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Application of the Space Syntax method in accessibility studies, Antalya city case

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Abstract

Accessibility is an expression of the space and the quality of the city. Ensuring the free circulation of people with disabilities in urban areas is related to the development of community standards and the accessibility of transportation systems. Therefore, the physical environment and transportation systems should be arranged as accessible. The life quality of disabled people is related to the environment in which they carry out their daily activities. New methods can be used to ensure accessibility along with the developing technological opportunities and fast and accurate solutions can be obtained. Therefore, scientific studies as in all other fields should be open to new methods. It is essential to adapt to this process for occupations in the field of physical planning such as urban design, architecture and landscape architecture. The space syntax method specializes in the study and design of urban development, in particular, the design of pedestrian connections and public spaces. The method makes direct observations on pedestrian and vehicle movements and uses computer programs designed to predict how the new recommendations will have effects on such issues. The space syntax works to define the complex physical structures of cities and provides objective and consistent results using mathematical methods in which the spatial system is represented. In this study, the current situation of street accessibility in Antalya city has been examined by using the space syntax method. As a result, it was revealed that 2 of the 31 axes found in Antalya city center had very low accessibility scores, 17 of them had several problems on accessibility, but accessibility could be achieved with various improvements, and 12 axes had high accessibility scores. At the end of the study new proposals have been revealed to the problem areas.

Keywords: Space Syntax, Antalya city, Accessibility, Barrier-free design

Introduction

Human is a social entity that communicates with the environment and creates their social lives with interactions. People are required to interact with their environment to maintain their social existence. One of the most important socialization opportunities in society is the environment. Public spaces, parks, squares, and shopping centers in the neighborhood where individuals live are places that allow them to communicate with the community.

In societies, it is possible to talk about the diversity of

individual depending on gender, age, ethnic origin or racial differences. In this diversity, it is possible to identify disabled people as a social category (Öter, 2018).

Failure to provide appropriate services to disabled people in society is an indicator of the failure of the social organization. One of the basic ways to cope with the negativity disabled people face is to make them visible in social life (Burcu, 2011). The most important detail in this context is making urban spaces accessible to disabled individuals.

Accessibility is an expression of the quality of the space

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and the city. The source of the problem that disabled people experience about accessibility is not their obstacles, social barriers. Consequently, in order to eliminate these problems, the main components that constituent cultural and physical barriers must be regulated. In this process, in addition to point solutions, it is important to obtain a wider perspective and head for technology use.

The most important component in the creation of accessibility is the streets. In this study; the current status of street accessibility in the whole city has been examined by using the Space Syntax method. To determine the usage potential of the pedestrian paths within the research area, the software named Axwoman 6.3, which is installed in the Arc GIS 10.0 program, was used. Accessible axes were identified in the city of Antalya, field studies were carried out and new proposals were introduced at the end of the study.

Materials and methods

In this study, the accessible axes of the Antalya City were defined by the Space Syntax method using through the master plan (13.01.2014 / 36).

Space Syntax is a research method developed by Bill Hillier and Julienne Hanson (1984) and it is based on human movements and perception. The method is used to recognize the cities and internal structures of the buildings (Şikoğlu and Arslan, 2015). The Space Syntax method is one of the most influential scientific movements in the fields of architecture and urban design as a set of techniques used to study the spatial textures of buildings and cities and as a chain of theories combining space and society (Hillier and Hanson, 1998). The method tries to reveal the interrelationships between the unknown characteristics of the city and the observed functions. These functions are also associated with land use patterns, social-economic performance and crime rates. Space Syntax treats spatial configuration as an independent variable. Studies show that Space Syntax analysis is informative about movement patterns. As the model explained the current situation, it also tests the possible effects of different suggestions on the movement patterns in the design process. New design alternatives are used to investigate, evaluate and predict results (Hillier and Hanson, 1984).

The spatial analysis begins with a re-representation of the urban pattern. Spatial analysis is a method for understanding the social logic of urban fabric, in other words, for reading the potential of physical space to bring people together depending on the movement within (Çil, 2008). This analysis aims to create the hierarchy of the streets in the settlement, from the most used areas to the least used space. The streets that pass through the most are integrated, while the lesser ones are called segregated (Şikoğlu and Arslan, 2015).

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using mathematical methods in which the spatial system is represented (Özer, 2006).

According to the method, people entering a settlement walk through the linear axes where the breaks are at least, and they move their movements according to their viewing distances during this walking distance and try to match these lines in mixed spaces. As a result, there is a chain of safe movements and spaces created by people. The points of view, vistas and building features between mixed spaces are in parallel with the movement pattern in urban space (Özbek, 2018). In the method, the size of the settlement is expressed as the number of lines. The axial map of the open space structure of a settlement consists of the least number of straight lines passing through each convex space and forms axial connections. The continuity of the axles with the addition of other axles is important (Özyılmaz, 2009). Several studies on various cities with different backgrounds have shown that the Space Syntax Theory, and its analytical methods, is an efficient way to analyze urban areas in terms of accessibility (Alkamali et al., 2017).

The methods employed in this study sought to compare the degrees of accessibility through the evaluated streets qualitatively and quantitatively. The qualitative analysis was examined with the site studies by measurements and taking photos.

Axial Maps are the primary Space Syntax method to analyze the street network in terms of its integration and accessibility (Kubat et al., 2012). Axial lines correspond to the longest and fewest line extensions possible crossing one or several spaces. A set of these intersecting lines would form an axial map. The axial map is used then to calculate the integration values of each line which measure the degree of depth, or shallowness, of the spatial configuration under study (Al Sayed, 2014).

The axial map is the basis of spatial analysis in settlements (Hillier and Hanson, 1984). The axial line integration analysis says something fundamental about the spatial integration of public green and open spaces. Integrated spaces will, according to the theory of natural movement (Hillier et al., 1993), play a more central role in the urbanity. These spaces will not only be more frequently visited and used, but they will also probably get better known because they are located in more legible places and at the same time within the people's daily movement patterns (Stahle, 2005).

In the next stage of the study, an observation form, designed for this study, consisting of 11 criteria was formed to observe the pedestrian paths which have the highest integration value. Criterias used in observation form defined as; Infrastructure, Pavements, Ramps, Pedestrian way, Distinction borders, Lighting height, Height of crown base, Tree continuity, Tactile paving, Frequency of benches, Social facilities. The form is designed to have a range of 0 to 3 points on various factors. In the study, as improper 0 points, bad 1 point, average 2 points, and excellent option 3 points were determined. Accordingly, the maximum value of the path can be 33, whereas the minimum value is 0. These total values were divided into 3 and were classified as inadequate between 0-11, average between 12-22 and sufficient between 23-33.

As a result of the classification, axles with a value between 0-11 are represented in red, 12-22 in orange, and 23-33 in yellow. Thus, the walkability of accessible roads in the city has been demonstrated.

At the last stage, roads which are suitable for accessibility were specified and new suggestions were made for inappropriate

pedestrian paths.

Findings

As a result of the Space Syntax analysis, the integration value map that identifies the accessible axes of the city is shown in Figure 1.

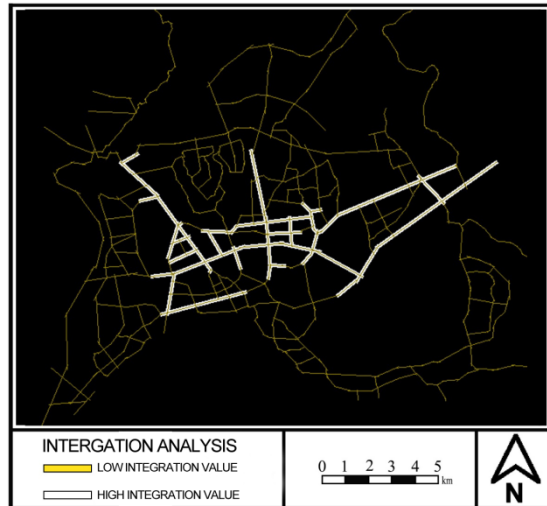


Figure 1. Integration analysis of streets

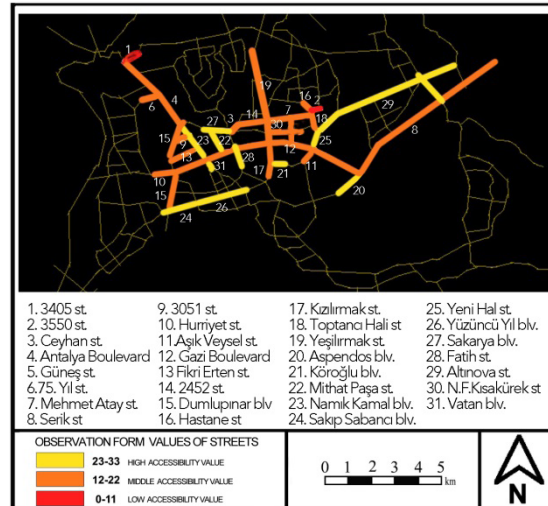


Figure 2. Observation form values of streets

Results and Discussion

In the results of working; The space syntax method is thought to be more effective in detecting areas with a high density of use. Therefore, it is thought to be more appropriate to use this method in the site selection stage to create new green areas. It is foreseen that prioritization of the streets with high integration value will result in faster social integration in the community.

It is a fact that the participation of all individuals with or without a disability to social integration is important to social life. It is necessary to create a barrier-free design for all individuals instead of specially designed areas. For this reason, it is necessary to organize the streets in the city as barrier-free.

As a result of the study, it was observed that there was no distinction between vehicle and pedestrian route in all 31 areas except a small part of Dumlupınar Boulevard. This distinction is essential for visually impaired people. It is stated that a distinction should be made between pedestrian and vehicle roads and if this distinction is to be made with plants, it should be made from non-toxic, thornless and soft textured plants (Yilmaz et al., 2013).

During the study, the positive and negative aspects of space syntax method were observed. To increase the accuracy of the method, it was realized that the master plan should be carefully drawn to the computer and the drawing should be repeated several times. The reason for this is that the breaking point of the drawn axles is effective in the analysis. The axial map can contain some differences since the quality of axes depends on the person who draws the axles (Kaya, 2015). In this study, especially where the pedestrian paths are broken, it was observed that the points where the axle lines end and start again are effective. For this reason, it is emphasized that the repeating of the drawing with a second person or that the person repeats the same drawing will increase the accuracy of the method.

Conclusion

This study primarily aims to show the advantages of using space syntax method in accessibility studies and to show that the process can progress quickly and accurately. The study also revealed that the space syntax method could be used in determining the areas with high pedestrian potential before design and planning applications.

Compliance with Ethical Standards

Conflict of interest

The authors declared that for this research article, they have no actual, potential or perceived conflict of interest.

Author contribution

The contribution of the authors to the present study is equal. All the authors read and approved the final manuscript. All the authors verify that the Text, Figures, and Tables are original and that they have not been published before.

Ethical approval

Not applicable.

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Data availability

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Consent for publication

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