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The rationale behind growth patterns:

Socio-spatial configuration of Izmir, Turkey 1700s – 2010

Işın Can

Izmir Institute of Technology
isincan@iyte.edu.tr

İrem İnce

Izmir Institute of Technology
iremince@iyte.edu.tr

Claudia Yamu

Vienna University of Technology
claudia.yamu@tuwien.ac.at

Abstract

Izmir, which the recent excavations have shown to be an 8000-year-old city, has gone through various stages in its development process. It was an important harbour city located on Turkey's west coast, triggering commerce between east and west. When the inner harbour was revitalized in the 17th century, trade activities increased and the city became an even more popular destination for Levantines¹. By the 19th century, therefore, Izmir's morphology was defined by its cosmopolitan structure, especially where the historical centre emerged.

The urban pattern changed drastically during the period between the end of the 19th century and the beginning of the 20th century. In each period, intrinsic and extrinsic socio-spatial dynamics including natural and man-made disasters, planning decisions, and the exchange of Greek and Turkish immigrants determined the growth processes of the city.

This study investigates the generative rules of Izmir's urban structure by looking at nine different periods based on intrinsic and extrinsic dynamics. These periods were chosen according to the availability of historical maps and data. We observed morphological changes throughout the 1700s and the years 1836, 1856, 1876, 1885, 1905, 1922, 1941, and 2010. In order to analyse urban transformation and growth processes coupled with underlying indicators, this study uses segment angular analysis. Socio-spatial dynamics are discussed for each period. This paper aims to reveal how intrinsic and extrinsic phenomena shape urban form in cities. By looking at a hybrid city like Izmir incorporating radial, orthogonal and organic patterns, this study tries to understand urban transformation over time using space syntax analysis.

Keywords

Configuration, urban history, morphology, urban growth, space syntax.

¹As a word with its roots in French history (Şenocak, 2008), "Levantine" is a term used for citizens who came from Europe and settled in the East, mostly in harbour cities.

1. Introduction

There are various studies in planning and urban design for modelling the urban growth of cities. A few of them use statistical models in an attempt to examine the determinant influences on urban growth; others, particularly in space syntax literature, test morphological models to explore generative rules forming urban structure. Al-Sayed et al. (2009) for example developed a diachronic model to reveal spatial growth and to understand the logic embedded in the formation of space. This was done to observe transformations and mutations, causes and emergence, regularities and particularities of urban form through time. Al-Sayed and Turner (2012) elucidate urban growth studies on the basis of two strands: first, theories developed from socio-spatial phenomena and second, by reconstructing phenomena with the help of computational models in order to test theories. It is important to combine both strands in morphological studies. In synchronic states of growth we are confronted with two processes that direct urban growth: the evolutionary process and self-organization (Al-Sayed and Turner, 2012).

According to Lynch the city is a construction in space, but one of vast scale, a thing perceived only in the course of long spans in time (Lynch, 1969, p.1). In this line of thought we need to understand urban growth processes through time not only to design strategies for the future but also to cope with environmental and social problems. Environmental change, demographic transition, and human inequality are some of the challenges facing planners in the process of rapid urban growth (Blanco et al., 2009). Urban growth appears to be characterized by two significant phenomena: firstly spatial factors with the change in the rural landscape, especially the transformation of rural areas into urban areas, and secondly changes in population rates transforming villages into towns and cities (Bhatta et al., 2009 and Clark, 1982 in Thapa and Murayama, 2010). Therefore it occurs both physically and socio-economically, and is one of the most important challenges of our century as we face the problems of land shortage, urban expansion, migration, urban sprawl, and environmental issues. There are various factors that trigger urban growth processes. As Thapa and Murayama (2010) emphasise, the growth processes behave differently in different contexts and environments. Drivers of urban growth can be economic, political, or physical. The impacts of different drivers can vary across distinct areas of cities.

Modelling urban development is important in order to understand the complexity of urban growth processes. As Cheng and Masser (2003) underline, urban expansion is part of the agenda of managing sustainable development that has been widely studied by geographical information systems. Both land redevelopment laws and various actors shape the process of growth. Urban road infrastructure and developed areas are major determinants of urban growth processes compared to master plans (Cheng and Masser, 2003).

This study uses angular segment analysis as it helps reveal the generative structure of growth (Al-Sayed et al., 2012) based on road infrastructure using foreground and background techniques. Thus, we can illustrate a route hierarchy underpinning the idea of self-organizing processes. Hierarchy is a discrete gradient established by growth of agglomerations (Batty, 2006). Growth of settlements entails a reorganization of spatial systems, including their hierarchy of centres and sub-centres or centrality and periphery. The idea of centrality is a good example to help us understand the relationship between an emergent structure and processes (Yamu, 2014, p. 45). Al-Sayed et al. (2012) observed that highest integration values are highlighted in the downtown areas of cities with bottom-up growing processes. As the urban structure grows, these values are spread over the city. Especially after the second half of the 19th century with its top-down planning decisions, cities experienced imposed uniform grid plans. Al-Sayed et al. (2009) conclude that models support discussions of how to integrate new emerged structures within the current urban form, as well as future planning strategies (Al-Sayed et al., 2009).

In addition, Alfasi and Portugali (2007) suggest linking planning theories, laws and spatial characteristics of a city. Going forward, we have to be aware that cities are rather complex (Yamu 2014) and plans of whatever kind are not the only driver shaping the city.

In this context, Izmir underwent different growth processes, also influenced by unpredictable events such as fires and earthquakes. The city evolved during various eras including the Hellenistic, Roman, Byzantine and Ottoman. In the Ottoman period, the predominant morphological structure of the city was shaped by the immigration of Greek, Armenian, Jewish and Levantine communities, who came from Europe attracted by the trading activities of the harbour city (Şenocak, 2008). However, the city preserved its robustness until the beginning of the 20th century in the sense that the urban system was able to be highly operative while undergoing changes on a local scale due to bottom-up processes. After the establishment of the New Turkish Republic, Izmir was subject to citywide planning actions in the 20th century. Consequently, this paper aims to understand the rationale behind Izmir's growth patterns from the 18th century until now. These growth patterns were either self-organised, emerged structures or planning decisions imposed from above.

This study uses space syntax as a theory and method. Segment analysis is preferred over axial analysis. We use citywide and local measures to compare and analyse different periods of urban growth. Additionally, we have recourse to urban planning history for placing our analysis within the context of the socio-economic and political situation of each selected period. This study aims to find out how intrinsic and extrinsic properties of the urban structure influence spatial characteristics of cities such as integration, choice, and legibility.

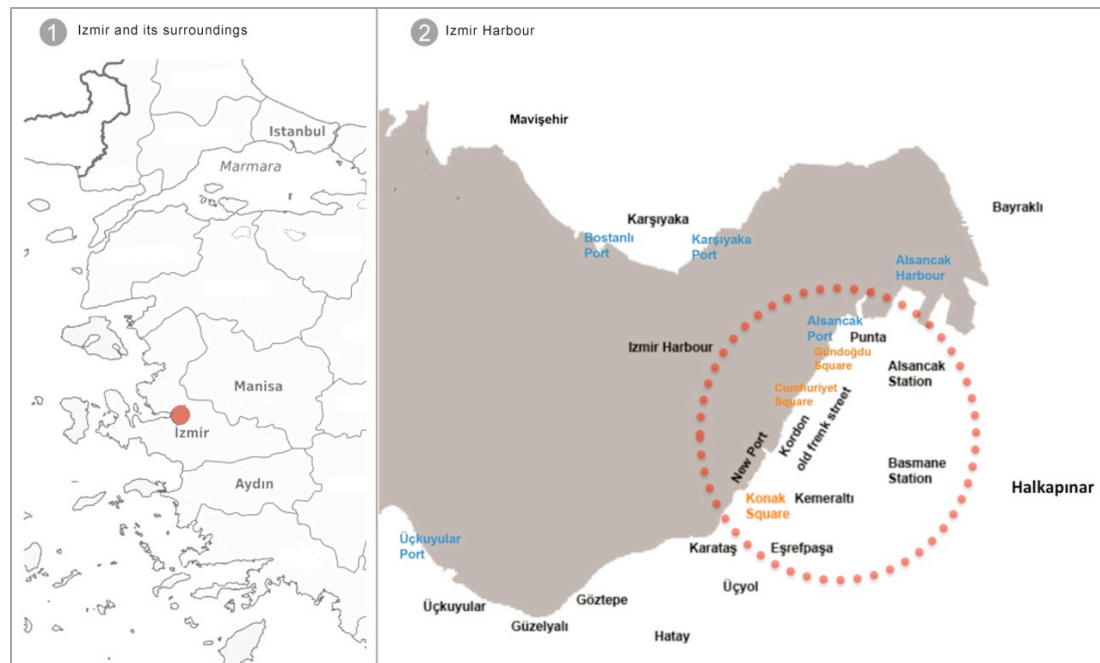


Figure 1: Izmir's location.

2. Analytical Study

Data

Izmir has experienced various growth processes throughout its urban history. Herein we analyse the 1700s and the years 1836, 1856, 1876, 1885, 1905, 1922, 1941, and 2010. The periods identified were limited by the availability of historical maps as raster images. Maps which originated before the 19th century are not accurate in their scale. From the second quarter of the 19th century on we were able to use maps produced by engineers such as Thomas Graves (1836), Luigi Storari (1856), and Lamed Saad (1876). Subsequently, Georgiades (1885) and Baedeker's (1905) maps are less detailed than the previous three. In contrast, the 1922 map is a rough map with inaccurate dimensions and plot divisions. Finally, 1941 and 2010 maps and data are provided by Izmir

Municipality. Despite data inconsistencies in the maps of 1885, 1905, and especially 1922, they can still reveal the changes for the purposes of comparison.

Methodology

Hillier argues that space syntax analysis is believed to demonstrate that "how the urban system is put together spatially is the source of everything else" (Hillier, 1999 in 2007, p.126, electronic edition). Although space syntax theory is not free from known methodological problems that continue to be addressed (Batty, 2013), and neglects the third dimension as an influencing property for orientation and way finding (Ratti, 2004), it still serves as a widely-used and robust tool for relatively quick and effective spatial analysis on an urban scale.

This study conducts normalised angular segment analysis (Choice) for comparing nine morphological phases. In comparison to axial analysis, segment analysis has the advantage of segmenting streets according to junctions. Therefore it can analyse a system segment by segment and angle by angle. For local measures we add a metrical radius using the 10% rule of a system's coordinates as input values for processing. Thus we can work with the same relative local measure for all time periods. All maps are scaled on the basis of the 2010 map.

Further, we reveal with correlations how the part and the whole are related to each other within the system. Synergy (correlation between global integration and local) is used to show the spatial and social interaction for each period, whereas the study applies intelligibility (correlation between global integration and connectivity) to identify how easily people can navigate within the urban system. The mean values of syntactic measures are put together in a table to show the morphological comparisons. In the following section, the comparison of morphological properties is explained in detail.

Comparison of Morphological Properties

The hybrid pattern of Izmir emerged intrinsically on the basis of its cosmopolitan social structure, natural topography and inner harbour functioning as a sheltered basin.

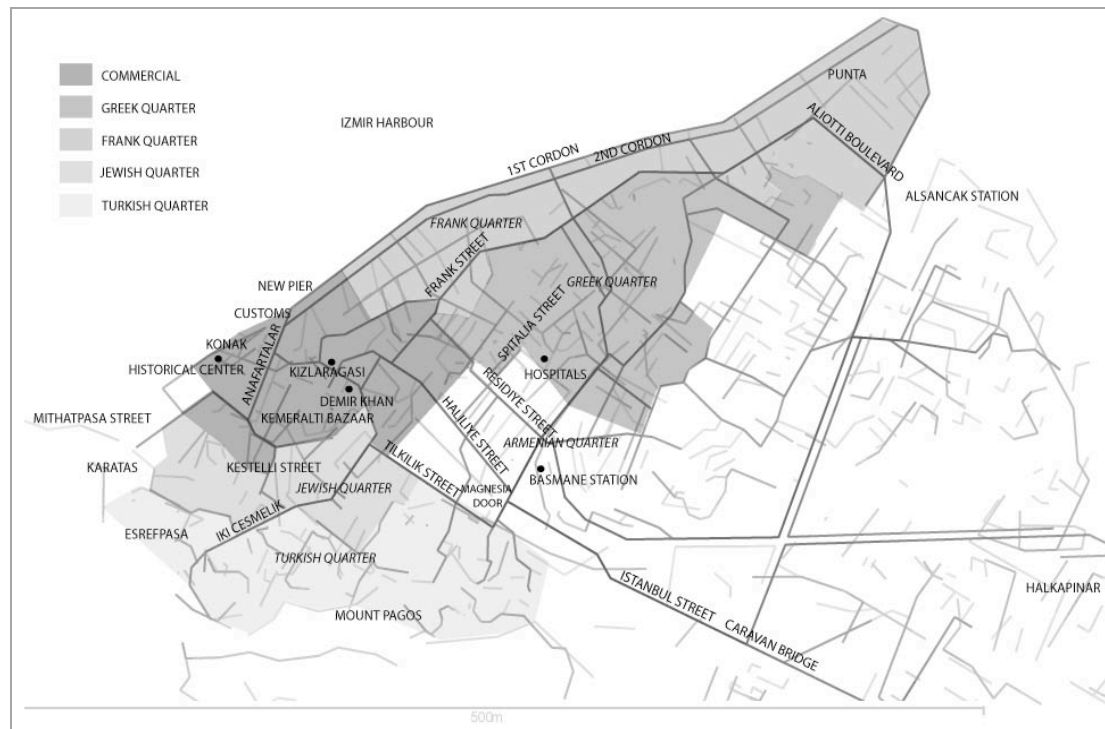


Figure 2: Izmir's main routes and places produced from the 1885 map.

The 1700s morphological analysis depicts two main axes connecting the urban centre with the city's eastern areas. As part of the Silk Route connecting East and West, merchants entered into the city via the Caravan Bridge and Istanbul Street. The second historical path voyagers used was the gate of Magnesia (Manisa) (Figure 2). Segment analysis depicts both axes carrying merchants into the core of the city to Kemeraltı (Figure 3). As Hillier (1996) mentions in "Cities as movement economies", space is the main generator forming the movement and, as a consequence, the economy as well. Where the two axes merge, the main economic powerhouses of the city such as Kızlarağası Han and Demir Han (accommodation and commercial place for merchants) emerged together with two mosques in close proximity. Both created two interlocked urban centres fed by the two arteries Tilkilik Street and Haliliye Street, with the bowl-shaped Anafartalar Street as the first commercial street of the city defining the waterfront of the old inner harbour (Figure 2). However, by the 18th century the inner harbour had silted up and a new port was constructed in the northern part of the historical centre. This led to the development of a waterfront area parallel to the sea, which was known as Frank neighbourhood.

<i>Years Maps</i>	<i>Int_Seg_RN (normalised)</i>	<i>Int_Seg_Rloc (normalised)</i>	<i>CH_RN (normalised)</i>	<i>CH_Rloc (normalised)</i>	<i>Mean Depth</i>
1700s	1.94	1.27	2.44	1.15	6.76
1836	2.53	1.75	3.62	2.40	14.32
1856	2.82	2.07	3.85	2.86	15.12
1876	2.97	2.06	3.88	2.73	15.20
1885	2.75	1.90	3.99	2.63	11.14
1905	2.75	1.75	3.92	2.33	11.39
1922	2.51	1.78	3.80	2.49	12.22
1941	2.96	2.32	4.25	3.28	18.99
2010	3.67	2.72	4.99	3.93	30.41

<i>Years Maps</i>	<i>Connectivity</i>	<i>Intelligibility (Con/IntRN)</i>	<i>Synergy (R3/RN)</i>	<i>Int_RN</i>	<i>Int_R3</i>
1700s	2.83	0.14	0.40	0.85	1.46
1836	3.10	0.10	0.26	0.59	1.52
1856	3.21	0.08	0.29	0.63	1.60
1876	3.28	0.10	0.41	0.64	1.59
1885	3.92	0.12	0.36	0.79	1.86
1905	3.57	0.13	0.50	0.79	1.75
1922	3.55	0.16	0.34	0.65	1.67
1941	4.10	0.03	0.08	0.53	1.88
2010	3.87	0.02	0.09	0.41	1.85

Table 1: Means of syntactic measures.

The spatial analysis of 1836 highlights a remarkable development around the commercial centre (Kemeraltı). Integration, choice, and connectivity values have increased (Table 1). For the first time, we identify different emergent morphologies reflecting social organisations of ethnic groups and their neighbourhoods. Around the old inner harbour area and between the centre and Kadifekale organic structures with dead ends appear due to the daily practices of Turks and Jews as well as the steep slope topography of the city. By the waterfront, however, we identify many plots and narrow streets (verhane) because of high demand and the popularity of the Frank neighbourhood. There were extensions toward the sea, hence the plots were long and narrow in layout. After Anafartalar, Frank Street was the second trade axis connecting the historical core with the northern part of the city. This street was the place where European products were sold and where Levantines mainly lived. In the global choice analysis the main roads such as Frank Street, İki Çeşmelik Street, Haliliye Street, Tilkilik Street, and Reşidiye Street more or less delineate the invisible boundaries of each of the ethnic neighbourhoods (Figure 2 and 3).

However, this demarcation was not very strict. Abensur-Hazan (2013) points out that as time passed some of Izmir's citizens resided in ethnically diverse neighbourhoods. The administrative centre in the Ottoman era was at Konak Square along the seashore. As an important westward-looking port city in the 17th century, privileges were granted to foreigners and non-Muslim communities. This resulted in a flourishing of the city along the coast towards the north. Levantine houses, hotels, warehouses, cafes, and consulates emerged parallel to the sea (Beyru, 2000; Bilsel, 2000; Baltazzi, 2009; Milton, 2009; Can, 2012). In Turkish neighbourhoods cul-de-sacs functioned as semi-public spaces and trading activities were distinctly separated from the private spaces. In contrast to this spatial arrangement, especially in the Frank neighbourhood, living and trading activities were mingled and this phenomenon was reflected in the spatial structure of the neighbourhood with, for example, mixed uses, passages, courtyards, and narrow streets.

In the 1856 global segment analysis Frank Street comes to prominence due to street connections with higher choice values. Anafartalar and Spitalia streets thus passed their dominance on to Frank Street. Frank Street has been extended and now connects the northern "Punta region" to the south (Figure 2). Frank Street has become more integrated into the system, which was by no means a coincidence. Until the mid-19th century, growth processes in the city were intrinsic and bottom-up. As time goes on the appearance of minor interventions can be clearly identified, signalling top-down processes of urban development. Choice values shifted towards the southeast in this period due to the development in both Frank Street and the Armenian Quarter. When the 1836 and 1856 analyses are juxtaposed there is a tremendously increased population in the Frank neighbourhood, spatially indicated by longer plots and a higher number of them. Moreover, self-emergent patterns have been overlaid by uniform grid structures. In the street network of 1856 we also identify grid intensification underpinned by the increase in segment lines. In the south, steep topography limits urban growth in Kadifekale (Mount Pagos), whereas towards the north agricultural fields provided for transformation and grid intensification. Organic grid intensification was carried out in the Greek neighbourhood.

Bilsel (2000) states that Izmir started to prosper economically with the introduction of the Commerce Regulations in 1838 and the modernization efforts and constitutional reforms of the Ottoman government. Therefore spatial organization and the production of space types in the city were defined by multiple actors in addition to its multi-ethnic social structure and culture.

For instance, the Armenian quarter has an impact on the global and local choice values as the result of a new spatial arrangement. Reşidiye Street now has a stronger connection to Frank Street and the waterfront compared to the earlier periods. In this context Bilsel (2000) emphasises that this arrangement was designed by two architects assigned by the Ottoman government after the fire disaster in the neighbourhood in 1845. This was the first top-down planning and development activity the city carried out; known as "Ebniye Nizamnamesi", public improvements and first development regulations enacted in 1848 triggered these types of implementations with uniform grid arrangements.

Moving on, the analysis of 1876 correlates with the first breaking point in Izmir's urban history for important top-down planning interventions. New railway stations (Alsancak station and Basmane station) and new rail services between Aydın (a city in the south) and Izmir as well as Manisa – Turgutlu (cities in the north and east) and Izmir carried traffic from western Anatolia to Europe. In 1866-1876 the docks and in 1880 the new customs house were built (Karadağ, 2008 in Yatağan et al., 2009; Can, 2012). With the construction of the docks, the Greek population increased due to the immigration of workers from mainland Greece and the islands to Izmir (Parlak in Morali, 2005; Can, 2012). The new quay invigorated the social life of the waterfront area, with various activities encouraging Izmir's citizens to stroll along the seashore (flâneur). A horse-driven tramline also started to operate between Punta and the historical centre of Izmir. Consequently the "Punta" region developed, with the first attempts at land speculation by foreign entrepreneurs. The construction of both the quay and the railway at the end of the 19th century triggered this development.

This in turn had a major influence on the city's morphological pattern, which changed drastically due to the involvement of European entrepreneurs and financial aid from the Ottoman government,

which gave the city an economic boost (Bilsel, 2000). The 1876 model exposes these differences compared to earlier phases, such as the construction of First Cordon Street and Second Cordon Street along the bay. First and Second Cordon streets directly connected the northern part of the waterfront area to Anafartalar Street and the historical centre. Those streets affected the choice values of Frank Street in the global segment analysis. Istanbul Street strengthened its choice value together with the railway roads in the global analysis.

These changes can be still observed between the 1876 and 1885 models, although the street network in 1876 is in more detail and thus incorporates a higher number of street segments. The 1885 analysis reveals that the railway and station constructions influenced land speculation on the city's green fields near the railway in Halkapınar neighbourhood (Figure 2). Differing from the previous 1876 analysis, the European and Turkish customs houses by the new port were infilled? in 1885. A new pier with a customs house was constructed, which is today known as Konak Pier. In this period, French entrepreneurs decided to connect Basmane Station with the customs house on the pier via a road (Fevzipaşa Street, 1941). This was realised in the early periods of the New Republic of Turkey. Levantine street names are another indicator revealing that the northern part of the city was being developed by European entrepreneurs, e.g. "Aliotti Boulevard" (Bilsel, 2000) connecting Frank Street to Alsancak Station.

Due to the increased population triggered by investments and employment, Izmir expanded with the emergence of new residential areas. Both the opening of Mithatpaşa Street in 1880 and subsequently the construction of the tramline between the centre and Göztepe (southern part of the city) in 1883 connected the centre with the newly developed residential areas to the south (Yüksel, 2006). This period was the epoch of transport development.

Due to the rearrangement of urban blocks in the area of infill development an important change is highlighted in the 1905 model, as these new blocks removed the direct connections between First/Second Cordon Street and Anafartalar Street (commercial area). The values of First Cordon Street, in particular, decreased in comparison with Second Cordon Street and Frank Street. It might have been a government strategy to connect these two important streets linking to the administrative centre of the city, Konak Square. This public space was becoming the junction of various activities from commerce to formal demonstrations. Again in this period we see the construction of the Clock Tower (1901) as the representation of modernization efforts in the Ottoman Empire. Konak Square represented the symbolic power of the government (Zandi-Sayek, 2001) and became the focal point of celebrations and festivities. First and Second Cordon Street hence functioned as a parade street between Konak and Punta for various activities and celebrations. In this period intelligibility and the synergy of the urban structure is higher than in the other periods (Table 1).

The 1922 model represents the second breaking point in the urban history of the city. The base map is the last information we have before the Great Fire of Izmir (September 13, 1922), in which two thirds of the urban structure was destroyed. Although the model is not as detailed, it highlights interesting information about Izmir's urban form at that time. The model reveals that the city had started to extend south-eastwards towards the areas of summerhouses, transforming these areas into residential areas (Karataş and Eşrefpaşa neighbourhoods). İkiçesmelik Street and Mithatpaşa connected the historic core with these south-eastern areas. Kestelli Street directly connected the new pier and customs house with İkiçesmelik Street and the Turkish and Jewish neighbourhoods via the urban block rearrangements in the historical centre (Figure 2).

After the Great Fire and the Turkish War of Independence the New Turkish Republic intended to rebuild the city in line with the new national identity, including its architecture (Bozdoğan, 2008). The 1930s was therefore the period of the country's first rational planning efforts. Using imported planning approaches and with the help of Western architects and planners (Jansen, Danger and Prost, Albert Bodmer, and Le Corbusier) most of the cities were reconstructed with zoning according to modern planning principles. Although there had been previous attempts at top-down planning, such as the construction of railways, roads, and the development of Punta area, the first quarter of the 20th century saw the emergence of city-wide planning activities involving larger land

arrangements. Among other things, this was the consequence of the destruction of whole areas by fire and war. However, it also changed the cosmopolitan as well as the socio-economic structure of the city. The Levantine community was not accorded the same privileges as before, hence Izmir lost a remarkable population together with its vital social life.

In the growth processes of the 1940s, the areas that had burnt down (Greek neighbourhood) were rearranged according to the 1925 master plan of Danger and Prost (revised in 1933), based on “Ecole des Beaux Arts” principles. The modern urban structure of Alsancak (the former European Quarter and some parts of Punta) was formed by this plan, with radial roads, junctions, and public squares. However, the plan was criticized as it was only concentrated on the dilapidated parts of the city rather than being holistic (Bilsel, 2009; Kaya, 2002; Can, 2012).

Konak Square strengthens its centrality as the city expands towards the north-east and south-west. Major routes merge in the main administrative centre of the city. Compared to the 1922 analysis, Frank Street disappears and 1st Cordon has higher choice values. The previous plans for Fevzipaşa Street were finally implemented in 1941 (Yılmaz, 2000). Hence in the foreground of the urban structure the main routes are highlighted: Fevzipaşa Street, by connecting the centre with the northern part of the city, has higher choice values. Kültürpark, formerly part of the Greek neighbourhood, with its vast green area, takes its place in the core of the city. In the model it is left empty, as the park is enclosed by walls. When the 1885, 1905, 1922 and 1941 analyses are compared, it is apparent that the main routes that spread over the urban structure in 1941 are longer continuous lines. With the first rational top-down decisions, a radially formed grid has increased the choice and integration values in the 1941 segment analysis. Additionally, we know that the tramlines were replaced by bus services in 1937, especially between Konak and Göztepe.

Finally, arriving at today’s model, we can see that the city grew enormously between 1941 and 2010. In addition, the extrinsic properties of the urban structure were influenced or imposed by various planners and architects, such as Le Corbusier (1949) and Kemal Ahmet Aru (1955), as well as by master plans of institutions including Izmir’s first metropolitan master plan (1973), the master plan of the municipality (1989), the new city centre master development plan (2003), and the urban regional development plan (2007). Moreover, acts and laws enabled a change in the morphology of the city, such as the Condominium Act (1965), which allowed the conversion of the four-storey apartments into high-rise apartment blocks, and the new Development Law (1985). In the 1950s and 60s Turkey was faced with rural/urban migration, and the city developed towards its periphery. In order to meet the housing demand *gecekondu*² appeared on the edge of cities. In the 1980s cities started to struggle with urban sprawl and mass housing projects came into existence. In the 1990s, private entrepreneurs, as in the late 19th century, again forged ahead and superseded the public sector in the growth process of the city. Gated communities, shopping malls, and large-scale developments emerged as new types of spaces and behaviours, with different types of space production superseding the *yap-sat*³ (build-sell) system (Can, 2010; Can, 2012). The recent master plan for Izmir determined the location of the new city centre in the harbour area, Bayraklı. The administrative centre in Konak is now dissolving as some government buildings have already moved to the new centre. There are discussions to relocate the municipal buildings from the historical centre to Bayraklı. In the street network of 2010 the new city centre is affecting the integration and choice values and there is a decrease in the centrality of the old historical centre, Kemeralı.

² A *gecekondu* is a kind of indigenous urban vernacular but not a slum; an urban housing solution for low-income groups (Pamir, 1982, p.16).

³ *Yap-satçılık* (build-sell) is a system that emerged after the Condominium Act. The small contractor reaches agreement with the landowner and obtains building permission. He starts building with a small capital outlay, selling flats during construction to increase his capital. Thus by this system the small contractor can sustain the building of apartment blocks on various empty lots (Tekeli, 2008).



Figure 3: Normalised angular segment analysis (Choice) RN for Izmir.

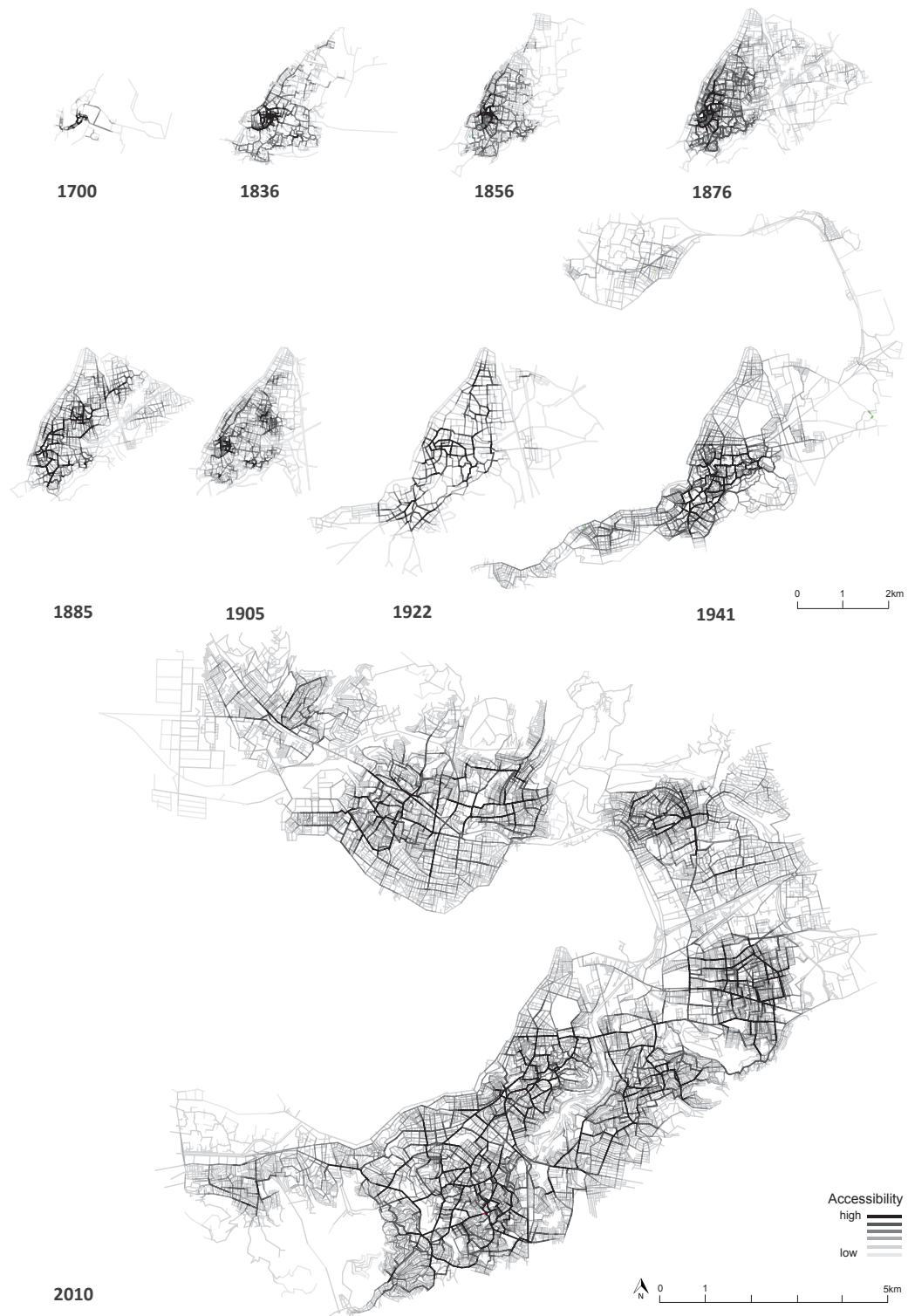


Figure 4: Normalised angular segment analysis (Choice) R local (10%) for Izmir.

3. Conclusion

Izmir has experienced various changes in its macro-form. Nevertheless, compared to its counterparts in the space syntax literature (Al-Sayed et al., 2009; Al-Sayed and Turner, 2012; Milan-Gomez et al., 2012), top-down implementations were more extensive and have had a more powerful impact on the urban structure of the city. At the end of the 19th century and the beginning of the 20th century top-down interventions were on a small scale and urban growth was mainly guided by bottom-up processes, such as the space production of different ethnic neighbourhoods, rearrangements of small urban blocks, extensions, and infill developments in the waterfront area. Subsequently, with the advent of foreign enterprises, multiple actors, development regulations, public improvements, and the modernization efforts of the Ottoman government, the city first started to expand through the development of transport. Secondly, in the 20th century, professional planning was used as a tool in the first master plan for the redevelopment of dilapidated areas of the city after the Great Fire. Later on, larger-scale arrangements and developments emerged through the impact of legislation, regulations, and global economic developments.

Spatial analysis revealed that although Anafartalar Street was initially the main trade axis of the city, with the new emergent trade axis of Frank Street the northern part developed under foreign enterprises. The choice values of Frank Street increased until the construction of 1st and 2nd Cordon Streets. Between 1836 and 1856 there is an increase in the segment lines, and self-emergent structures started to be overlaid by uniform grid structures resulting from both bottom-up and top-down processes, as mentioned above. There are more continuous lines by 1856. Briefly, the segment analysis of both global integration and choice values increased in each period except in the street networks of 1885, 1905, and 1922 (Table 1). In the 19th century the mean values for local choice and integration measures decreased, and by the 20th century this is reversed. This could be explained by the emergence of various sub-centres as the city expanded southwards, northwards, and eastwards. Again, as emphasized above, the connectivity of the system increased in each period except 1905 and 1922; it is important to reiterate that these two maps are not detailed base maps like the others. Centrality increased in the first quarter of the 19th century, but by 1922 there is a decrease and shift in the centrality of the urban structure. This supports the ideas developed by Al Sayed et al., 2012, suggesting that as the system grows, the high integration values of downtown areas spread over the expanded areas. In 1925 the first master plan was developed for Izmir, and it was implemented in 1933. This crucial change can clearly be seen in the urban form and spatial analysis of 1941, where the top-down planned area (Alsancak, Punta region) does not appear in the local choice analysis. Another spatial characteristic is that the mean depth of the urban structure of Izmir increased after the 1940s (Table 1).

In this study we tried to explore the intrinsic and extrinsic characteristics of Izmir through overlapping space syntax analysis and socio-spatial factors that affect urban growth. We believe that diachronic city models have to be combined with an examination of the historical development of the city in order to better understand the underlying reasons and “generative rules” for growth processes and urban morphology. In Izmir there are more highlighted sub-centres with higher choice and integration values in 2010 than there are in 1941. Consequently, there are more sub-centres with clusters of small line segments in the background of the city compared to the foreground with its longer continuous lines. Centrality has shifted towards the north-east to the new urban core. However, from the 1940s onwards we can see that the intelligibility and the synergy of the city have decreased. Hence we can conclude that there is less relation between the parts and wholes of the city due to the imposed master plans and developments (Table 1). In the 1949 and 2010 models we have seen that top-down processes have caused a disconnection between local and global measures of the city (intelligibility and synergy or connectivity). This means that it is more difficult to navigate within the city, and parts of the urban structure do not correlate well with the whole. Izmir, as a hybrid city composed of organic, grid and radial structures, has less unity and connection among the three above-mentioned measures.

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