A new complementary model for integrating historico-geographical and configurational approaches: the case of Famagusta

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Abstract. *This paper presents a 'complementary model' for analyzing urban form by utilizing the historico-geographical and configurational approaches of urban morphology to achieve a better comprehension of the evolution of the urban form and, in particular, of the street formation of Famagusta. The results confirm that structurally the historico-geographical character and configuration of the town are determined by socio-economic activities. Within this context, both approaches identify the historical patterns of urban form as the key element to comprehend the relationship between socio-economic activity and urban form, which are both configurational and historical. Famagusta, a small historical town located in the eastern part of Cyprus, lacks a detailed urban morphological study and has been used to test this complementary method. The complementary model tested in Famagusta represents the strong relationship between land use and socio-economic activities, which determine how the urban form is transformed throughout the last six historical periods, and how socio-economic changes affected the urban form during these processes. Following political conflicts in the 1960s and the division of Cyprus in 1974, Varosha became the "ghost town" it remains to this day. These are the major hindrances to further development of the city toward the south. With the establishment of the Eastern Mediterranean University in 1979, the overall socio-economic structure of Famagusta has undergone rapid development. The Walled City remains intact and functioning, but is no longer the centre of socio-economic activity of the region, and the most integrated place in terms of global integration.*

Keywords: Urban form, historico-geographical approach, space syntax, street network, Famagusta

Urban morphology provides a range of concepts and tools that articulate the different aspects and elements of urban form and the relations between them. 'The morphological method is the combination of empirical observation and a deeper intuition into the idea that guides the patterns of changes over time as an organism that interacts with its environment' (Jensen, 2016).

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According to Vance (1990), the study of urban form involves examining not only the existing physical elements of a city but also their development throughout history. Kropf (2009) has summarized four major schools of thought in urban morphology, seeking a shared reference point for integration of various morphological approaches. Kropf's line of inquiry was further developed by Oliveira *et al*. (2015) in a single case study in the city of Porto, Portugal. Whitehand *et al*. (2014) applied the concepts of typological process and morphological period in England and China, between the mid-nineteenth century and the late-twentieth century. According to Kropf (2017), there are four broad approaches to urban morphology, each focusing on different aspects of urban form and using different methods and tools. The procedural typology and configurational approaches have origins in the fields of architecture and urbanism. The historico-geographical and spatial analytical methods emerged from the fields of geography and planning. Because of the complex nature of cities, it is hard to contend that any single morphological approach can fully address all the challenges of this complexity to achieve the objectives of urban morphology. Three of the key challenges facing urban morphology are the sharing of disciplinary boundaries, the efficient communication of different morphological approaches, and the development of combined approaches (Whitehand, 2012). Larkham (2006) states that there is a great opportunity to explore the complementary potential of the various traditions – historico-geographical and configurational – for research cooperation. While substantial attempts have been made to address this issue over the last few years, the gaps remain largely unbridged. This gap can be addressed, in part at least, by overlapping the cartographic representation of historico-geographical analysis and configuration patterns of street networks.

This paper focuses on the potential of combining the historico-geographical approach with the configurational approach as a complementary model to the analysis of the urban form of Famagusta, in order to test the model, through a better comprehension of the evolution of the urban form of Famagusta in relation to socio-economic factors. This study contributes by developing potential ways in which the two morphological approaches can be used complementary in practice and research. Combining these two approaches can provide a new understanding of the development processes of urban form. Hitherto, urban morphological research examining the combination of the historico-geographical and configurational approaches has been limited. However, given the fundamental difference between the two viewpoints, especially in terms of the complementary qualitative and quantitative existence, communication between them has been neither easy nor straightforward, resulting from their different disciplinary traditions and theoretical grounding. The proposed combination of these two approaches is based on an appraisal of their theoretical deductions in order to achieve a stronger and more efficient combination of the two traditions.

First, both historico-geographical and configurational approaches have the same view that the urban grain is a key object of analysis in examining the relationship between urban forms and the various human activities occurring within them. The majority of studies that rely on the historico-geographical approach take an externalist view of the effect of socio-economic activities upon the evolution of urban form (Gauthier and Gilliland, 2006). In this respect, it is perhaps more accurate to comprehend the configurational approach as a genuine internalist viewpoint, in which space is understood as having its own formal logic (Hillier and Vaughan, 2007).

Secondly, both historico-geographical and configurational approaches consider the emerging structure of urban spaces as a spatial basis for explaining its socio-economic activities, rather than solely the specific physical geometries. Both approaches organize the historical patterns of urban forms as the key element to understanding how socio-economic activity is reflected in the built environment (Griffiths *et al*., 2010).

Thirdly, both historico-geographical and configurational approaches have similar

exploratory goals (Gauthier and Gilliland, 2006). The historico-geographical approach focuses on the evolutionary processes of urban forms; however, prescribing future urban forms is not the initial goal of the viewpoint in itself (Whitehand and Gu, 2010). However, the configurational method has often been used to evaluate the physical form, street system and structure of cities by analyzing street configurations and accessibility as well as prescribing the future condition of urban form (Oliveira, 2013).

Historico-geographical and configurational approaches

Research in both historico-geographical and configurational approaches has shown that the emerging structure of space is a description of a social nature rather than a formal geometric concept of particular physical objects. The historico-geographical approach seeks to clarify the geographical structure, patterns, and character of human settlements through a methodical investigation of their essential elements and development through time (Humboldt, 1849). In this approach, from an evolutionary perspective, this structure is addressed in terms of the interrelation between streets, building plots, and buildings (M. R. G. Conzen, 1962). The origins and development of the historico-geographical approach can be found in M. R. G. Conzen's work, especially his book on the small UK town of Alnwick (M. R. G. Conzen, 1960). Within the townscape, Conzen distinguishes three form complexes: town plan, including the streets, the land utilization pattern and the building fabric. M. R. G. Conzen's town plan analysis aims to investigate the configurations of streets, plots, and buildings created over time (M. P. Conzen, 2018). Since detailed medieval written records have survived less well in many medieval cities, for these areas, it is important to use an approach that uses cartographic and historical sources to adopt changes in medieval urban landscapes. Town-plan analysis is a method for accomplishing this (Baker and Slater, 1990). For mapping medieval urban landscapes, the plan-analysis method uses the most accurate cartographic record of Britain, the first-edition series of large-scale plans, surveyed in the mid-late nineteenth century. The importance of these plans for studying urban history was first recognized by M. R. G. Conzen in the 1960s when he analyzed Alnwick's town plan to show the development of cities for different historical periods. He used the plan-analysis method to identify patterns in the spatial development of historical urban landscapes. However, town-plan analysis does not rely exclusively on the existence of historical maps but is able to reconstruct the development of urban environments. 'This analysis explains the geographical structure and character of towns through a systematic analysis of their constituent elements and development through time' (Kropf, 2009, p.113). Conzen (1960) begins by distinguishing five general aspects: site, function, townscape, socio-economic context, and development. The site is defined principally in terms of the spatial relations; the function is more limited to particular classes of activities.

Looking at the general aspects of the historico-geographical approach, the socio-economic context is the combination of different activities and functions over a wider area. In this respect, any given building and land utilization is a part of the socio-economic context. This triple division of urban landscape covers the conceptualizations for studying urban development (Whitehand, 2009). Kropf (2009) developed a critical analysis of a set of essential texts on the historico-geographical approach and argued that further critical assessment is required, in particular about the aspects of the physical form.

Within this scope, the historico-geographical approach becomes an important indicator by understanding the land utilization and plot configuration during the process of understanding the street form evolution and development throughout history. In addition, it helps to give a practitioner a framework to underpin either physical development proposals or policy/plan development. Understanding the whole process in a holistic way brings a wider perspective to morphological studies.

The configurational approach involves the measurement of street network structures to assess the characteristics of different configurations. In comparison with traditional approaches to urban morphology, the analysis of street networks privileges the analysis of built-up areas (Lévy, 2005). Hillier and colleagues established this method in the 1970s as a way of quantifying features of urban form and recording interaction and movement within space. Configurational analyses, represented by space syntax methods, makes it possible to develop a set of theories about the relationship between urban space networks and the socio-economic factors (Hillier *et al*., 2010). Space syntax methodology has been widely and successfully adopted for analyzing the relationship between urban configuration and socio-economic factors; however three aspects have been debated.

First, space syntax is criticized in its original topological formulation for giving significance only to topology and ignoring distance metrics or 3D details of the urban system, such as land use and building height (Xiao and Webster, 2017). In this context other approaches, such as the historico-geographical approach, can be applicable. Ratti (2004) pointed out that the axial map does not take into account the different building or land uses.

Secondly, space syntax has also been criticized for the process through which it creates an axial map. Batty (2001) has shown that the process of creating axial maps is arbitrary, as there seems to be no formal evidence showing a unique set of axial lines for a space. Such ambiguity would lead to the inaccurate creation of the axial map that would affect the results of analysis.

Thirdly, Ratti (2004) concluded that there was a discontinuous transformation of geometry to topology in the process of generating an axial map, criticizing space syntax systematically. While one may criticize space syntax for having insufficient descriptions of the city, an analogous critique of other urban theories can be made, that they are shallow when it comes to including social systems and their spatial implications (Batty, 2013; Ratti, 2004).

Developing the complementary approach to urban form

This study developed a methodological framework in order to understand urban form through a complementary model of historico-geographical and configurational approaches. The mixed method approach is chosen because the research subject is intricate and cannot be interpreted particularly well through quantitative or qualitative methods alone. However, the proposed combination of these two approaches is essentially based on theoretical frameworks. This model can be applied by overlapping the maps of historico-geographical analysis and configuration patterns of street networks. To carry out a practical investigation on the continuous history, this study picked up three particular points in the time span from the 1190s onwards. Data were collected from three selected areas (see below), and transferred to ArcGIS and Depthmap X. In this way, the areas are shown to have comparative advantages in terms of historical process and particularly socio-economic activities, and areas more likely to be confronted with growth that may lead to rapid development of the physical environment and consequently changes and continuities of street configuration can be identified.

This methodology tests the use of qualitative and quantitative procedures to describe the factors influencing the urban form and its associated socio-economic activities. Table 1 indicates the general framework and methodological outline used to develop the complementary approach based on a testing model, which consists of three primary phases: the theoretical background, the empirical study, and the research findings. The theoretical background phase investigated the fundamental literature underpinning the research on urban form from the two relevant morphological approaches. The empirical study comprised three stages:

1) the categorization of variables and data,

2) the measurement of variables, which are derived from the corresponding approach, and

3) the testing of the model to analyze the case study. An analytical model comprising

methods from the historico-geographical and configurational approaches was built in ArcGIS based on the street network data acquired from the main elements of morphological characteristics. Space syntax analysis was undertaken using Depthmap X software to unravel the syntactical growth processes of Famagusta during the historical period.

To assess the selected case study in terms of the complementary approach, the main elements of the morphological characteristics were first evaluated based on the historico-geographical method by documenting the evolutionary process: the townscape, town plan, land utilization, and building fabric were assessed by examining the process of urban development. The GIS tools contributed to the quantitative analysis process and data acquisition, which can support the historico-geographical approach as a complementary tool.

Secondly, space syntax methodology was used to evaluate the street network configuration and to explore the different spatial levels of syntactic values in relation to distinctive phases of city development. The space syntax method enables the quantification of configurational spatial relationships in built environments and of their relationship to utilization patterns of socio-economic activity. The selected districts were evaluated according to measures based on topological and geometrical terms. There are three broad methods to configurational analysis: the first is based on metric distances of physical networks and uses a primal graph of the street network (Porta *et al*., 2006). The second approach is based on topological distances on a dual graph of the street network; axial analysis of space syntax is a typical example of the dual approach (Hillier and Hanson, 1984). The topological measures used in axial analysis include global and local integration, connectivity, choice and intelligibility. The third approach is based on geometrical (angular) properties. This form of urban modelling has been explored in a number of accessibility studies using the street network as the basis of the analysis (Hillier and Iida, 2005). The segment map is usually generated from an axial map (Turner, 2004).

Another essential concept in space syntax is the measure of accessibility based on a topological viewpoint. Accessibility measurements are computed by integration, connectivity, and choice in space syntax. The measure of choice denotes how one can cross from one location to another to make a through-movement trip. The measure of integration defines how easily one location can be reached in relation to another. Therefore, by investigating the accessibility of the street networks, space syntax could facilitate the prediction of the human movement pattern.

In this study, angular segment analysis was used to calculate global and local integration, connectivity, choice, accessibility and intelligibility values. For assessing the geometrical accessibility of streets, segment angular analysis was used to identify the shortest angular paths through the spatial network. The graph statistically indicates network accessibility as a potential through radius–n movement: in other words, every segment has a value and colour (from red to blue) according to how many times the angular path falls between all other segment pairs in the system: red lines represent the highest values and dark blue lines the lowest ones. By converting the street networks into axial lines, the urban area can be quantified and each line's connectivity can be calculated in order to evaluate the topological accessibility of streets. Local and global integration were also measured, as was intelligibility, which is defined as the degree of correlation between global integration and connectivity values in the system. In addition, this study used SPSS software for statistical analysis to calculate the correlation between different variables and the ranking of each district in each variable: between local and global integration and between global integration and connectivity. The historico-geographical analysis and syntactic data were combined into a GIS. The GIS platform offered the opportunity to integrate street configuration and historico-geographical method to measure three main properties of urban form: street network configuration, morphological region and town plan analysis in different morphological periods. This incorporation

Table 1: The general framework and methodological approach of the study

Theoretical Background

Historico-geographical approach

Morphological Period	
Morphological Region	
Town Plan	
Variables to Measure	
Town plan	Townscape
Street Pattern Plot Pattern Building Pattern Urban block components	Land Utilization Plan Unit Type Building Type Process of urban development

Space syntax method

Data Types: Metric Non–metric	Axial Length is the simplest of all morphological measures that can be derived from the axial map. Segment analysis is any analysis of a segment map.
Variables to Measure	Connectivity is a property of each line within the network of interconnected lines.
	Global Integration: The degree to which that space is integrated from a system as a whole. Local Integration: The degree to which that space is integrated from a partial system consisting of spaces.
	Choice measures movement flows through spaces.
	Intelligibility is defined as the measure of the correlation between global integration and connectivity values of the axial lines.
	Accessibility can be measured through the connectivity, integration, and intelligibility of urban layout represented by axial lines.

Empirical Study

Method	**Variables to Measure**	**Tools**	**Aim of methodologies**
Configurational approach represented by Space Syntax	1. Axial length 2. Segment length	UCL Depthmap X software focuses on the axial map of Famagusta throughout its historical process of development.	Relationship between space and movement based on axial and segment angular analysis. In this study, the focus is on accessibility as the potential for 'through movement'
	3. Connectivity 4. Integration (Global–Local) 5. Choice 6. Accessibility 7. Intelligibility	SPSS Statistical Analysis developed an integrated model of syntactic variables as a single statistical model to improve the understanding of space configuration through the Pearson correlation.	
Historico-geographical Method	8. Town plan Street System Plot Pattern Building Pattern 9. Townscape Land Utilization Plan Unit Building Fabric	GIS (Geographic Information System) has contributed to data acquisition for urban morphology analysis, which can facilitate the historico-geographical and space syntax approach as a complementary model.	The basic methods of this approach include observations of the physical fabric and analysis of the process of historical development based on historical maps and plans The relationship between urban form and socio-economic factors.
Complementary Method	This methodology has proposed that these two approaches complement each other by enabling the examination of the association between urban form and street network. The historico- geographical and configurational approaches in combination can be summarized in three items: – These two approaches in combination can help to better elucidate the historical process of urban form. Both approaches organize the historical patterns of urban forms as the key element to understanding how socio-economic activity is reflected in the built environment. – The historico-geographical approach focuses on the evolutionary process of urban forms. The configurational approach has often been used to evaluate the street network of cities. – Combining these two approaches making it possible to describe the developing street network through history and therefore, the socio-economic activities. It revealed that the relationship between urban form and socio-economic factors is both configurational and historical.		

into GIS has also allowed examination of the relationship between the built environment and the patterns of socio-economic activities in accordance with their spatial location by collecting street network data from different periods. The redrawing of historic maps, coupled with axial and segment analysis, enabled the assessment of the evolution of the urban layout of the city throughout different periods.

Famagusta as an area for morphological study

This research focuses on three districts of Famagusta, which is one of the most important port cities of Cyprus. Parts of the city have been physically divided since 1974 due to the Cyprus conflict (Önal *et al*., 1999). The history and development of the urban centre of Famagusta and the walled city as a unique region of the city date back to the first century A.D. This city has developed throughout seven particular periods:

- the initial period (648–1192), the origin of the city
- the Lusignan period (1192–1489), when the Famagusta street pattern emerged around the main square)
- the Venetian period (1489–1571): the form of streets developed particularly in the medieval era, particularly the Venetian period
- the Ottoman period (1571–1878): Ottoman features influenced socio-economic and physical structures of the city
- the British Colonial period (1878–1960): the development of the city to the south and Famagusta port took place in this period;
- the Republic of Cyprus period (1960–1974), when Turkish Cypriots mostly lived inside the walled city and Greek Cypriots settled outside the walls toward the Maraş district
- the period of Divided Cyprus (following the war in 1974). During this period Cyprus was divided into two parts, with Greek Cypriots in the southern side and Turkish Cypriots in the north.

This study focuses on the last six periods because no relevant data have been available so far for the initial period (648–1192). The division of Cyprus in 1974 and the establishment of the Eastern Mediteranean University have significantly changed the form of Famagusta, although the historical walled city has managed to maintain its strong medieval character (Perbellini, 2011). Figure 1 shows the evolution of Famagusta city during the last six historical periods.

Figure 2 shows the location of the three districts studied. Their selection was based on their distinctive physical and functional characteristics, evolution and growth. The selected districts represent three different urban growth patterns: the first district, in the historical core of city, is the walled city (Suriçi). In terms of city organization, the walled city developed under different social, economic, cultural and political influences (Doratlı *et al*., 2003). The second district is Polatpaşa Street, representing the British and Republic of Cyprus periods. The importance of this district relates to the expansion of the city during the British period and the development of historical boundaries towards the closed area of Varosha (Maraş). The third district is Ismet Inönü Street. The entrance to the Eastern Mediterranean University, which has stimulated urbanization in the northern side of the Walled City, is located on this street, whic also contains the highest concentration of commercial buildings.

Combining historico-geographical and configurational approaches in the three selected districts of Famagusta

The traditional spatial organizational pattern in Famagusta has been substantially transformed into modern development. In terms of city organization, the walled city has developed throughout history in different phases, under different social, economic, cultural, and political conditions. The Venetian buildings were located around the market square and Liman Yolu Street, and other buildings were distributed throughout the centre. The Ottomans

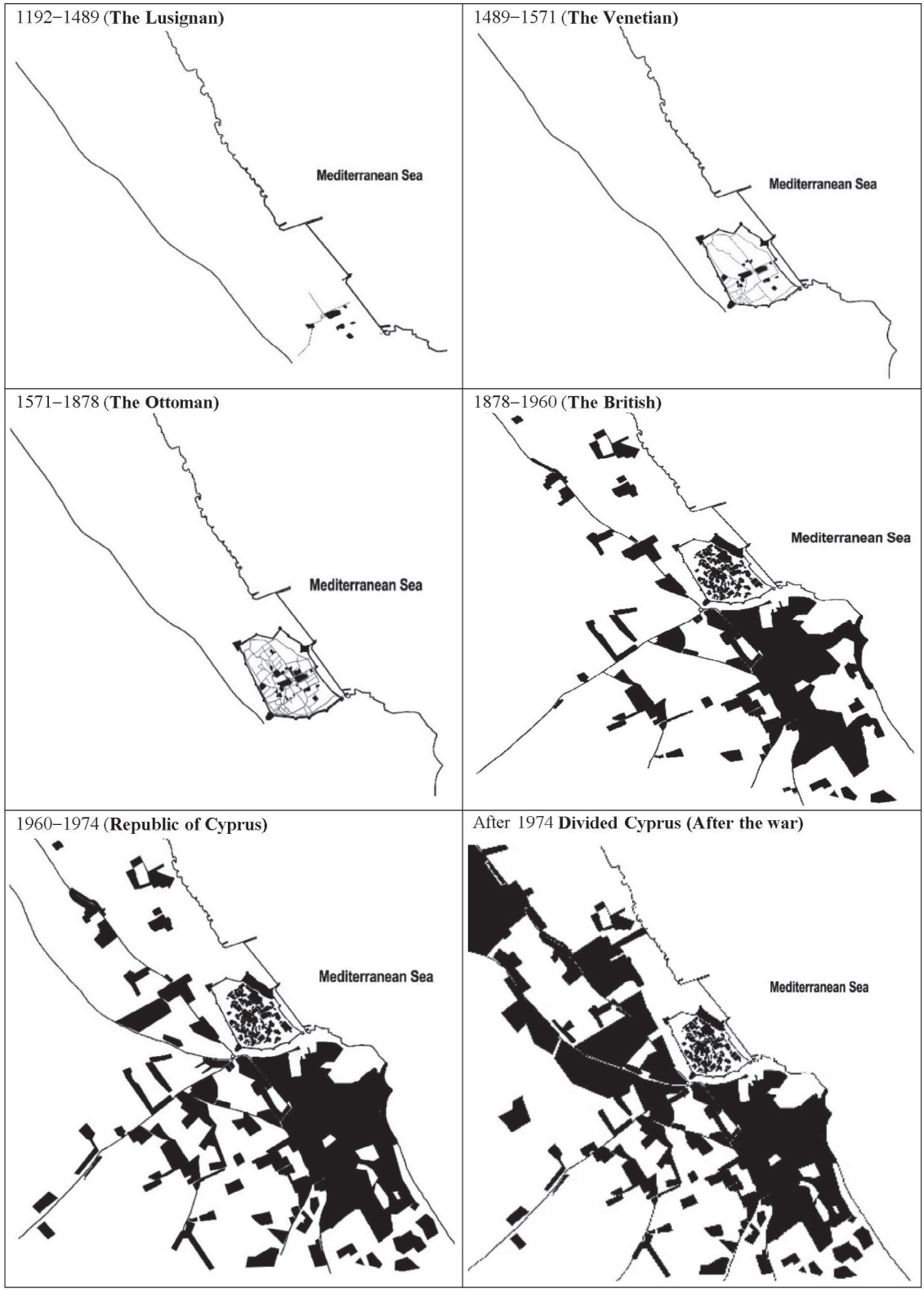


Figure 1. Historical periods of Famagusta's urban growth.

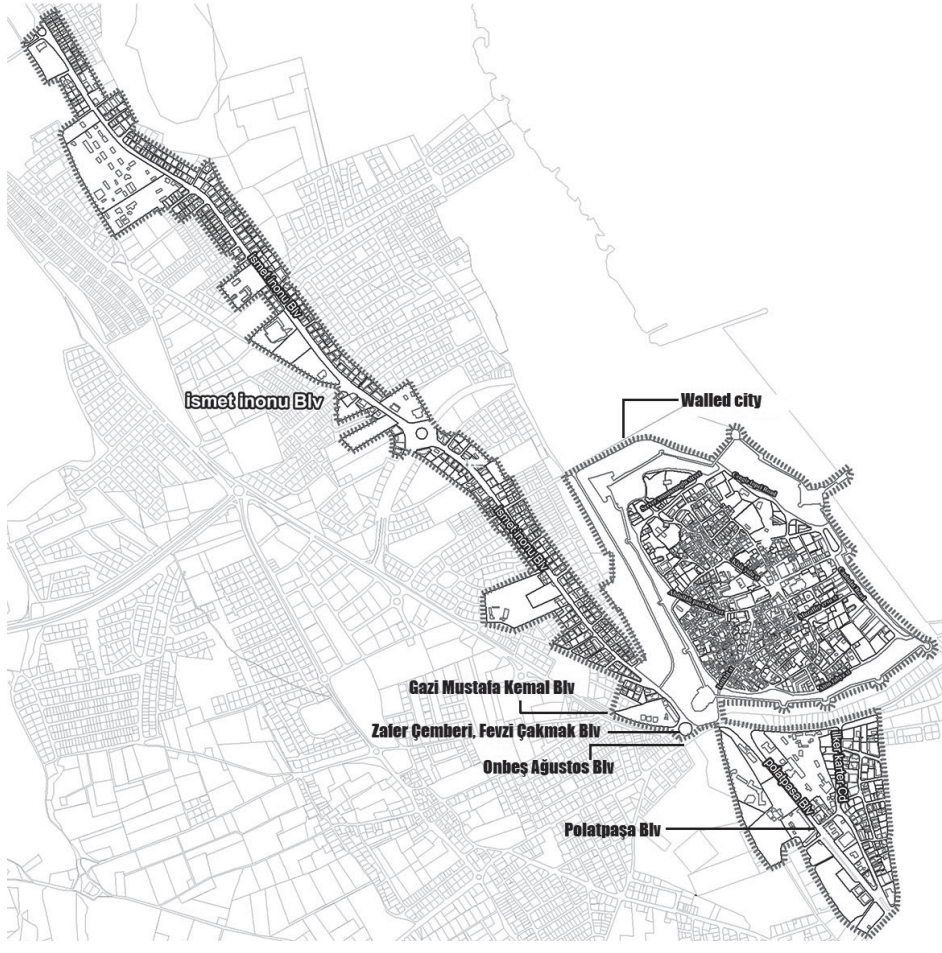


Figure 2. Location of the three selected study districts.

built a small number of buildings in the old town. During the British period, development expanded outside of the city walls, including Polatpaşa Street; however, the expansion of the city in this period was mostly towards the Varosha (Maraş) district (Luke, 1965; Önal *et al*., 1999). Development spread outside and all around the walls after 1960; housing development was particularly pronounced after the 1974 war (Cömert, 2013).

Figure 3 illustrates the syntactic analysis of the evolution of Famagusta from its historical core, in accordance with the different historical periods. In addition, it combines the space syntax visualization and town plan elements in a single map by overlapping the axial maps and plot patterns. Combining land-use patterns with space syntax measurements makes it possible to describe the spatial properties of the urban form, thereby providing a new classification system for spatial types of urban areas in relation to their socio-economic performance during the periods. Figure 4 illustrates the current building and land utilization of the selected districts overlaid with the axial maps, showing the changes in the configuration of the street network within each area. The main land uses of the historic district are public utilities, commercial, and residential. Famagusta's commercial activities are concentrated on Ismet Inönü Street.

In the Lusignan period, the city developed in an organic pattern around the St Nicholas Cathedral, creating a main axis of expansion. During the Venetian period a relatively high number of roads and gateways and churches were constructed, elevating Famagusta role as a centre of commercial activity in the

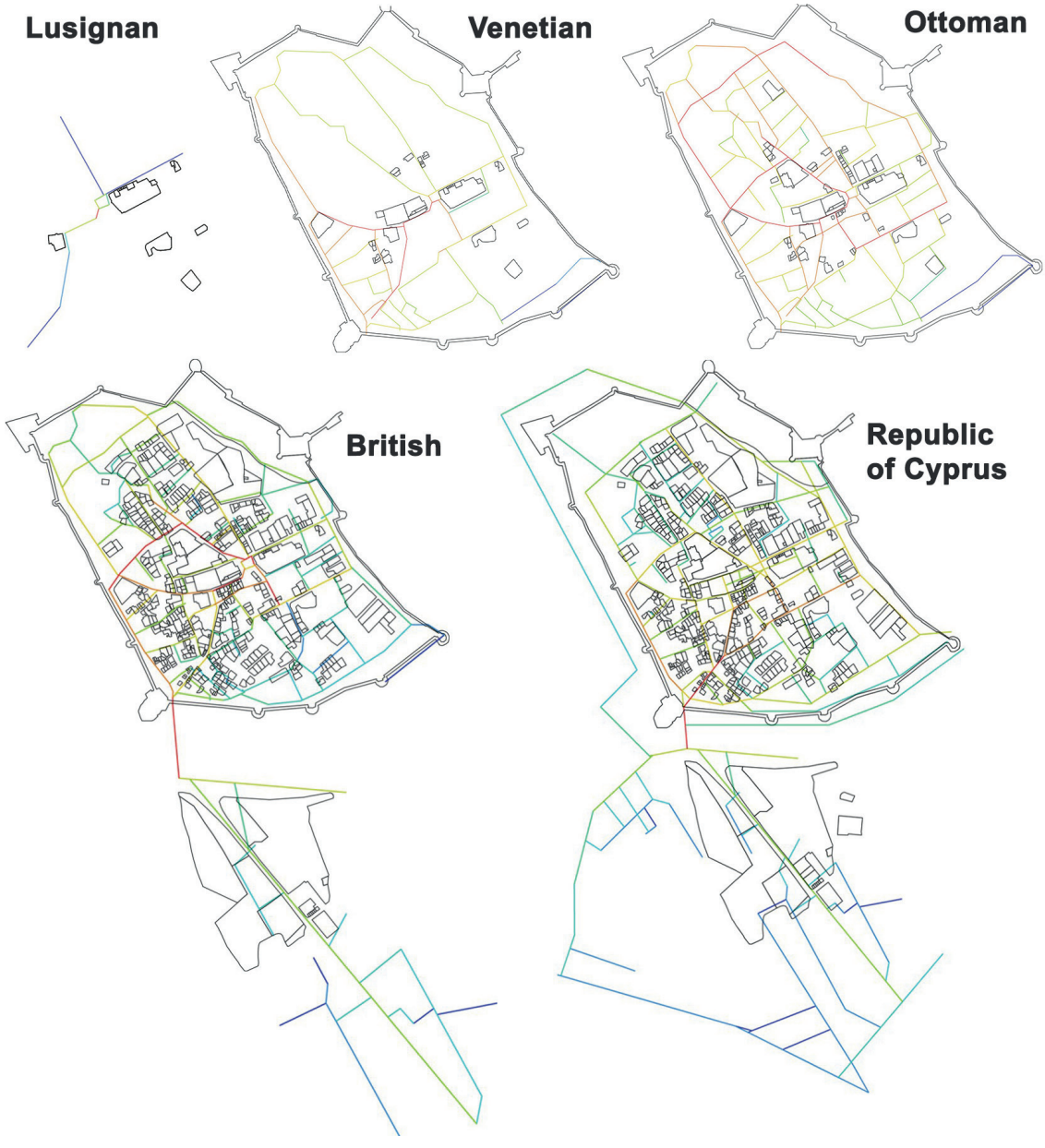


Figure 3. Syntactical growth processes of Famagusta during the historical periods by overlaying the axial maps and plot patterns in different historical periods.

Mediterranean (Mason *et al*., 2014); the streets with high integration values at the radii of 250 m, 500 m, 1000 m and the total average integration (radius n) include Istiklal Road, Server Somuncuoglu, and Sinan Paşa Street. It was during this period that the main gates to the walled city developed and buildings were placed around the market square in the historic core of the city. During the Ottoman period, complimentary accesses and multiple new streets interconnected the network within the walled city, with most axes having a high integration value at the radii of 250 m, 500 m, 1000 m and radius n. During the British period, development expanded outside the city walls and accelerated towards the south, including Polatpaşa Street; however, the highest integration values remained within the walled city. During the Republic of Cyprus period, the direction of development

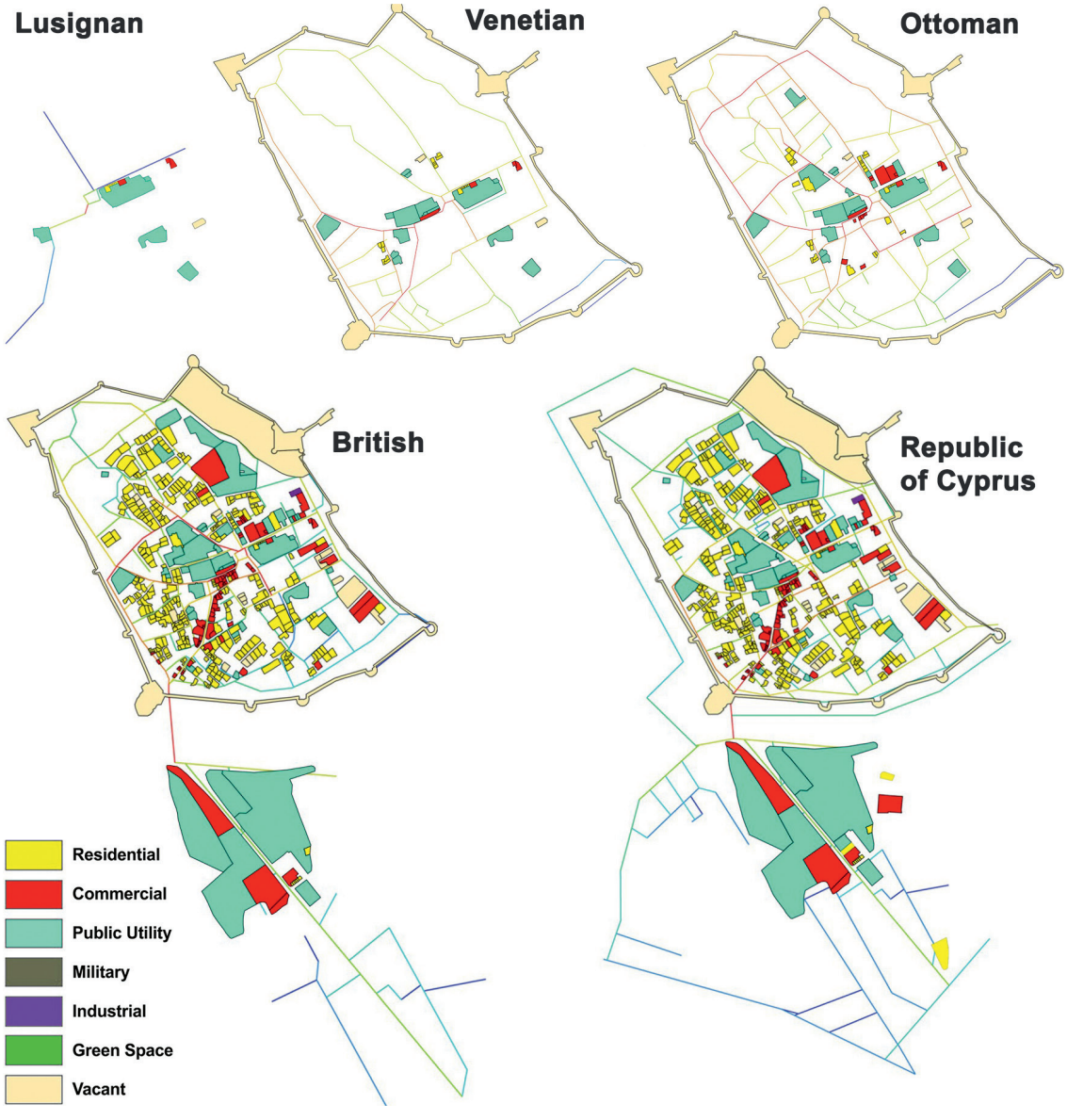


Figure 4. Combining land utilization and axial map global integration to show the changes in urban configuration in Famagusta from the Lusignan to the Republic of Cyprus period.

changed towards the west of the walled city; the street network system further expanded, including Istiklal Road and Lala Mustafa Paşa Street, driving the connectivity axis of the walled city to the outside. In the contemporary city, the historic district has low global integration and high local integration.

Following M. R. G. Conzen's analytical approach, the specific characteristics of the urban elements that together constituted a town's plan were examined. This is used to define areas of morphological homogeneity into the five morphological plan units (Figure 5). The first plan unit, the pre-urban core, appeared with the castle. After this, a medieval settlement appears along the Sinan Pasha, Namık Kemal, and Liman Yolu streets. Figure 6 illustrates the overlapping of the space syntax analysis with the building fabric into the one map to describe the morphological properties of the different elements of the built environment over time.

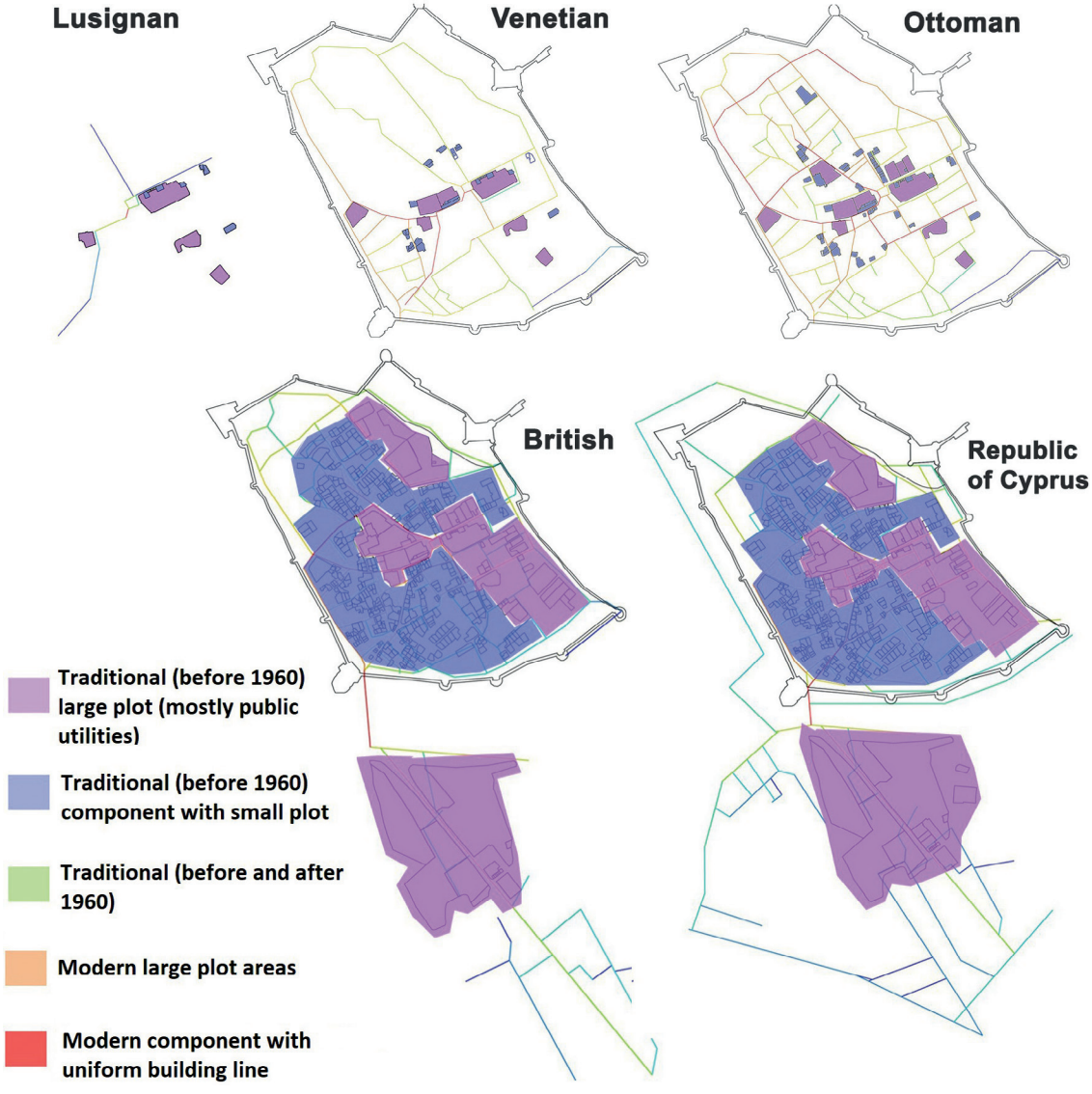


Figure 5. Overlaying the space syntax analysis with the plan unit analysis to give one map for different periods of Famagusta.

Figure 7 represents the overlapping of the space syntax analysis (axial integration) and historico-geographical analysis for 2020. In recent years, the city has expanded to the north-west due to the division of Cyprus in 1974, military-controlled areas, the Varosha Closed Area (south-eastern neighbouring region), and the establishment of the Eastern Mediterranean University in 1979. In the three decades since the University's foundation, Famagusta's rapid urbanization has contributed to the transformation of urban development and significant changes in the urban spatial structure. In recent years, the growth of urban areas and the evolution of urban form have become important symbols of urban development (Önal *et al*., 1999). The Walled City is no longer the most integrated place, as it once was, in terms of local integration.

Figure 8 shows the local and global integration of Famagusta, highlighting the axes with high integration. Unexpectedly, Ismet Inönü Street is not the most integrated path in the city in the angular global integration map; this is probably due to the lack of connections,

Figure 6. Overlaying the space syntax analysis with the building fabric analysis to give one map for different periods of Famagusta.

between this and other streets, resulting from the siting of military bases. Moreover, the walled city district as a whole has the highest value of local integration at a radius of 500 m. Ismet Inönü and Gazi Mustafa Kemal streets have the highest axial choice values. Ismet Inönü and Beş Ağustos streets have the highest angular global choice values, and the inner axes of the walled city and district of the Eastern Mediterranean University are identified as having the highest local values for angular local choice (Figure 9).

A high level of accessibility is essential for generating lively streets and for developing

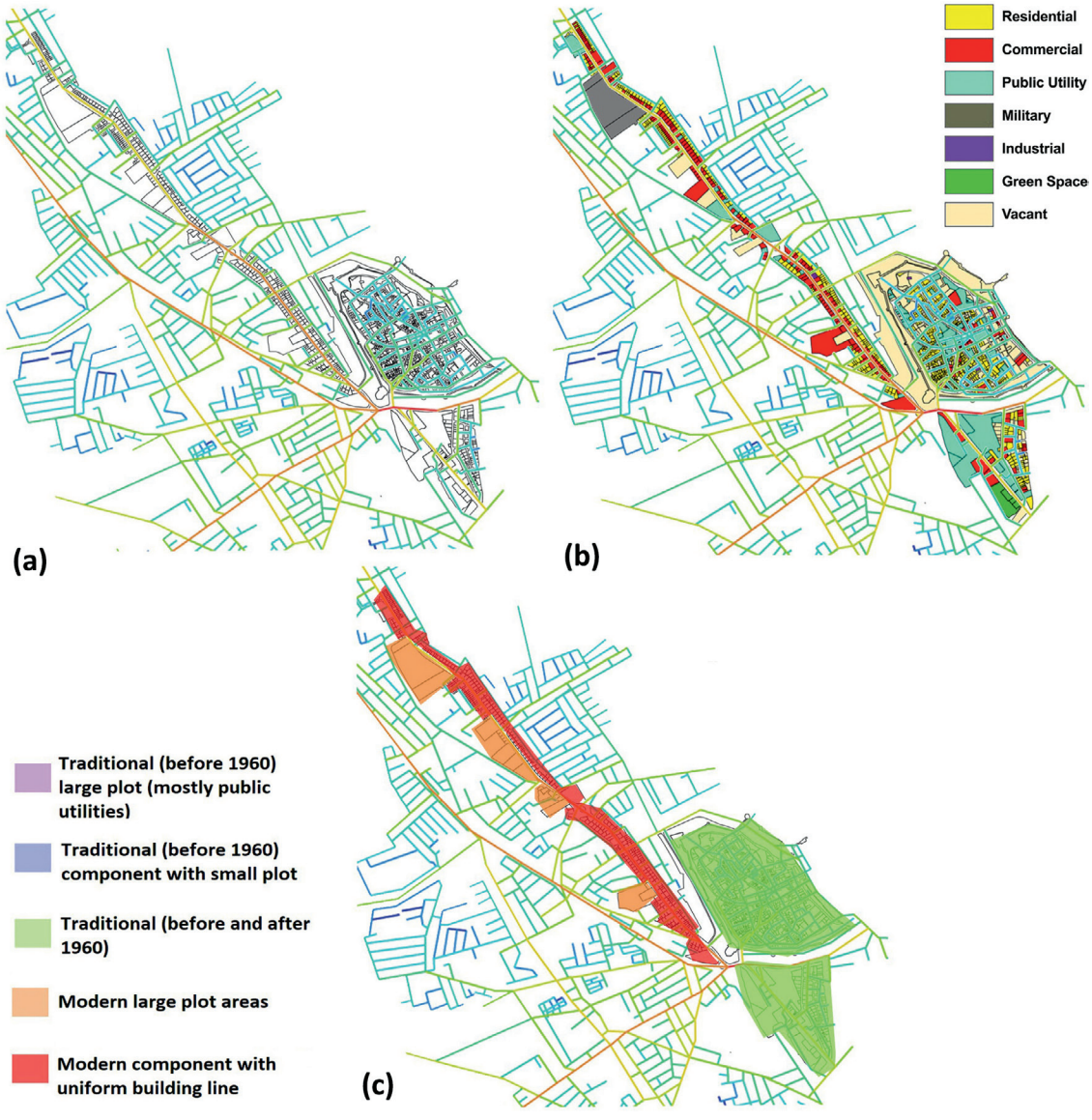


Figure 7. A) overlaying the axial map and plot patterns for 2020. B) overlaying the axial map and land utilization for 2020. C) overlaying the axial maps and plan units for 2020.

socio-economic activities. Figure 10 shows the angular accessibility maps; Gazi Mustafa Kemal, Ismet Inönü, and On Beş Ağustos streets have the highest accessibility. This analysis shows the importance of the Ismet Inönü Street as a commercial use with high availability to other parts of the city and the importance of this as a socio-economic driver.

Finally, the intelligibility analysis was computed by SPSS, which demonstrates that the area of Polatpaşa Street has the highest level of intelligibility compared with the two other districts. While the local and global integration of Ismet Inönü Street are higher than those of Polatpaşa Street, they are in second place in the SPSS computation in the domain of connectivity, as well as global integration and local integration, with the values of 0.35 and 0.51 respectively – close to the overall averages of the city which are 0.36 and 0.59. The walled city has the lowest integration value and the lowest intelligibility. Table 2 shows the classification of the three selected districts

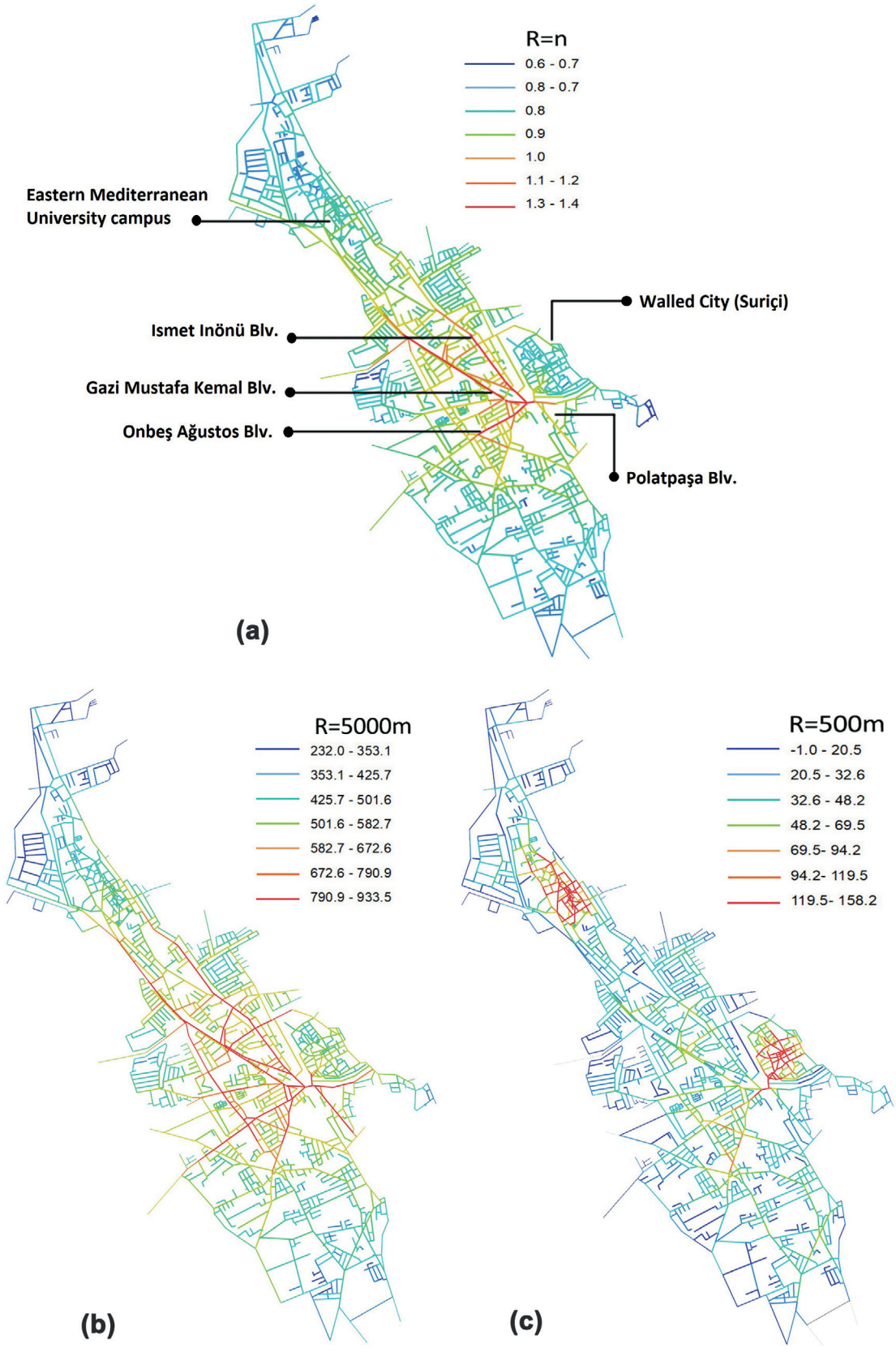


Figure 8. A) Axial integration. B) Angular global integration. C) Angular local integration.

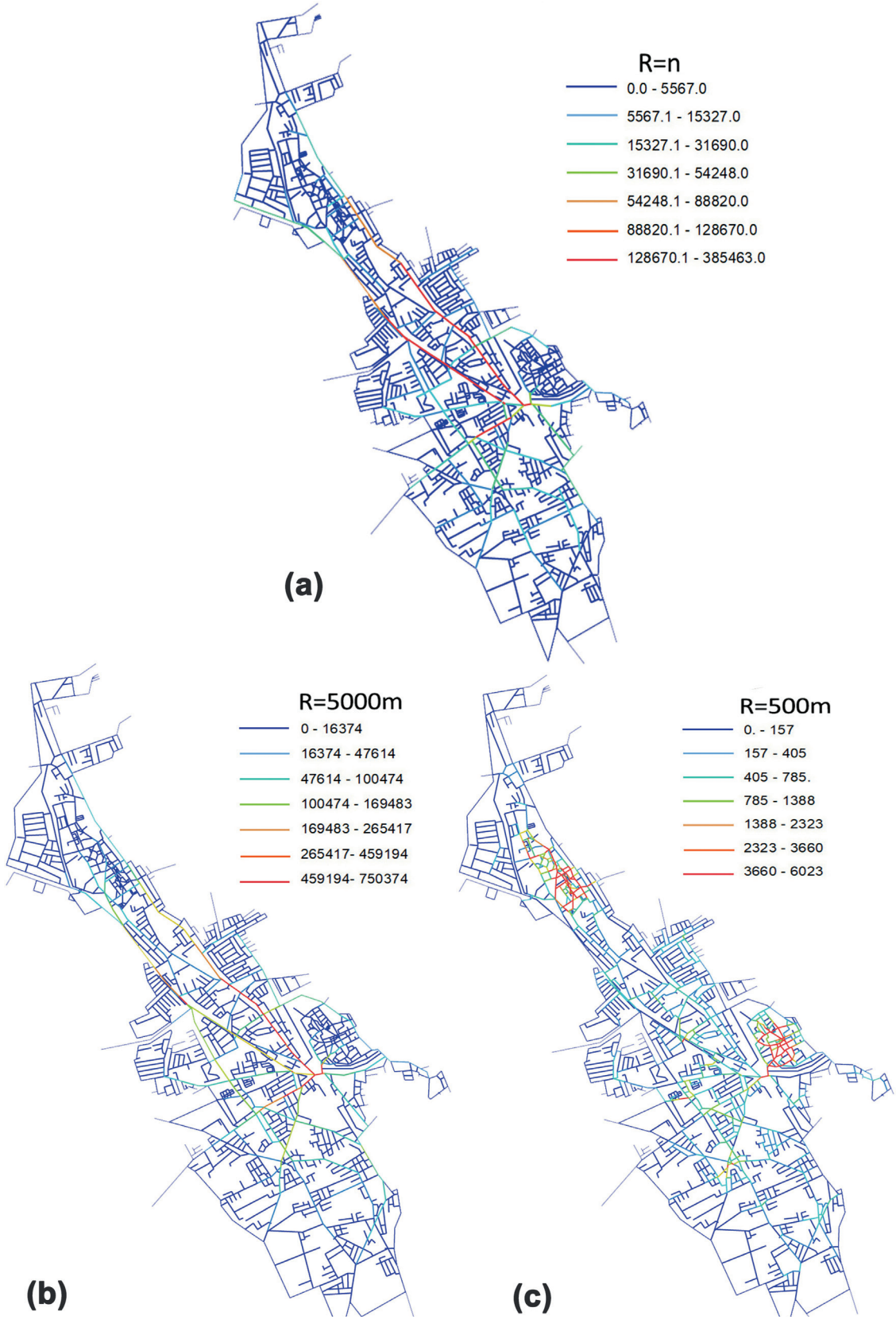


Figure 9. A) axial choice. B) angular global choice. C) angular local choice.

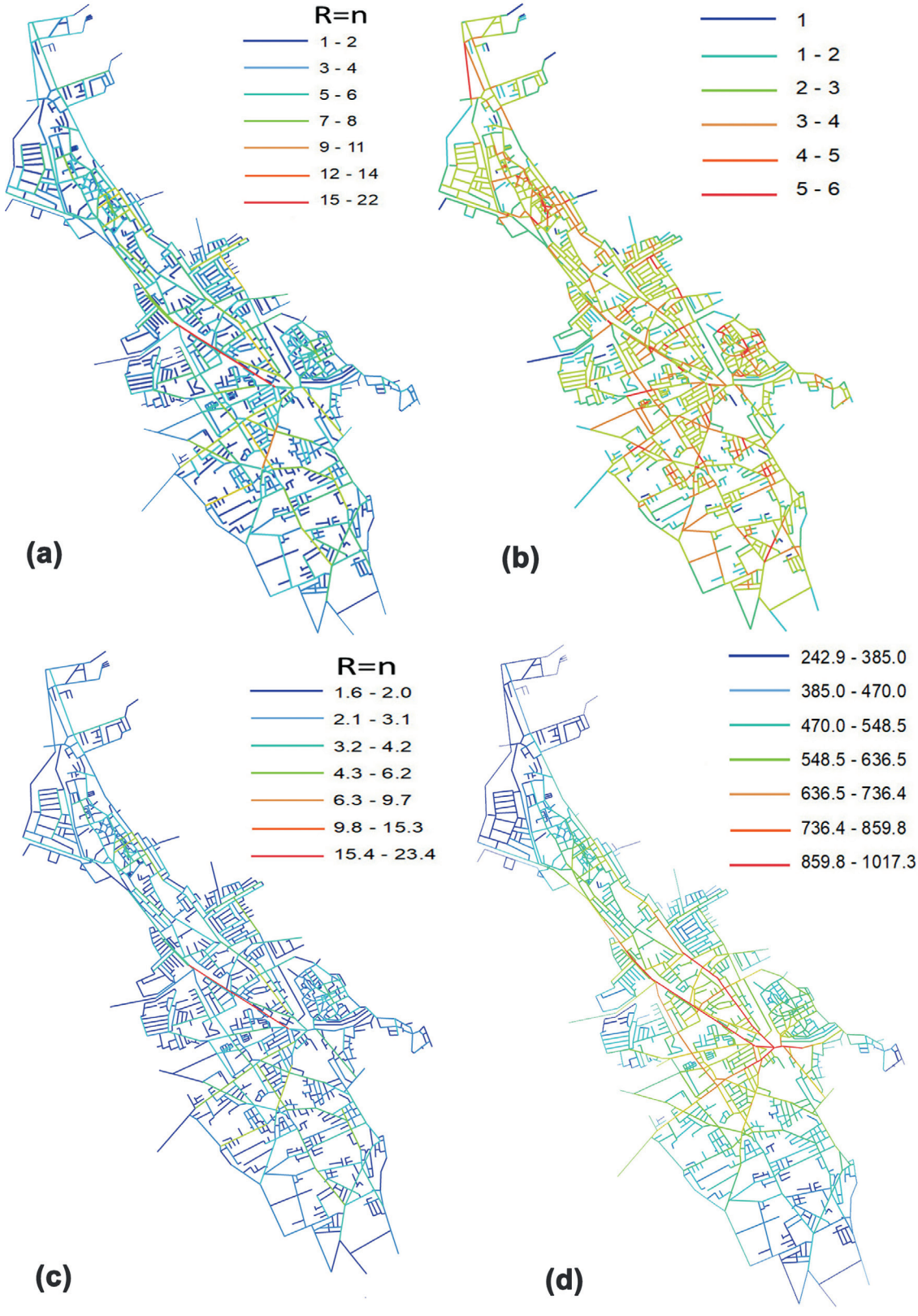
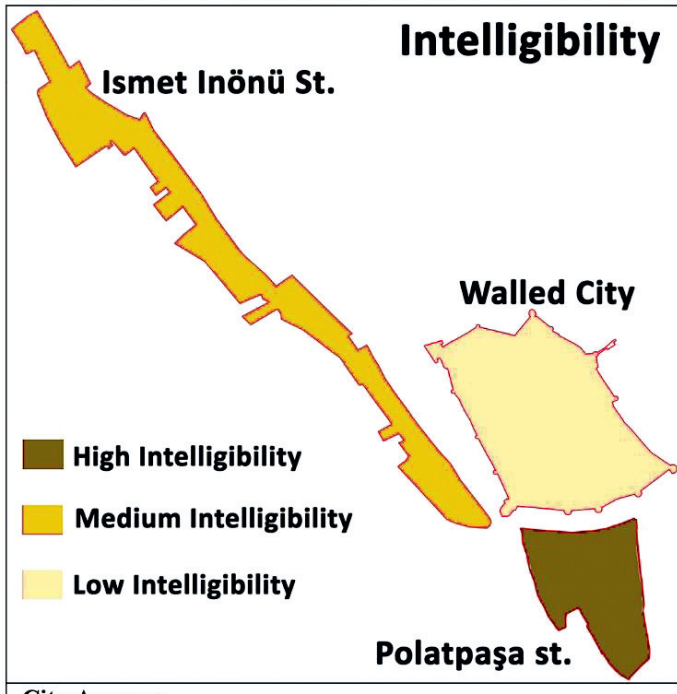


Figure 10. A) axial connectivity. B) segment analysis of connectivity. C) axial accessibility. D) segment analysis of accessibility based on connectivity and integration.

Table 2. The ranking of three districts in each variable based on intelligibility

	Connectivity	Integration [Global]	Integration [Local] R3	Intelligibility	
				Global Integration/ Local Integration	Global Integration/ Connectivity
City Average	3.63	0.67	1.68	0.59	0.36
Districts					
1. Ismet Inönü (N=95)	5	1.01	2.03	0.51	0.35
2. Polatpaşa (N=33)	3	0.90	1.62	0.79	0.39
3. Walled City (N=190)	4.38	0.68	1.92	0.27	0.14

Note: Correlation is significant at the 0.01 level (2-tailed).
Correlation is significant at the 0.05 level (2-tailed).
N is the number of lines in the axial map.

based on different variables and eventually their intelligibility.

Discussion

This research explains the spatial connections between socio-economic activities and urban form. The analysis using the historico-geographical approach, especially the land utilization, expresses the socio-economic status of the districts. Using the configurational approach, Ismet Inönü has the highest accessibility, integration, intelligibility and the highest socio-economic status of the three districts. Polatpaşa Street and the walled city are second and third respectively in this hierarchy. Figure 11 represents the districts based on having the highest and lowest integration, accessibility, and intelligibility.

The proposed model shows that, in general, the explanatory nature of the historico-geographical approach and the prescriptive power of the configurational approach means that one can significantly extend the research scope and enrich the knowledge provided by the other. It can be argued that the combined approach creates a new path for addressing the recent challenges to urban morphology and synergizing the socio-economic activities/ factors in the city. Functionally, the historico-geographical and configurational character of

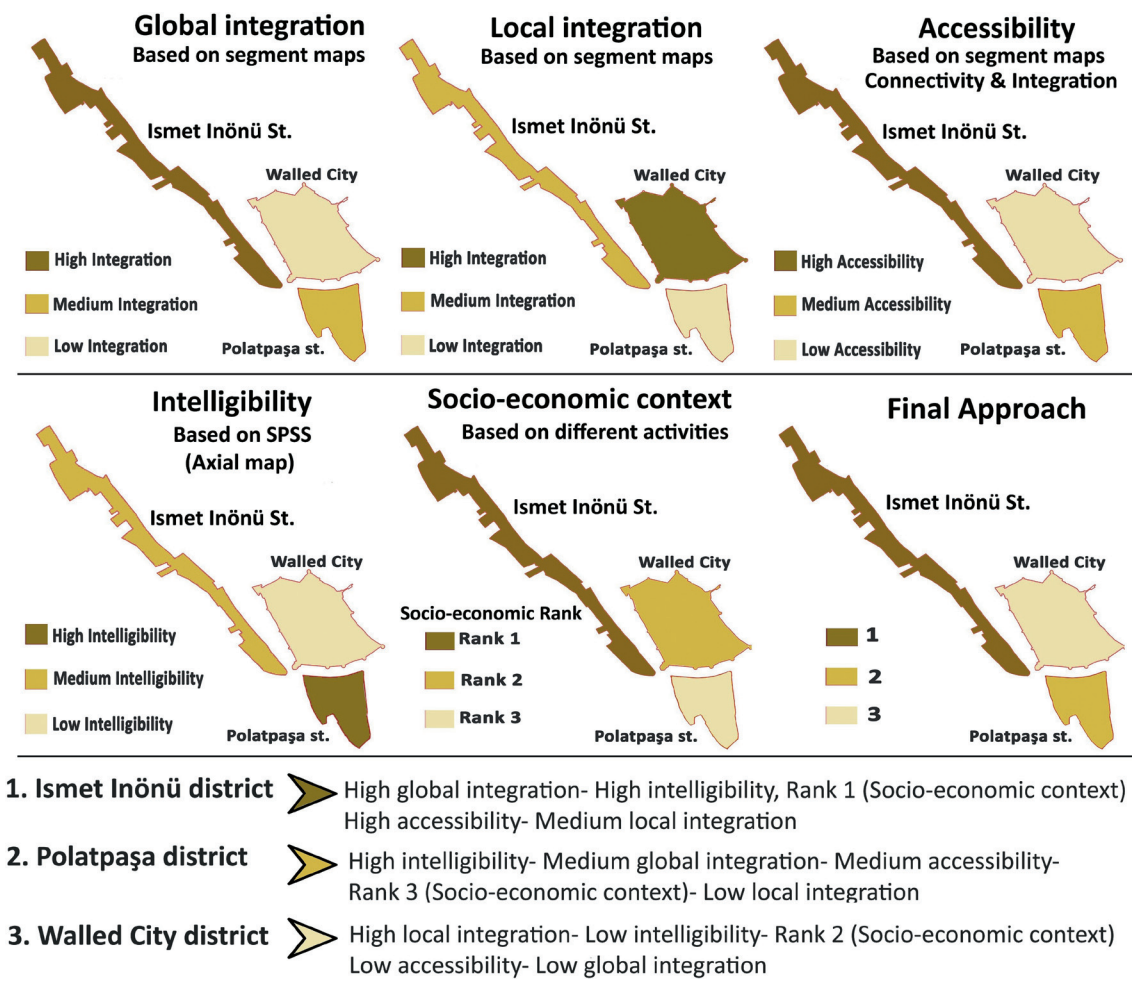


Figure 11. Model for analyzing the urban form by using historico-geographical and configurational approaches.

a city are determined by socio-economic factors (Yang, 2019). By investigating and comparing urban form across different morphological periods, on the one hand, comprehension about the continuities and changes of street configuration can be applied to illustrating the historical development of a city and the interrelationship between urban form and socio-economic activity. The historico-geographical method helps to understand the developmental process of urban form through the formative process. In this approach, the urban form is seen as a hierarchy of the composition of morphological regions, defined by a distinct combination of streets, plots, and building blocks. Conversely, the configurational approach takes urban form as a hierarchical spatial structure in which streets are not considered as constituent areas but rather as a continuous network that organizes and links plots and buildings (M. R. G. Conzen, 2004). Space syntax analysis diverges from the Conzenian approach, because its focus is not on the morphological periods, but on the relationship between patterns of movement, land uses and street networks. However, both viewpoints can be combined into a complementary approach to the study of the built environment. Further research could explore the general relationship between particular morphological organizations and prevailing socio-economic activities on the premise that they cannot be fully understood separately. In the case study discussed here, the high

accessibility of Ismet Inönü Street, with a more suitable potential for more active functions and more important applications with higher socio-economic activities, stands out against the more remote areas of Polatpaşa Street and the Walled City, which have limited accessibility and less socio-economic activity. The two approaches could be combined to rank the study areas and disentangle the relationship between the city's street network accessibility, its configuration, the hierarchy of streets and town plan elements. The results obtained from this study suggest that the proposed method has the potential to provide a new perspective on the city's evolutionary trend. This complementary model can serve as a starting point for evaluating the extent to which configurational representations of contemporary built environments might equally help to illuminate historical patterns of urban transformation.

Conclusion

The complementary method tested in Famagusta demonstrates the strong relationship between land use and socio-economic activities, which reflects the insight into the evolution of the city in terms of physical and socio-spatial conditions and products. Although both methods work separately and satisfactorily, this complementary method helps to configure the usages of spaces within the scope of socio-spatial relations by the means of the historico-geographical approach. In addition, the combination of the space syntax visualization and town plan elements in a single map with the overlapping of axial maps and plot patterns shows that land-use patterns with space syntax measurements make it possible to describe the spatial properties of the urban form. Thus a new classification system is provided for the spatial types of urban areas in relation to their socio-economic performance through the growth and development of the city. In this research, plots and building patterns provide a piece of information on the land utilization whether it is commercial, industrial, or residential throughout the transformation of urban form on one hand and space syntax analysis provide a broad understanding of the spatial relation and integration during the urban transformation on the other. The integration/overlapping of the two methodologies delivers a broader understanding of how urban form is transformed throughout history and how socio-economic changes affected the urban form during these processes. The proposed complementary method can produce an enhanced understanding of physical and socio-economic development, and historical development of urban form upon the data from its history. Given the potential for collaboration between these two morphological research traditions, in order to produce a more robust framework for testing and applying, this complementary method could be a solid basis for future researches and practice.

This study therefore recommends that the configurational analysis complement historico-geographical analysis by promoting understanding of the street network in terms of its relationship with the evolutional process of the city. In particular, the lack of sensitivity to historical processes of urban form in the configurational approach may be remedied by the historico-geographical approach while, in return, the configurational approach can rectify the absence of role of space production rules in the evolution of the urban form in the historical approach. In combination, the historico-geographical and configurational approaches ensure an enhanced analysis of the relationship between street plan, plot pattern and land use, which enables to designate the connection between streets networks and specific districts through the understanding of how streets of socio-economic activity are embedded within them.

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