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The Effect of Urban Form on Functional Organization of Space: A Critical Perspective on the Role of Configuration in Urban Planning by Comparing Three Districts in Ankara, Turkey

Res. Assist. Ebru Sevik[1], Res. Assist. Hulusi Eren Efeoglu[1]

[1] Department of City and Regional Planning, Faculty of Architecture, Middle East Technical University, Ankara, Turkey

Abstract

The configurational studies illustrate that there is a determinant relationship between human mobility and the built environment. For decades, the behavioral sciences have thoroughly elaborated on the effect of the built environment on human behavior based on the perceptual dimensions. An innovative approach to this relationship has opened another perspective in the last decades with the development of Space Syntax Theory (SST), which considers the topological structure of the street network as the primary conditioner of human movement. The research based on SST also suggests a strong correlation between the urban land uses and the configurational structure of the city. On the other hand, many inconsistencies are addressed by scholars criticizing the reductionist approach of the theory from planning and design perspectives. In this sense, this study focuses on the association between functional patterns and configurational structure of space in three different urban contexts in Ankara, which vary in terms of planning and development processes: Ulus District, Bahcelievler Neighborhood and Eryaman District. Within each case study, the topographical integration patterns are revealed by using space-syntax analysis and compared with the existing land-use patterns, observed pedestrian intensities, and main focal points. The potential central areas conditioned by the topological structure in all three areas are then evaluated, and a critical perspective is developed in terms of the role of configurational analysis in urban planning and design processes.

Keyword: *Urban Morphology, Space-Syntax, Ulus, Bahcelievler, Eryaman*

Introduction

Investigating the spatial logic of the city has become one of the main challenges of planning and design disciplines, especially after the 1960s. Many studies have been conducted to understand the spatial complexity of contemporary cities, among which the configurational approach provides a broad methodology to investigate the structural morphology of space. Revealing the configurational structure of the city allows one to understand how each element of the settlement is positioned with respect to the others. Such a conception provides an operational insight to reveal the potential of a place in terms of achieving vitality in urban space. In this regard, the methodology addressing urban configuration opens a generative research field in morphology beyond an analytical discipline.

The correlation between the movement patterns, land use distributions, and configurational structure of the cities has long been a focus of attention to understand the complex nature of cities. It is argued that the configurational pattern of the urban form influences the movement patterns in terms of accessibility and thus centrality, and this relation conditions the distribution of land-uses concurrently. On the other hand,

such arguments developed by Hillier et al. (1984) through extensive elaboration on Space-Syntax Theory, which is considered as one of the leading methods to understand the structural morphology, has been criticized by many scholars because of its reductionist approach.

In this sense, within the framework of the existing theoretical efforts on configurational approaches, this study presents a critical perspective on the association between functional patterns and configurational structure through empirical analyses conducted in three different urban contexts in Ankara, Turkey. Based on the findings, it is suggested that although the topological measures afford strong indicators, qualitative aspects should be instrumentalized to guide further planning and design decisions considering the contextual characteristics of the place.

Background

Offering a mathematical morphological language for the study of urban form in relation to society, Space Syntax methods are widely used to explain, mainly, the configurational properties that generate pedestrian movement in cities. As the pioneers of the configurational approach to the space-society relationship, Hillier and Hanson's (1984) use of theory contributes significantly to the understanding of how the built environment affords human movement on local and global scales (Hillier and Hanson, 1984). Based on the morphological qualities of 'centrality' and 'integration', the theory explains why certain urban settings afford more mobility patterns than others and attract certain kinds of land uses on specific configurational structures.

The theory, discussed in detail in the book "The Social Logic of Space" by Hillier and Hanson (1984), rejects the pure metric properties of space and argues that the basic element conditioning the mobility is the *topological structure* of space. Accordingly, the space-syntax method investigates the structural properties of urban form through the graph analysis based on the spatial order of the street network. The analysis represents the streets with axial lines, which are the least and longest lines drawn through the streets, eliminating the metric distances from the analysis (Hillier et al. 1984), since "people move linearly" and "seek linearity in complex routes" (Hillier, 2005; 2007). The studies showed that the preference of a pedestrian moving in an urban space is not based on the shortest route to the destination but on the road with the least angle change (Hillier, 2005). This behavior of a pedestrian is termed as 'natural movement', which is primarily generated by the urban grid itself (Hillier et al. 1993).

The topological measure of the street networks is also found to be the major structure attracting retail land uses, which can benefit from the passing trade (Hillier et al. 1993). Based on this hypothesis, it can be argued that the already existing retail activities are located in good locations, which are topologically conditioned to be so, or functions other than retail are located in a way to minimize the possible interference of through movement (Hillier et al. 1993: 30). Hillier et al. (1993) explain the co-presence of both high rates of movement

and attractors with a three-fold relationship called 'movement economy', in which the configuration is assigned to have the causal primacy (See Figure 1).

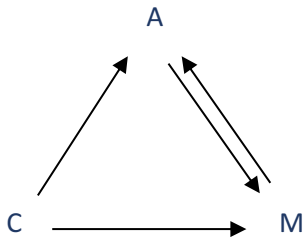

***Figure 1**: Movement Economy Diagram (Hillier et al. 1993: 31)*

(A: Attraction, C: Configuration, M: (natural) Movement)

Such a deterministic approach to human movement and land use distribution based on the topological properties of the space, however, raised some questions criticizing particularly the simplistic propositions that the axial representation of street network presents. Although the inconsistencies[1] that Ratti (2004a) systematically points have found corresponding answers by Hillier and Penn (2004), these answers are not found well enough to satisfy the issues raised by Ratti (2004b). In addition, the absence of semantics from the analysis, reduction of space-society relationship to mere movement, and the ignorance of complex informational dimension of space are found to be critical shortcomings that the theory is incapable of explaining:

> *"A theory that systematically underestimates the role of space in information and communication in the production of systems of practice will inevitably be limited in grasping society–space relations" (Netto, 2016: 31)*

Ratti's (2004a) reference to the La Dèfense case explains well the critique of disregarding the three-dimensional world and existing land-use patterns in the analysis. The area, which was developed as an office zone, illustrates that while a partially planned urban area has a very poor connectivity pattern in terms of configuration, the presence of tall buildings creates an attraction and increases the vitality of space, which is also the case for such movement generators as bus stops, underground stations and wide pedestrian sidewalks (Ratti, 2004a: 492). If the configuration, then, is not involved as a fundamental component in the planning and design process, it is reasonable to expect that the given decisions concerning the social, economic, technical, and environmental aspects, which are geographically sensitive issues, may create inconsistent conditions for human mobility that is conditioned by the syntactic structure of the space (Ratti, 2004a: 492).

[1] For a detailed review of the inconsistencies put forward by Ratti, see *Ratti, C. (2004) Space syntax: some inconsistencies. Environment and Planning B: Planning and Design,* 31(4), pp. 487-499

Methodology

This research applies an integrated methodology in three different characteristic districts (Bahçelievler, Eryaman, Ulus), which have significant roles in the urbanization process of Ankara. Accordingly, four main stages are followed in each site: *first*, the ***global and local integration patterns***[2] conditioned by urban form are revealed through the space-syntax analysis; *second*, the ***existing land uses*** are mapped by field studies to understand the functional organization of space; *third*, the ***intensity of pedestrian movements***[3] in each area are observed through non-participant observations; *four*, the public ***nodes and focal points*** located in each site are indicated for the comparison with integration patterns. For each site, the analyses are superimposed and evaluated in order to reveal the relationship between the configuration of space and the other three parameters mentioned above. The contextual differences are then evaluated from a critical perspective, which help to drive some conclusions for the role of the configurational approach in planning and design studies.

Study Areas

Having different formation processes in terms of planning decisions and periodical dynamics that affected the development of each site in unique ways, three urban settlements are selected to provide a relevant framework for the discussion of the relationship between configurational morphology and urban planning although they are contextually different.

To begin with, ***Ulus District*** constitutes the historical core of Ankara, where Ankara Castle and early settlements are located. After the establishment of the Turkish Republic, most of the governmental institutions, financial and commercial facilities were placed in Ulus. Since Ulus district has an important memorial value for Turkish history, there has always been an effort to protect this district. In 1932, Jansen's plan aimed to preserve the historical settlement area surrounding the Ankara Castle (See Figure 2). In the following years, several conservation plans were proposed for the Ulus. Today, besides being a business district, Ulus is an important historical tourism destination. This study covers approximately 620 hectares of area, including Ankara Castle, historical settlement area, commercial and governmental facilities.

[2] Global integration analysis gives the integration value of a line related to all other lines in the system (with radius 'n'), and local integration maps illustrate the integration value up to e.g. three lines away from each line in every direction (with radius 'R3'). In urban systems, local integration is given as the best predictor for pedestrian movement, while global integration is more related to vehicular movement (Hillier, 2007, p.109-119). As the analysis sites cover a large area, which afford both pedestrian and vehicular movements, both measures are analyzed.

[3] Due to coronavirus restrictions during the fieldwork conduct, the pedestrian count could not be made comprehensively. The maps do not show numerical or statistical data. They only give a general idea about the density pattern of the pedestrian movement throughout the weekdays.

Figure 2. *Ulus District, Ankara Master Plan 1932 by Jansen (left), (Source: METU Maps and Plans Documentation Unit); Study area and Existing situation of Ulus District (right)*

As the second site, ***Bahçelievler District*** was originally planned in 1934 by Jansen[4] as a low dense residential area composing of row and detached family houses with gardens (See Figure 3). Since there was a bureaucratic cooperation, which was responsible for the construction of this neighborhood, it influenced Jansen's design to have detached houses rather than row houses. After the 1950s, the rapid urbanization as a result of the increased population in Ankara caused an urban transformation in the district, and increased land prices surrounding the neighborhood triggered plot-based transformations. After the implementation of Yücel-Uybadin Plan in 1957, the demand for multi-storey building construction had been allowed (Songülen, 2012). Currently, Bahçelievler District comprises high dense, four-story apartment buildings and is located in the central part of Ankara. In addition, increasing building density and human mobility have attracted a retail cluster over the two main streets of the district. Today, Bahçelievler is not limited to the 30 hectares where Jansen initially proposed, but rather it expanded to 230 hectares of a residential area, which is under investigation within this study.

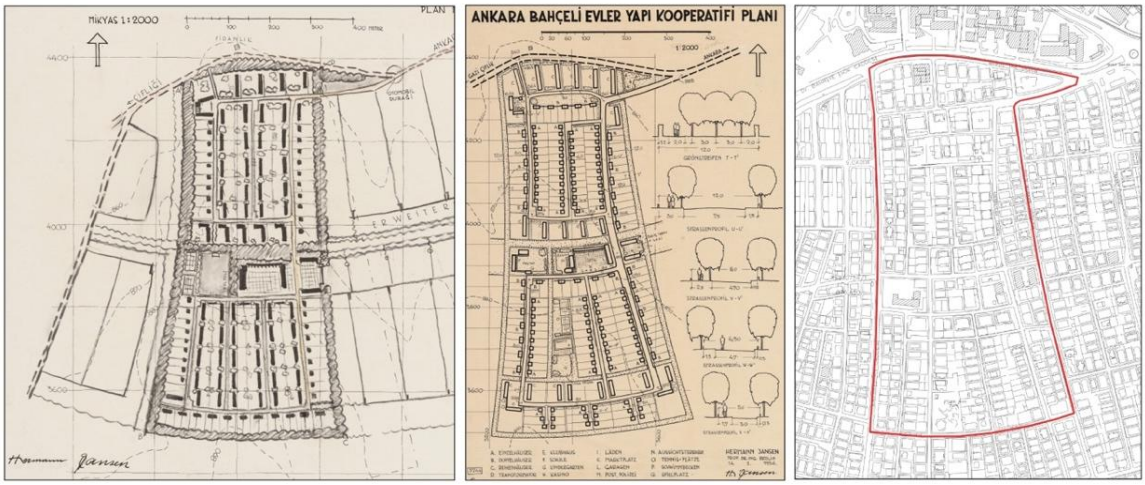

Figure 3. *The original proposal of Jansen (left); Revision of the first design by Jansen (middle), (Source: TU Berlin, Architekturmuseum); Existing situation of Bahçelievler Neighborhood (right)*

[4] Hermann Jansen is a Berlin-based architect and planner. After winning the Ankara Master Plan Competition in 1928, Jansen prepared a master plan for the capital of Turkey in 1932.

Lastly, ***Eryaman District*** is considered to be one of the most important mass housing projects in Ankara. The general layout of the Eryaman district was proposed with The New Settlement Areas Project led by the Ministry of Development and Housing in 1979. After the implementation of the new master plan for the west axis of Ankara in 1990, this area is planned as a satellite city located approximately 20 km away from the city centre. The Ankara Master Plan Bureau prepared the initial design within the 1200 hectares residential area. In 1994, due to the need for a peripheral highway, the proposed schema was revised. The final plan has 954 hectares of a residential area that reflects the neighborhood unit concept throughout the area (See Figure 4) (Kavas, 2016).

Figure 4. *First Proposal for the New Settlement Areas Project (left); Revision of the first design (middle), (Source: Keskinok Personal Archive); Study area and Existing situation of Eryaman District (right)*

The layout of the plan offers several neighborhood units with local centers. Each unit is connected to each other and has public spaces to encourage social interaction. According to the project report, it is aimed to design local centers for all neighborhood units in which all social facilities and technical infrastructures exist. In addition to the local centers, two major centers are proposed surrounding the metro stations. The development of Eryaman District is planned based on ten stages. This study examines nearly an area of 510 hectares that includes the fourth, fifth, sixth stages of the project.

Results and Discussions

In each study area, firstly, space syntax analysis is conducted, and integration patterns are revealed. Once the local and global integration maps are produced, the land-use patterns are analyzed on the central axis having the highest integration values. Following this, the existing pedestrian intensity and urban nodes are mapped, which are then compared with the integration maps.

According to the global integration map in **Ulus district**, it is revealed that the roads proposed and implemented by the Jansen plan have the highest integration values because of the strong axiality, while the historical (organic) fabric is less integrated and more isolated. Likewise, the local integration map offers a picture in which the historical urban pattern is even more isolated within the whole network (See Figure 5). Since the level of integration is very low, it can be argued that these places do not have the capacity to act as central and attractive places. However, when the land use patterns, existing pedestrian intensity, and the

urban nodes are examined, it is seen that these historical fabrics have a generative role in the creation of functional density and urban movement even if the topological integration value of the area is low (See Figure 6). In other words, although the historical fabric has the lowest integration values both in global and local scales, they have a crucial role in creating vitality in Ulus District.

*Figure **5**: Global (left) and local (right) integration analyses of Ulus District*

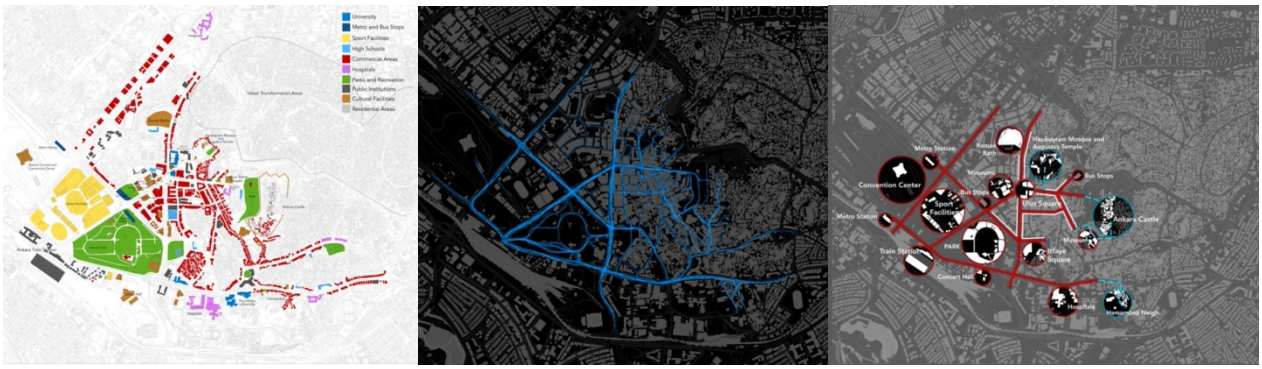

*Figure **6**: Land use (left), pedestrian density (middle), urban nodes (right) of Ulus District*

The global integration map in **Bahçelievler District** demonstrates that the axis serving as an arterial road in Ankara has the highest integration value, as expected. This axis, which is located on the southern edge of the neighborhood, includes public institutions and provides a connection between the city center and the western part of Ankara. The other most integrated axes at the global scale are located inside the Bahçelievler District (See Figure 7). Since there are many commercial facilities on these axes, they form a sub-center for Ankara, which corresponds to the high integration values at the global scale. Similarly, there is a consistent relation between the functional pattern and configurational structure at the local scale. When the axes with higher integration values are examined, it is seen that they are compatible with land use, human movement, and urban nodes such as metro stops, urban parks, schools, and hospitals (See Figure 8).

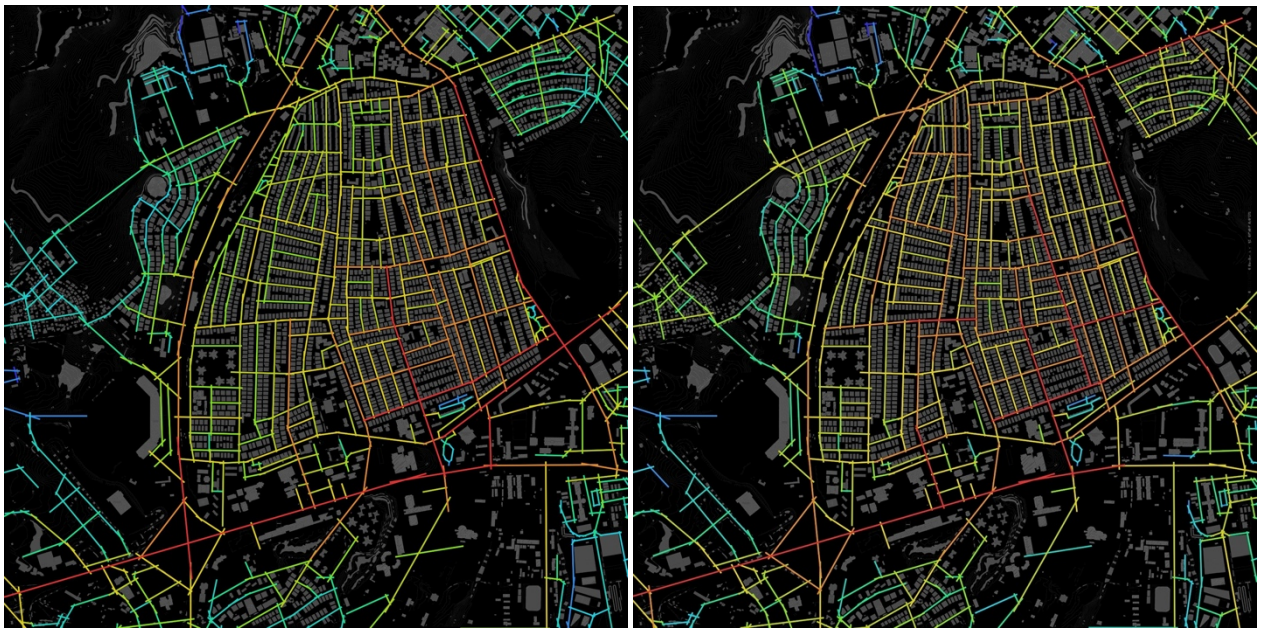

*Figure **7**: Global (left) and local (right) integration analyses of Bahcelievler District*

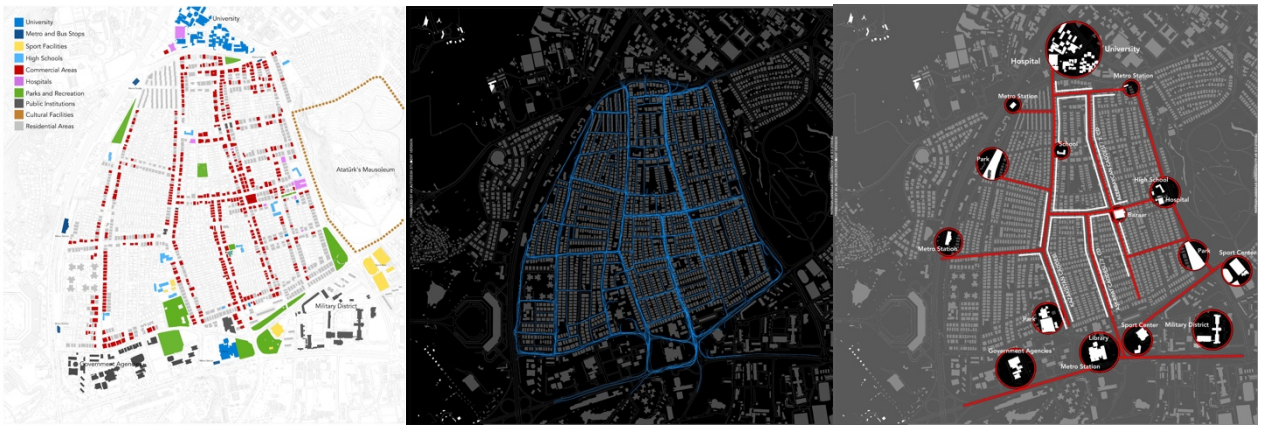

*Figure **8**: Land use (left), pedestrian density (middle), urban nodes (right) of Bahçelievler District*

In **Eryaman district**, the global integration map shows that the main arterial road where two metro stations, shopping malls, and stadium are located has the highest integration level. This axis is already expected to be the most accessible place because of its centrality. When the local integration analysis is run, it is expected that the center of each neighborhood unit should be the most accessible places, but conversely, it is revealed that the main arterial vehicular roads in the Eryaman district have the highest integration levels. Contrary to expectations, neighborhood centers have lower integration values at the local scale (See Figure 9). Additionally, unlike the plan proposal, there is no such uniform distribution of neighborhood centers. There are only two big shopping malls on the most integrated axis, but other marketplaces are located both within and on the peripheries of the units, which do not correspond to the plan decisions well. As a result, most of the human movement within the district is based on motorized transportation rather than the non-motorized mode of movement. Although the main axis at the center of the district has the highest pedestrian density,

the reason for that is not the presence of a well-developed commercial area throughout this road but the existence of two metro stations.

*Figure **9**: Global (left) and local (right) integration analyses of Eryaman District*

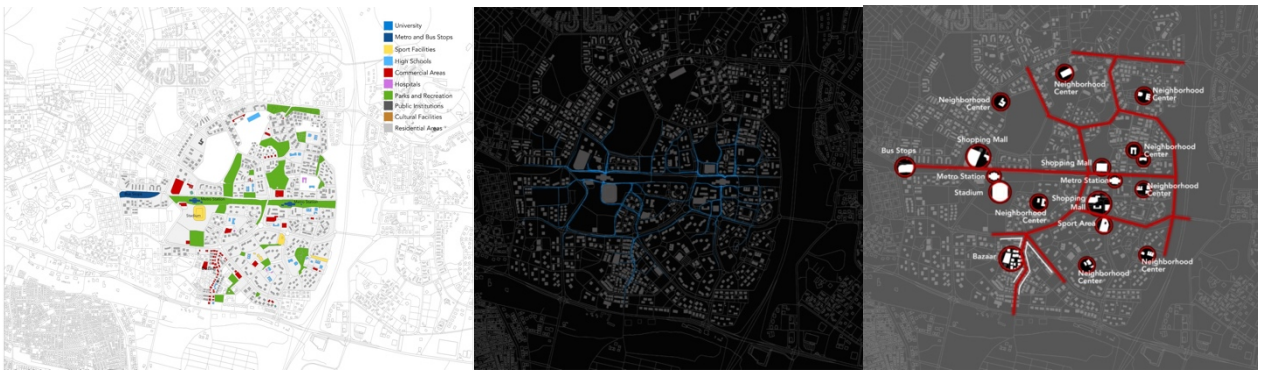

*Figure **10**: Land use (left), pedestrian density (middle), urban nodes (right) of Eryaman District*

Conclusions

When the three districts are contextually evaluated in terms of planning and development processes, major differences come to the forefront, which can explain the inconsistencies found within the analysis.

In Ulus District, traces of the modern planning approach are found on the very strong axes, which extend the traditional urban fabric towards the new development direction. The plan conserves the historical residential settlement completely and orients the capital's development on these new axes where the governmental functions are located. A challenging issue here is to integrate the complex traditional fabric, which affords three-dimensional stimuli to orient movement and functional organization within an irregular topological structure, with the regularly defined geometry offered by the plan. However, it is seen that the physical transformations that occurred during the development of the site left the traditional fabric isolated and disintegrated at the configurational level. Additionally, although the traditional fabric formerly had a residential function, it was transformed into a historico-cultural center in time containing various functions

and activities in itself and became one of the most visited sites of the city. In brief, the case of Ulus District evidently demonstrates that since space syntax cannot use such context-specific inputs in the analysis, inconsistencies may arise if the research disregards the qualitative aspects related to the semantics of space.

On the other hand, Bahcelievler district is a totally planned area, which leads the development and transformation process of the district coherently with respect to the underlying topological structure of the initial plans. Therefore, though the district has experienced a dramatic increase in density, it has an identical typo-morphological structure within the overall area. It can be argued that such a coherent development over time led to the emergence of functional diversity with respect to the topological measures, where the non-residential uses concentrate on certain integrated axes within the district. In sum, the analysis revealed that the existing mobility patterns, land use distribution, and the location of the focal points have compatible spatialities in Bahçelievler District.

By contrast, in Eryaman District, there are many inconsistencies in terms of the integration patterns, and mainly of the existing land use distributions. Although Eryaman is a mass housing area, it is seen that the aim for promoting integrated public spaces through the neighborhood unit concept could not be well maintained. One reason for that can be the transition from the cooperative type of development, which is produced with a perspective of promoting social life and public spaces, to the type of development that produces luxury housing areas. As a result, though it was aimed to create multifunctional centers within the neighborhood units, these areas are found to be the most isolated sites in the existing situation. On the other hand, the roads that divide each unit are found to be more integrated having a higher potential for non-residential uses. This contradiction can lead us to the conclusion that some of the neighborhood centers are not fully developed because the proposed centers do not generate such an attraction topologically.

All in all, it is possible to infer some conclusions from these findings for further planning and design implementations and for the involvement of the topological approach in these processes. Firstly, especially in areas having unique contextual values, such as the historical fabric, topological measures may not provide strong indicators by themselves to guide further planning and design decisions. Since qualitative aspects related to the semantics of space are disregarded in space-syntax, it becomes likely to acquire inconsistent outputs from the analysis. Therefore, it should be combined with further qualitative methods to provide a more accurate knowledge base for planning and design studies. Secondly, in order to achieve vitality in the urban environment, it is necessary to create coherent structural morphology to prevent fragmentation within the urban fabric. By designing a place that is well integrated in itself and with its surroundings topologically, a good mixture of functional diversity can be attracted, and space syntax can be instrumentalized to achieve this diversity in design processes. Lastly, it is therefore essential to achieve a balance between the segregation and integration level of an urban setting through, for example, encounter spaces. These interfaces containing a diversity of functions can offer a ground for social interactions. In order to increase

the potential for encounter, topological measures can be instrumentalized to create such interface zones by design.

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