problems start when the responsibility for thinking about cities, streets and public spaces moves from the individual enjoying the buzz of the boulevard to the collective of professional institutes charged with creating place. Density prevails over intensity and we revert to simplifications. Assumptions are made - incorrectly as we have seen - that the quality of street life will be in direct proportion to the density of people in an area. That if we have more people then the streets will be busier and the busier the streets, the better the place. But then the counter view is quite reasonably made that people need quiet streets and so densities should not be too high. And a compromise is eventually reached for neither super high nor super low densities; neither towns that are too big nor too small. And if we need big towns then they

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should be broken up into manageable parcels. Since we want pedestrians then we should pedestrianise.

We end up with an urbanism of averages and a morphology of enclaves through an approach that is much too simplistic to ever create great place. It is not born of science and it does not reflect human experience: people know instinctively that you can turn off the busiest street in the city and immediately find yourself on a lane that is one of the quietest; that the intensity of the urban experience can transform itself in seconds. This is one of the great joys of exploring great cities: they are not pervasively busy; they are intensely quiet as well. They have a foreground grid of busy streets and a background grid of quiet ones. If we can systematically measure urban intensity then we will understand how towns and cities work in ways that will transform practice. And by transforming practice we will transform place (figure 5.).

Figure 5. Nur-Sultan Masterplan, Kazakhstan, in which an urban block structure creates a network of busy 'foreground' and quiet 'background' streets. (Space Syntax Limited © 2019) (URL-1)

The Future for Intensity

The professions will be unwise to avoid the opportunities presented by technology. Both the technologies of data capture, visualisation and analysis as well as the technologies that are affecting human behaviours: broadband, social media, augmented reality (AR) and artificial intelligence (AI). Human activity is becoming ever more intense and this gives us another reason to systematically measure urban intensity. People are walking more slowly, ensconced in virtual worlds at the same time as participating in physical space; seeing their surroundings augmented with pop-up information. The trend will continue as AR on our smartphones becomes AR on our spectacles. As well as talking to each other we will be talking to objects on display in shops, to screens in buildings and on streets, and to ourselves – our digital twin may appear as an avatar walking alongside us in our peripheral vision or in front of us when trying on clothes for us. This intensity of communication can already be seen in early adopting countries, especially China, and it may seem strange at first. But there was a time, not long ago, when it seemed strangely ostentatious to put down a mobile phone on a table in a public place.

The brain has a finite processing capacity and so what goes into handling increased visual information will have to be taken away from the control of bodily function. People may therefore adapt to the amplified intensity of visual stimuli by moving ever more slowly. We will need more space for these intense activities and the obvious place is the street, where we will need more space for people. Road space will have to narrow and footways will have to widen. We will need more places to sit and lean - to be sticky.

And this presents a choice for designers: continue to disagree about the best way to measure density or embrace intensity and anticipate the radical transformation of place (figure 6.).

Figure 6. Nur-Sultan Masterplan, Kazakhstan, created by Space Syntax through a place-based and data-driven design process. (Space Syntax Limited © 2019) (URL-1)

REFERENCES

Hillier, B., & Stonor, T. (2017). Kevin Lynch Memorial Lecture. Retrieved from https://timstonor.wordpress.com/

Parham, E. (2017). *Milton Keynes Housing and Transport Strategy*. Retrieved from https://spacesyntax.com/project/milton-keynes-housing-and-transport-strategy-2/

Stonor, T. (2019). Beyond Placemaking: 7 Dimensions of "Place Performance". Retrieved from https://timstonor.wordpress.com/

URL-1. Master Plans. Retrieved from https://spacesyntax.com/

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Resume

Tim Stonor is an architect and urban planner who has devoted his career to the analysis and design of human behaviour patterns: the ways in which people move, interact and transact in buildings and urban places. He is an internationally recognised expert in the design of spatial layouts and, in particular, the role of space in the generation of social, economic and environmental value.

Tim is the Managing Director of Space Syntax, an urban planning and design company created at University College London in 1989 to develop and apply predictive design technologies. He is a Director of The Academy of Urbanism, a Visiting Professor at The Bartlett School of Architecture, University College London, a Harvard Loeb Fellow and Deputy Chair of the UK Design Council.