

# An integrated framework for assessment of urban forms and their transformation

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## Abstract

This paper addresses an integrated framework on the basis of different urban morphological theories: historico-geographical approach, space syntax, and the Morpho method. It includes eleven criteria focusing on the assessment of urban forms and their transformations. These criteria are the accessibility of streets, connectivity of streets, intelligibility, synergy, street block size, plot size, building coverage, floor area ratio, block-plan size based on the town-plan or ground plan; building height and total constructed area (density of buildings) based on building fabric. Sekiz Mahalle (Konya, Turkey) is used to validate the methodological procedures of this integrated framework. The implementation of the methodology enables a strong basis for how an urban area should be transformed, and what should be followed before any interventions in the urban landscape. It is argued that this methodology can provide a smoother transition of the physical form of cities. It can play a substantial role in the preparation of municipal plans and designs in which any change is needed, balancing the conservation and transformation of morphological constituents of the urban landscape.

## Keywords

Historico-geographical approach, Planning practice, Space syntax, Urban transformation, Urban form.

## 1. Introduction

Urban form's transformation and change stand in cities life from the formation of the first settlements until today's contemporary urban landscapes. These changes will also continue in the future. While different elements of urban form, such as streets, plots, and buildings, undergo alterations, a set of questions come into existence for the future townscape management. While the urban landscape experiences dramatic transformations what should be protected for the future? Which characteristics of the urban landscape should be maintained? Does the transformation or change of distinct elements enhance the urban landscape, make this landscape better? Do they transfer the assets and the heritage of previous societies to future generations? While cities undergo physical changes, the planning framework needs new, more systematic, and more explicit methods and approaches to analyse, plan and design cities. A great deal has been written on the assessment of urban forms and their transformation or change. Yet, the lack of systematization and simplicity of technics gives rise not to an understanding of how to approach urban forms transformation. This paper explores an integrated framework based on three urban morphological theories, offering an explicit understanding of urban forms. This paper aims to propose an integrated guideline for physical interventions carried out in an urban area and, then, for analysing and prescribing urban forms transformation. More clearly, it pretends that the city or parts of cities under analysis should be assessed on the basis of the proposed methodology, and then, it should be addressed in regard to this framework. Following this line, it is possible that the urban character can be conserved, and then a balance between change and continuity can be established. This paper, firstly, begins with a theoretical framework addressing different urban morphological theories. Secondly, it identifies an integrated methodology for the assessment of urban form's transformation, informing planning practice and urban landscape

management. Thirdly, it describes *Sekiz Mahalle* neighbourhood and then focuses on the examination of this neighbourhood. Fourthly, the discussion part addresses fundamental problems of urban forms transformation and change, how these transformations should be assessed, and how the examination of the area based on the proposed methodology can inform planning and townscape management. It ends with conclusions.

## 2. Theoretical framework

Urban morphological analysis gained strength after 1950s under the umbrella of different urban morphological approaches (Batty, 2007; Batty & Longley, 1994; Caniggia & Maffei, 1984; Conzen, 1960; Muratori, 1959; Hillier, 1996). While the first attempts were about to establish a scientific theoretical framework for urban morphological schools of thought, the recent efforts are about bridging the theory and practice (Barke, 2015; Bell, 2012; Çalışkan & Marshall, 2011; Holanda, 2021; Kropf, 2017; Larkham & Morton, 2021; Monteiro & Pinho, 2021, 2022; Oliveira, 2015, 2021a, 2021b; Oliveira & Monteiro, 2021; Samuels, 2019; Strappa, 2021; Ünlü, 2019; Whitehand, 2000, 2013, 2021; Whitehand & Morton, 2004). The combination of different morphological approaches and methods has recently been an important tool to operationalize theories for practice. Kropf (1993 & 1996) established a framework on the basis of the work of M.R.G. Conzen and Gianfranco Caniggia – particularly the concepts of 'plan unit' and *tessuto urbano* (urban tissue). The combination of these two different approaches provides a basis for a form-based zoning of France. In this way, the delineated zones play a potential role in local zoning system to maintain the existing character of the town. Griffiths et al. (2010) propose a joint framework combining historico-geographical and space syntax approaches. In their study, they related the configuration of historical street networks with the persistence of socio-economic activity in the built environment over time. They presented the configurational and historical relationship

between suburban built form and socioeconomic activities. Oliveira (2013) established the Morpho method for measuring urban forms on the basis of the historico-geographical and space syntax theories. It offers a framework for the most relevant information about cities by assessing the physical form of urban areas. Li & Zang (2021) offer another substantial attempt for a combination of historico-geographical and configurational approaches to urban morphology in order to explore their complementarities. The combination of these two approaches presents an enhanced understanding of the historical transformation of urban form for both urban areas with incremental growth and those with fast-changing urban landscapes. Recently, Monteiro & Pinho (2021) developed 'MAP' (Morphological Analysis and Prescription) integrating historico-geographical, space syntax, and process-typological approaches - specifically based on morphological regionalization, angular segment analysis, and typological process - aiming at constituting a strong tool to identify and characterize morphological zoning that can introduce an effective set of rules for urban form's transformation.

This paper is developed on the basis of the three morphological theories of urban form, benefitting from the recent researches that combine different approaches. The first is the historico-geographical approach, as the prominent approach identified within the field of urban morphology, dealing with the development process and characterization of the townscape. The second is space syntax approach which focuses on the quantitative analysis of urban form. Space syntax research began in the centre of 'Land Use and Built Form Studies' at the University of Cambridge, and it gained a new impetus at University College London, mainly by Bill Hillier & Julienne Hanson (Oliveira 2016, 2022). The third is the Morpho method which addresses the physical characteristics of the urban landscape that are more permanent in time and that can offer the most relevant information on the city's form (Oliveira, 2013, 2020). While the first

two approaches directly contributed to the design of the methodology, the Morpho rather remained an inspiring method. Unlike those efforts mentioned above, the methodology in this paper aims to give a particular focus on the assessment of urban form's transformation, providing a more explicit and detailed methodology.

## 2.1. Historico-geographical approach

The historico-geographical approach, also referred to as the British morphogenetic approach or Conzenian approach, was developed by M.R.G. Conzen and promoted by J.W.R. Whitehand and his colleagues at the University of Birmingham. Its roots go back to the works of German geographers in the early 20<sup>th</sup> century (Fritz, 1894; Schlüter, 1899; Hassinger, 1916; Geisler, 1918). As such, this approach is probably the oldest one identified in the field of urban morphology (Kropf, 2017a; Oliveira, 2022). Morphogenetic method, the conceptualization of historical development, terminological precision and cartographic representation are the main characteristics of the approach (Conzen, 1960; Ünlü, 2021; Whitehand, 1977, 1981, 1992a, 1992b, 2001, 2016). Solid evidence of the approach can be found in the work of M.R.G. Conzen, particularly in his book on the small market town of Alnwick. Crucial concepts were proposed and developed by Conzen in this book. The first part recognises the three form complexes of townscape. In the book, the focus is only on the town plan (streets, plots and the block plans of buildings). The second part addresses the growth of Alnwick's built-up area, considering morphological periods, and the key concepts of fringe belt and burgage cycle (the life cycle of a plot held by a burgess). The third part of the book takes into account the town-plan analysis of Alnwick. Conzen identifies the geographical structure of Alnwick into four orders on the basis of plan divisions (Conzen, 1960; Oliveira, 2019a, 2019b). In 1975 & 1988, Conzen characterized the historico-geographical structure of Ludlow two times. In this

identification, he analysed the three form complexes in a hierarchical manner into distinctive morphological regions. As such, he expresses that the concept of morphological region is the climax exploration of the historico-geographical structure of the urban landscape (Conzen, 1975, 1988, 2004; Whitehand, 2009; Oliveira & Yaygin, 2020). The tripartite division of form complexes is one of the fundamental aspects of Conzen's theory for identification of the physical structure of the urban landscape (Oliveira, 2019a, 2019b). The three form complexes are distinguishable as town plan, building fabric, and land and building utilization. The town-plan is the most spatially 'encompassing' of the three form complexes. In essence, the town-plan of cities is made up of three main elements: streets, plots, and buildings (more precisely block plan of buildings). Here, streets are the methodological hallmark of space syntax. The building fabric can be distinguished by architectural characteristics, building type, age, height, construction materials. The land and building utilization is generally considered into broad categories such as commercial, residential, institutional, industrial, recreational, or urban 'fallow'. It can display the smallest scale spatial heterogeneity within the townscape (Conzen, 1960, 2004; MP Conzen, 2018).

## 2.2. Space syntax approach

The space syntax approach is formed as a substantial theory and method in urban morphological analyses. In the development of space syntax approach, three seminal books by Bill Hillier and Julienne Hanson became important in addition to a substantial set of seminal articles published in the 1970s. The first is 'The social logic of space' (Hillier & Hanson, 1984), the second is 'Space is the machine' (Hiller, 2007), and lastly, 'Decoding homes and houses' (Hanson, 1998). Space syntax focuses on space and on the relationships between space and movement. It offers a set of techniques for analysing space and human activity patterns in both buildings and cities. It also offers a set of theories linking space and society.

Space syntax addresses where people are, how they move, how they adapt, and how they develop (Hillier & Vaughan, 2007; Oliveira, 2016). Space syntax is built on two formal ideas which try to reflect both the objectivity of space and our intuitive engagement with it (Hillier & Vaughan, 2007):

- i. "space is not a background to human activity, but is intrinsic to it.
- ii. human space is not just about the properties of individual spaces, but about the interrelations between the many spaces that make up the spatial layout of a building or a city. This is what we formally call the configuration of space, meaning the simultaneously existing relations amongst the parts which make up the whole. In other words, what happens in any individual space - a room, a corridor, a street or a public space - is fundamentally influenced by the relationships between that space and the network of spaces to which it is connected".

Space syntax comprises four fundamental components, which are used in all applications, analysis of spatial relations, representations of space, interpretive models, and theories. The common feature of the approach is the focus on the topological and geometric attributes of physical form with the goal of understanding the interrelationships between different measures and attributes, the ways in which different spatial configurations affect the use of physical environments and buildings (Kropf, 2017b). Spatial configuration is a fundamental concept in the approach. In terms of space syntax, spatial configuration corresponds relations between spaces which take into account other relations (Hillier & Vaughan, 2007; Kubat et al., 2012). Several software tools are available to undertake space syntax analysis.

## 2.3. Morpho method

The focus of *Morpho* is on the town plan as the key element for the identification of the townscape. The method was first applied to the streetscape in 2013 by Vitor Oliveira (Oliveira, 2013). Then, it moved to the city scale, addressing not only the present form of the city but also the evaluation of planning proposals for its future development (Oliveira & Silva, 2013). The method has been used to make comparisons between

different cities (Oliveira & Medeiros, 2016; Oliveira et al., 2020). Recently, the method has been related to the socioeconomic and environmental aspects of urban areas (Oliveira, 2021). The first attempt of the method consisted of the measurement of seven assessment criteria: accessibility of the street system, accessibility of plots, age of buildings, dimensions of street blocks and plot series, alignment of buildings, the ratio of building height to street width, and finally, building use. Yet, the method focused on a reduced number of criteria associated with the characteristics of townscape and urban form elements, all related to the town plan. These are the dimension of street blocks, the spatial accessibility of the street system, the coincidence between building and plot frontages, and the density of plots (Oliveira et al., 2020).

### 3. Methodology

An integrated framework is proposed for the assessment of urban forms and their transformation based on historico-geographical approach, space syntax, and the Morpho method (mainly inspiring). The main goal of this paper is to constitute a strong instrument to understand townscape elements and their transformation and change based on a set of explicit criteria, and then to prescribe the physical transformation and change. The methodology provides a powerful basis to establish a balance between

conservation and transformation of urban forms. The methodology is fundamentally constructed on the basis of three different urban morphological approaches and methods. The methodology is mainly constructed on the body of historico-geographical approach to urban morphology. Space syntax has been the other substantial contributor to the methodology in terms of assessing streets and their change. Finally, the Morpho method is addressed to make the methodology stronger. The methodology is firstly designed on the basis of form complexes (more precisely based on town-plan and building fabric), and then, morphological constituents (streets, street blocks, plots, and buildings); and a set of criteria, benefiting from historico-geographical approach, space syntax approach and the Morpho method. In this regard, eleven criteria are addressed for the assessment and understanding of urban forms' transformation. These criteria are accessibility of streets, connectivity of streets, intelligibility, synergy, street block size, plot size, building coverage (relation between bloc-plans and plots), floor area ratio (expresses to which extent a plot is constructed in the three dimensions), the block plan size on the basis of the town-plan; building height, and total constructed area (density of buildings) on the basis of building fabric (see Table 1). A substantial urban regeneration area within Konya, Turkey is addressed to implement the methodology.

**Table 1.** Procedural framework for the methodology.

Form complexes	Morphological constituents	Criteria	Approach/Method
	Streets	Accessibility of streets	Space syntax approach / Morpho method
		Connectivity of streets	Space syntax approach
		Intelligibility	Space syntax approach
		Synergy	Space syntax approach
Town-plan	Street blocks	Street block size	Historico-geographical approach
	Plots	Plot size	Historico-geographical approach
	Plots/Buildings	Building coverage	Historico-geographical approach
		Floor area ratio	Historico-geographical approach
Buildings	Block-plan size	Historico-geographical approach	
	Building height	Historico-geographical approach	
Building fabric	Buildings	Total constructed area (Density of buildings)	Historico-geographical approach

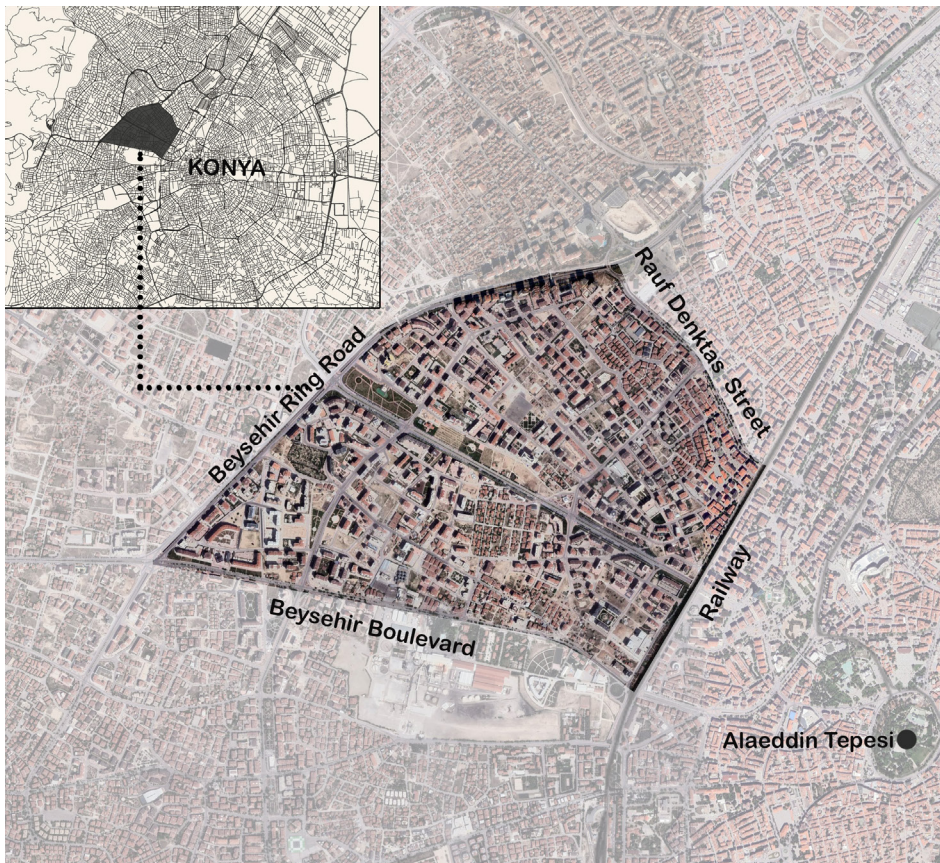
### 4. The definition of *Sekiz Mahalle* neighbourhood

Urban forms are being transformed through municipal plans and a wide range of other planning instruments with the concern of physically bad conditions or new economical investments. While the main goal of these transformations is improving the quality of the physical environment, the results are generally the accumulation of capital. This creates substantial changes in the urban landscape components, namely, the-town plan, building fabric, and land and building utilization. Konya, in Turkey, is one of those cities that undergo small

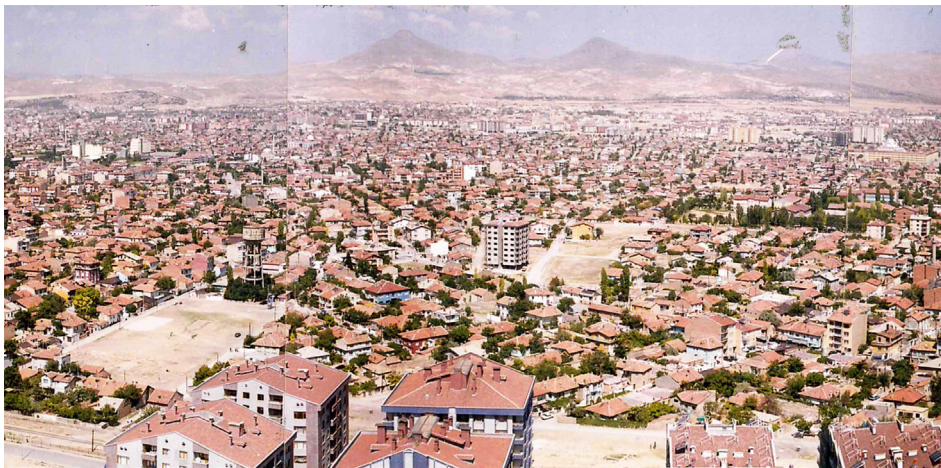


and large-scale transformations. In addition to our case study, the city was exposed to many other transformations (such as Kule Site and Surroundings, Karatay District Centre, Surroundings of Old Bus Station, Meram Et Kombinası, Caybası District, Mevlana Cultural Centre and Surroundings, Surroundings of New Justice Courthouse, the Old Industrial Area) through urban regeneration projects and the changes in municipal plans.

*Sekiz Mahalle* neighbourhood is selected for making the comparison between former and actual forms to make it more relevant, and for full implementation of the methodology. It is the largest transformed area, affecting the town-plan and building fabric. The study area is enclosed by the Railway in the east, Beysehir boulevard in the south, Rauf Denktaş Street in the northeast, and Beysehir ring road in the northwest (see Figure 1). The area includes Mimar Sinan, Seker Murat,



**Figure 1.** The location of *Sekiz Mahalle* neighborhood.



**Figure 2.** *Sekiz Mahalle* neighbourhood in 2001 (Selcuklu Municipality Archive, 2016).



Selcuk, Yeni Selcuk, Hacı Kaymak, Molla Gurani, Kilicarslan ve Ozlem units. The construction activities started in the 1950s in an illegal way in the study area. After the establishment of Konya Seker Fabrikasi (sugar factory), the area let in immigrants from rural surroundings. The construction of illegal houses continued until the 1990s. In the 2000s, Konya Metropolitan Municipality took a decision to transform the area through planning interventions. In this regard, the area started to transform in 2004. While the former landscape (before its transformation in 2004) is comprised of single-family houses, the current landscape consists of contemporary apartment blocks (see Figure 2 for the former, and figure 3 for the current urban landscape).

### 5. Morphological analyses and findings

The methodology in this paper is applied for analysing the former (2001 urban landscape which is a turning point for its transformation) and existing (2022 urban landscape) urban landscape of *Sekiz Mahalle*, demonstrating the differences between both landscapes based on firstly form complexes and morphological constituents and then, a set of criteria. All criteria identified within the methodology were applied one by one.

In this study, the axial analysis method was implemented for the initial four criteria. Although the angular segment analysis method is more com-

monly used than axial analysis in Space Syntax studies today, the axial analysis technique was preferred in this study for the calculation of the intelligibility criterion. In this context, the axial maps of the city were drawn by using ArcGIS software. The axial analyses were carried out by using Deptmap software, which is a special tool for space syntax analyses.

#### 5.1. Accessibility of streets

Using space syntax, the accessibility of streets is presented through the axial global integration and axial local integration. Integration is a normalised measure of distance from each space to all others in a system. In general, it is an indicator of how easily a person can go ahead from a particular space to all others (Hillier & Hanson, 1984). Axial global integration is defined as the integration values of axial lines at the infinite radius which can be employed to symbolize a representation of integration pattern at the largest scale. Axial local integration is defined as integration values of axial lines at radius 3, which can be used to represent a localised picture of integration. (Hillier, 1996, 2007). Analysis of axial maps of *Sekiz Mahalle* reveals the accessibility of the neighbourhood increased in terms of axial global integration measurements (see Table 3). While the most accessible streets in 2001 were concentrated in the south and north of the area, in 2022 the most accessible streets are in the middle of



**Figure 3.** *Sekiz Mahalle* neighbourhood in 2022 (Photograph by the authors).

the area on larger scale. (see Table 2). Looking at the axial local integration, the average accessibility of streets is smoothly increased. On the contrary, the maximum level of local integration is quite increased. (see Table 3).

**5.2. Connectivity of streets**

Connectivity measures the number of spaces immediately connecting a space of origin (Hillier, 1984). In this application, axial connectivity is addressed to measure the connectivity values. Axial connectivity is the number of other lines with which an axial line intersects. The physical transformation of *Sekiz Mahalle* reveals a more connected street system. While the value of streets' connectivity in 2001 is 3.8, it is 4.1 in 2022 (see Table 3). Although the number of streets decreased, the level of connectivity increased. The connectivity of streets in 2001 and 2022 is presented in Table 2.

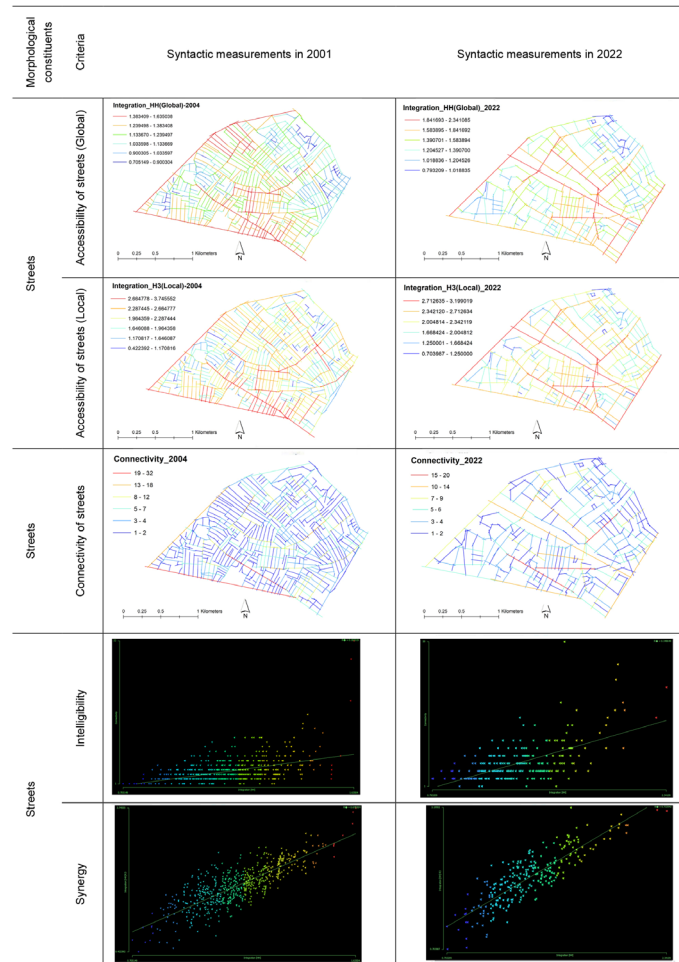
**5.3. Intelligibility**

Intelligibility (or axial intelligibility) is the level of correlation between axial connectivity and axial global integration values. A strong correlation, or 'high intelligibility', implies that the whole can be read from the parts, and the spatial order can be easily predictable by users (Topçu et al., 2021; Hillier et al., 1987; Hillier, 1999; Kubat, 1997; Boz & Kubat, 2021; Zhang et al., 2013). The intelligibility value of *Sekiz Mahalle* in 2022 is higher than those values in 2001. This demonstrate that the urban landscape in 2022 is more intelligible than the urban landscape in 2001 (see Table 2 and 3).

**5.4. Synergy**

The concept of synergy (or axial synergy) is defined as the correlation between local integration radius-3 (local integration) and radius-n (global integration). It measures the level to which the internal structure of an area rinterrelates to the larger-scale system in which it is embedded (Hillier, 1996, 2007). A high value here refers to a high relationship with a large-scale system. The synergy value of *Sekiz Mahalle* smoothly increased after its physical transformation (see Tables 2

**Table 2.** Comparison of syntactic characteristics by 2001 and 2022.



**Table 3.** Comparison of syntactic values by 2001 and 2022.

Criteria	Syntactic Values		Results
	2001	2022	
<i>Accessibility</i>			
<i>Integration Global</i>			
Min.	0.7052	0.7932	Increased
Max.	1.6350	2.3410	Increased
Average	1.1459	1.3708	Increased
<i>Accessibility</i>			
<i>Integration Local R3</i>			
Min.	0.4224	0.7040	Increased
Max.	3.7456	3.1990	Decreased
Average	1.9579	1.9623	Increased
<i>Connectivity</i>			
Min.	1	1	-
Max.	32	20	Decreased
Average.	3,8	4,1	Increased
<i>Intelligibility</i>	0.43	0.59	Increased
<i>Synergy</i>	0.82	0.86	Increased
<i>Number of Axial lines</i>	609	271	Decreased

and 3). In this regard, the correlation between local and global integration in 2001 is stronger than those in 2022.

**5.5. Street block size**

Street block is a substantial criterion that was applied into the case study, corresponding the low resolution of the urban landscape. Street block



maps are mapped on the basis of GIS with natural breaks intervals. The arrangement and organization of street blocks is presented in Table 3. While the minimum and maximum size of street blocks increase, the average is increases. This shows that a little amount of street blocks after transformation is smaller than the previous situation. Number of street block also reduces (see Table 4 and 5). Decrease in street blocks numbers and rise in the average of street blocks demonstrate that the number of streets reduces. This creates less accessible

landscape.

**5.6. Plot size**

Plots are another important element that constitutes street blocks with their aggregation. They are also the smallest land use unit of the townscape. The arrangement of plots is examined in terms of their size. The organization of plots for both 2001 and 2022 is presented in Table 4. Looking at the plots in 2001, they mostly consist of small size. A less amount of plots is medium and large. The minimum size of plots in 2001 is smaller than those

**Table 4.** Physical characteristics by 2001 and 2022.

Morphological constituents	Criteria	Physical characteristics in 2001		Physical characteristics in 2022	
Street blocks	Street block size				
Plots	Plot size				
Plots/buildings	Building coverage				
Plots/buildings	Floor area ratio				

**Table 4 (continued).** Physical characteristics by 2001 and 2022.

Morphological constituents Criteria	Physical characteristics in 2001	Physical characteristics in 2022
	Buildings Blok-plan size	<p>(m2)</p> <ul style="list-style-type: none"> <li>44 - 349</li> <li>350 - 1340</li> <li>1341 - 3975</li> </ul>
Buildings (3D) Building height	<p>(number of storey)</p> <ul style="list-style-type: none"> <li>1</li> <li>2 - 5</li> <li>6 - 13</li> </ul>	<p>(number of storey)</p> <ul style="list-style-type: none"> <li>1 - 5</li> <li>6 - 11</li> <li>12 - 20</li> </ul>
Density of buildings Total constructed area	<p>(m2)</p> <ul style="list-style-type: none"> <li>44 - 890</li> <li>891 - 3752</li> <li>3753 - 11923</li> </ul>	<p>(m2)</p> <ul style="list-style-type: none"> <li>48 - 2419</li> <li>2420 - 6615</li> <li>6616 - 23060</li> </ul>

in 2022. While the maximum size of plots reduces, the average plot size is quintupled after the transformation in the urban landscape. The number of plots is quite reduced (see Table 5). In 2001, plots were comprising single-family houses. On the contrary, multi-family apartment blocks are erected on the plots after the transformation. This gave rise to the enlargement of plots.

**5.7. Building coverage**

Building coverage shows, to which extent a plot is covered by a building or a structure. The range value of building coverage is between zero and one. It also identifies how much of a plot is open. It provides a basic relationship between a plot and a building. The analysis of building coverage of *Sekiz Mahalle* is presented in Table 4, classifying them into three intervals based on natural breaks. While the minimum and maximum ratio of building coverage do not change, the

average of this ratio decreased after the transformation of urban landscape elements or form complexes. A fall in the building coverage demonstrates an ascent in the open space, including private and public spaces.

**5.8. Floor area ratio**

The floor area ratio is a measure of a floor area of a building associated with the plot's size where the building is located on. The floor area ratio is comprised by dividing the total building area by the plot area. The floor area ratio is the relationship between the total area that consists of the area of each floor and the total area of the plot on which the building stands. The floor area ratio of *Sekiz Mahalle* is presented in Table 4, categorising it into three different intervals. While the minimum level of the ratio is the same for 2001 and 2022, the maximum level is quite increased. Looking at the average, the ratio is almost tripled (see

Table 5).

### 5.9. Block-plan size

The block plan of building is one of the most important the town-plan element. It is an area where a building stands and restricted on the ground by the lines of its comprising walls. Different types of block-plan contribute to the production of different types of the built environment. This criterion is examined in terms of block-plan size. The organization of block plans is indicated in Table 4. Looking at the analysis, the minimum and maximum block plans in 2001 are larger than those in 2022. On the contrary, their average block plans increased in 2022 due to the size of large apartment blocks. The transformation of single-family houses into multi-family apartment blocks decreased the number of building in the area (see Table 5).

### 5.10. Building height

Buildings are the most visible elements of the urban landscape. They represent the townscape through their scale and characteristics. In this paper,

the building height is examined as an important determinant of the urban landscape on different scales. The distribution of building height is presented in Table 4, classifying them into three intervals. Building height is identified as the vertical distance between the ground level and the highest point of the building. When two different urban landscapes, before and after the transformation of the area, are compared, the maximum building height is increased in 2022. The average building height is quintupled (see Table 5).

### 5.11. Total constructed area (density of buildings)

The total constructed area is resembling the floor area ratio but is not precisely the same. While the floor area ratio indicates to which extent a plot is filled in three dimensions, the total constructed area expresses the total constructed area on each plot and in the area as a whole. This criterion apparently presents the area intensified after its transformation. The total constructed area of each plot is indicated in Table 4. When considering the plot scale, the total constructed area of each plot in terms of maximum size and the average quite increased. The total study area is densified in terms of the buildings constructed on (see Table 5).

To sum up, the transformation of urban forms, which are firstly on the basis of the town-plan and building fabric, secondly morphological constituents (streets and street blocks, plots, and buildings) thirdly a set of criteria, is an important fact in cities' life. In the case of *Sekiz Mahalle* neighbourhood, different characteristics of townscape are examined. On the street scale, there are 4 criteria implemented in the area. Analysis reveals that accessibility of streets, both on the global and local scale, increased after the transformation of the area. Looking at the connectivity of streets, it is clear that the street system in 2022 is more connected than those in 2001. The intelligibility value demonstrates that the correlation between axial connectivity and axial global integration of streets in 2022 is stronger than those in 2001.

**Table 5.** Comparison of physical characteristics by 2001 and 2022.

Criteria	Physical characteristics		Results
	2001	2022	
<i>Street block size</i>			
Min.	327	286	Decreased
Max.	76201	58241	Decreased
Average	7321	10594	Increased
N. of street blocks	362	210	Decreased
<i>Plot size</i>			
Min.	41	49	Increased
Max.	38770	25266	Decreased
Average	406	1968	Increased
N. of plot	6531	1017	Decreased
<i>Building coverage</i>			
Min.	0	0	-
Max.	1	1	-
Average	0.40	0.20	Decreased
<i>Floor area ratio</i>			
Min.	0	0	-
Max.	3.5	5.16	Increased
Average	0.60	1.75	Increased
<i>Blok-plan size</i>			
Min.	44	48	Increased
Max.	3975	2312	Decreased
Average	121	290	Increased
N. of buildings	6940	1543	Decreased
<i>Building height</i>			
Min.	1	1	-
Max.	13	20	Increased
Average	1.42	6.36	Increased
<i>Total constructed area</i>			
Min. (each plot)	44	48	Increased
Max. (each plot)	11923	23060	Increased
Average(each plot)	224	2404	Increased
Total constructed area	1557223	3710724	Increased



The synergy value is higher in 2022. Streets blocks as an important element of the urban landscape underwent a substantial change after their transformation. Their organization associated with streets is quite different. The average of street blocks increased. As street blocks, plots have an important difference when compared with the previous physical structure. The average building coverage decreased in relation to building heights. The floor area ratio is the other important criterion examined. The average ratio is almost doubled. Block plans as one of the most important elements of the town-plan underwent a dramatic transformation. In 2001, almost all buildings were single-family houses. On the contrary, they were replaced with large-scale multi-family apartment blocks. Building heights as the most visible element of the urban landscape is totally different from the previous physical environment. While the previous heights are generally one and two storeys, the existing townscape mostly consists of eighteen storeys. Total constructed area in terms of each plot, and the study area as a whole experienced a dramatic

transformation (see Figure 4).

## 6. Discussion

Morphological analysis of *Sekiz Mahalle* is carried out on the basis of a set of criteria identified in the methodology. It integrates three different morphological theories and tools, namely, historico-geographical approach, space syntax approach and finally the Morpho method, by constituting an explicit and simple implementation process. As previously indicated, the Morpho method indirectly contributed to the design of the methodology. Indeed, it has an inspiring role in the identification of the procedural framework of the methodology.

The methodology provides a substantial basis for an effective preparation of municipal plans, design projects and urban renewal projects where the character of the urban landscape is not considered. Looking at the morphological analyses of *Sekiz Mahalle*, the first four criteria reveal constructive results by the comparison of the urban landscape of 2001 and 2022, focusing on the town-plan (streets in particular).



**Figure 4.** Buildings in 2001 (top right and left) and in 2022 (bottom right and left).

Syntactical analyses, which are accessibility of streets, connectivity of streets, intelligibility and synergy, confirm that a transformation in the street system reinforces the street structure. When comparing the streets in 2001 and 2022, the syntactical values of the existing urban landscape increased, and this demonstrates that the municipal plan enables a better physical environment in terms of the first four criteria just mentioned above. On the contrary, the rest of the morphological criteria implemented in *Sekiz Mahalle* presents a different aspect of the transformation practised in the neighbourhood in terms of the town-plan and building fabric (two prominent form complexes). Form complexes or the urban landscape elements are important physical elements of urban form for a society. They can keep and maintain emotional experiences and precious assets of a society. In the comparison of the 2001 and 2022 landscapes, street blocks, plots and buildings were assessed on the basis of the following criteria: street block size plot size building coverage floor area ratio block-plan size building height total constructed area (density of buildings). These criteria consist of main elements of urban form that can play a substantial role in planning proposals and a wide range of planning applications. Looking at each of these criteria one by one, it is clear that *Sekiz Mahalle* neighbourhood underwent a dramatic transformation, not taking into account the previous urban landscape elements. The street block size is an important input for plans. While small size street blocks enable a more permeable pattern, large size gives rise to an impermeable environment. A subdivision of large street blocks will enable a more permeable pattern. A soar in plot size destroys the previous organization of plots and buildings, not considering them as precious assets. Apparently, building coverage decreased. As a result of a decrease in building coverage, while the common green areas should have increased, on the contrary, the semiprivate green areas have increased. Floor area ratio and total constructed area are two criteria that refer to the density of buildings in different ways. An increase in

these elements brings a dense structure and causes insufficient infrastructure. Block plans and building heights are important for referring to the building scales. Conservation or small changes of both elements contribute to the maintenance of the heritage.

Analysis of *Sekiz Mahalle* demonstrates that the interventions in the streets system, in relation to accessibility, connectivity, intelligibility and synergy, were slightly carried out in a constructive way. Yet, in terms of the other aspect, namely the rest of the criteria proposed within the methodology, there is no positive reflection. In this regard, a strong balance should be established between transformation and conservation of urban forms elements, considering the previous character of the urban landscape. This will provide a powerful basis for continuity of urban forms, focusing on the town-plan and building fabric (taking into account streets, street blocks, plots and buildings). Any transformation and any change in the previous character or traditional landscape should follow a deep exploration of the urban landscape taking as a reference this integrated methodology on the basis of different elements of urban form and different urban morphological approaches.

## 7. Conclusion

This paper has three substantial contributions to the field of knowledge. The main conclusion/contribution is that this paper presents an integrated framework on the basis of three urban morphological theories. The results from the case study demonstrate that while the new organization of streets presents the positive aspect of transformation, the other aspects of urban form are not sufficiently considered. This indicates why an integrated framework is important for the assessment of urban forms for their future transformations. The second contribution is that this methodology presents the importance of form complexes, with a particular focus on the town-plan and building fabric. Analysis of *Sekiz Mahalle* neighbourhood shows that when any transformation becomes existent in

an urban area, it should follow the previous structure of the townscape for conserving previous assets, and establish a balance between the change and continuity of the physical character. Moreover, this paper demonstrates the importance of streets, street blocks, plots and buildings due to their role in the structural organization of the townscape. The last substantial contribution is the potential of the methodology in planning practice, justified by its implementation in the case study. The methodology validated that the balance between the existing urban forms and the introduction of new urban forms is important for a smoother transition of forms. It is clear that urban forms transformation should be considered on the basis of an integrated framework before any decision to intervene. This paper provides a strong basis to inform planning practice based on the integration of different morphological views. It is an important instrument to develop a framework for urban forms transformation and the maintenance of forms. It is argued that an integrated framework on the basis of urban morphological tools and theories is essential in the preparation of planning proposals and new designs.

## References

- Barke, M. (2015). Further thoughts on research and practice in urban morphology: a British perspective. *Urban Morphology*, 19(1), 96-99.
- Batty, M. (2007). *Cities and complexity: understanding cities with cellular automata, agent-based models, and fractals*. The MIT press.
- Batty, M., & Longley, P. A. (1994). *Fractal cities: a geometry of form and function*. Academic press.
- Bell, S. (2012). Bridging academia and practice, *Urban Design and Planning* 165, 201-202.
- Boz Günay, M., & Kubat, A. S. (2021). Investigating morphological changes of a capital city: The case of Ankara. *Journal of Design for Resilience in Architecture and Planning*, 2(Special Issue: Space Syntax), 129-146. <https://doi.org/10.47818/DRArch.2021.v2si039>
- Caniggia, G., & G. L. Maffei. (1984). *Composizione Architettonica E Tipologia Edilizia II: Il Progetto Nell'edilizia Do Base*. Venice: Marsilio.
- Conzen, M. P. (2018). Core concepts in town-plan analysis. In V. Oliveira (Ed.) In *Teaching Urban Morphology*, 123-143. Cham: Springer.
- Conzen, M. R. G. (1960). *Alnwick Northumberland*. London: George Philip.
- Conzen, M. R. G. (1975). Geography and Townscape Conservation. In H. 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*, 253-272. Cambridge: Cambridge University Press.
- Conzen, M. R. G. (2004). *Thinking about urban form*. Oxford: Peter Lang.
- Çalışkan, O. & Marshall, S. (2011). Urban morphology and design: introduction, *Built Environment*, 37, 381-92.
- Fritz, J. (1894). *Deutsche stadtpläne, beilage zum programm 520 des lyzeums Strassburg*. Strassburg: Heitz & Mündel.
- Geisler, W. (1918). *Danzig: ein siedlungsgeographischer versuch*. Danzig: Kafemann.
- Griffiths, S., C.E. Jones, Vaughan, L., & Haklay, M. (2010). The persistence of suburban centres in Greater London: Combining Conzenian and space syntax approaches. *Urban Morphology*, 14, 85-99.
- Hanson, J. (1998). *Decoding homes and houses*. Cambridge University Press, Cambridge.
- Hassinger, H. (1916). *Kunsthistorischer Atlas Von Wien Österreichische Kunsttopographie 15*. Prana, Wien.
- Hillier, B. (1996, 2007). *Space is the machine: A configurational theory of architecture*. Space Syntax, London.
- 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. <https://doi.org/10.1068/b4125>
- Hillier, B., Burdett, R., Peponis, J., &



- Penn, A. (1986). Creating life: or, does architecture determine anything? *Architecture & Comportement/Architecture & Behaviour*, 3(3), 233-250.
- Hillier, B. & Hanson, J. (1984). *The social logic of space*. Press syndicate of the University of Cambridge. Cambridge.
- Hillier, B. & Vaughan, L. (2007). The city as one thing. *Progress in Planning*, 67(3), 205-230.
- Holanda, F. D. (2021). Atrium-house: an exercise in self-analysis. In V. Oliveira (Ed.), *Morphological Research in Planning, Urban Design and Architecture* (pp. 217-239). Springer, Cham.
- Kropf, K. S. (1993). An Inquiry into the Definition of Built Form in Urban Morphology (Unpublished PhD thesis), University of Birmingham, UK.
- Kropf, K. S. (1996). An Alternative Approach to Zoning in France: Typology, Historical Character and Development Control. *European Planning Studies*, 4, 717-737.
- Kropf, K. S. (2017a). *Handbook of Urban Morphology*. London: Wiley.
- Kropf, K. S. (2017b). *Bridging configurational and urban tissue analysis*. In Proceedings of 11th Space Syntax Symposium, Lisbon (pp. 165-1).
- Kubat, A.S. (1997). The morphological characteristics of Anatolian fortified towns. *Environment and Planning B: Planning and Design*, 24(1), 95-123. <https://doi.org/10.1068/b240095>
- Kubat, A. S., Rab, S., Guney, Y. I., Ozer, O., & Kaya, S. (2012). Application of Space Syntax in Developing a Regeneration Framework for Sharjah's Heritage Area. In *8th International Space Syntax Symposium*, Santiago De Chile, 1-17.
- Larkham, P. J., & Morton, N. (2021). Conservation and (Sub) urban form: reviewing policy in Stratford Upon Avon, 2004-2019. In V. Oliveira (Ed.), *Morphological Research in Planning, Urban Design and Architecture* (pp.43-68).
- Li, X., & Y. Zang. (2021). Combining the historico-geographical and configurational approaches to urban morphology. *Urban Morphology*, 25, 23-41.
- Monteiro, C., & Pinho, P. (2021). MAP: a methodology for morphological analysis and prescription. *Urban Morphology*, 25(1), 57-75.
- Monteiro, C., & Paulo P. (2022). The research-practice gap: comparing planning and morphologically based proposals. *Urban Design International*, 1-16.
- Muratori, S. (1959). Studi per una operante storia urbana di Venezia. *Palladio*, 1959, 1-113.
- Oliveira, V. (2013). Morpho, a methodology for assessing urban form, *Urban Morphology*, 17, 149-61.
- Oliveira, V. (2015). The Plan-Process-Results (PPR) methodology for evaluating planning. In Woltjer J, Hull A, Ruth M, Alexander E (Eds.) *Evaluation in integrated land-use management*, Ashgate, Aldershot, 139-64.
- Oliveira, V. (2016). *Urban Morphology: An Introduction to the Study of the Physical Form of Cities*. Cham: Springer
- Oliveira, V. (Ed.) (2018). *Teaching urban morphology*. Springer International Publishing.
- Oliveira, V. (2019a). An historico-geographical theory of urban form. *Journal of Urbanism: International Research on Placemaking and Urban Sustainability*, 12(4), 412-432.
- Oliveira, V. (Ed.) (2019b). *JWR Whitehand and the historico-geographical approach to urban morphology*. Springer International Publishing.
- Oliveira, V. (2021). Urban form and the socioeconomic and environmental dimensions of cities, *Journal of Urbanism*, 15.
- Oliveira, V. (Ed.) (2022). *Urban Morphology: An Introduction to the Study of the Physical Form of Cities*. Cham: Springer
- Oliveira, V., & Medeiros, V. (2016). Morpho: combining morphological measures, *Environment and Planning B: Planning and Design*, 43, 805-25.
- Oliveira, V., Medeiros, V., & Corgo, J. (2020). The urban form of Portuguese cities, *Urban Morphology*, 24, 145-66.
- Oliveira, V., & Monteiro, C. (2021). On a morphologically-based method for architectural practice: The Lindo Vale House. In V. Oliveira (Ed.) *Morphological Research in Planning, Urban Design and Architecture* (pp. 195-216). Springer, Cham.
- Oliveira, V., & Silva, M. (2013). Morpho: urban morphological research and planning practice, *Revista de Mor-*

*fologia Urbana*, 1, 31-44.

Oliveira, V., & Yaygin, M. A. (2020). The concept of the morphological region: developments and prospects. *Urban Morphology*, 24, 35-52.

Schlüter, O. (1899). Über Den Grundriss Der Städte, Zeitschrift Der Gesellschaft Für Erdkunde. *The Indian Medical Gazette* 34, 446-462.

Selcuklu Municipality Archive. (2016). Townscape of *Sekiz Mahalle* neighbourhood in 2001.

Strappa, G. (2021). The Terni Cemetery—Considerations on the Relationship Between Reading and Design. In V. Oliveira (Ed.) *Morphological Research in Planning, Urban Design and Architecture* (pp. 141-163). Springer, Cham.

Topçu, M., Aköz Çevrimli, B., & Ge-yikli, H. B. (2021). Syntactic Legibility of Image Elements: Eskisehir Case. *Megaron*, 16(4), 644-658.

Ünlü, T. (2019). Managing the urban change: A morphological perspective for planning. *ICONARP International Journal of Architecture and Planning*, 7, 55-72.

Ünlü, T. (2021). Historico-geographical approach in the study of urban form: roots, development and reflections in the study of Mersin, Turkey. *Journal of Design for Resilience in Architecture and Planning*, 2(1), 01-16. <https://doi.org/10.47818/DRArch.2021.v2i1008>

Whitehand, J. W. R. (1977). The Basis for an Historico-geographical theory of urban form. *Transactions of the Institute of British Geographers NS*, 2, 400-416.

Whitehand, J. W. R. (Ed.) (1981). *The Urban Landscape: Historical De-*

*velopment and Management; Papers by MRG Conzen*. London: Academic Press.

Whitehand, J. W. R. (1992a). Recent Advances in Urban Morphology. *Urban Studies*, 29, 619-636.

Whitehand, J. W. R. (1992b). *The Making of the Urban Landscape*. Oxford: Basil Blackwell.

Whitehand, J. W. R. (2000). From Explanation to Prescription. *Urban Morphology*, 4, 1-2.

Whitehand, J. W. R. (2001). British Urban Morphology: The Conzenian Tradition. *Urban Morphology*, 5, 103-109.

Whitehand, J. W. R. (2009). The Structure of Urban Landscapes: Strengthening Research and Practice. *Urban Morphology*, 13, 5-27.

Whitehand, J.W.R. (2013). Urban morphology research and practice. *Urban Morphology*, 17, 3-4.

Whitehand, J. W. R. (2016). Recent Changes in Urban Morphology. *Urban Morphology*, 20, 3-4.

Whitehand, J. W. R. (2021). Conzenian research in practice. In V. Oliveira (Ed.) *In Morphological Research in Planning, Urban Design and Architecture* (pp. 19-42). Springer, Cham.

Whitehand, J. W. R., & N. J. Morton. (2004). Urban Morphology and Planning: The Case of Fringe Belts. *Cities*, 21, 275-289.

Zhang, T., Chiradia, A., & Zhuang, Y. (2013). In the intelligibility maze of space syntax: a space syntax analysis of toy models, mazes and labyrinths. In Kim, Y.O., Park, H.T., Seo, K.W. (Eds.), *Proceedings of 9th International Space Syntax symposium*. Sejong University, Seoul, pp. 82.1-82.17.