A Comparitive Study of Space Syntax Analysis between Traditional Antakya Houses and Social Housing Complexes by TOKI

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Abstract

Space syntax analysis method is used to define the regions, cities, built environments, building groups, spatial models, and indoor organizations at different scales and to examine their interaction with social structure. This study aimed to analyse the spatial organization of traditional atria by using the space syntax method and to reveal the socio-cultural effect of atria. The spatial morphology and behavioural models regarding the traditional Antakya houses and social houses built by the Housing Development Administration of the Republic of Turkey, the institution that has the largest share in the construction of high-rise buildings in Turkey, were compared and analysed through the space syntax method As a result of the study, it has been determined that the privacy of family and women directly affects the design in traditional Antakya houses. On the other hand in TOKI buildings has been observed that individual privacy was given more importance and it has been determined that this was not created by building design decisions, but by the entrance doors of the rooms.

Keywords: Space syntax, traditional Antakya house, TOKI buildings, socio-cultural interaction

Mekân Dizimi ile Geleneksel Antakya Evlerinin Analizi ve Toplu Konut İdaresi'nin Sosyal Konutları ile Karşılaştırılması

Öz

Farklı ölçeklerdeki bölgelerin, kentlerin, yapılı çevrelerin, bina gruplarının, mekânsal modellerin ve iç mekan organizasyonlarının tanımlanması ve bunların sosyal yapı ile etkileşiminin incelenmesi için space syntax analiz yöntemi kullanılmaktadır. Bu doğrultuda çalışmanın amacı, space syntax kullanarak geleneksel avluların mekânsal organizasyonunu analiz etmek ve böylece avluların sosyokültürel etkisini ortaya çıkarmaktır. Çalışmada, Geleneksel Antakya evleri ile Türkiye'de yüksek katlı konutların üretiminde en büyük paya sahip olan Toplu Konut İdaresinin sosyal konutları mekansal morfolojisi ve davranış modelleri space syntax yöntemi ile karşılaştırılmış ve analiz edilmiştir. Çalışmanın sonucunda geleneksel Antakya evlerinde aile ve kadın mahremiyetinin tasarımı doğrudan etkilediği tespit edilmiştir. Öte yandan TOKİ yapılarında bireysel mahremiyete daha fazla önem verildiği gözlemlenmiştir ve bunun bina tasarım kararlarıyla değil, odaların giriş kapılarıyla oluşturulduğu tespit edilmiştir.

Keywords: Mekan dizimi, geleneksel Antakya Evi, TOKİ, sosyo-kültürel etkileşim

1. Introduction

A courtyard is a traditional building unit that has been used for many years. Courtyards are spaces that activate social and family-oriented activities, offer meeting places, strengthen social relations and meet the need for socialization (Almhafdy et al., 2013; Bekar & Koç Altuntaş, 2021). Many house types consist of units constructed around atria and where atria are used as living space. The first houses with atria date back to the Neolithic period. The architectural works of that era in Turkey were found first in the Turkish city of Burdur "Hacilar" Mound and "Kurucay" Mound. The buildings there were found to have an anterior room or courtyard and the main room, one or two floors, and a form within which megaron-type houses were adjacent around a courtyard (Naumann, 1975). Having been examined in different periods for its rooted history, the courtyard is a significant element for architectural history. However, as a result of technological development and changes in construction materials, buildings' height values have increased but the use of atria has been neglected by the designers in an ever-increasing trend. Therefore, conservation experts and scientists emphasize the importance of courtyard on an international level and perform studies to protect this culture.

Certain researchers examined the impact of social, cultural and climatic factors on traditional Turkish atria (Ozorhon & Ozorhon, 2014; Bozdogan, 1996; Orhun, Hillier & Hanson, 1995; Torus, 2011; Bozkurt & Altınçekiç 2013; Bekleyen & Dalkılıç, 2011). Bozkurt & Altınçekiç (2013) reviewed the properties and historical development of Anatolian atria from a chronological perspective. Orhun, Hillier, & Hanson (1995) evaluated the concept of the courtyard in Turkish houses through the 'difference factor' by using 'syntactic analyses. Bozdoğan (1996) interpreted the traditional atria through the architects who were trained in the west. Bozdoğan also assessed the atria seen in different regions of Anatolia on the concepts of old/new designs particularly seen in Torus Mardin houses (2011). Bekleyen & Dalkılıç (2011) investigated the impacts of climate and privacy-related measures on the properties of Diyarbakır houses with traditional atria. In their study with the statement *"Turkey has a series of different local housing culture with unique characteristics"*, Ozorhon & Ozorhon (2014) compared the regions of Cumalıkızık and Mardin with specific courtyard culture to examine the traces of sustainable designing criteria in the vernacular housing architecture of Turkey.

The Antakya district of Hatay that was examined in the present study has hosted many different civilizations, which enriched the architectural characteristics of the city. With their region-specific characteristics, the traditional Antakya houses have been a different indicator of this richness. However, based on the current documents, this richness has not been conserved properly and these houses have lost their authentic features owing to wrong interventions and environmental issues (Kutlu, 2018). The common point examined in the studies performed regarding the region was the issue of conserving and documenting the authentic elements of traditional houses such as atria. The limited number of national and international studies and failure of taking necessary measures continue affecting the regional heritage adversely (Arıman, 2002; Kutlu 2018; Kaypak, 2010; Demir, 2004; Pellecchia, 1992).

The focal point of the present study was to make deductions with universal importance from the atria of traditional Antakya houses, which were the central elements of designing for these houses, by using the space syntax method. Space syntax is a method developed in the 1970s by Bill Hillier and Julienne Hanson and based on human movement and perception (Şıkoğlu & Arslan, 2015; 11). Used to reveal the relationship between people and the spaces they live in, the space syntax method has been a topic for many studies since the day it was introduced (Table 1). The literature reviews indicated that the space syntax method was a set of methods that were developed to define the processes constituting the spatial organization and the social structure in the background by analysing the spatial organization features of built environments and which were supported through the relevant theories. Hillier & Hanson (1984) proposed the concepts of 'depth, integration, and connectivity to analyse these methods through digital terms; the present study also focused on these terms.

Table 1. Literature review on space syntax method

Literature review on space syntax method	
Depth	Huang, Chiou & Li (2019); Alitajer and Nojoumi (2016); Jiang, Claramunt & Klarqvist (2000); Klarqvist (1993); Lima (2001); Czerkauer Yamu (2010); Atak (2009); Hillier (2007); Bafna (2003); Mustafa & Hassan (2013); Fladd (2017); Asif, Utaberta, Sabil & Ismail (2018); Ascensão, Costa, Fernandes, Morais & Ruivo (2019).
Integration	Huang, Chiou & Li (2019); Zhang, Zhang, J., Yu, & Zhou (2018); Alitajer & Nojoumi (2016); Kamalipour, Memarian, Feizi, & Mousavian (2012); van der Hoeven & van Nes (2014); Jiang & Claramunt (2002); Hillier (2007); Bafna (2003); Dursun (2007); Asif, Utaberta, Sabil & Ismail (2018).
Connectivity	Huang, Chiou & Li (2019); Zhang, Zhang, J., Yu & Zhou (2018); Alitajer & Nojoumi (2016); Khalesian, Pahlavani & Delavar (2016); Hillier (2007); Bafna (2003); Dursun (2007); Asif, Utaberta, Sabil & Ismail (2018); Ascensão, Costa, Fernandes, Morais & Ruivo (2019).

The space syntax method was used as the main research method to particularly review the traditional Antakya houses in the study. How the Antakya houses with atria made extensive social and cultural deductions through the spatial and organizational patterns was examined. In addition, the impact of socio-cultural properties on the spatial formation and the sustainable development of Antakya cultural courtyard heritage was discussed. This study aimed to reveal the common and variable properties of housing concepts that have differed in time by utilizing the space syntax and transition diagram models. The spatial organization prominently differed in the periods where social and cultural differences emerged. Another objective was to develop a different perspective toward the topics of spatial relationships and organization in the context of house/housing that differs in traditional or modern forms.

2. Method

Space syntax uses the concept of graph theory to analyse the spatial organizations covering concepts at different scales, such as building, building groups, neighbourhood or urban areas, and people's activity within these spaces. Graph theory considers the spaces as a point (corner) and reflects the connections through lines (Ruohonen, 2013). The present study was based on the concept of indicating the inter-spatial relationship in a linear approach. Therefore, the sizes of spaces were neglected, and the space syntax method was used. This method was introduced by Hillier and Hanson at the end of the 20th century to explain the connectivity between spaces and social relationships. Space syntax helps perform the spatial organizations which enable people to express the common points and differences in a building (Hillier & Hanson, 1984; Dalton, Hölscher & Turner, 2012).

2.1. Space Syntax Analysis Systems

The spaces of traditional architecture have effective, social, cultural, and hierarchical relationships. Space syntax facilitates the process of analysing these relationships through certain analysis systems. The traditional Antakya houses that had rich spatial relationships which had yet to be analysed through the space syntax method before were examined in the study.

The method of signs formed by Donald Preziosi was interpreted to examine the relationships in the organization of buildings. The sign "I" was used to expressing the indoors, while "O" was used to mean outdoors, "M" was used to reflect the intermediate spaces, and "_" was used to indicate the transitions between the spaces (Figure 1, Sun & Wang, 1987).
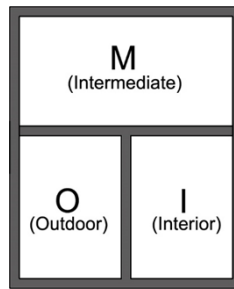
Figure 1. Analysis of indoors, outdoors, and intermediate spaces (Created by Authors.)

Hiller and Hanson stated that spaces had two different actors as 'residents and visitors and that spatial behaviours were modelled based on these actors (Hillier and Hanson, 1984). There are different probabilities for architects within indoors (I), outdoors (O), and intermediate spaces (M) in the context of traditional architectural space organizations. The change of gaps between M, O, and I in the context of spatial organization results in new probabilities (Figure 2).
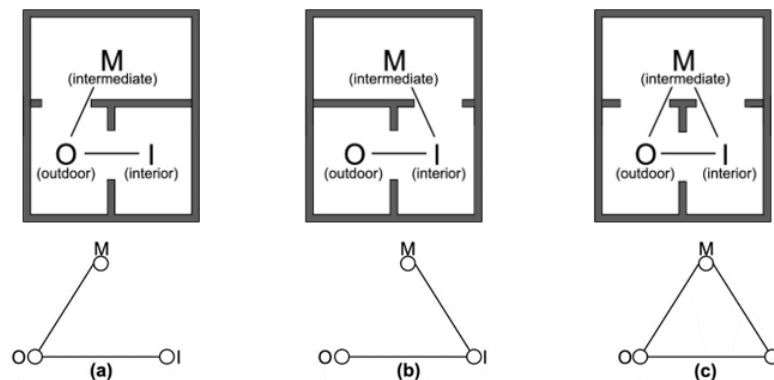

Figure 2. The analysis of the relationship between indoors, outdoors, and intermediate spaces (Created by authors.)

Based on the spatial relationship analysis map above, different relationships may emerge between the spaces. In graph (a), the transition from the "M" to "O" or "I" is a possibility. Moreover, in the graph (c), the mutual transition can be performed from "M" to "O" or "I". The presence of (O) and (I) is important in dual space syntax form, but the presence of third space (M) is also an important factor. However, mutual access between these three spaces decreases privacy. The spatial relationships in the graph (a) and (b) are fewer compared to graph (c)., which indicates that graph (a) and (b) has better privacy compared to graph (c).

2.2. Space Syntax-Digital Methods

Space syntax is determined through various analyses. To perform these analyses, Convex Map diagrams showing the inter-spatial relationships of buildings should be prepared. The convex map is a diagram based on the plan of a building to define the inter-spatial relationships. The dimensions of spaces are not important in the convex map diagram because the diagram aims to digitally determine the space syntaxes by revealing the presence of spaces and relationships between these spaces (Ostwald, 2011, 450).

One of the digital analyses used in this study was the spatial "depth" analysis. The mean depth analysis indicated as "MD" is defined as calculating the area that is to be passed to reach from one point to another (Huang, Chiou, and Li, 2019). The deeper space is the higher impact of this space as compared to other spaces. That is, the impact level of a space increases as the number of places or spaces a resident need to pass to reach that space increases (Jormakka, Schürer, Kuhlmann, Halu & Demirhan, 2016).

In the "MD" analysis, the root level is not included in the depth calculation and is accepted as "0". The number of spaces in each depth level has multiplied the value of that level. Following the multiplication, the results are collected, and the result is divided into a figure that is one less than the total number of spaces including the entrance. This value can be accepted as k-1 or indicated as

"MD". The result of analysis formula reflects the mean depth figure regarding the spaces including their entrances. The higher the MD value is, the deeper the space becomes; moreover, the rate of departure from the root also increases (Figure 3, Czerkauer- Yamu, 2010).

$$MD = \frac{Total\ value\ of\ depth\ for\ all\ spaces\ from\ the\ root\ space}{Total\ number\ of\ space\ in\ the\ graph(k) - 1}$$
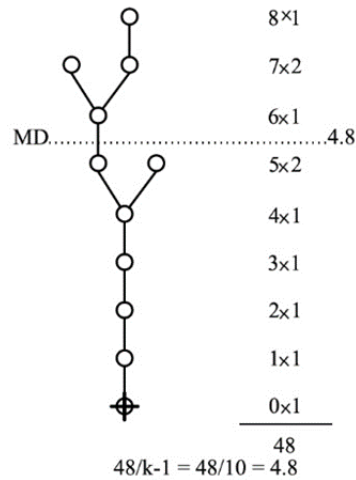

Figure 3. Calculation of depth analysis interpreted from Czerkauer-Yamu (2010)

Relative asymmetry (RA), the second digital analysis form, enables the comparison of spatial organizations based on the concepts of depth and proximity (Özbek, 2007). RA value varies from point to point, like MD value, based on the depth of all spaces from the entrance. The total number of spaces is shown with k, while the depth analysis is indicated with MD and relative asymmetry is displayed with RA. The integration or isolation of an area in a system is indicated through the RA value of that area. The higher the RA value is, the lower the integration value becomes (Czerkauer-Yamu, 2010).

$$RA = \frac{2(MD - 1)}{Total\ number\ of\ space\ in\ the\ graph(k) - 2}$$

The last digital analysis to be used in this study is the control value (CV) revealing the value of the connection between a specific space and other spaces. Klarqwist explained CV as the value of controlling the direct transition from space to its neighbours (Klarqwist, 1993). This value is directly proportional to the connectivity of space. Spatial connectivity increases as CV becomes higher, and it decreases with the lower CV. The CV is the total figure regarding each space emerging as each space equally shares the value of 1 among its neighbors. For instance, a space with five neighbours conveys the value of 0.2 to each neighbour (Baç, 2012).

3. Result and Discussion

To reveal the change of spatial organization between the periods when social and cultural differences emerged, the traditional housing typology of Antakya and social housing practices used to meet the housing needs of people with low income (TOKI) were compared. [TOKI (Housing Development Administration of Turkey) is an institution that is affiliated to the Republic of Turkey Ministry of Environment, Urbanization and Climate Change and mainly aims to produce social housing.] Accordingly, the concepts of house/accommodation/sociocultural building which have changed from the traditional to the current periods were examined.

3.1. Traditional Antakya Houses

Antakya is located in the Mediterranean Region of Turkey and has hosted many nations such as Romans, Byzantines, Arabs, and Turks since the Palaeolithic era (Downey, 1961).

The excavations performed in Antakya indicated that the courtyard system used in the traditional houses of current times was a reflection of the civil architecture from the Roman era (Figure 4, Stillwell, 1961).

Figure 4. General view of traditional Antakya Houses, photo by Çağlar Yavaşoğlu (2016)

According to the plans of Roman houses, the courtyard is accessed from the street. Courtyard is the space that ensures access to all elements of a building and that is an important architectural element in housing plans (Pellecchia, 1992). Similarly, most traditional Antakya houses were affected by the traditional culture and constructed as introverted spatial organizations with atria and intense privacy-based intentions, which emerged as a result of interpreting the "courtyard" model of Roman houses. In the traditional Antakya houses, the atria were accessed from the street through an arched door. The floors of the atria with an almost-square form generally consisted of pitch-faced stones, hammer-dressed stones, or rubble stones. The facades of the buildings facing the atria that were connected to the outer facade solely through the entrance door generally had alcove and structures for feeding birds. Introverted structures of atria can be explained with the desires of residents to isolate themselves from others within their properties or with the importance of privacy (Demir, 2004; Erdoğan, 1996).

Atria, which are the most important feature of traditional Antakya houses, shape the designs. Therefore, the scope of the study was limited with a single building reflecting the common properties of Antakya houses to examine such an important construction unit and to make interpretations in this regard more easily. Located at Zenginler Mahallesi-Kastal Sokak in Antakya, architectural properties of "Turkish Association for Assisting Veterans, Martyrs, Widows, and Orphans" with a door number of 8 indicated that the building had all characteristics of Antakya houses (Figure 5, Figure 6, Demir 2004; Arıman 2002; Erdoğan 1996).

Figure 5. Location of "Turkish Association for assisting veterans, martyrs, widows, and orphans" (Created by authors.)

- Constituting approximately one-third of the building, the courtyard shaped the design.
- In this plan type, all spaces open to the courtyard
- The courtyard was accessed through an arched entrance door on the south-eastern facade.
- The courtyard was bordered by indoor spaces in the northeast and southwest directions, by the main wall with the entrance door in the southeast direction, and a neighbouring building in the northwest direction.
- All spaces on the ground floor were accessed through the courtyard. Moreover, the upper floor was accessed using the stair in the courtyard.
- The courtyard had authentic elements such as a well, terrace, and various trees, which were among the important elements of Antakya houses.
- The facades facing the courtyard had flat and arched gaps.
- Courtyard facades had upper windows at a height figure of 2 meters. Windows in traditional Antakya houses did not consist of glass; they were made of wooden covers. The upper windows that were always open were designed for ventilation and seeing the sunrise as the wooden covers of the main windows were closed at night.
- Windows of the rooms faced the courtyard.
- The courtyard was one step higher than the street level for the protection of the building from rainwater.
- The available floor of the indoor spaces was 40 cm higher than the threshold.
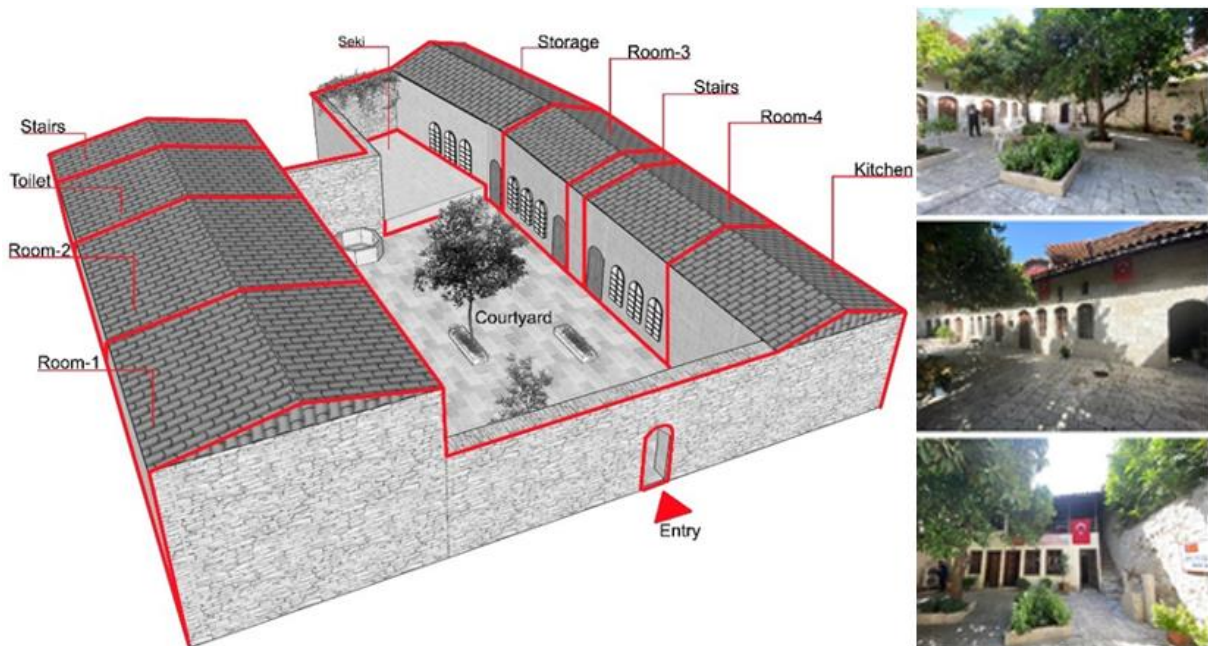

Figure 6. 3D Form and visuals of the building used by the Turkish Association for assisting veterans, martyrs, widows, and orphans (Created by authors.)

The building that was reviewed in this study and used as an authentic house were re-functioned and enabled public use to contribute to the socio-cultural structure, which indicated how important the building was. Based on its location and architectural characteristics, it was one of the most important examples reflecting the important characteristics of traditional Antakya houses.

3.2. Social House Construction by TOKI

The modern housing policies in Turkey have reached a different dimension through the contributions of the private sector and the cooperation of local authorities. One of the most important branches of this differentiation consists of the social houses constructed by TOKI which emerged in Turkey in the 1980s—a period when transformations of economic policies occurred in Turkey and other countries.

The reason behind the establishment of this institution was to regulate the support provided to the public or non-public investments or working principles of construction companies to meet the housing need of the public (Eşkinat, 2012, 160).

The Undersecretariat of Housing was abolished in 2003 while the General Directorate of Building Land Office was abolished in 2004; the authorities of these institutions were transferred to TOKI. With the increased number of authorities, TOKI has been criticized constantly for the last couple of years owing to its projects, the lands which were processed by the institution, sub-contractors of TOKI constructions, characteristics of workmanship, monotony in its projects, and absence of architectural identity in TOKI houses. TOKI houses are believed to adversely affect the lifestyles in the cities with certain historical and geographical characteristics and to show no observations toward the urban environment without establishing a connection with the city (Figure 7, Gür, 2012).

Figure 7. TOKI social houses in different Turkish cities (photographs TOKI, 2021)

Based on TOKI's statement "Our target of constructing 500,000 houses was fulfilled in 2011; our next target is to construct 700,000 new houses by 2023, and reaching the figure of 1,200,000 houses", it is clear that Turkey is a significant house construction centre (TOKI, 2021). However, TOKI's practices of constructing new houses in the present times have become a topic that should be qualitatively and quantitatively examined, and that concerned the construction and housing sectors, professional chambers, and the public.

3.3. Examination of Traditional Antakya Houses Through Space Syntax Method

The southwestern section of the building reviewed in the study consists of two floors, while the other sections have one floor. This study was assessed within the limits of the ground floor as the main designing element of traditional Antakya houses was the courtyard and the main connection points of a courtyard were the spaces on the ground floor. The convex model of the building was formed in the space syntax model. The reason behind the formation of this model was to reveal the relationship between the spaces of the building. Starting from the original form of the floor plan, convex map diagrams and diagrams of inter-spatial relationships were prepared using the AutoCAD program. In addition, the axonometric charts prepared to show the spatial locations and relationships between them on a perspective chart were formed using the SketchUp: 3D Design program (Table 2, Figure 8).

Table 2. Convex map analysis diagram of traditional Antakya House and axonometric chart

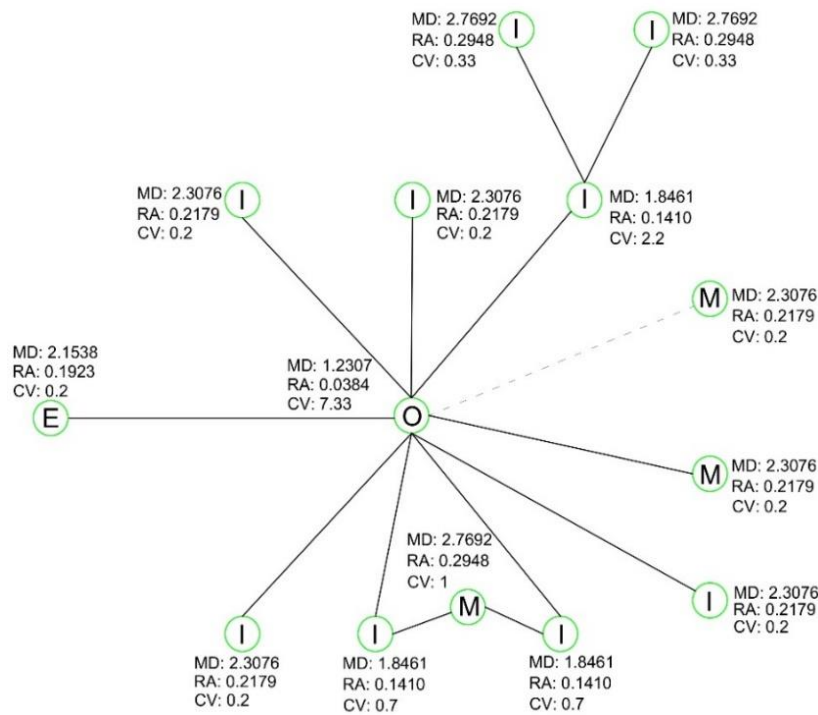| Building Plan	Convex map	Axonometric view

Figure 8. Spatial relationship diagram

The entrance door of the building opened to a central courtyard. The spaces were accessed through the courtyard which served as a place for separation to reach different locations in the same building. Therefore, as a connection point, the courtyard had a lower MD (1.2307) and RA (0.0384) value, and a high CV (7.33) owing to being the space with the highest number of neighbouring spaces, which shows that the connectivity and integration of the courtyard were better compared to all other spaces in the building. MD (2.3076), RA (0.2179), and CV (0.2) of room-1, room-2, terrace, storage, stairs, and kitchen sections were the same. These results indicated that the connectivity and integration-related characteristics of the spaces were the same. The MD (1.8461) and RA (0.1410) scores of room-3, room-4, and toilet sections were the same but CV values were different, which arose from the result that the accessibility of the spaces was the same while the number of neighbouring spaces (the space of entrance) was different. The MD, RA, and CV values of the toilet-men and toilet-woman spaces, where the number of doors to access these spaces were high and which were the most private points in terms of spatial integration, were 2.7692, 0.2948, and 0.33, respectively.
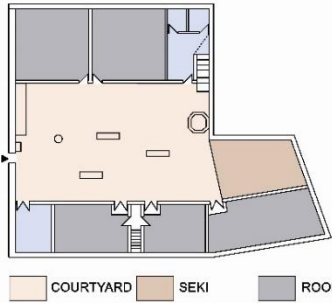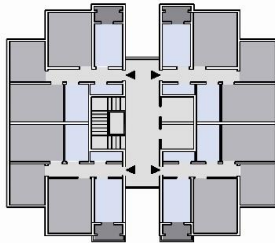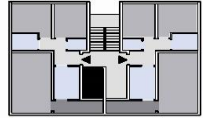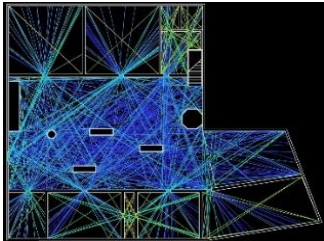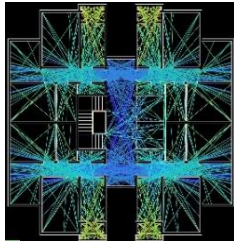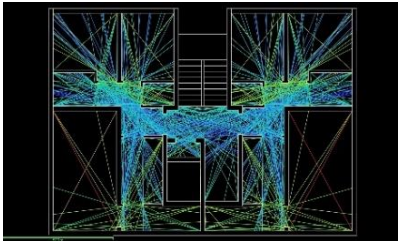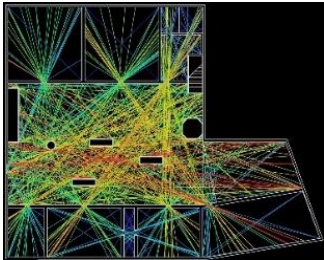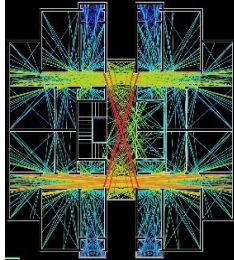
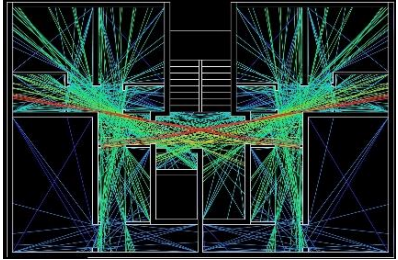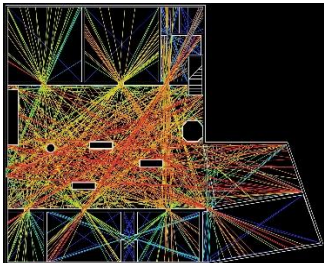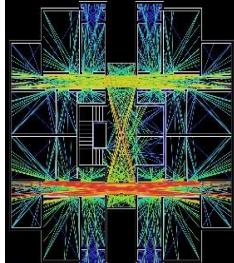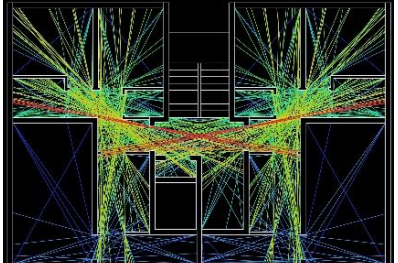The traditional Antakya houses were extensively discussed based on the space syntax method in the analyses and assessments above. The houses with atria, which were the main house types in Antakya, had many important spatial properties which were difficult for other house types to possess. However, the individual settlement form based on courtyard typology cannot adapt to the growth of population in direct proportion to the general population increase. It should be noted that high-rise buildings provide well-equipped houses for more users while terminating the traditional atria and social and cultural values.

Table 3 formed based on the visibility analysis in the space syntax method compared the traditional Antakya houses with two different settlement structures based on connectivity, integration and depth indexes, and TOKI social houses (Table 3).

- The entrance and corridor of high-rise social houses had high connectivity and integration, meaning the privacy decreased in high-rise buildings compared to the traditional houses.
- The highest unit of connectivity in the rooms of high-rise buildings emerged in the door-to-door location of different flats on the floors. Indoor areas of a flat could be seen from the door of another flat, affecting the notion of privacy.

- The connectivity and integration indexes were minor in the rooms of houses with traditional atria, while their depth values were high. Atria balanced the privacy in these buildings as a semi-permeable space. However, rooms of TOKI houses were generally protected through doors, meaning the indoors could be displayed if the doors were opened. In traditional houses, all rooms had privacy as atria in these buildings prevented the exposure of private areas to all other areas.

- Near formation of TOKI social house blocks resulted in low privacy even in balconies, the only extroverted areas in these houses. Moreover, the privacy of other flats could be violated through the windows owing to the closeness between the blocks, and curtains were obligatorily drawn in most of the day consequently, which prevented residents from utilizing the natural daylight and ventilation in terms of sustainability.

- Although spatial functions of high-rise buildings were functional, no unit could serve as the traditional atria. Not only did people lose their outdoor spaces to contact nature when a central outdoor area such as a courtyard was absent, but they also lost their domestic communication areas.

Table 3. Convex map analysis diagram of traditional Antakya House and axonometric chart

Properties	Traditional Antakya House	Housing Development Administration of Turkey (TOKI)
Plan Map		
Depth		
Integration		
Connectivity		

As noted, before, the courtyard is designed as the centre of a house, and it functions accordingly. Therefore, it should be closely integrated and related to all spaces. Space syntax values indicated that the lowest RA value and highest CV were present in the atria. Both values suggested that atria were integrated into other elements in the traditional Antakya houses and had proper connections to other functions, which was also verified with the visibility analysis.

4. Conclusion and Suggestion

This study reviewed the space syntax analysis concepts/practices and the relationship between the properties of certain buildings in a certain area and the cultures and lives of the people in that area.

Undergoing a rapid urbanization process, Turkey preferred a new housing structure with mass housing projects to meet the housing needs of the population that was concentrated in cities. Housing projects such as TOKI met the urban housing needs of sections that had financial issues, but the traumatic results that reflected on our social and cultural lives emerged upon the unplanned urbanization. Mass housing projects consisted of multi-story, plain, and uniform concrete blocks, but these projects became the topics of discussion owing to their relationships with architectural heritage and traditional residence.

The results of space syntax comparison between the traditional houses and TOKI social houses indicated that privacy was not observed in the apartments. Traditional houses observed privacy which consisted of constructive measures to protect the family rather than personal actions. In multi-story houses, rooms have been turned into spaces that can be locked or kept closed by their owners. Therefore, privacy was ensured through room doors rather than architectural designs. The transformation from traditional to high-rise houses arose from the new lifestyle and technology, but the physical and mental needs of people should always be considered in the designs of houses. Accordingly, examining the houses with traditional atria extensively to increase the privacy in high-rise houses and to reveal the cultural concepts that were absent in modern life will certainly help meet the basic needs of the society.

The failure to find a solution to the changes in family structures which are seen in modern or traditional houses may result in damages to the buildings. For instance, the enlargement of families living in the traditional Antakya houses with atria results in the division of building sections, which may cause the traditional atria to lose their authenticity or disappear in time. To improve the urban architecture of Antakya, new houses that observed the environment, space, society, culture, and behaviours from a family-based perspective and that ensured cultural sustainability should be designed. Considering the dimension of new social house constructions and the area where social houses spread, the entire area including the perimeter should be reviewed from a holistic and contemporary designing strategy, and social expectations should be met. Consequently, cultural values could be adapted to the modern designs better and sustainability of cultural heritage can be ensured. Houses designed with socio-cultural values will inevitably satisfy the residents and increase the wealth level in the region.

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