MEASURING URBAN MEMORY THROUGH A QUANTITATIVE APPROACH: SPACE SYNTAX

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Many historical settlements are losing their peculiar characteristics, including their cultural values and their urban identity. These lead in turn to the loss of the urban memories, none of which can be replaced, which make such settlements unique. An analysis of the characteristics and structures of local settlements is best obtained by ensuring the continuity of their cultural and social values. In addition, assigning them up-to-date functions as well as cultivating an appreciation of such settlements' historical importance and the creation of a social conscience for their conservation is believed to lead to a greater chance for their preservation. This approach can also be an inspiration for modern and contemporary designs. For this reason, the examination of settlements through the realization of their global forms and their urban memory requires novel and interesting approaches. To achieve this, linking their morphological and historical characteristics to their dynamic forms stand out as themes that should be emphasized in both urban design and architecture.

At this point, it is possible to mention a mathematical model that can analyse urban patterns and measure urban memory through a comparative interpretation. The traces of the past can be examined through the use of a quantitative model. Space Syntax is a method for describing and analysing the relationships between spaces, and offers a set of techniques for the representation, quantification and interpretation of the relationships between buildings and settlements (Hillier & Hanson 1984, Hillier, 1996). Space Syntax has been adopted and developed in hundreds of universities and educational institutions as well as in professional practices. Built on quantitative analyses and geospatial computer technology, Space Syntax provides a set of theories and methods for the analysis of spatial configurations at all scales. The aim of this presentation is to explain the contribution of Turkish researchers to this quantitative approach (Kubat & Özer, 2008, Kubat 2010, Kubat 2014).

The presentation has two parts, the first consists of the application of Space Syntax on the historical traces of settlements in Anatolia (Kubat 1997), the reflection of this study and its use in world city analyses; the second gives some examples of its application on real projects within Turkey, and the contribution of Turkish researchers to its development.

1) Characteristic urban patterns of Anatolian towns;

Kubat (1997), comparatively analysed the traces of history and urban memory of nine fortified towns in Anatolia using "Space Syntax". This analysis was carried out by applying the basic concepts and methods of the descriptive theory of space which were developed at the Architectural Studies unit at UCL (Hillier & Hanson, 1984; Hillier, 1996). The characteristics of space that are intrinsic to Anatolia, not only because of its geographical location but also

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because of the influences of several civilizations, can be defined by means of mathematical interpretation (Kubat 1997). This study, together with an examination of the morphological history of Istanbul (Kubat 1999) were the beginnings of the use of term "morphogenetic", and the adaptation of a novel model termed "Space Syntax" in Turkey. Kubat and Topçu (2007), made comparative quantitative analyses of pedestrian movement patterns in two Anatolian towns. In Konya; Ottoman and Turkish characteristics are evident, and in Antakya; Roman and Islamic patterns overlap. (Topçu and Kubat 2012). The terminology and the morphological methodology used in both of these were adapted from Kubat's 1997 study of Anatolian citadels.

The work of Asami & Kubat (2001) and Asami et al (2004) employed quantitative indices by using GIS to reveal the traditional Turkish character in street network analyses in several cities in Turkey and in comparators in other parts of the world.

These studies of Anatolian urban culture through the use of Space Syntax also shed light on research studies conducted in India and the Arabic world. Thilagam and Benergee (2015) presented the spatial configuration of seven medieval temple towns in southern India. These had evolved under a predominantly religious influence and accordingly reflected the significant features of the Hindu genotype. Mohareb and Kronenburg (2012) analysed and compared the urban edges of historic walled Arab cities, in the belief that their study would assist in developing appropriate interrelationships between the historic urban fabric and adjacent urban developments. The comparative spatial configuration patterns and land use activities of four Arabic cities were analysed through the use of GIS as well as Space Syntax.

Another interesting and similar approach was used by Choudhary and Adane (2012). In this study, five cities with similar topographic and geographic conditions from central India were analysed in terms of their configuration. This was done in the hope of better understanding culture-specific human preferences regarding space proxemics. The syntactic parameters and measurements of these Indian cities were also comparatively analysed against others, including Iranian, Arabic, Brazilian, British and Portuguese cities.

Eskidemir and Kubat (2017) conducted research into the urban fabric of Anatolian towns which were originally built during the Roman Empire, and which share similarities with settlements on the Italian Peninsula. These Anatolian towns have undergone repeated changes with the arrival of different cultures, ranging from Anatolian Turks to the later Ottomans, who were under the influence of Islam. Eight fortified towns of Roman origin in Anatolia and Italy were selected as paired examples for this study, and the interrelation between their morphological values and quantitative values were obtained by using Space Syntax to establish the methodology of the study.

2) The second part of this presentation is concerned with about how Space Syntax has been used to examine significant urban design, urban planning and transportation issues in Turkey. Turkish architects and planners believe that their studies into the subject have made contributions both to the Space Syntax methodology and to actual planning issues within Turkey (Kubat &Özer 2008, Kubat 2010, Kubat, 2014).

This contribution can be summarized as:

- the application of Space Syntax to actual projects: the redesign of a declining historical area in Istanbul (Kubat et al., 2004); the conversion of a brownfield site into an innovative park in Kayseri (Kubat et al 2012, Kevseroğlu & Kubat, 2015); and a study of the impact of an urban design project in Taksim Square and Gezi Park in Istanbul (Kubat 2015, Kubat et al., 2015),

- the development of a new methodology for pedestrian movement and wayfinding patterns (Özer & Kubat 2007, 2014 and 2015),
- the development of a new means of representation, and a new model for a vehicle transportation network (Kubat et al., 2007),
- the development of a 3D perspective model to include topographic parameters in the Space Syntax methodology as a contribution to the ongoing studies in the UK (Asami et al., 2001, Kubat et al 2003, Hillier&Iida 2005). The form of Istanbul is analysed by taking account of its rich topography and thus the street network of Istanbul's historical peninsula is illustrated on a three-dimensional surface by using GIS and Space Syntax.
- the application of Space Syntax to define evacuation routes during an earthquake, which is one of the real-world problems facing Turkey (Sarı & Kubat 2012),
- the organization of the Sixth International Space Syntax Symposium (SSS6) in Istanbul, Turkey (2007).

Brief explanations of some of the above research projects:

Evaluating the Impacts of an Urban Design Project: A Multi-phase Analyses of Taksim Square and Gezi Park, Istanbul, (Kubat 2015, Kubat, Gümru, Özer & Argın, 2015)
This research study explores the opportunities and challenges in taking a syntactic approach to the spatial analyses of different phases of the pedestrianisation project in the rapidly transforming political centre of Istanbul. The results of this paper, which were derived by using the tools offered by Space Syntax, demonstrate the effects of the changing spatial layout on pedestrian movement levels, and provide insight towards understanding the preferences of pedestrians when their usual choice of route is blocked and they are forced to use alternative paths. The paper also provides input for the urban design project which will be implemented in Taksim Square by the Istanbul Metropolitan Municipality (İBB).

The Effect of Built Space on Wayfinding in Urban Environments: A Study of the Historical Peninsula in Istanbul (Kubat, Özer & Özbil, 2007, Kubat & Özer 2008)
The primary aim of this research project is to enhance the spatial and visual organization of Istanbul's historic core by evolving a spatial regeneration strategy from the perspective of the pedestrian. The Sultanahmet district, the heart of historic old Istanbul and a popular sightseeing area, was chosen as the study area. Embedded within a rich cultural and historical heritage, the historical peninsula of Sultanahmet includes monuments, examples of civil architecture, and archeological remains. The area, which is officially registered as a 'Conservation Site', has been exposed to an intense vehicle and pedestrian demand that led to its degeneration. With its original methodology, efficient spatial models, strategic approach, and significant findings, this project was funded by the Istanbul Metropolitan Municipality and is anticipated to be used as a unique design framework for prospective urban design and pedestrianization projects for Istanbul

Casualty Mitigation Proposal for High Density Settlements in Earthquake-Vulnerable Areas, **Evacuation and Access** (Sarı & Kubat, 2012)
Space Syntax analysis has been used as a major tool in this study for defining orientation principles within urban areas. The study focuses on settlements with high building density in Istanbul for the purpose of casualty mitigation after an earthquake. Put simply, highly populated areas with vulnerable buildings will suffer road blockages due to building collapses. These road blockages may change the orientation of people and act as obstacles for the

emergency services such as ambulances and fire brigade vehicles. The aim of the study is to propose a model that ensures that every single residential unit can be reached after an earthquake according to both the anticipated evacuation and access routes and also the settlement patterns of Istanbul. With these outputs, it is expected the local authorities will have a starting point and classification for intervention programmes when drawing-up earthquake prevention plans.

Application of Space Syntax in the Regeneration and Transformation of Galata and Hendek Street (Kubat, Eyüboğlu & Ertekin, 2004) consultancy: Karimi & Stonor (Space Syntax Ltd).
Project supported and prepared for the Urban Regeneration Department of the Istanbul Metropolitan Municipality. The main issues of the project are the economic regeneration of the historic Galata region, and the elimination of the disjointed nature of the commerce- and retail-oriented Istiklal Street. Research and proposals were urgently needed to define the reasons for the area's decline and to help in the regeneration of its once lively nature. Space Syntax was used to propose a spatial redevelopment plan for Galata's historical urban core, which was aimed at the creation of a larger and unified activity center by improving the physical connections between the two important parts of Istanbul's town center.

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