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***Assoc. Prof. Dr. Ayşe SİREL***



# Traces of Religion-Focused Spatial Development in Ayvalık, a Coastal Town



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**Abstract:** *Some of the coastal settlements in the Aegean Sea have been the center of commerce throughout history. Beyond being a transfer point where commercial goods arrive and leave, these ports helped shape cities around them as areas of cultural interactions. Within this context, other cities of the Aegean Sea region developed in similar ways. Even though these urban centers may become rivals in time, commonalities in their special formation appear vividly to an observant eye. The common elements as well as the ongoing relationships between the coastal towns in terms of production, population and cultural flow constitute an important part of the public memory of these towns. Doing a historical reading of Ayvalık sheds light on other settlements in the Aegean Coast as it reveals common values and shared memories of people. Such a reading also explains the existing cultural texture as a part of its historical heritage. Within this context, our goal is to investigate the spatial and social traces left by the various periods of Ayvalık by paying specific attention to church-centered settlements that contribute to urban planning of the area.*

**Keywords:** *Ayvalık, coastal town, traces, religious focuses, doors*

## Bir Liman Kenti Olan Ayvalık'ta Dini Odaklı Mekânsal Gelişmenin Oluşturduğu İzler

**Özet:** *Ege Denizi'ndeki kıyı yerleşmelerinin bazıları, tarih boyunca ticari ilişkilerin yoğunlaştığı liman kentleri olarak varlıklarını sürdürmüşlerdir. Liman; sadece ticari malların gelip gittiği bir transfer noktası olmasının ötesinde, kültürel ilişkilerin etkileşim alanı olarak da kentleri biçimlendirmiştir. Bu bağlamda Ayvalık'la birlikte Ege Denizi coğrafyasının diğer kentleri, birbirlerine oldukça yakın bir mekânsal biçimlenme ve gelişim sürecini paylaşmışlardır. Bu süreçte kimi zaman ortak aktörler, etkiler ve ilişkilerle ancak kimi zaman da farklılıklarına rağmen bu kentlerde oldukça benzer bir kentsel çevre inşa edilmiştir. Ortak etkiler altındaki karşılıklı etkileşim ve ilişki, tarihin bazı dönemlerinde kopmuş olmasına rağmen, ortak geçmişlerin geniş paydası ve bunun oluşturduğu benzerlikler bütünüyle yok olmamıştır. Liman kentleri arasında ürün, nüfus ve kültür akışında ilişkilerin süreklilik sağlayan unsurları kadar kesintiye uğramış unsurları da bu kentlerin hafızasının önemli bir parçasını oluşturmaktadır. Ege Denizi Liman yerleşmesi olarak Ayvalık özelinde tarihsel okuma yapmak, kent hafızasının öne çıkan değerlerini hatırlayarak görünür kılmak ve mevcut özgün dokunun kültürel miras olarak korunma bilincini gündemde tutması bağlamında önem taşımaktadır. Bu çerçevede, Ayvalık'ın geçirdiği dönemseller süreçlerin bıraktığı mekânsal ve sosyal izlerin peşinden giderek, yerleşimin kilise odaklı mekan organizasyonları ve bunlara bağlanan kentsel koridorlar incelenmiştir.*

**Anahtar Kelimeler:** *Ayvalık, Liman kenti, İzler, Dini odaklar, kapılar.*

## **1. INTRODUCTION**

As an important coastal settlement of the Aegean, Ayvalık has a rich and unique structure in terms of its cultural and natural heritage. While it was an important coastal town in the past, the traces of concentric alignment with the coast and the cultural elements manifested in various towns signal to a rich architectural design. As seen in the typical settlement schemes of the coastal towns, the warehouses, industry and service buildings (factories, insurance companies, banks, consulates and others), trade and accommodation buildings and houses are intricately connected in terms of their structures. These elements closely resemble the architectural design of other coastal towns situated in the Aegean and the Mediterranean trade routes. In addition, a significant aspect of these towns is the construction of churches, as triggering elements in the spatial growth scheme of Ayvalık settlement with their squares and neighborhoods they have defined outside of their own subjective identities; squares as second dimension and churches in third dimension in a social context and it represents the uniqueness of Ayvalık. Morphological studies, used as a method to analyze the multi-layered formations of spatial character, provide a useful approach for studying Ayvalık. Such focus forms are the conceptual base of the study.

## **2. TOWNS-IDENTITY LAYERS AND SPATIAL TRACES**

The towns are constantly characterized with the relationships and boundaries that vary according to time and place. Transformations and disruptions in relations are stratified as past landscape of every town and articulated to the identity of the town. These identity elements are reflective of the spatial traces. These preconceptions and the geographical, ecological, economic and political conditions that lead to interchanges in production modes, techniques, tools, populations and relationships also transform the relations of towns with each other. Historically, similarities between some towns have become more apparent through continuity in these relations. Beyond the analogical approaches, the “Set-up” Assemblage theories of Latour (2007) and DeLanda (2009), which focus on empirical elements through an interdisciplinary lens, highlight the unexpected details and actors, which are thought not to provide information on the whole beforehand, as a data class [1, 2]. The morphological studies developed with similar approaches are used in analyzing the identity layers over the interrelated facts and forms. Thus, in this study the methodical approach in analyzing the historical port city of Ayvalık is determined through the gates, urban traces and the social-spatial focuses. At the same time, these have created the conceptual framework of the study.

In order to address the morphological development of Ayvalık through the development of religious buildings as pivotal points, agriculture and industrial fields have been considered, and the need to identify a framework for pursuing different traces to support these studies has emerged. In readings and on-site investigations carried out during the research workshop and field studies, typification of function and style of entrance doors were used in paths connecting religious focuses for researching the relationship between doors and structure while following the cultural and structural traces on both sides of the Aegean Sea.

When the door is used as a conceptual metaphor depending on the same method, the relationship between the development of ports and other highways, which are the entrances of forms carried to the town through commerce and population, and the development of the town can be interpreted in a different way.

In the context of interchanges and common heritage specific to coastal towns, the conceptual approach of Braudel (2013) comes to the forefront as a theoretical support for the method and draws attention to the flows and boundaries of tangible and intangible heritage values formed in geographical conditions [3]. In Mediterranean studies, it is emphasized that technical and cultural network relations are more intense and

continuous in Mediterranean coastal towns. In this context, while the Mediterranean coastal towns have shown specific cultural bunching, the spatial considerations of social relations bear the traces of a continuous migration within themselves until today. Thus, despite intense commercial competition, and even after the wars, the preservation and use of the form, technique and the structures of the predecessor have been sustained in certain processes as an *apriori*. According to Braudel (2017), since the 18th century, the importance of historical maritime trade focuses has been passed on to the emerging industrial towns, with the prominence of the relations of coastal towns with developing industrial zones, depending on the development of “*Puertos Secos*” of roads and customs [4]. The master zoning plans were made after the 1944 earthquake in Ayvalık and the correlation of the land connection roads with other industrial towns and especially the formation of the Ataturk boulevard, a boundary between the settlement area and coastal line of the town, have restricted the Coastal Town qualification of Ayvalık as described by Braudel (Figure 1).

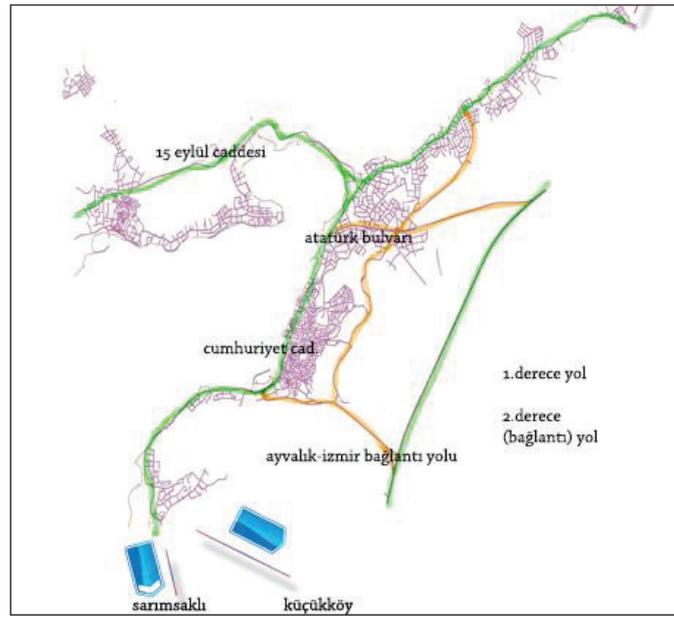


Figure 1. Ayvalık Connection Roads and Road Grading [5]

### 3. IDENTITY TRANSITION IN MEDITERRANEAN COASTAL TOWNS AND STRUCTURAL TRACES IN AYVALIK

Some of the coastal settlements in the Aegean Sea have existed throughout the history as coastal towns where commercial relations were centered. Beyond being only a transfer point where commercial goods arrive and leave, the harbor has also shaped the cities as a space of interaction for cultural relationships. Within this context, other cities of the Aegean Sea region, in addition to Ayvalık, have shared a very close spatial formation and development process with each other. In these processes, a quite similar urban environment has been constructed in these cities; sometimes together with common actors, effects and relationships, other times with their differences. In conceptual approaches addressing culture-identity-town relations, the conditions of transformation in the mentioned forms, the channels providing the interchange of forms and the thresholds controlling them are often addressed by using the road and the door metaphor. The roads that provide migration and thus cultural transition and the doors determining their boundaries in forms also stand out as determinants in the redefinition of the common heritage.



*Picture 1. Door types as housing and housing-commerce entrance in the town texture of Ayvalık.  
(Photographed by Yağcı, E. 2017)*

When the historical break points triggering the social transformations and spatial transformations are superposed in Ayvalık in order to determine the continuity of the forms and cultural flow of the materials as well as their flow in geographical conditions, similarities with the coastal settlements on the other side of the Aegean Sea can be established by the agricultural production determined by the climate and ecology of the town and the forms of produced surplus value exchange.. As the spatial evidences of similarities, when the parcel forms and coast-land directions as urban themes, religions structures, door-window forms and details and building construction techniques and materials as the founding focuses of the town are superposed with the verbal history studies, it is determined that the spatial traces indicating the development of Ayvalık under the influence of other towns and cultures as a coastal town continues until today.

Simmel (2009) defines the interaction between the people and cultures as a form of exchange. In his phenomenological approach, which reads the relation between the towns and spiritual life as “the image of the external beings”, he evaluates the disintegrations and integrations between two places or cultures by using the bridge and door metaphors [6]. Again according to Simmel (2013), if the door expresses a controlled restriction, it becomes more important than the bridge in terms of exceeding the boundary, accepting the other, and connecting with the outside.

The construction of the doors in Ayvalık as a transition element through types, qualities and forms concretizes the structural traces of the social and commercial network relations that provide continuity in the socio-spatial development of the town. As a cultural connection element, when the similarities of Ayvalık doors with Lesbos Island doors are superposed with population exchange stories, oral history studies, historical photos and document readings with regard to building construction arrangements of the exchange period, it becomes more obvious that the cultural and formal connections between these two places, which lie on two different Nation-State boundaries in the two sides of the Aegean Sea, are sustained in forms. In population exchange stories (Pekin 2014) and memories in Turkey (Kalogeropoulou Yalcin 2017), the subjective interpretation that the place to be left due to the population exchange is associated with cultural similarity rather than by establishing an otherness through the connection established by cultural transition, and the familiarity reserves the potential to be evaluated within the framework of a common heritage (Figure 2) [8, 9].



Figure 2. Transition analysis through the door entrances of church-centered commerce-houses produced within the scope of the study.

#### 4. BREAKPOINTS AFFECTING THE SPATIAL DEVELOPMENT OF AYVALIK IN THE HISTORICAL PROCESS

The population of Ayvalık has undergone constant change and let in immigrants and as a result, a mixed society has emerged under the effect of a mixed culture. Within the urban history, there have been breakpoints affecting both social, physical and economic structure. The facts such as the presence and afterwards closure of Ayvalık Academy, exchange process, extension of neighborhood units, destructive earthquakes, extension of the port and the roads with coast filling, the presence of olive oil and soap factories and their afterwards functional change, forming of new zoning rights in different periods by amending the urban plans, announcement of urban protected areas and Ayvalık and its Archipelagos as natural park, and multipartite structure of wide range legislation that contradict and conflict with each other can be shown as examples of these breakpoints.

##### 4.1. Ancient Period

According to the findings in the area, the settlement dates are HELLENISTIC period 330 B.C.; 30 A.C.; ROME period 30 A.C.-395 and BYZANTIUM period 395 A.C.-1453 [10]. It is a very old settlement named as Cisthana, Taliani and Kydonia throughout the history. The first settlers are Mysians. The Milesians, who migrated to the Greek islands, established small colonies in the Yund islands in Ayvalık Gulf [11]. In the ancient period, the islands in front of Ayvalık were called as “Nekatonnesoi”. It is known that this name originates from Apolla, also known with the nickname “Nekatos”, the chief god of the ancient city of Nesos-Nasos, which has the same name with the island’s largest island Nesos or Nasos (Alibey) island. Accordingly, the same islands were also called as the Nekatos Islands (Apollo Islands).

Although no remnants were found in the place that is assumed to be the old Kydonia, it is understood that it is a settlement center belonging to Hellenistic (B.C.330-A.C.30), Roman (B.C.30-A.C.395), and Byzantium (A.C.395-A.C.1453) periods according to the information obtained from the artifacts collected from the surface.

Yorga Sakkari states in his book [12] that Ayvalık is affiliated to Ayazmand. The name of Ayvalık is mentioned again in a 1186-1172 dated royal decree in the archives of the Topkapı Palace Museum. Different approaches regarding the establishment of Ayvalık are described in Yorgo Sakkari's book and one of these is that Ayvalık was established by the population who migrated from the nearby islands and the Lesbos Island in order to escape from the pirate attacks. Ayvalık, a convenient refuge for immigrants, has become the most developed town among the towns which were established together with it.

#### **4.2. The arrival of Turks in Ayvalık**

According to various myths, Turks settled in the area formerly known as Taksıyarhis. However, they found the immigrants who did not comply with their own ethnic roots and therefore, they withdrew to the nearby Turkish cities.

Ottoman Turks began to capture the Aegean coasts at the beginning of the 15<sup>th</sup> century. The Ottomans who conquered Ayvalık and its surroundings between 1430 and 1440 set up bases in some of the Yund islands. Ayvalık was built on a hill that overlooked the port in those years. This port-city relationship has enabled the development in agriculture, trade and culture.

According to another opinion, the town was founded by Turkmens. Even today, some of the old locals of Ayvalık remember the Turkmen villages such as Ceşnigir, Eskiköy and Hanaylı, of which the population dealt with olive cultivation.

#### **4.3. The Ottoman Period; Between the 15<sup>th</sup> and 16<sup>th</sup> Centuries**

The period between the 15<sup>th</sup> and 16<sup>th</sup> centuries covers the development period of the Ottoman Empire and its domination of the region. Although Piri Reis mentioned the Pirgos Port and the coasts of other Greek islands in his book "Kitab-ı Bahriye", which he wrote in 1513, he mentions neither a town nor a village named as Ayvalık. Also, Piri Reis speaks of Yund islands in his book. It is believed that Cunda Island which is located on the opposite side of Ayvalık is the place that is referred in Piri Reis' book.

The Edremit Gulf and Ida Mountains are clearly visible in Piri Reis' Map. The shape of the Lesbos Island is quite similar to today's maps. While the fact that Ayvalık Gulf and Cunda Island are slightly distant from their present form draws the attention, the hills in Ayvalık are vividly depicted in blue, green and brown colors, just like the Ida mountain and the streams around Ayvalık that are clearly indicated on this map (Figure 3).



Figure 3. Ayvalık Map of Piri Reis [13]

#### 4.4. 16<sup>th</sup>-17<sup>th</sup> Century Periods

In the travel book of Evliya Celebi, there is no place with this name in the map of Aegean coast made by Turkish mariners in the 16<sup>th</sup> century. We do not see such a town in the map which was prepared by Turkish mariners at the end of the 16<sup>th</sup> century and placed in the beginning of the 9<sup>th</sup> volume of the travel book of Evliya Celebi showing the Aegean coasts. Although they do not state the exact establishment date of Ayvalık, they indicate the date when the village status was cancelled and Ayvalık became a town center.

According to “Yorgo Sakkari”, the formation of a settlement in Ayvalık developed at the end of the 16<sup>th</sup> century and at the beginning of the 17<sup>th</sup> century, though it does not depend on a definite source of information. In this period, the population of Ayvalık started to increase and it grew economically with the migration of the Greeks from Greece [14].

#### 4.5. 18<sup>th</sup> century period

According to Yorgo Sakkari, Ayvalık underwent a quiet and insignificant period until the 18<sup>th</sup> century and developed after obtaining the autonomy document. The autonomy certificate was given to the Ayvalık Greeks by Cezayirli Hasan Pasha in 1773. The Turks migrated out of the settlement. Ayvalık started to trade with European countries and a welfare period was experienced [15].

During the Greek migration that took place in Anatolia in the second half of the 18<sup>th</sup> century, some Greeks came to Ayvalık from the opposite islands, and first settled in the north-east of the town, in the place called Eğribucak and then in the place where the port is located today [16].

#### 4.6. 19<sup>th</sup> century period

At the beginning of the 19<sup>th</sup> century, the Greek population exceeded 30.000 and it became a famous and large city recognized by European cities, having foreign consulates and banks [17]. By the end of the 19<sup>th</sup> century, the city regained its previous richness and the harbor was completed, making it convenient for ships to approach the coast. From the 19<sup>th</sup> century on, the emergence of the eclectic architectural character seems to be effected by foreign architects or minority architects educated abroad [19]. The first printing house was established in 1819. This date is important considering that the first printing house was built in Istanbul in 1840 at the time of the Ottoman state.

In 1843, Ayvalık was connected to Balıkesir and the district organization was established. The level of social and economic development in Ayvalık in 1890s was quite high. As a result, the economic structure of Ayvalık, strengthened by industrialization and trade activities in the 19<sup>th</sup> century, was reflected as an architectural diversity in urban texture of the settlement. The location of the houses in the city plan forming an important building group in this diversity was determined by its industry and port city identity. The houses are located adjacent on a narrow parcel beyond the coastline. Therefore, the entrance facades of the houses were tried to be put forward and the economic power was presented as an indicator in the facade character of many houses. In addition, as a result of the economic structure, the base floors of some of the houses were planned as stores/warehouses, and this approach affected the formation of the facade arrangement [20].

#### **4.7. 20<sup>th</sup> Century Period**

The Greeks who occupied Izmir during the War of Independence captured Ayvalık on May 29, 1919. Ayvalık was rescued from Greek occupation on September 15, 1922. Pursuant to population exchange principle agreed between Turkey and Greece in accordance with the Treaty of Lausanne, Ayvalık Greeks migrated to Greece and Turks from Lesbos, Crete and Macedonia settled there.

Ayvalık Greeks were migrated to Greece in accordance with the “Peace Treaty” signed on July 24, 1923 in Lausanne, Switzerland. In accordance with the same treaty, Crete, Lesbos and Macedonian Turks were brought to Ayvalık. However, it is known that the settlement of these immigrants and the registration of the land could not be successfully carried out and that the olive groves deteriorated (Figure 4).



*Figure 4. The refugees who were obliged to pass to the opposite coast during the exchange [21]*

There were 18 olive oil factories and 13 soap factories in Ayvalık in 1938. The population of the town was 13.088 consisting of only Turks according to 1935 population count, and over 8.000 of them were the immigrants coming outside of Turkey. In 1944, a severe earthquake caused damage. Most of the damaged buildings were in Cunda Island. 30 people lost their lives and 5.500 buildings were damaged in the earthquake (Figure 5).

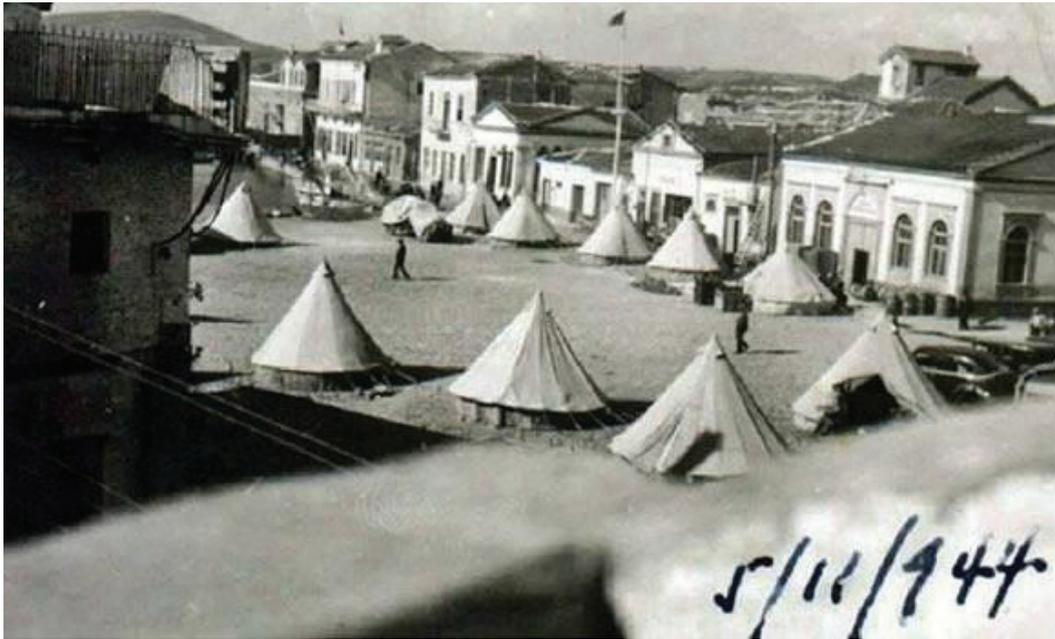


Figure 5. Earthquake tents in Ayvalık after the 1944 earthquake [22]

The coastal road was opened in 1950 (Figure 6). After 1960, people coming from large cities to Ayvalık played a decisive role in the formation of new holiday sites (Figure 7). Natural and cultural areas in Ayvalık were declared as historical and natural protection zones in 1976. However, as a result of the inadequate protection of natural areas, social awareness studies were carried out with the efforts of the non-governmental organizations, and initiatives have been launched on its inclusion in 2017 UNESCO World Heritage List.



Figure 6. View of Ayvalık Coastal road, 1950's [23]



Figure 7. Hürriyet Newspaper headline [24]

## **5. DEVELOPMENT STAGES OF AYVALIK SETTLEMENT AND RELATIONS BETWEEN RELIGIOUS LANDMARKS**

### **5.1. Street and Square as a Public Space**

Understanding the pattern of formation and development of settlements is not about the urban form of a single settlement. Community relations and types of location uses in that settlement are also an effective factor in the formation of the settlement. All these data bearing the interface features such as settlement texture, relations between buildings and streets, physical texture of locations, integration of indoor-outdoor spaces, etc. are the reflections of the social structure of that region on the location. When we examine the neighborhoods, some places are narrowed and extended and some of the streets are opened directly to the gardens rather than to the entrance doors of the buildings, or while geometric solid forms are more definitive in a settlement, indoor building islands, dead-end streets may form a texture in another region of the same settlement that cannot be exactly read. Such specific situations are the consequences of the reflection of the cultural and social life of such spaces. In each period, similar social groups defined themselves in different urban forms. Thus, the relationship between urban form and social structure has formed the essence of morphological research.

Urban open spaces which we define as public spaces are the centers of social relations and are successful interfaces. The quality of such locations, which reinforce the socialization needs and environmental recognition of the people living in the settlements, are the important physical places that form the quality of the settlements. The qualities of buildings that define open spaces are also decisive identification elements of the settlement. Buildings are the visual symbols of settlements and it is necessary to read the identity of the settlement over their associations, scales and functions.

The street that can be identified as a public place in the historical settlement texture of Ayvalık is a common living space. There is a sense of public unity and intercourse in the house-street interface. Therefore, it is believed that the individuals living in this area could establish close relations with their surroundings and transform the places into a living space.

The streets and squares examined in the historical settlement texture of Ayvalık appear as a system of relations in which the people living there provide their daily social unity. The centralization of church squares and their immediate surroundings before the population exchange is now readable through a local relationship in a different social structure as parts of the same neighborhood. Both the physical effect created by powerful icons such as churches, and the effect of being a point of attraction, indicate that the mentioned effects of the same structures still continue, despite the varying uses of them. Within this context, understanding the assembly areas formed by the churches that trigger the settlement patterns of Ayvalık as identity elements, while being used as mosques today, offers a clue to understanding the social life in Ayvalık.

### **5.2. Churches as Identity Structures and Their Orientation**

We can say that the churches were triggering elements in forming the urban structure and leading the housing texture in the periods when the Greeks lived there. The church-centered neighborhoods and the social relations they created continue to exist in Ayvalık today.

When we consider the developmental stages of the town, it is apparent that the city developed around the churches at every step. The stages of Ayvalık settlement expanded from the hills to the coasts by centering on the churches. While there were 11 churches in the past, only 9 of them still exist today. While some of

these churches preserve their original function, the rest of them were converted into mosques after the population exchange. With this context, knowing the construction dates and the transformations of these churches in Ayvalık, helps us understand the history of Ayvalık.

In this historical chronology, we encounter different chronologies in different texts for the churches. The church history followed by Psarros in the process of urban development was chosen in this study. According to the construction dates, the churches are Taksiyarhis, Agios Dimitrios, AgiosYannis, MesiPanagia/Metropol, Kato Panagia, Agios Georgios, Agios Nikolaos, Profitis Ilias, and Agia Triada (Figure 8).

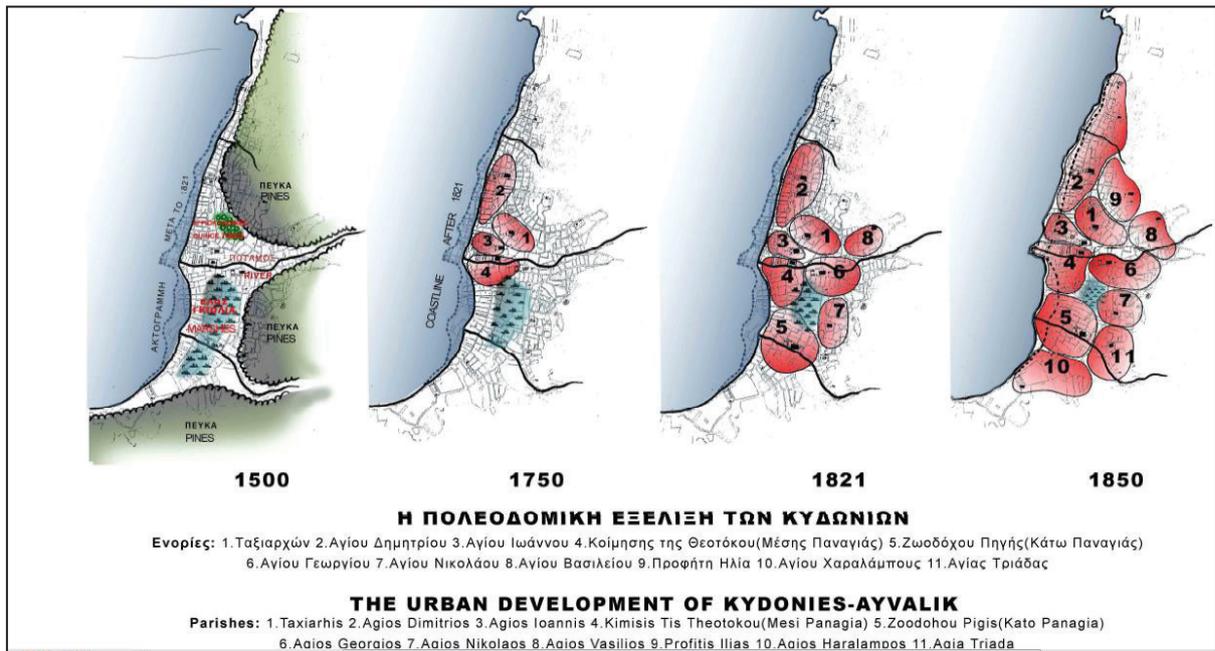


Figure 8. Ayvalık's urban development scheme [25]

When the church architecture is examined generally, a semi-circular structure with a short semi-dome generally located on the short front facade of the church, which determines the worship direction and the direction of the priest's ritual, is observed. The axis taken perpendicular to this structure is called the apse axis.

Therefore, it was determined that the worship direction of 9 churches in the town were almost perpendicular to the coast [26]. As seen in Figure 9, the apse axis of the Feneromoni is almost parallel to the coast. It can be said that this is the effect of being a holy spring instead of a church among the founding elements of the town. There are two transportation axes which can be considered parallel to the coast in the city where the education is intensive, and despite the organic city texture, direct access of the churches especially to these axes is possible. In other words, as the churches have a view of the sea, it is possible to access the coast from the church through a single street. However, there is an exceptional situation in Profitis Ilias Church, located at the highest point of the city. Due to the high rates of education, the most organic texture in the city is formed around this church. Accordingly, there is an indirect access to the coast; but in terms of view, the church which is clearly the most associated with the sea, is Profitis Ilias Church.

Within this context, the structural dominance separated from the traditional house structure formed by the churches has caused them to form an assembly area due to the hilly topography. These churches, as benchmarks with the important axes that go down to the coast, have turned into centripetal objects that reveal themselves on the sloping land.

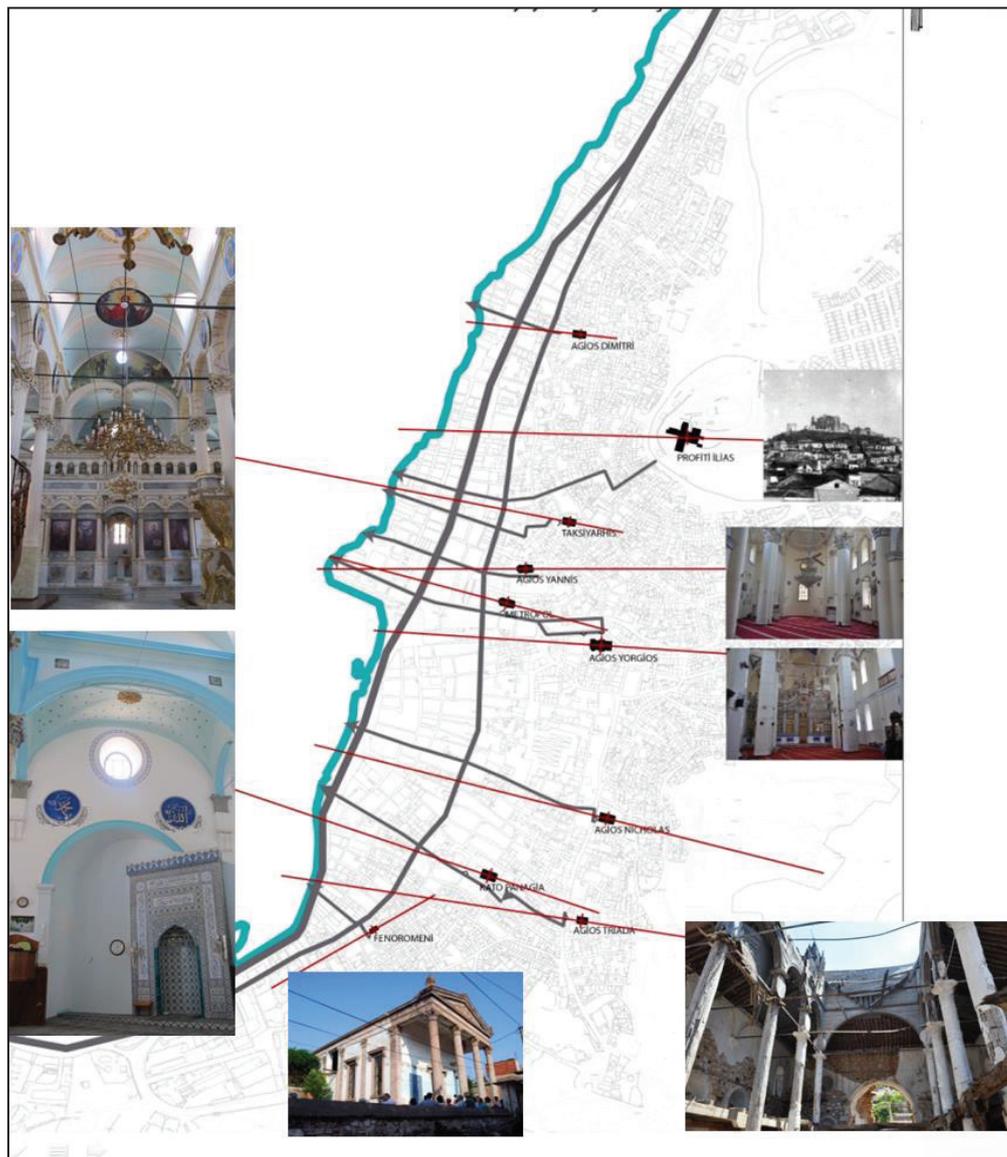


Figure 9. Upside axes of Ayvalık Churches produced under the study

### 5.3. Assembly Areas

The churches read as centripetal, pivotal objects in settlement are important landmarks in Ayvalık topography within the scope of the study. Although some churches have been converted into mosques, schools and warehouses with different functions, it was observed that they have exhibited a decentralized standing with their monumental presences for the social relations established by the town-dwellers and the new spatiality they created, with the transmission of social memory and experiences.

Figure 10 focuses on the physically existing churches, their access and diffusion areas were separated with grey rings according to their intensity, and the surrounding intersection points and their incidences have been determined. It has been observed that the determined assembly areas are in association with current trade links and the red commercial axles were processed in addition to the gathering areas indicated with yellow spots. Thus, the assembly areas, intersection points and trade links have been revealed.

In line with these analyses carried out around the churches, it was observed that the spreading, access areas and gathering areas formed around them were generally at intersection points and these medium focuses were supported by trade function.



*Figure 10. Focal-Point Centered Assembly Areas and Links produced within the scope of the study*

The gathering spaces around the religious buildings continue to be the areas that the locals of Ayvalık still carry out their daily routines that allow new encounters and relations. These focal points, which bring the locals and visitors together, also caused commercial relations to shift towards this point from the coast. It was observed that each focus had a different spatial characteristic when the present usage patterns of the intersection points are examined over the assembly areas and commercial relations determined under the focus of churches (Figure 11).

The links of the churches deemed as focus points are shown in red, and the physical connections of the assembly areas are shown in gray. In this study, two of the study groups carried out researches on the use of intersection points allowing spatiality and socialites under the focus of churches on the central settlement of Ayvalık.



Figure 11. Focal-Point Centered Gathering Areas and Links produced within the scope of the study

In order to illustrate the detailed examination of these intersection areas determined under the focus of churches, the assembly areas located around the AgiosYorgios Church, named as Çınarlı Mosque today, have been numbered in Figure 12.



Figure 12. A Detail from Focal Points Centered Assembly Areas-Links and Identity Elements Produced within the scope of the study.

The observed differences and use patterns of these intersection points will be explained under a sequence number.

The assembly area no 1 is the largest gathering area around Çınarlı Mosque and the area where trade function is the most intensive. For this reason, it is an area where the user density is high and continuously moving. All the spots surrounding the intersection point have a commercial function.

The assembly area no 2 was formed by connecting a narrow street, which coincides with the gate of the mosque garden, to the main street. Since the mosque's gate coincides with this intersection point, it is an area where the mosque community usually convenes and spends time and where male users are dominant. As the user density continues for long and without any interruption, the top coverings and olive trees are frequently seen in the streets of Ayvalık.

The assembly area no 3 consists of a small square which corresponds to the apse of the church with a short distance connection with area no 2. Since there is a big tree and a large space in its center, it turns into a bazaar area on certain days of the week.

The assembly area no 4 is an area where the user population is diversified when compared to other assembly areas and the commercial function is intensive. The tables and chairs of the cafes that extend out are seen as the reflection and continuity of the culture of spending time and sitting in the street. Contrary to other assembly areas, it is an intersection point attracting the tourists in Ayvalık since the commercial function here consists generally of the cafes.

The assembly area no 5 is a vista point establishing a visual relationship with the assembly area no 1 and in which we can observe both religious structures at the same time. Again, contrary to other areas, this point, which has a high concentration of commercial functions, also contains functions that can serve the locals and the owners of the nearby houses.

## 6. SYNTHESIS

In the study conducted with the assumption that the settlement texture is formed around the religious buildings in the central settlement of Ayvalık, after defining the links and relations of the focuses with present trade connections, the relations between the houses and the gathering points were defined. In order to be able to read the inner-outer and private-public area connections through parcel, building and street relation, the relations of the doors with the street as permeability and interface objects were examined.

The doors can be seen as the physical layers through which we can read the performances, movement and time of daily routines. They are interfaces that connect the inner to the outer by restricting the daily activities of the town-dwellers between the private and public area. Three different doors were observed in Ayvalık in the singular buildings surrounding the churches and assembly areas. These are the building entry doors, store doors and garden doors that differ in quality and scale. While these physical interfaces, which are part of the daily routines of the town-dwellers, facilitating the visual monitoring of street texture, they are involved as founding elements for the town-dwellers to participate in routine activities and encourage them to spend time on the streets.

While the entrance door and the garden door are the interfaces that open to the daily flows of the private area of the town-dwellers, the store door is the door where people dealing with olive cultivation mostly kept their jugs in the past. In this case, we can assert that while entrance and garden doors were defining the social thresholds, boundaries and passages, the store door allows the basic elements with which the town-dwellers provide their livelihood and which constitutes the economy of the town to be read through physical traces. Therefore, the visual theme constituted by the single buildings throughout the town provides social thresholds and information source about the historical process of the town (Figure 13).



*Figure 13. Relations between doors and assembly points produced within the scope of the study.*

## **7. CONCLUSION**

In the historical process, Ayvalık has become the most active harbor following Izmir. As a natural harbor on the sea routes from the beginning of the 19<sup>th</sup> century and being a production center with its soap and olive oil factories, Ayvalık continued its close relationship with other islands. The economic structure and production relations shaped by industrial and maritime trade activities influenced the population movements of Ayvalık as well as the formation of its urban texture, space setup and the diversity of buildings [27].

It is possible to understand this unique structure of the settlement's spatial setup through many components constituting the town. From the building scale to the traces of the road system, the effects of the natural structure and to the articulation of public spaces, formations provide us clues about the place. As a coastal settlement, the spatial organization of other public buildings, such as factories and customs buildings, has determined a specific coastal use. Together with this coastal use, although it may appear as if the production-trade and administrative activities and housing areas have been separated in the morphological setup of Ayvalık, after a deeper examination it becomes obvious that these relations have been interlaced. For example, workshops with separate entrances on the base floors of the houses were used as olive oil and wine production areas and have constituted a part of the economy of the city.

Another form of relationship with the coast is the wind corridors formed by the streets going down perpendicular from the housing areas to the coast. It is also known that along with the streets as the urban living spaces, the churches are important focal points and benchmarks. In addition to these features, the squares formed around the churches define the meeting points of those who live there.

Within this context, the social changes experienced by Ayvalık in the historical process appear under the unifying effect of geography with a mixed structure formed by common habits and cultural elements. The reflection of this mixed structure on the urban space should be considered as common values between cultures that penetrate through the sea gates of the town as well as the social relations that extend from the interior space to the street. Together with all these features, Ayvalık town symbolizes the continuity of a common memory.

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## Explorations on “Chora”



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**Abstract:** The Ancient Attic Greek word Chora, which is translated as space or place, has been one of the tropes used by philosophers and architects alike during the end of the twentieth century. Chora, for example, has been one of the privileged deconstructivist terms used by Jacques Derrida as well as Elisabeth Grosz. It has also been one of the key terms used by architectural historian Alberto Perez-Gomez who is well known as an architectural theorist and a promoter of a phenomenological approach to architecture. It is rather intriguing that these different approaches to architecture and architectural meaning both use the notion of Chora which relates to the critical issue of space versus place. Although the notions of space and place have been explored extensively within architectural discourse as one of the keys to architectural meaning, they are not the focus of this research. This study rather is an exploration of the notion of Chora through examining its interpretations by different characters. The aim is to explore possible paths that could open themselves for us to understand architecture and architectural meaning.

**Keywords:** Chora, space/place, Derrida, Grosz, Perez-Gomez

### “Chora” Üzerine Keşifler

**Özet:** Antik Dönem Atik Yunanca diline ait, uzay, mekan, bölge veya mesken anlamalarında kullanılan *Chora* kelimesi yirminci yüzyılın sonlarına doğru felsefecilerin ve mimarlık teorisyenlerinin çok kullandığı bir terim olmuştur. Örneğin, Jacques Derrida ve Elisabeth Grosz gibi dekonstruktivist teorisyenlerin kullandığı ayrıcalıklı terimlerden biridir *Chora*. Mimarlık disiplinine fenomenolojik yaklaşımı savunan öncü mimarlık tarihçisi ve teorisyeni Alberto Perez-Gomez’de *Chora* terimini pek çok çalışmasına konu edinmiştir. Uzay ve mekan konseptlerine dair açıklama getiren *Chora* teriminin birbirinden farklı bu yaklaşımlar tarafından kullanılıyor olması ilgi çekicidir. Mimaride anlam konusunun temel bileşenlerinden uzay ve mekan kavramları mimarlık disiplininde yirminci yüzyılın belki de en çok çalışılan alanlarından biridir. Ancak bu çalışmanın odak noktasını *Chora* terimi oluşturmaktadır. Çalışmanın amacı *Chora* teriminin farklı karakterler tarafından yapılan yorumlarını inceleyerek, bu terimin mimarlık ve mimaride anlam konusunu aydınlatmada bize hangi yolları açabileceğine dair bir keşif yapmaktır.

**Anahtar Kelimeler:** *Chora*, uzay/mekan, Derrida, Grosz, Perez-Gomez

## 1. INTRODUCTION

*Chora*, a word in Ancient Attic Greek written in the form of *Χώρα*, means "place" in different senses. The Greek-English Lexicon provides six different meanings of the word *Chora*: place or space in general in which a thing is defined, as partly occupied space, the residence, the habitation, the place where we live, land, country, town, territory; the position, proper place of a person or a thing, filling a person's place, taking a position, to be in his position [1].

*Chora* has been one of the tropes used by philosophers and architects alike during the end of the twentieth century. It has been, for example, one of the privileged terms in French philosopher Jacques Derrida's deconstructivist discourse as well as the theme of the architectural work produced by Peter Eisenman in collaboration with Derrida for one of the pavilions at the Parc La Viletter in Paris, which is well documented in the *Chora L Works* [2]. The notion of *Chora* has also been used as a trope in philosopher Elisabeth Grosz's feminist [3], and architectural theorist Alberto Perez-Gomez's poetic [4] discourses. It has also been used as the title of the three volumes collection *Chora* edited by Perez-Gomez and Stephen Parcell [5]. The last work that will be referred in this study is the book by Indra Kagis McEwen, one of Perez-Gomez's students: *Socrates' Ancestor: An Essay on Architectural Beginnings* [6].

The study attends to the task of unravelling rather an obscure notion of *Chora* by examining interpretations of it by different characters as it relates to architecture and specifically to the notions of space and place. The aim is to explore possible paths that could open themselves for us to understand architecture and architectural meaning.

## 2. CONTEXTUALIZING CHORA

The concept, *Chora*, is introduced to discourse in Plato's *Timaeus*. In this text Plato deals with the physical theory and specifically, on how the universe has come to existence. The argument of *Timaeus* is based on the premise that the universe is not eternal but has been divinely created. Looking at the order and beauty of the universe, Plato infers a good creator/craftsman, which he calls *demiourgos*, working with an eternal blueprint, a paradigm. This blueprint is an excellent model as its source is divine. While looking at these pre-existing forms, the *demiourgos* gives these forms a sensible inscription, and thus they become perceivable, i.e. as the things we can see and touch. This is how our sensible world came into existence; it's a copy, a representation of these eternal beings.

Thus, Plato argues, there are two kinds of being; *eidōs*, the eternal unchanging being, "that what is always is and does not have becoming", the divine; and the sensible world, becoming, "that what is always coming to be and perishing and never is", the mundane [7]. The former, being, posited as a paradigm, can be grasped by thought and reason and is referred as "Idea" or "form." The latter, becoming, a copy of a paradigm, can only be grasped by opinion with non-rational sensation, and is referred as perceivables, or sensibles.

In *Timaeus*, Plato feels the need to introduce another kind of being, the third kind, *triton genos*. This third kind is neither the eternal *eidōs*, nor its sensible copy, but the place in which all these types are inscribed, *Chora*. In order to understand the nature of this third kind, Plato gives the example of constantly producing different shapes out of the same physical material, gold. At any given moment, if one tries to define what this is, one cannot simply say triangle, or circle since it will be misleading. The shapes are

mere different appearances of the same material. Rather, one needs to take into account the underlying unchanging quality of the material, gold, out of which these differing shapes are produced. He posits that:

The same account also [holds] for the nature that receives all bodies. [We] must always apply the same to it, for it doesn't at all lose its own power. For it always receives everything, and it never in any way takes on any shape similar to any of the [things] that enter [it]. For it is established in [its] nature as a recipient of everything, and is moved and shaped by what enters, and appears different at different times because of them. The [things] that enter and depart are copies of what always is, impressed by them in a way that is marvelous and hard to explain [7; p.61].

*Chora* has the same nature as gold, which doesn't have a shape of itself but rather acting as a means for the shapes to come into being. It is an invisible and shapeless form; it is the in-between from the Ideas, i.e. the eternal forms, the paradigm, to the perceivables, the things that we can see and touch, the copies of the paradigm. In Plato's words, *Chora* is; "the space... always not accepting destruction, but providing a base for everything that has coming to be, itself grasped by a spurious reason, without sensation, scarcely trustworthy" [7]. Its nature is to hold, nurture, and bring into the world.

### 3. THINKING OF *CHORA* AS MOTHER

You can compare, Plato says, the divine paradigm with the father, the sensible world with the child or the infant, and this place of inscription with the mother or nurse. It is the substance in-between Ideas and perceivables, such as mother in-between father and child. In Elizabeth Grosz's words, the role of this substance is

to nurse, to support, surround, protect, incubate, to sort, or endenger – the worldly offspring of the Forms. Its function is a neutral, traceless production, a production that leaves no trace of its contributions and thus allowing the product to speak indirectly of its creator without need for acknowledging its incubator [3; p.50].

The use of mother, father, and child metaphor gives another twist to the meaning and interpretation of *Chora*. It becomes a tool to understand the perception of the feminine in Ancient Greek world, the founding of western ideology.

The insights provided about the nature of parenthood in Ancient Greece in architectural historian Indra Kagis McEven's work, *Socrates's Ancestor*, helps us clarify the perceived role of mother in bringing a child into the world. Although McEven doesn't specifically talk about *Chora*, the discussion of mother and giving birth comes up during her discussion of Plato's understanding of *episteme*, the legitimate knowledge. She mentions that legitimate knowledge, or true opinion as Plato describes, is bounded by the chains of recollection, and that recollection is the memory of the world of Ideas known before birth. Then she asks:

"Which birth? Whose? Was it the birth of bright-eyed Athena who, in that 'outrageous myth ... a diagram of motherless birth,' sprang fully armed from the head of Zeus, never having known the darkness of the womb?" [6; p.127]

This provocative questioning of the birth of Athena in fact questions the Ancient Greek understanding and awareness of the nature of birth and the role of mother and father in this process. McEven then suggests, "The men of classical Greece, especially the men of Athens, for whom Aeschylus spoke when he said 'the mother is no parent of the child,' knew nothing about birth" [6]. Aeschylus' words, which McEven refers follows like this:

This too I tell you, mark how plain my speech  
The mother is no parent of her child  
Only the nurse of the young seed within her.  
The male is the parent, she as outside friend  
Cherishes the plant, if fate allows its bloom [6; p.127].

McEven's critique of the Ancient Greek understanding of the role of mother is taken one-step further by the feminist Elizabeth Grosz's argument. According to Grosz,

The notion of *Chora* serves to produce a founding concept of femininity whose connection with women and female corporeality have been severed, producing a disembodied femininity as the ground for the production of (conceptual and social) universe [3; p.50].

However, one can suggest that the role of women was already severed in this period and thus was used as a metaphor in the explanation of *Chora*, instead of *Chora* producing the disembodied femininity. Moreover, Grosz's argument might be thought of as a critique of the understanding of the femininity in Ancient Greek world and as a reflection of it in the western ideology, more than trying to contextualizing or providing an understanding of the notion of *Chora* itself.

There is yet another perspective proposed by Perez-Gomez in terms of *Chora* and femininity. Following the line of the previously-mentioned arguments, Perez-Gomez also suggests that the use of the mother metaphor was "appropriate for this neutral receptacle, because biological traits were believed in classical Greece to be an exclusive attribute of the male semen." [4, p.19] However, after briefly mentioning the importance of the believed connection between the head and the womb, without specifying its relevance, he concludes that the nature of *Chora* is both male and female. Here is his argument:

... in describing the marrow, the male life substance and seed that Plato believed the lofty spherical head, seed of ideas, and of course, the male penis, he also described a substance practically identical to the neutral plastic mass receptacle in question... Genetic misconceptions aside, the prima materia is then androgenous; it's both male and female; it's both the receptacle and the semen, the substance, a receptacle of all visible and sensible things, which is itself invisible and formless [4; p.19].

Although his suggestion of thinking of *Chora* as both male and female is interesting in itself, it is questionable if his argument has a valid ground.

#### 4. CHORA IN THE ARCHITECTURAL DISCOURSE

We mentioned earlier Grosz' use of the term *Chora* as a passage way through which she expresses her feminist ideas related to western ideology. For Perez-Gomez, on the other hand, *Chora* becomes an interesting concept that he wants to use to articulate and express his ideas about architecture. One can see support for this argument in his text about *Chora*. In “*Chora as Architectural Meaning*,” Perez-Gomez begins with criticizing the current situation of architecture as a discourse and as a practice. He questions, “What architecture represents within the context of our everyday life, other than male egocentric will or repressive political or economic forces?” [4; p.16] According to him:

We simply cannot afford to give up our quest to identify what constitutes a meaningful order for human life—the promotion and perpetuation of which has been the embittered concern of architecture—and accept market indicators, personal success, aesthetic fashion, some vague formal mysticism, indices of giddiness and titillation, or mere difference as the criteria for an appropriate, reportedly significant architectural practice in the age of Nihilism [4; p.16].

Once can only glimpse the core of his argument about the meaningful order of life. He then questions, “Could architecture then embody values of a different order than these rooted in fashion, formal experimentation, or publicity and be cast in forms other than the seductive gloss characterizing all present mechanisms of cultural domination?” [4; p.16]. The way to find that alternative order is proposed by means of exploring the notion of *Chora*. It is even postulated as “...our only legitimate means for the articulation of practice” [4; p.18].

Perez-Gomez suggests that discussing the original Greek understanding of the space in architecture will help us to clarify the values we need in the architectural discourse. He equates Plato's use of the term *Chora* with that of place as well as space. He says, it is “both cosmic place and abstract space, and it is also the substance, the material, of the human crafts.” For him *Chora* is the “*prima materia*” which has no definite character of its own and yet is the ultimate reality of all things. His way of describing *Chora* resembles the McEven's suggestion of the importance of making.

According to Perez-Gomez, *Chora* is “the substance of dreams...distinct reality to be apprehended in the crossing, in the chiasm of being and becoming.” [4; p.20]. In order to support his argument, he suggests the connection of *Chora* with chorus in the Ancient Greek rituals, and especially *dromena*, which developed into drama. The significance of his argument comes from the fact that the word *chorus* is derived from the word *Chora*. In these rituals, the *chorus*, the group of dancing and singing men often in charge of lamenting destiny, is presented as the center of the activity. It has the function of cheering, acting as part of the spectators as well as actors, and thus crossing the gap in-between the two. He describes;

Tragedy inhibits a space of transition... The event takes place in the choir, the space of the *Chora*, for an epiphany of what Plato called metaxy... A disturbing moment in the in-between of ignorance and knowledge, of time and timelessness, of imperfection and perfection, of hope and fulfillment, and ultimately of life and death [4; p.20].

Perez-Gomez further argues that *mimesis* in this context signified not imitation, like a copy, but rather the expression of the feelings and the manifestation of experiences through movement, musical harmonies, and the rhythms of speech, an acknowledgement through the body's presence of its intermediate location between being and becoming in the *Chora*. Another Greek word Perez-Gomez incorporates to emphasize the crossing of the chiasm is *katharsis*, meaning a purification or reconciliation between the darkness of personal destiny and the light of the divine, *dike*, divine destiny.

And finally, Perez-Gomez describes what we could get out of this study of the Greek word *Chora*. He argues that the understanding of *Chora* as closing the gap between ideas and perceivables "would immediately undermine the common distinction that, in fact, dates from only 19<sup>th</sup> century between contained space and material container. It is simultaneously the work, the physical substance and the space; there is no distinction." [4; p.21]. *Chora* is the *significature* of architecture, providing the base for the poetic discourse he is looking for.

While for Perez-Gomez *Chora* is a means to explain his poetic discourse, for Derrida it is one of the terms he uses in his discourse of deconstructive reading of texts. As Grosz suggests,

*Chora* thus follows a long line of deconstructively privileged terms in Derrida's text... These terms each designate or locale a point of indeterminacy or undecidability, a point at which the text's own writing exceeds its explicit goals and logic where the text turns in on itself and ties itself into a strategically positioned knot [3; p.48].

Derrida's reading of *Chora* also shows how the logic of *Chora* relates to other apparently unrelated claims of the *Timaeus* and its explanation of the origins of the universe. One of the examples is Derrida's analysis of Plato's own self-conception, generally represented as Socrates in his texts. Socrates, according to Derrida, pretends to include himself among those

... whose genus is to have no place, he does not assimilate himself to them. Hence he holds himself in a third genus, in a way, neither that of sophists, poets, or other imitators, not that of the philosopher-politicians. In a third genus and in the neutral space of a place without place, a place where everything is marked but which would be 'in itself' unmarked [2; p.23].

Derrida's text about *Chora* as well as the notion of *Chora* itself has been the theme of the work that has been produced as collaboration between Jacques Derrida and Peter Eisenman. Bernard Tschumi, the architect of the Parc La Vilette in Paris, France, invited Derrida and Eisenman on May 1985, to work together on one of the Parc La Vilette's gardens, which is one of the several gardens that he proposed to different artists, writers or musicians, as to make a contribution to the urban culture of the time and La Vilette. The collaboration is documented in the work *Chora L Works* (Figure 1). Derrida presents the role of *Chora* in the dialogue with the Jeffrey Kipnis as follows:

*Chora* is the theme of which we have been speaking; *Chora* is the scene we played; *Chora* is the character, which I play with Peter. But *Chora* is also the space in which all these take place, and whence appears the unstable character of metonymy in all of this [8; p.166].

For Derrida architecture, as well as law, is the ultimate test of deconstruction. The work could even be considered as testing the strength of the resistance to deconstruction, especially technological and economical resistance. The project's budget and its incompatibility with the proposed work is one of the examples. Tschumi writes,

The first project submitted by Eisenman-Derrida was twice over budget. The collaborators were then asked to modify the design to fit within the cost constraints. However, when the project was resubmitted it was six times over the budget. The French administration even questioned the collaborators' desire to build the garden [8; p.166].

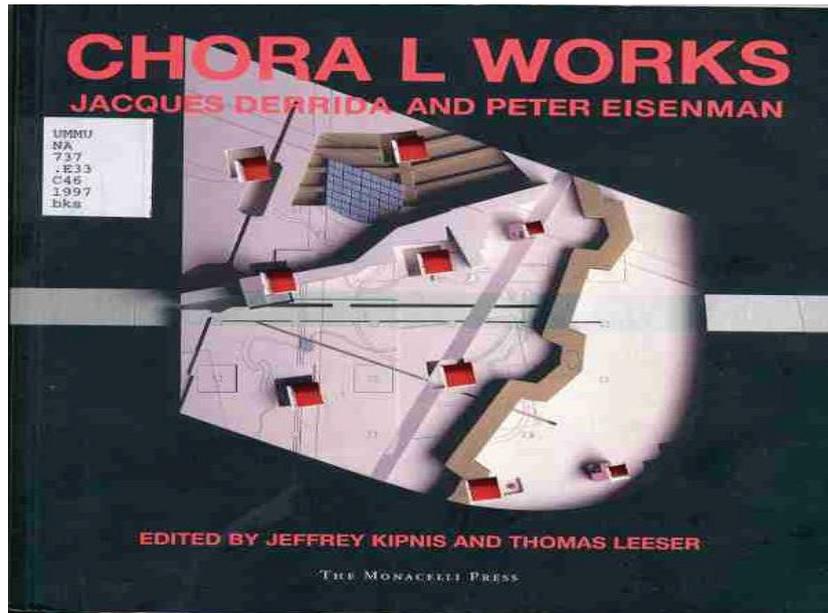


Figure 1. *Chora L Works*

This project provides an opportunity for Derrida he experiences working on an architectural project. His role is to provide the philosophical inspiration for the project, as well as for the architect. While he is trying to stay away from the role of the architect, he still cannot escape getting involved in the architectural aspects of the project. He describes his approach as follows;

To the extend I was engaged in this collaboration with Peter, perhaps I felt myself to be too much the philosopher to assume any architectural responsibility. I was therefore resistant to architecture while at the same time hoping, no doubt, to be more of an architect than Peter [8; p.166].

For the architect of the project, Peter Eisenman, *Chora* is a concept proposed by Derrida as a philosophical basis from which the architectural work will spring. Eisenman is delighted to work with Derrida. This collaboration provides an opportunity for Eisenman to work directly with the philosopher whose ideas he adopts for his own discourse. Eisenman describes his admiration of Derrida as such, “First of all Jacques, I am too much in awe of you... in our collaboration I am in such an awe of you that it was

very hard for me to confront you." [8; p.93]. Still this condition doesn't eliminate the contradictory positions of the two. Derrida himself, for example, criticizes Eisenman's approach to make the project an object rather than an architectural work.

## 5. PARADOXICAL *CHORA*

The use of the mother metaphor, apart from shedding light on the Ancient Greek understanding of femininity, helps us to understand the notion of *Chora*, as does the use of the golden shapes example. Still, Plato's presentation of the notion of *Chora* itself is problematic. It seems as though whatever Plato might have tried to express the nature of *Chora*, it was not, and would not have been enough. Why the definition of *Chora* is so problematic for Plato seems to be a key point to understand the very notion of *Chora* itself.

I suggest there is a relation between the description of *Chora* being problematic and the use of the Greek term *Chora* itself as a terminology and not one of its translations as space or place. For Derrida this is related with the interpretation of the word *Chora*. He explains,

whether they concern the word *Chora* itself (place, location, site, region, country), or what tradition calls the figures proposed by Timaeus himself (mother, nurse, receptacle, imprint-bearer), the translations remain caught in networks of interpretation [2; p.16].

However, I believe there is more than just the lack of proper translation. *Chora* itself is presented to us as a new concept that we are not accustomed to, for which we don't even have a suitable word. Derrida, for example, insists on not using the definitive article for *Chora*. The article "presupposes the existence of a thing," and according to Derrida this is unacceptable. His argument is supported by Plato's description of *Chora*, which is not a part of the types of existence that Plato himself based his discourse on. Derrida's own explanation follows:

But what is said about *Chora* is that this noun does not designate any of the known or recognized or, if you like, received types of existent, received by philosophical discourse. i.e., by the ontological logos which lays down the law in the Timaeus: *Chora* is neither sensible nor intelligible [2; p.17].

Derrida further argues that *Chora* was even alien to Plato himself: "*Chora* is irreducible to everything that gives Plato's philosophy coherence... It's something which cannot be assimilated by Plato himself, by what we call Platonic ontology, nor by the inheritance of Plato." [2; p.10] This description suggests that not only Plato himself couldn't assimilate *Chora*, but also we, the contemporary modern human, sharing the western ideology with him, cannot assimilate it. And, the reason for not being able to understand *Chora* is presented as being related with the Platonic world-view. Derrida argues:

What Plato in the Timaeus designates by the name of *Chora* seems to defy that 'logic of contradiction of the philosophers', that logic of 'binarity of yes or no.' Hence it might perhaps derive from that 'logic other than the logic of logos... the logic of the myth, mythos [2; p.15].

The logis of the myth here refers to the world-view before Plato. In order to shed light on this logic of the myth, I will refer to different universes proposed by Plato and Anaximander.

## 6. DIFFERENT UNIVERSES OF PLATO AND ANAXIMANDER

McEven contrasts Plato's description of the universe in *Timaeus* with that of Anaximander's. In Plato's description, she argues, "The entire universe is an artifact constructed as a *paradeigma* by a craftsman, a *demiourgos*." [6; p.41]. In this description, the universe is the definite, eternal nature, whose pattern or paradigm is the immutable Idea that Plato's *demiourgos* copied when he made the world of Becoming in time. On the other hand, Anaximander talks about a "boundless nature (*hetera tis physis aperios*) from which all the heavens arise and the *kosmoi* (orders) within these heavens." [2; p.13]. Heavens in Anaximander's universe might be compared to Ideas in Platonic universe. However, there is a significant difference between the two. Plato's Ideas are eternal, non-changing and prioritized over perceivables, which are considered mere copies of Ideas. In Anaximander's universe the source of heavens as well as cosmos is the same boundless nature, "*hetera*". The structure of the universe proposed is not hierarchical. As McEven suggests, Anaximander

does indeed postulate (*hetera*) some other boundless nature-as-coming-to-be, which encompasses and, like the helmsman of a ship, steers all things, giving rise to heavens and the *kosmoi* within them. But this boundless source is *hetera* 'other'; it is unknown and unnamable. [2; p.16].

In other words, there is an intricate closeness between heavens and the *kosmoi*. The difference, the separation proposed by *Chora* between the nature of immutable Ideas and copies of them is not here. There are no Ideas different from perceivables, no heavens different from *kosmoi*. McEven suggests this source, this boundless nature, "other," was simultaneously made to appear and discovered through the making. It might be helpful if one thinks of making as the creation of the heavens in one's hands. In Plato's description, on the other hand, the Ideas, ideal immutable forms, are completely away from one's reach; they exist apart from the living being.

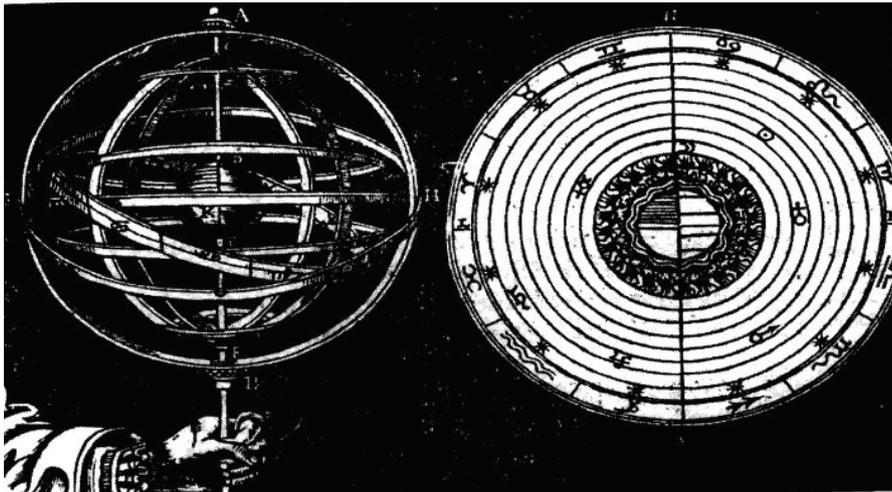


Figure 2. Anaximander's Image of Cosmos

The difference between Plato's universe from Anaximander's, and thus the difference between the nature of *Chora* and *hetera*, becomes clearer when she describes Anaximander's model of the universe. Anaximander, "presiding at the birth of theory", made an image of *kosmos*, whose constituent parts were

a celestial sphere, a map of the world, and a sun clock (gnomon). According to McEven this is a critical point in history since "the image, as an image, for the first time presented *kosmos* as a spectacle, a *theoria*" [2; p.20]. McEven argues that Anaximander's cosmic model,

as he himself was well aware, could have taken any number of forms, for as he speaks of them, the heavens and the kosmoi within them are plural. Indeed, part of his speculation was the positing of the existence of unlimited worlds [2; p.47].

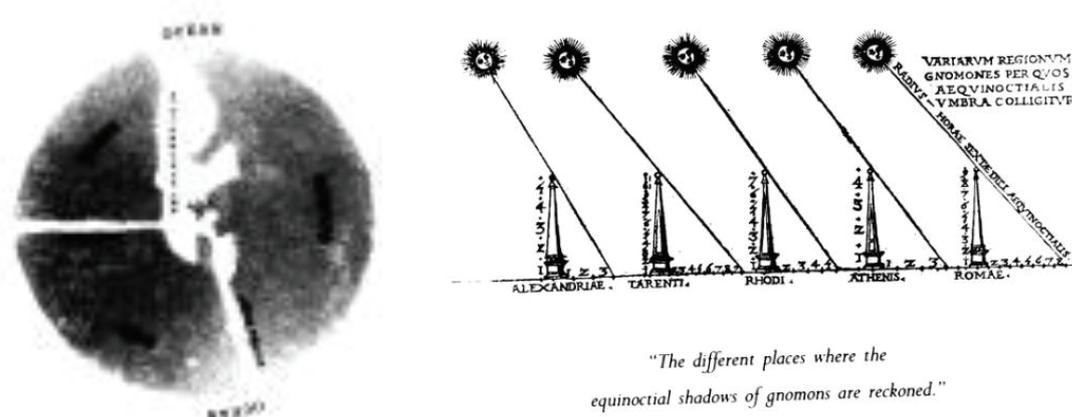


Figure 3. Anaximander's map of the world (left) and Sun clock gnomon (right)

However, Anaximander's model, once made, was recognized as having coherence, and confirmed the configuration of a universe from experience to have the Earth, and Hellas, at its center. Because of this, and because there were no others, McEven argues, Anaximander's became the model: "in Plato the *paradeigma* for a *demiourgos* whose creation of *kosmos* was no longer a question of *making* a world appear, but a matter of representing one through the duplication of an immutable pattern." [6; p.47]. The point McEven directs our attention is the devaluation of making, the craftsmanship, and elevating the value of *theoria*, theorizing, and most importantly their separation. This, I believe, is directly related with the difference that is put between the object and subject, which is necessary for theorizing. Although this point is interesting in itself to examine further, it's outside of the scope of this paper.

Although McEven, Perez-Gomez's student, argues that Plato's universe reflects the hierarchy, duality, of being and becoming, and thus puts the corner stones of the western ideology, Perez-Gomez himself criticizes the very understanding of Plato's articulation of reality as a simple duality of being and becoming. He suggests Plato's feeling of "the need to introduce a third term to do justice to his experience of human affairs," [4; p.19] as an indication of his postulation of reality as a unity between the two worlds, the Ideas and perceivables. This argument is very questionable given the body of literature about the significance of Plato's role in the creation of dualistic western ideology.

## 7. FINAL WORDS ON CHORA

For Perez-Gomez, "*Chora* is the sight of darkness that is our nature and must be preserved for the survival of humanity" [4; p.31]. To understand and to explain *Chora*, however, has been problematic since the day Plato introduced it into the discourse. Derrida further suggests that it will be always

problematic and that Plato's words that "this is how one can glimpse *Chora* – in a difficult, aporetic way and as if in a dream," is equal to saying "This is what hence forth all the interpretations for all eternity, of what I say here, will look like" [2; p.19]. The reason why is critical. *Chora* has been introduced by Plato out of the necessity to make the creation story introduced earlier a coherent one-in spite of the fact that the third kind introduced made the ontological logic laid down in the *Timaeus* more incoherent. And I argue that it is because *Chora* itself cannot be part of the universe proposed by Plato. Rather it is reminiscent of the logic of myth existed before him. [10] And although Perez-Gomez is right to direct our attention to the problems that architectural discourse and practice are facing, *Chora* itself cannot help us clarify the meaning of architecture and thus create meaningful environments necessary for the survival of humanity.

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# Analyzing the Residential Energy Efficiency Concept through Systemic Feedback Approach



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**Abstract:** Construction projects include several dynamic features consisting feedback structures, time lag and nonlinearity in cause-effect relationships among project fundamentals. These aspects cause projects to act in complex conditions, which are incomprehensible, unforeseen and difficult to manage. Therefore, during project processes, development of project performance acquires creating mental models and decision heuristics. This article seeks to develop our knowledge capacity about relationships of project parameters in the context of building energy efficiency concept. The objective of the study is to provide a feedback mechanism based on building structure, retrofitting action and also end-user behavior. At the end of the paper, suggested feedback model is analyzed and general behavior of the system is evaluated.

**Keywords:** System dynamics, systemic feedback approach, residential energy efficiency

## **Konut Enerji Verimliliği Kavramının Sistemik Geribildirim Yaklaşımıyla İncelenmesi**

**Özet:** Yapım projelerinin temelinde, geri bildirim mekanizmaları, zaman gecikmeleri ve sebep-sonuç ilişkilerinde lineer olmayan çeşitli dinamik yapılar yer almaktadır. Bu yapılar, projelerin anlaşılabilir, öngörülemez, yönetilmesi güç, karmaşık bir hal almasına neden olur. Bu sebeple, proje performansının geliştirilmesi için proje süresince, zihinsel modeller ve karar verme mekanizmaları buluşsal yöntemlerle desteklenmektedir. Bu çalışma, bina enerji verimliliği kavramını temel alarak proje değişkenlerinin ilişkilerindeki bilgi kapasitesini geliştirmeyi amaçlamaktadır. Çalışmada aynı zamanda, bina yapısına, yenileme faaliyetine ve nihai kullanıcı davranışına dayalı bir geri bildirim mekanizması oluşturulmaktadır. Araştırmanın sonucunda, önerilen geribildirim modeli incelenmekte ve sistemin genel davranışı değerlendirilmektedir.

**Anahtar Kelimeler:** Sistem dinamikleri, sistemik geribildirim yaklaşımı, konut enerji verimliliği

## **1. INTRODUCTION**

Construction projects require overall planning, organization and control of the works from beginning to completion. Demands and complexity increase in both big and small scaled building projects. In the long run, these issues cause some changes on time, scope and the goal, which are the keystones of a project, furthermore it brings back the alterations of project performance and cost. For instance; in any process of a project, demands of the client regarding the design of the project create delays besides budget exceeding.

Over the years, need and desire find themselves a place in a sustainable context and its sophistication in construction industry. With sustainability approach and energy efficiency concepts, construction industry has faced with the different dimensions of the building sector. Due to the two main considerations, sustainability is strongly connected to the construction sector. First one, building trade is more effective on the environment when compared to the other human actions; building and construction sector uses the 25-40% of the total energy in OECD (Organization for Economic Cooperation and Development) countries and also 'built environment' leads to 40% of the world greenhouse emissions [1]. Second consideration is the leaning of people to transform their houses to more comfortable and healthy places. However, arising complexity and need to construct new sustainable buildings or to convert the old buildings to new ones started to bring risks, disturbances, changes, excessive energy consumption, delays and cost overruns in tow.

Retrofitting is a crucial part of both meeting emission decrease purpose and replying the user's need. It also supports the energy use in a more effective way and generates sustainable lifestyles [2]. As in all construction projects, in retrofitting ones; feedback, time delays and nonlinear relations affect the project performance in a reducing way and complicate the management of the project [3]. Moreover, the prediction of future energy concept and cost savings become difficult.

Construction projects include several dynamic features such as feedback structures, time lag and nonlinearity in cause-effect relationships among project fundamentals. These aspects cause projects to act in complex conditions, which are incomprehensible, unforeseen and difficult to manage [4].

The effects of dynamic project characteristics can't be understood and run efficiently by managers. So, during project processes, the development of project performance acquires creating mental models and decision heuristics.

This research seeks to develop the understanding of our knowledge capacity about the relationships of project parameters within the frame of building energy efficiency. In the study, system dynamics (SD) modeling technique supporting a holistic view of arrangement is applied for the understanding [5] of a residential building construction project.

## **2. LITERATURE REVIEW**

### **2.1. New Building Construction and Retrofitting Project Characteristics**

Budget and time define the main characteristics of construction projects. These interdependent components in fact affect each other during project processes. For example, a decrease in budget causes the slowdown of project completion [6].

In the literature study of Favié and Maas [7] the characteristics of building projects were defined and some of the most common characteristics of the projects were determined respectively, to be: Project complexity, size (floor area, number of stories, etc.), type (residential, office, public building, building

retrofitting, etc.), political, legal and economic conditions, completion time of the project, contract form and liability division, project location and environmental concerns, technological improvement level, lifespan of project, project value and quality etc.

Since new building construction projects have more economic and environmental restraints, retrofitting projects has become crucial. Quality increase and cost decrease, replying environmental requirements and integration of new technology with old structure are some of the retrofit projects justifications.

According to Sanvido and Riggs [8]: “A retrofit project is the modification or conversion (not a complete replacement) of an existing process, facility, or structure. Such modification may involve additions, deletions, rearrangements or not-in-kind replacements of one or more parts of the facility.”

The retrofit projects have many limitations for stakeholders as different from grass roots projects. Owners, constructors, operators and designers are not free to realize whatever they want to do. However, good management strategies can overcome the possible budget, schedule, mitigation problems and such. Below, the constraints are explained in terms of retrofit projects.

**Information** is limited in retrofit projects. Buildings can be old and also scope of project, used materials and drawings cannot be clear.

**Time** is another constrain that becomes restricted until a plant is shut down. Since the time is affected by all factors, it is a crucial parameter that should be managed carefully.

**Space** is the necessary area for operations in retrofit projects, so it is one of the most important constraints. In an existing structure, while retrofitting implementations, laydown areas, narrow accesses and area for the equipment and rigging can cause problems.

**Environment** is constrained; because air temperature, working with risky materials, elevated noise and vibration affects retrofitting project process and completion [8].

## 2.2. Building Energy Efficiency Concept

Building energy efficiency is the scope that the energy use per square meter of floor area of the building meets the established energy consumption criterions for that specific building type under identified climatic conditions. Building energy consumption benchmarks are seen as symbolic values for common building forms against that an actual performance of the building can be analyzed.

Building energy consumption standards are obtained from the analyses of different building types within a certain country. Median level of performance which is taken from all buildings in specific category is accepted as typical benchmark. The benchmarks differentiate according to country and building type. They are used in HVAC applications, lighting and electrical implementations. Heat loss measure called “U-Value” is also one of the ways to define the building energy performance. U-Value is defined as the transfer rate of heat (thermal transmittance) through one side to another which becomes temperature difference. The measurement unit of U-Value is  $W/m^2K$ . The lower the U-Value is, the better the energy efficiency becomes. Since the openings in a structure gain or lose heat, the amount of required energy increases for heating and cooling. Therefore, most building codes arrange minimum standards for the energy efficiency of doors, windows, walls and skylights.

In countries, the demand for energy services is increasing day by day, so the governments are in cooperation with end-users to meet growing demand and to extend the generation capacity. With energy efficiency investments, lots of benefits are provided in buildings. For example; energy use is reduced by balancing space heating/cooling and water heating activities; household appliances, office machinery and lighting tools are adapted for effective electricity use; the value of property increases, required capital outlay and stand-by systems' costs decrease; depending on all of these benefits, end-user comfort rises considerably [9].

Looking at the building as a whole, the architectural and energy design of the building must be considered together. Hence, the requirements for lighting loads and interior improvement can be met by minimizing the capacity of mechanical and electrical systems and by architectural design solutions [10].

The holistic structure approach can be implemented effectively through simulation software, especially at the planning stages. Thus design objectives can be controlled and design changes can be re-assessed before implementation. In the study, the system dynamics approach is used to evaluate the energy efficiency status of a building, by determining impact parameters, and by analyzing the relationships of variables with a holistic approach.

### **2.3. System Dynamics Approach**

SD approach rejects traditional methods requiring detailed component models in projects, and it focuses on behavioral modes and feedback relations of dynamics [11]. Feedback perspective is the main concept of the system dynamics. The behaviors of complex systems can be easily understood, explained and arranged with systemic feedback approach. Defining the possible project risks is very important to get a timely intervention; so that the risks don't comprise of individual factors. It is necessary to manage and look at the whole system to determine the risks and its effects [12].

Regarding the history of System Dynamics (SD), SD is a way of going beyond traditional realm of systems approach towards a wide-ranging complicated engineering problems. SD takes an interest with internal relation of different factors of a system on schedule. In addition, SD takes the dynamic quality by integrating such concepts as stock, flows, feedback and delays. Accordingly, SD sheds light on the dynamic behavior of system in time. SD is a knowledge domain and therefore it can be considered as a logical extension of systems engineering (SE) and systems analysis (SA). SD explicitly checks out the dynamic behavior that develops because of delays and feedbacks in the system. Jay W. Forrester, who is the management professor at the MIT/Sloan School, is seen as the founder of this novel method to comprehend and figure out the problems in the business and social science domains. SD had a significant intellectual effect across the world. Very notable and disputable applications of SD are the growth of world models, World2 and World3, which were put out in World Dynamics (1971) and in The Limits to Growth (1972) chronologically. Despite using system dynamics, the world models were in the line of fire from a very wide range of disciplines, government and academia, they accomplished to bring some of the very important difficulties and troubles that humankind is facing today to the front row of academic and political thought process. As a method, system dynamics has been successfully used in a broad array of business and socio-economic areas to comprehend the troubles and find out different policy interventions. It is believed that SD is such a substantial tool that it could be utilized successfully for a wide range of problems, but for the growth of SD, it needs a leap to go beyond where it is today [13].

SD field appeared in the late 1950s under the leadership of Jay W. Forrester. A novel discipline came into existence, called Industrial Dynamics and it was first implemented in the area of the strategy management of industrial obstacles [14]. Industrial problems took on a different perspective and were named “System Dynamics” following the book “Urban Dynamics”. Being the second field, “World Dynamics (and Limits to Growth)” which was on the growth of population and financial development policies came into being during the late 1970s. Since then SD has spread out to a lot of various areas such as project management, economy, education, energy, politics, psychology and health. [14].

The founder of system dynamics, Jay W. Forrester became a part of MIT as a graduate student in the Electrical engineering department, and Gordon S. Brown employed him as research assistant in the new servomechanisms laboratory in 1940. In 1956, Forrester participated in the MIT Sloan School of management and he formed the system dynamics basis there, a way to comprehend the dynamic face of varied business related matters and troubles. He made a larger use of system dynamics in business management area and officially mentioned the SD methodology in his book *Industrial Dynamics* that was printed in 1961. The fact that he met and discussed with former Boston mayor and then visited professor at the MIT caused spreading of the SD method to make out the urban housing problem in the Boston Metro area, which resulted with the publication of *Urban Dynamics*, his next book, employing system dynamics methodology in the field of social sciences [13].

### 2.3.1. Systemic Feedback Approach

The word dynamic has a meaning of “change” with the effect of time factor. In dynamic behavior, variables are active and have systemic feedback sense. Population growth, inflation rates, supply chains, etc. are some of the dynamic events and their dynamic acts should be conducted, changed or sometimes cancelled.

In a dynamic system, variables should be described internally. This approach creates an endogenous perspective for a system. It doesn't mean there are no external forces affecting the system. The main point is that external effects can't be controllable and manageable whereas feedback problems need to be managed and controlled continually. Feedback problems also require observation, assessment of impacts and getting different solutions.

#### 2.3.1.1 Main Concepts of System Dynamics

To mention System Dynamics, a “system” phenomenon is thought firstly. Basically, “a system” occurs from elements coming together with each other in a significant way. It is probable to give body system, trading system, legal system, health system and etc. as examples to the systems.

When system yields problems, complexity increases; and to explore problems and to find possible solutions, “**modeling**” concept exist. Problems are searched specifically, so models are set on particular issues; in other words, the whole system isn't modeled. According to the problem, model can be in practical or theoretical way, but only in case of a matter and objective existence.

System structure is formed with the whole relations of system variables [14]. Depending on structure, dynamic behaviors exist. Dynamic behavior types are; constant, growth, decline, growth and decline, decline and growth and oscillatory as represented in Figure 1.

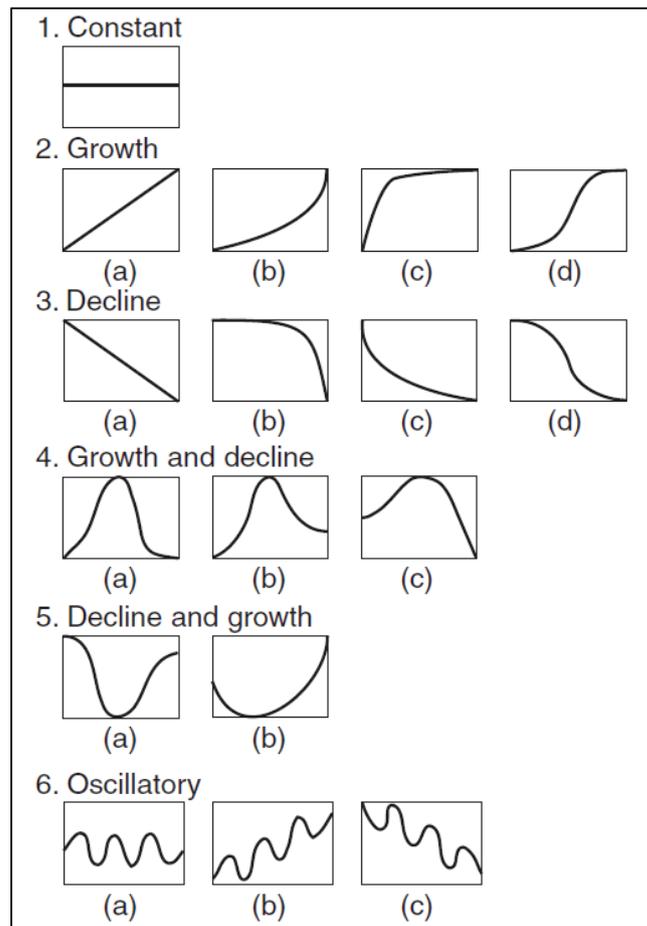


Figure 1. Detailed display of dynamic behavior graphs [14]

Based on the System Dynamics objective, it is possible to define some rules respectively for systemic feedback;

- Causal relations should be established instead of simple correlations. Simple correlations don't give us an idea about the causes of dynamics. In causal relations, input affects output and the replies of “why” are clear.
- Causal relation should be set in circular way overtime (feedback). By virtue of feedback logic and dynamic behavior, output can also influence the input as a result of input influencing output. In this situation, it is crucial to take into account that the casual relations are in a direct way.
- "Dynamic behavior patterns" should be adjusted instead of "event-orientation". Dynamic model can't be developed by considering the events in an isolated way. To create an accurate model, it is needed to investigate the underlying historical and structural causes of the events. With dynamic behavior diagrams, the causes of the problem can be more obvious, and depending on this, more appropriate policy analysis can be generated.
- An internal structure (endogenous perspective) should be generated in order to obtain dynamic behavior.

A forementioned dynamic behavior formation depends on structure. For structure representation, casual links and loops are created between elements. When the variables affect a dynamic behavior externally, it can only obtain an idea about the reasons underlying the behavior shown in the example in Figure 2.

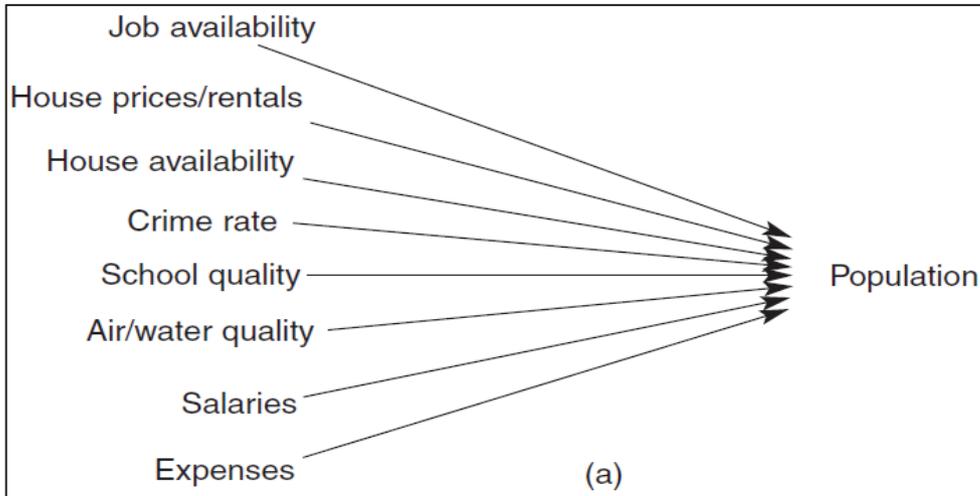


Figure 2. An exogenous model of city population [14]

However, to understand the main causes and produce possible policies about dynamic behavior, the variables of the structure should be related internally. Feedback approach is provided with internal structure displayed in Figure 3.

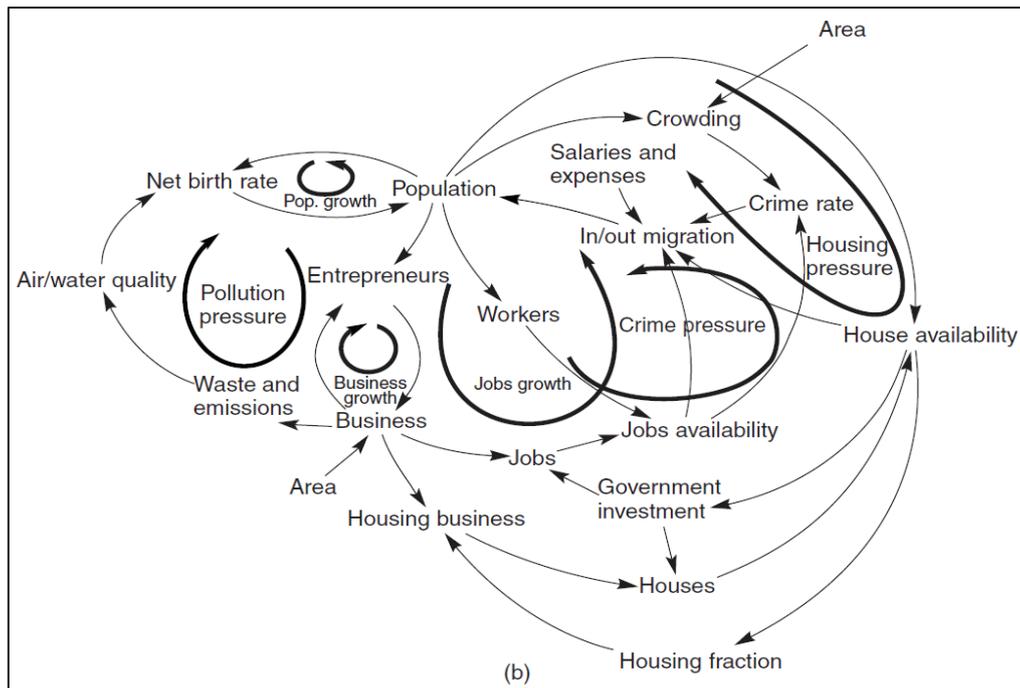


Figure 3. An endogenous model of city population [14]

- Systems approach should be properly defined  
 In systemic perspective, it is important to make the distinction between endogenous and exogenous structure well. External factors affecting the system can't be handled and it is difficult to define a boundary then. On the other hand, internal dynamics identifies the model boundary and the boundary is required to be established greatly. While determining the boundary, it is needed to recognize relations and interactions of internal variables with each other and also with external elements. Another issue to be noticed for systems perspective is the modeler's ability that decides the boundary of the model.

**2.3.1.2. Positive and Negative Feedback Loops & Causal Loop Diagramming**

Based on the relation of  $X \rightarrow Y$  causality (x is an input and y is an output), while X is increasing, Y is also growing. This effect has a positive meaning. If X increases and then Y decreases, this becomes a negative influence; Figure 4 shows negative and positive loop examples.

Causal loop diagrams (CLD) are formed with positive and negative feedback progresses. Cause and effect relations are identified with CLDs. CLDs don't include stocks and flows, they explicitly contain the stock and flow structure.

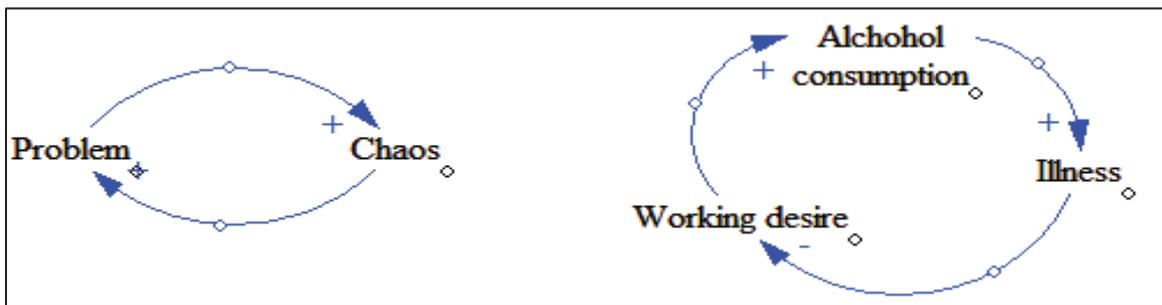
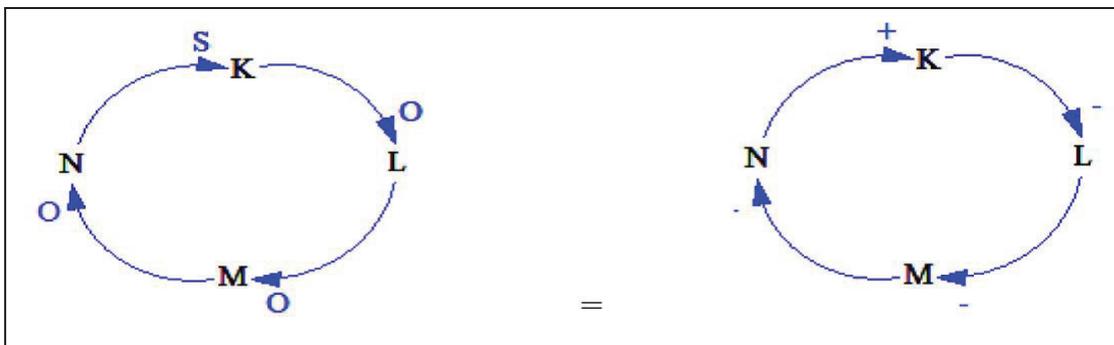


Figure 4. Positive and negative loops

Causal diagrams have some general symbols (letters) to indicate system's situation. (Figure 5 a and Figure 5 b).



- S: Same direction (plus (+) sign)
- O: Opposite direction (minus (-) sign)

Figure 5a. Signals of causal loops



R (Reinforcing):  Snowball rolling down icon

B (Balancing) = C (Counteracting):  Teeter-totter icon

Figure 5b. Signals of causal loops

### 2.3.2. System Dynamics Application Areas

Sterman [15] declares how widely practicable of SD is: “System dynamics has been applied to issues ranging from corporate strategy to the dynamics of diabetes, from the cold war arms race between the US and USSR to the combat between HIV and the human immune system. System dynamics can be applied to any dynamic system, with any time and spatial scale. In the world of business and public policy, system dynamics has been applied to industries from aircraft to zinc and issues from AIDS to welfare reform.”

SD modeling technique is specifically used in medicine, law, urban studies, global studies, environmental studies, information science, literature, history, economics, finance, chemistry, physics, etc. [15].

In the construction industry, SD usage has been increased in the context of managerial and improvement problems analysis [16]. In the field of construction management, system dynamics (SD) modeling techniques are often applied based on time and cost variables. Yaghootkar and Gil [17] searched the impact and significance of project management within the context of schedule-driven and capacity of resources. Nasirzadeh and Nojedehi [18] examined the labor productivity and its effects on project performance through the SD-based modeling approach. Xu et al. [19] studied “Public-Private-Partnership” (PPP) being one of the preferential procurement methods of highway projects. White [20] evaluated the minimization of SD models of projects in terms of variable numbers and non-linearity. Laslo and Goldberg [21] handled organizational conflict problem based on matrix structure, similar skilled group of people coming together for work practice in a multi-project environment. Eden et al. [22] compared the two approaches of litigation; system dynamics modeling technique and measured mile analysis. Nasirzadeh et al. [23] studied on construction risk allocation which was the important problem between contractors and owners. Titus et al. [24] searched the problems of construction industry in Kenya, depending on the fluctuations in construction activities and slow growth. Cui et al. [25] wrote about the effect of SD on cash flow management strategies on construction projects. Nasirzadeh et al. [26] handled the risk management problem of construction projects. Tang and Ogunlana [27] studied on dynamic performance of local construction organizations in Malaysia affected from Asian financial crisis. Tang and Ogunlana [28] addressed the changing activities of Asian construction sector with the effect of globalization. Love et al. [29] and Li et al. [30] focused on the construction rework impacts on projects. Lé and Law [31] analyzed the complex learning system in an architecture, engineering and construction

organization (AEC) industry. Chen and Fong [32] discussed the knowledge management capability (KMC) evolution and knowledge processes in construction firms in accordance with supplying the needs of changing market environment, conducting and controlling the challenges, and also estimating performance outputs based upon time factor. Tatari et al. [33] studied on enterprise resource planning systems (ERP) in construction industry which its proper management enables financiers or stakeholders to make successful investment and get accurate information flow about construction processes. Hwang et al. [34] addressed the problem of imbalance between supply and demand in Korean housing market.

The energy efficiency based on the residential building structure and the interior systems has been examined thoroughly in the built environment studies in the literature. In the case of studies other than the general one, the problem of CO<sub>2</sub> emissions in the urban context has been scrutinized. Onat et al. [35] addressed the U.S. residential buildings in order to find out the possible policies for decreasing or stabilizing the Greenhouse Gas (GHG) emissions in their research. Mid and long term policy effects of green buildings were studied with stock-flow diagram. Armenia et al. [1] mentioned that the energy saving was an important issue in recent years. The paper analyzed socio-technical factors to provide energy efficiency and technological improvement. Authors studied the relationship between building's technical performance and occupant's feelings about it. Blumberga et al. [36] examined that if First National Energy Efficiency Action Plan (EEAP) of Latvia was sufficient in its own context, it was due to the fact that Latvia had the big potential in energy savings with renovated apartment buildings, however planning processes were weak. Fong et al. [37] considered system dynamics model (SD) in an urban context. Main theme was to estimate the status of CO<sub>2</sub> emissions that are growing in Malaysia -especially Iskandar Development Region (IDR) and Johor Bahru city as urban conurbation- in the future. Thompson and Bank [38] applied System Dynamics (SD) modeling technique as a proof-of-concept approach. An air system model and infection sub-model was created and the impact of the bio-terrorist attack was examined. Dyrner et al. [39] addressed the energy efficiency scenarios based on household appliances in residential buildings with system dynamics (SD) modeling technique. Xing et al. [2] assessed the retrofitting action of building with the combination of system dynamics (SD) modeling technique and SAP tool –building physics model- and they called this model as ‘SdSAP’. Oladokun et al. [40] studied household energy consumption and CO<sub>2</sub> emission (HECCE) reduction system.

### **3. METHODOLOGY**

Lots of models adopting the system dynamics approach [5] include the dynamic aspects into models of project improvement. The project dynamic behavior hypotheses of the modeler are represented by feedback structure and a framework is created on the modeler's researches of the project behavior. In the paper, retrofitting construction project management is considered, depending on the concept, building energy parameters are identified as the dynamics, which can affect the project's performance throughout retrofitting process of the project. Further, SD model is used to evaluate the energy efficiency situation of a building by determining the impact parameters and analyzing their relationship in a holistic approach.

#### **3.1. Identification of Building Energy Efficiency Dynamics**

Considering the building retrofitting projects, the parameters of building energy efficiency can be taken as project dynamics, such as climate data, shading barrier, CO<sub>2</sub> emission, building zone, building material, used appliances, lighting, ventilation, heating-cooling, water heating, building location and form [41]. The parameters that complicate the projects and affect the project performance are briefly described below.

**Climate Data:** One of the important factors defining the building energy performance. It also affects the environmental performance and it is a determinant for the results of energy efficiency simulations.

**Shading Barrier:** It is defined as “surrounding buildings” that block the sun light of main building. Distance to the building, effect sizes and impact surface are the important parameters of shading barrier.

**CO<sub>2</sub> Emission:** It is the result parameter coming from the simulation of building energy performance. When it is thought that CO<sub>2</sub> emission is caused by buildings, it becomes an impact parameter in energy effectiveness.

**Building Zone:** Refers to the independent interior spaces of the building due to air-conditioning, heating and cooling systems. Units which have similar ingrain can be taken as separately or in common zones in a simulation program. Zoning facilitates the calculation of the energy performance.

**Building Material:** It describes any of the material constituting the building. While entering the data to the simulation program, columns, beams, walls, ceilings, slabs, building envelope, doors, windows etc. are considered as direct elements relating to the building performance. Especially building envelope is crucial factor for thermal insulation of buildings.

**The Appliances Used in the Building:** All kinds of electronic devices (computer, heater, kitchen equipment etc.) that are used for the furnishing of the building affect energy performance and efficiency.

**Lighting System:** Interior and exterior lighting elements and natural lighting factors support minimum energy consumption and provide energy efficiency.

**Ventilation System:** The model and capacity, type, power and age of the ventilation system are necessary variables for energy performance assessment and simulation modeling.

**Heating and Cooling Systems:** These systems are integrated to each other. Heat gains and losses, coefficients, temperature differences, material characteristics and impact values are considered as main determinants of the systems, and are entered in the simulation program separately for each element. Heating and cooling parameters are the most important factors that influence the building in energy efficiency context.

**Hot Water System:** Similar to the ventilation system, the capacity, power, type and age of the system define the hot water system parameters. This factor is seen as energy consumption data in simulation.

**The Location of the Building:** The topography of the building, distance between adjacent buildings, utilization time from the sun, direction of the facades are the main factors that designates the building location.

**Form of the Building:** The geometric structure, the size and number of doors and windows, roof details, number of the story, building and story height, building surface area, the location and size of the opaque and transparent components are crucial determinants for calculation of building energy efficiency [42].

These parameters affect the building's energy needs and performance when combined with the time factor, thus it is difficult to estimate and control the dynamic parameters. With system dynamics approach, the interrelations of the impact parameters are emphasized to provide right control of the systemic behavior and risks. Based on the parameters mentioned above, a feedback model is established for energy efficiency extent. In the development of the general feedback model, while some parameters are added directly to the loop, some parameters are not included.

### 3.1.1. Framework of the System Dynamics Model (Qualitative Model)

The study suggests a qualitative feedback model that provides information between project parameters in limited time and space. Model framework is generally based on residential energy demand (RED), residential energy consumption (REC) and heating and cooling energy efficiency (HCE) parameters which are acquired from the literature reviews and these variables are integrated to each other (Figure 6).

The causal map is created by "Vensim" software and the cycle descriptions are expressed in the following order; Loop 1 is residential energy consumption one and this loop is formed as REC → Comfort level → Quality of life → Size and Number of House → REC. Here, the parameters affect each other in a positive way, so this loop is called reinforcing or positive loop (R1). Loop 2 defines heating and cooling efficiency as Heating & Cooling Efficiency → REC → CO<sub>2</sub> Emission → Climatic Impact → HCE and it is a reinforcing loop again. When loop 2 and loop 1 are connected via comfort level factor, new cycle becomes balancing (B3) and it is shown as HCE → Comfort Level → Quality of life → Size and Number of House → REC → CO<sub>2</sub> Emission → Climatic Impact → HCE. It means that an increase in HCE balances REC via comfort level. Loop 4 includes RED → Use of Installed Capacity → Energy Cost → RED and the loop becomes reinforcing (R4). Loop 5 creates people satisfaction cycle based on energy cost such as; RED → Use of Installed Capacity → Energy Cost → People Satisfaction → RED and it is identified as positive loop (R5). Further, RED has a few different loops in itself consisting of energy price; another one of them is Loop 6 which is described as RED → Energy Capacity Depletion (ECD) → Energy Cost → RED. This loop is balancing (B6) because of the aim being to balance the demand. Loop 7 shows the relation of energy supply and demand. It is formed as RED → ECD → Investment Incentives → Energy Supply → Energy Cost → RED and this loop is balancing again (B7). Loop 8 is based on energy alternatives parameter and this relation is displayed as in RED → ECD → Energy Alternatives → Energy Cost → RED and this eighth cycle is reinforcing (R8). In loop 9, when conservation increases, energy demand decreases. Here, the loop becomes like RED → ECD → Conservation → RED and it is assigned as balancing loop (B9).



#### **4. CONCLUSION**

In the study, the effect of building variables on the energy efficiency was analyzed by feedback cycles. Residential energy efficiency feedback loop shows the relations of impact parameters and their effects on each other. In the model, comfort level is kept balanced by increasing heating-cooling efficiency and decreasing energy consumption. Moreover, people satisfaction loop is a reinforcing one and its escalation depends on energy demand, installed capacity usage and energy expense.

In the causal map, the parameters don't affect each other alone, and so it is not true to think that only one parameter changes the system's behavior; the system's behavior depends on the loops including all variables' relation. The resulting causal maps do not have the same strength, while some cycles are dominant in the system, some cycles may be weaker. There should be a control mechanism for this and thus feedback is the mechanism that controls this. To enlighten the subject with an example; when a house wall is destroyed, it is not easy to suppose status and effects of such parameters like the cost of demolishing a wall, the time spent in demolition, the arrangement to be done after demolition, etc. By creating a feedback model, the wall demolition/renewal system can be kept under control, the probabilities and the effects can be estimated to a certain extent and decision making process accelerates. Besides these, while setting a feedback model, it should be noted that making good adjustments such as which loop is to be balancing and which loop is to be reinforcing, directs the whole system.

Furthermore, starting from the change in home heat setting, the energy efficiency of public buildings such as office buildings; public offices can be assessed with system dynamics approach and the designs can be formed accordingly. The dynamic variables can be intervened before implementation, by planning energy efficiency applications practically and cost-effectively. In the planning phase, the possible effect of an unapplied element can be analyzed because it is not considered necessary in the design of the building. Also, the reasons of dynamics having bad effects on the system are defined, and it is intended to eradicate or minimize them by improving new and powerful policies.

##### **4.1. Limitation and Future Directions**

This paper is a part of an ongoing thesis study. The feedback diagram emphasized in the article is not enough on its own in the decision-making process. Although it is possible to see the interrelationships of parameters in these cycles, the model must be digitized with mathematical equations in order to develop effective decision-making mechanisms. In the following section, qualitative feedback model will be transformed to a formal structure. This formal-quantitative model will be integrated to the simulation program. After the simulation of dynamic parameters, different scenarios will be held and assessed based on a case study. Thus, more accurate estimates can be obtained about the system hence more effective scenarios can be produced and the applicability of these scenarios can be evaluated.

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# A Syntactic Approach to the Effect and the Role of *Hayat* and *Riwaq* in the Geometric Conception of Traditional Housing Architecture in Iran: Tabriz Houses



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**Abstract:** *In this study, the open and semi-open spaces of the traditional houses of Iran's Tabriz city in last two hundred years are analyzed. Hayat (court) is an open area that establishes the relationship between all the spaces of the house, arranges the functional spaces around it, and facilitates the transition between surrounding places. The role of hayat in the spatial organization of the houses will be discussed by focusing on its syntactic characteristics. Syntactic values of house spaces are depth, integration, circularity and isovist values. The aim of the study is to examine the role of “hayat” and “riwaq” in traditional Tabriz houses in the tradition of the central space and in design, in the light of the results obtained from the analyses of the plans of the selected houses. The work reveals the importance of these open and semi-open spaces over other spaces in terms of syntactic characteristics and the spatial sequence. Another point is to examine the influence of these spaces on the geometric understanding of the traditional architecture of Tabriz. Hayat, eyvan and riwaq are important architectural spaces that are often seen in important items of the city such as bazar, madrasah and caravanserai. The present study is supported from the results of ongoing doctoral thesis research at the Graduate School of Science, Engineering and Technology of Istanbul Technical University. Within the scope of the thesis, the evolution of the main living space from the traditional houses of Tabriz to the present apartments is analyzed syntactically. In the research presented here, only the results of the syntactic schemes are presented using the “Spatial Syntax” method.*

**Keywords:** *Tabriz, Traditional Houses, Hayat, Riwaq, Space Syntax.*

## ***Hayat ve Revak*'ın İran Geleneksel Konut Mimarisinin Geometrik Anlayışındaki Etkisi ve Rolü Üzerine Sentaktik Bir Yaklaşım: Tebriz Evleri Örneği**

**Özet:** *Bu çalışmada İran'ın Tebriz kentinin iki yüz senelik geleneksel evlerinin açık ve yarı açık mekânları irdelenmektedir. Hayat, evin diğer öğeleri arasındaki ilişkiyi kuran, evin işlevsel hacimlerini düzenleyen ve etrafında konumlanan mekânlara geçişi sağlayan bir mekândır. Bu özellikleri ile hayatın evin mekânsal dizimindeki rolü irdelenmektedir. Analizlerde ev mekânlarının derinlik, bütünleşme, döngüsellik (merkezilik) ve eşgörüş gibi sentaktik değerleri elde edilmiştir. Çalışmanın hedefi seçilen evlerin planlarına uygulanan analizler sonucundan elde edilen veriler ışığında, hayat ve revakın geleneksel Tebriz evlerinde merkezi mekân geleneğinin ve kurgusun içindeki rolünü irdelemektir. Bu açık geçiş mekânlarının diğer mekânlara göre sentaktik özellikleri ve mekânsal dizimdeki önemi ortaya konmaktadır. Diğer bir husus ise bu mekânların Tebriz'in geleneksel mimarisinin geometrik anlayışındaki etkisi ve rolünü irdelemektir. Nitekim hayat, eyvan ve revak; bazar, medrese ve kervansaray gibi kentin önemli öğelerinde de sıkça kullanıldığı görülen mimari öğelerdir. Bu çalışmada bu öğelerin “Tebriz'in geleneksel konut mimarisinin de ana öğeleri olduğu kabul edilebilir mi?” sorusuna cevap*

*aranmaktadır. Sunulan çalışmada İTÜ Fen Bilimleri Enstitüsü'nde devam eden doktora tez araştırmasının sonuçlarından yararlanılmıştır. Tez kapsamında Tebriz'in geleneksel evlerinden günümüz apartmanlarına kadar uzanan geçiş sürecinde ana yaşam mekânının evrimi sentaktik olarak irdelenmektedir. Burada sunulan çalışmada ise sadece geleneksel evlerde "Mekânsal Dizim" yöntemi kullanılarak sentaktik analizler şemalar üzerinden tartışılmaktadır.*

**Anahtar kelimeler:** *Geleneksel Tebriz Evleri, Hayat, Revak, Mekânsal Dizim*

## **1. INTRODUCTION**

Tabriz city lies in the center of Eastern Azerbaijan Province in the northwestern region of Iran. The traditional residential architecture of Tabriz persisted for many years, and until the Pahlavi period in the early twentieth century, the city's traditional texture and architecture had not changed. The architecture came into being in accordance with the demands of traditional lifestyle and did not change dramatically. An exploration of the houses of the north-western part of Iran, and Tabriz houses in particular, can give clues to shed light on the relationship between traditional residential architecture of Eastern and Southeastern Anatolia, Iraq and Syria. In this context, the findings and conclusions that will be reached through the analyses of Tabriz traditional housing architecture can actually help in revealing the general and common characteristics of traditional housing architecture in a larger region covering Azerbaijan, Eastern and Southeastern Anatolia and Mesopotamia.

When the residential architecture of Iran, and especially that of Tabriz is examined, the most important feature of the overall character is the tradition of introversion and the use of a central space in the spatial configuration. This characteristic is a traditional feature that has emerged from the region's climate and the local society's sense of privacy. Traditional houses usually have one or two floors. They also have basements used as pool rooms for relief in high summer temperatures. Additionally, a kitchen, and service and storage rooms are located on the basement floor under all of the building or covering a part of the building's basement. This tradition of introversion and central space in Iranian residential architecture continued until the early 20th century, but disappeared during the process of building the apartments. Thus, *riwaq* as a portico and semi-open transition space has lost its function and importance in contemporary Tabriz houses (Figure 1).



*Figure 1. An example of privacy and introversion in the Traditional Tabriz Houses of the 1920s [20].*

*Hayat* (court) and *riwaq* (portico) in Iran, and in the traditional life of Tabriz in particular, are the main spaces where households sleep and rest, and on special religious days they are used for cooking. People who come to the house from the outside are firstly hosted there too, so these spaces are used both as social and recreational spaces. These spaces provide contiguous and gradual transitions from outside and from public areas into the area devoted to private life. Therefore, they help households to control the level of privacy. On the other hand, *hayat* brings the people of the house together with the natural world, and in the same way, it ushers natural light and fresh air into other living spaces. This study will discuss the characteristics of *hayat* and *riwaq* in traditional Tabriz houses and how they organize the connection between the other spaces.

Methodologically, the present study will focus on the syntactical values of the spaces, obtained as a result of analyses conducted of the plan schemes using the spatial syntax method. There are studies of traditional Tabriz houses which mostly emphasize the structural and climatic features, however the syntactical approach has not been used in the studies of traditional houses of Tabriz. The graph analysis method was used in the housing studies of Memarian and Nezhad in their deliberative analyses of Kashan, Yazd, Shiraz and Ardebil houses, and only the depth and the integration values of the places were examined [1, 2].

## 2. SOCIAL LIFE AND SPACE SYNTAX

The space where the family lives in the traditional lifestyle of Tabriz forms a nexus of important socio-cultural factors. Family ties are the basis of the social communication. Occupational and economic relations do play a major role in the formation of city districts but nevertheless family ties and social relations have the most important role. In this context, the development of traditional houses was driven by the marriages of family members which caused the formation of new core families. As such houses were often built side by side and over time, in this way neighborhoods grew up.

The study is founded on the theoretical background of the socio-cultural structures and residential space syntax studies, and relations between human behaviors and space are examined through space syntax theories. It provides a syntactical analysis of how social and cultural factors influence the relationship between housing morphology and spatial artefacts. The techniques of measuring, symbolizing and interpreting the spatial configuration in buildings are defined as space syntax [3, 4]. The morphological structure of the building emerges from plans that use space syntax methods. Integration, depth, isovist and circularity are the basic syntactic parameters measured in all plans. Numerous researchers have studied housing through different disciplines and different perspectives [1, 2, 5, 6, 7, 8].

## 3. THE IMPORTANCE OF HAYAT AND RIWAQ

Tabriz houses are surrounded by high walls, and the social life is generally introverted. The surrounding walls are also intended to protect the food produced and stored by the family in the inner areas, from outside. These walls prevent the front door of the house from opening directly into the street. The house has been arranged in a way that enables the women to work, rest and have social relations comfortably. Thus, the rooms where everyday life takes place and where the guests are welcomed, in other words, the places where private, semi-private and public life occur, are separated in Tabriz houses. In this context, transition spaces that provide the passage and connection between spaces are important since they provide the spatial hierarchy required for privacy in the dwelling. In general, the concept of “privacy” refers to things that exist at the deepest level of a person. Various authors attempted to explain the term privacy by various concepts such as “withdrawal” [9], “limits of the power of others on individual [10], “personal control” [11], “the process of organizing interactions between people” [12], and “the total appearance of spaces that regulate and control the interaction between people” [13].

Rapoport [14] defines the limit of living space as "threshold". The threshold, a place between public and private spaces, is a position or line, sometimes physically visible, and at times unseen, that foreigners cannot cross without permission. Spaces located around *hayat*, the most important section in Tabriz traditional houses, are placed according to their privacy levels. Living rooms and bedrooms are located behind guest rooms, and there are transition spaces such as *riwaq*, *dehliz* (vestibule) and corridor in between. Even though the bedrooms in houses with single *hayat* are located around the courtyard with a guest room facing *hayat*, there is still a transition space between *hayat* and the room. Thus, it is ensured that passage to private spaces is controlled. Women and family life is private, so life is maintained in a closed space. In addition to the need for a cool climate, the walls of Tabriz houses are often elevated due to the conception of privacy nourished by religious and traditional beliefs, and it requires that the house is protected from outside. The courtyard wall is the threshold between private and public spaces. Entrance to the building is carried out via *hashti* (entrance hall of the building) and *dalan* (the passage corridor to the garden), so that visual and audio privacy are also ensured (Figure 3).

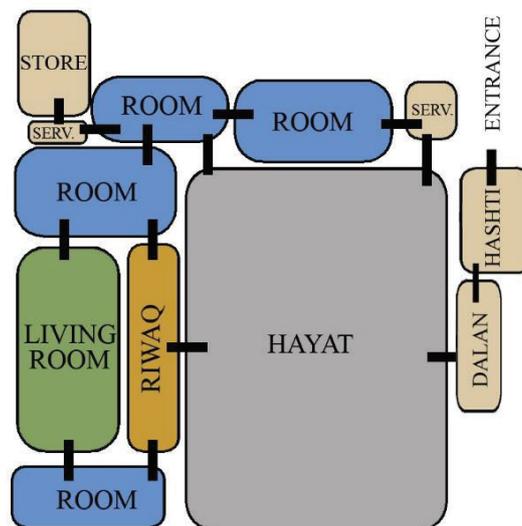


Figure 3. Diagram of configuration of the Alavi house

The symbolic meanings that *hayat* represent in Iranian houses are as follows:

- *Hayat* is the boundary that sets the limits of a house, and it prohibits the entry of strangers.
- *Hayat* unifies living spaces and provides communication between inside and outside.
- *Hayat* creates a cheerful, green and peaceful place for family.
- *Hayat* provides fresh air circulation.
- *Hayat* is an important element that organizes various spaces.

Another important semi open space is *eyvan*. The word “eyvan” in Persian, “eyvan” and “ayvan” in Turkish, and “iywan” or “van” in Arabic come from the word “ban”, which means “house” in Pahlavi Persian, and it is believed that this word passed from Persian to Arabic [15]. It is known as “sofa” in Anatolia, “tarma” in Iraq, and “riwaq” in Syria, according to Ünlu’s study [8, 16, 17] in Northern Mesopotamia houses. It is a multifunctional transition space between private and semi-public areas of houses, a food preparation and eating area where everyday life takes place [16].

In the Dehkhoda dictionary, the words “eyvan”, “sofa” in the form of crescent, and “mehrab” share the same meaning, while they are also used to refer to a long corridor, a living room, open houses and sitting rooms for the sultans. The word “eyvan” is used in the works of famous poets such as Ferdowsi, Manuchehri, Naser Khosro, Nizami and Khagani. “Pish eyvan” (fore-iwan) also denotes to a sofa situated at a higher place in an open space. [18] According to Ardalan [19] “eyvan” also has transcendental implications. In a different way, he describes *hayat* as the spirit and the rooms as the body of the house, and thinks that *eyvan* marks a transition area between these two worlds. Ardalan [19] argues that Iran's traditional architecture is in a dilemma. He claims that there is a transition between cultural and religious concepts as social factors which he defines as essence, and material, color and texture as physical factors [19].

Having the three sides closed, *eyvan* is usually covered with a vault positioned at the center of the building overlooking the courtyard. Firstly, it is used in homes in Mesopotamia and Central Asia, the feature is considered to be the most important element in mosque, caravansarai and madrasa buildings (Figure 4).

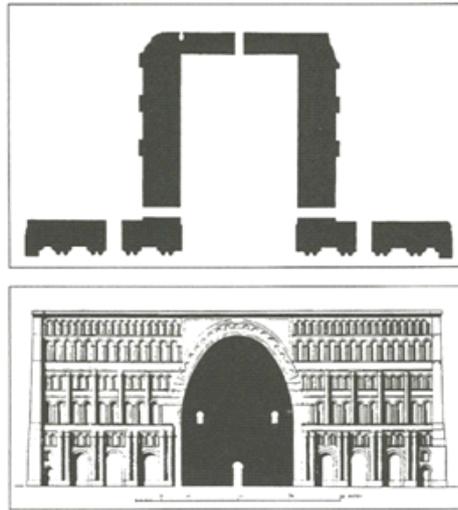


Figure 4. Eyvan-i Medayin (Ctesiphon), Iraq, 241.AC [4]

*Eyvan*, which is one of the main features of Iranian architecture, is also used in Tabriz houses, but there are no surviving examples of houses with an *eyvan* seen in the photographs obtained from the old houses and there are no examples in the plan schemes from the archives. The last two hundred years of Tabriz houses had semi-open spaces such as *sofa* or *riwaq* covered with flat or domed roofs, with a narrow and elongated square form with rows of columns. Although this space is referred to as *eyvan* in public and in the local language, in this work, such semi-open and transitional spaces are accepted as *riwaq*. *Riwaq* is interior with windows facing either side of the enclosed front garden and located behind the main living space or entrance hall. It is covered from three sides, but its front is open to the garden, which is located in front of the main living space and entrance hall. Thus, although *eyvan* and *riwaq* are seen as two very close-open space examples, their physical characteristics are different as well as their syntactical characteristics. Although *riwaq* serves as a transitional space between *hayat* and the main living space, i.e. *tenebi*, and rooms, it is also used as a climatic balancing item to protect from extreme warmth and cold. It is also the focal point of the building's appearance and facade arrangement, as well as the space where the ornaments are the most intensely used in the facade arrangement.

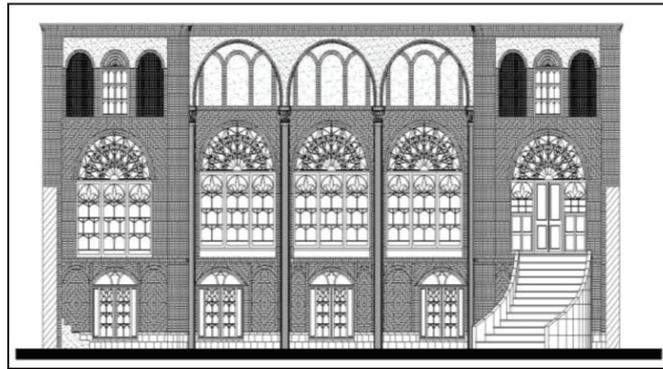


Figure 5. The example of the *Riwaq* from Tabriz *Qenjei House* [4]

The enclosed *riwaq* with row columns in front of the buildings in Tabriz is used in two different ways: In the first one, *riwaq* is situated at the same level as *hayat*, and in the second it is higher than *hayat*, acting as a terrace in front of the main living space. In Figure 5, it can be seen that there are semi-open spaces that have the same function in Iran, but are used in different shapes and elevations.

The largest open space of Iranian houses is *hayat*, and the open and semi-open spaces after that range from the level of *hayat* to the level of the roof. The semi-open spaces after *hayat* are, in turn, *eyvan* or *sofa*, then on the upper floor is *sharmi*, and on it, *mehtabi*. *Sofa* is a platform and a living area with higher elevation than *hayat*. In general, in the central and hot regions of Iran, the upper part of the roof and the transitional space formed around it are called *sharmi*. During the transition to *sharmi*, the whole house can be seen from above. In the traditional houses of Iraq, three sides are surrounded by other spaces and the open space to the courtyard is called *tarma*. *Eyvan* and *tarma* have similar functions and features, but unlike *eyvan*, the long axis of *tarma* is parallel to the front. On the other hand, *eyvan*'s front opening comprises arches but the *tarma* has a flat ceiling [20]. Ünlü and Şalgamcioğlu [8] explore the tradition of central space in the Anatolian, Northern Iraq and Syrian houses, and they claim that *eyvan* continues in Northern Iraq and Syria, but this tradition disappears in the transition towards the west of Anatolia [16]. In this context, it is emphasized that geographic and climatic factors play an important role in shaping introverted spaces, as seen in *eyvan*'s placement of the balcony to get the facing elements through an external terrace.

As for *riwaq* (portico); in architectural practice in Iran, Iraq, Turkey and Syria it is called by different terms and features, but all the examples have the same function even if they show differences in shape and position. Figure 6 shows that in Iran, Iraq, Syria and Turkey, *eyvan* is also used in different forms and terms (Figure 7).

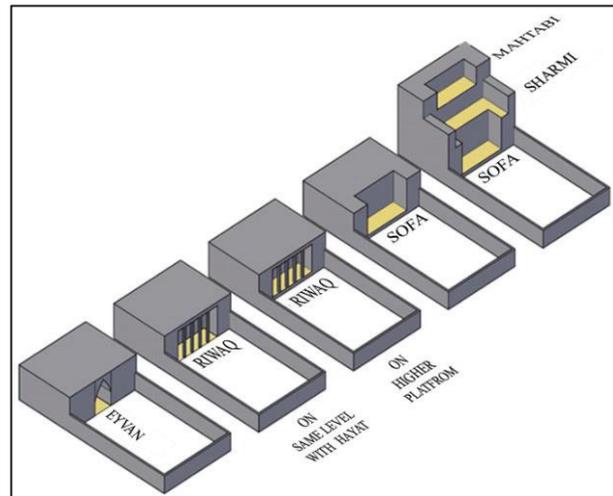


Figure 6. Schematic Demonstration of Eyvan, Riwaq, Sofa, Sharmi and Mahtabi, the Forms of Semi-Private Spaces Used in Traditional Houses of Iran

	WEST IRAN	EAST & CENTRAL IRAN	NORTH IRAN	SOUTH IRAN	IRAQ	TURKEY	SYRIA
EYVAN	✓	✓	✓	✓	✓	✓	✓
SOFA		✓				✓	
RIWAQ	✓	✓					✓
TALAR			✓		✓		
TARMA				✓	✓		
SHARMI				✓			
APADANA		✓					

Figure 7 The distribution of transitional spaces (Eyvan, Sofa and Riwaq) in Iran and in nearby areas [8, 17, 20, 21]

When we classify the plan types of traditional Tabriz houses according to the main item being *hayat*, there can be defined two main types, those with a *hayat* and those without one. The other important item in *hayat* plan types that we have covered in the scope of the research is the transitional spaces, *riwaq*. Three plan types can be established when plans are classified according to *riwaq*. The first type is a *riwaq* type, the second is a non-*riwaq* type, and the last type is a *riwaq* type with a balcony (Figures 8 -12).

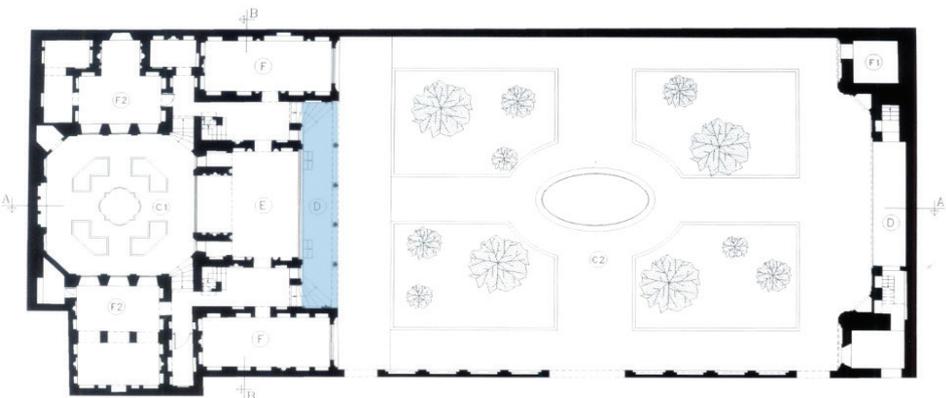


Figure 8. Traditional house plan with riwaq (1st Type), Behnam House [4]



Figure 9. Traditional non-riwaq (2nd Type) house plan, Rastegar House [4]

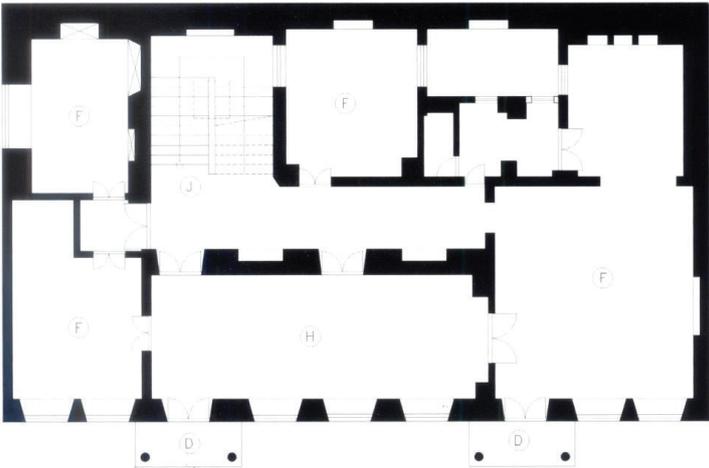


Figure 10. Traditional house plan with Balcony (3rd Type), Lalei House [4]

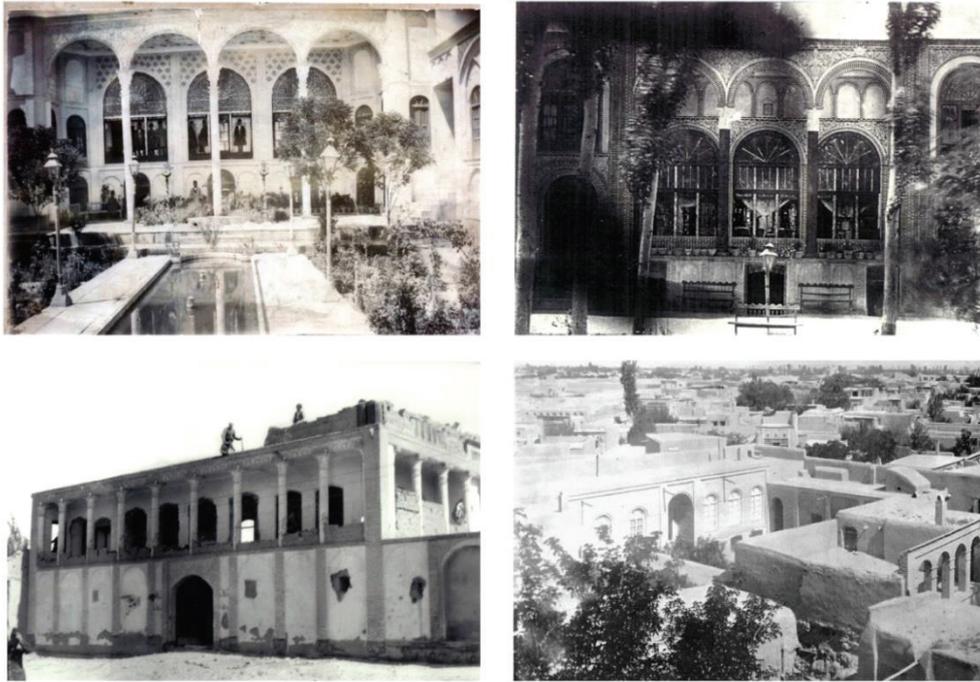


Figure 11. Different forms of use of the riwaq in traditional house of Tabriz [22]

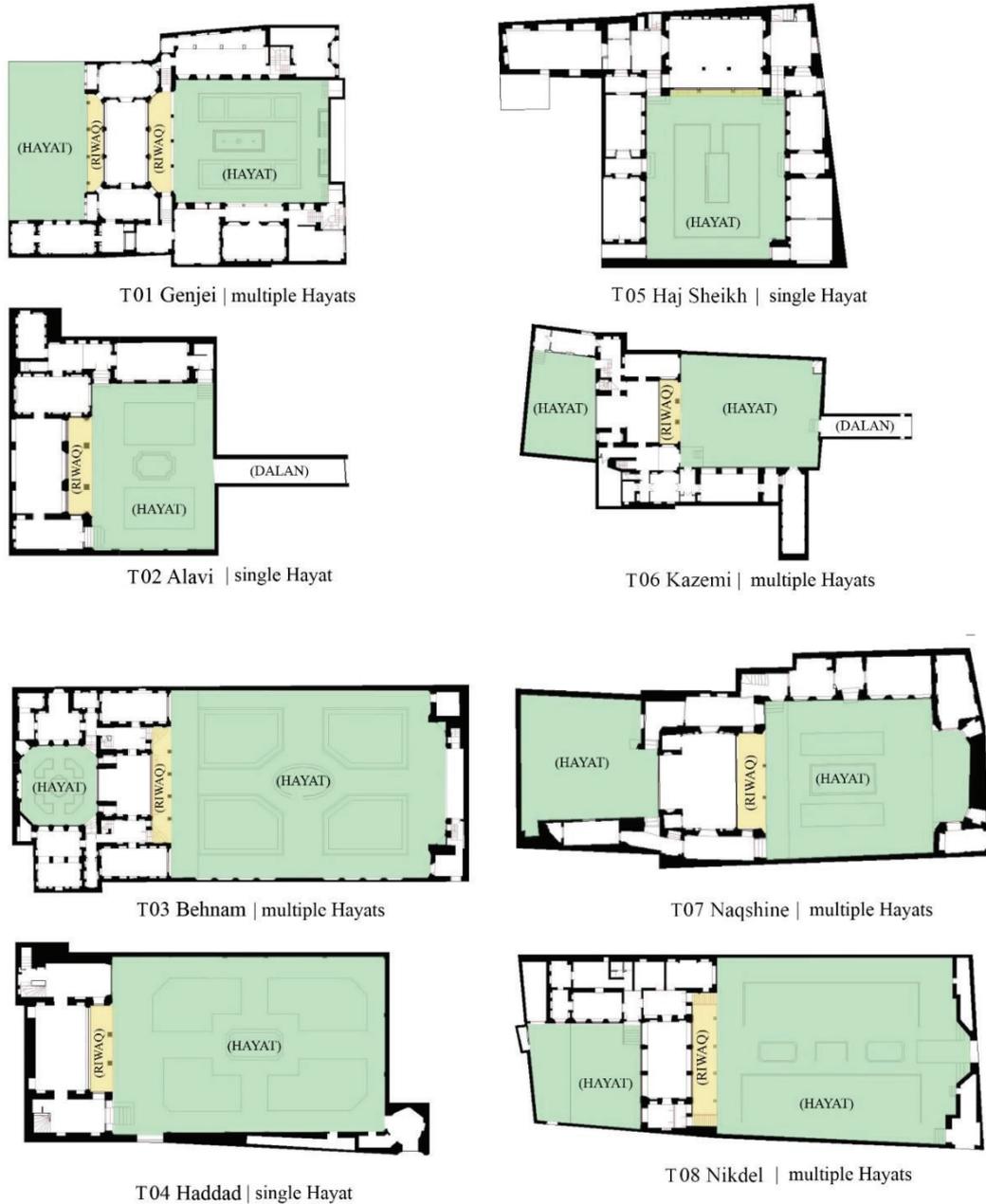
Besides outdoor transitional spaces, there are some indoor transitional spaces *dalan*, *dehliz*, corridor and stairs which have important roles in configuration of spaces. Some buildings have *dalan*, which is a covered corridor connecting entrance to *hayat*, and in other examples *hayat* can be entered directly, without any buffer zone between in and out. *Dehliz* is the second indoor place to be encountered while entering the building from *hayat* or *riwaq*. *Dehliz* is the space that provides the transition and circulation between the main living space and other spaces.



Figure 12. Tabriz, Example of Hayat in the Sharbat Oglu house

#### 4. METHODOLOGY AND SYNTACTIC ANALYSIS

Firstly, the basic information about the spatial organization of the houses which constitute the main basis of the study is obtained from the plans and drawings. The samples with repeating typology from fifty plan schemes were arranged in chronological order. Ten samples were selected from the houses with single and double courtyards, all with extensive layouts of the plan schemes. Samples are chronologically sorted according to the date of construction in Figures 13 and 14.



*Figure 13. Plan charts of the selected samples for analysis of traditional Tabriz houses*

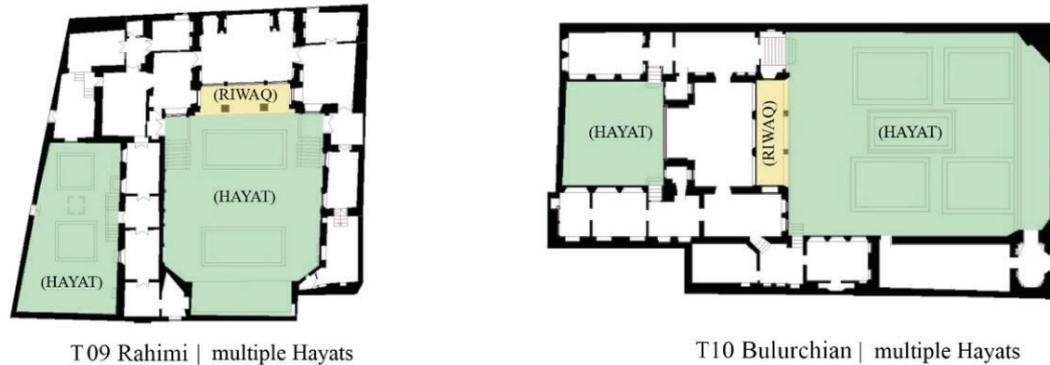


Figure 14. Plan charts of the selected samples for analysis of traditional Tabriz houses

In the first step of examining these examples in the figures 13 and 14, the interior spaces of the houses are divided according to their functional areas. Amorim [5, 23] defines this separation as four regions: social space, private space, service area, and transitional space. Based on this distinction, the daily activities for Tabriz houses and the spaces of Tabriz houses according to open and closed areas can be grouped as follows:

**Main Living Spaces:**

Main Living space (Guest room)

Living room (Eating and resting, watching TV)

**Private zone:**

Bedrooms (Sleeping and dressing)

**Outdoor Transitional & Social Spaces:**

Hayat and Riwaq (Transition, Sleeping and sitting)

**Indoor Transitional Spaces:**

Dalan, Dehliz, Corridor and Stairs

**Kitchen:**

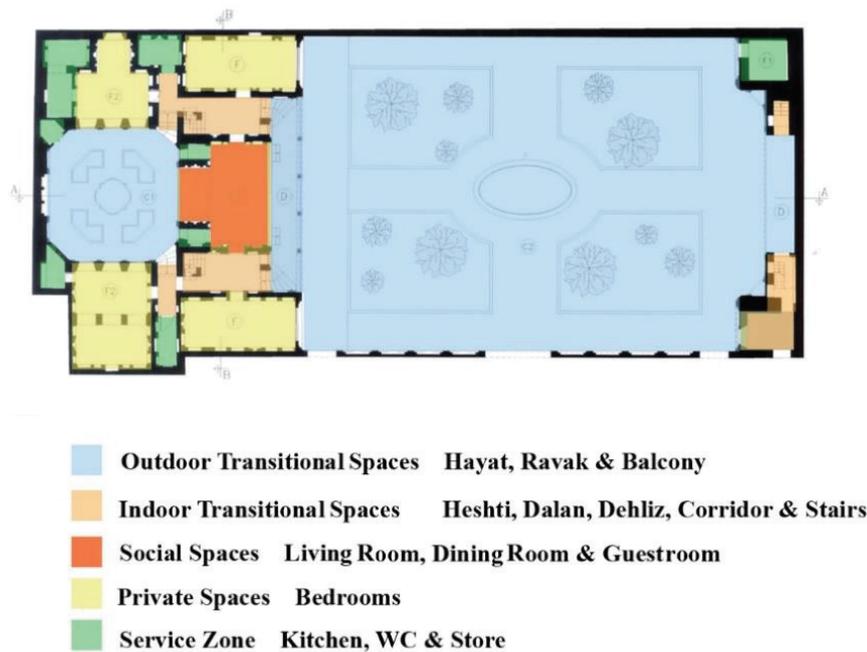
Cooking and Socializing area

**Service Zone:**

Basement floor and service areas around *hayat* (pantry, clothes and tableware washing and drying areas)

Toilet and Bathroom

Figure 15 shows the functional zones in Behnam house plan, as a sample of traditional houses of Tabriz with two *hayats* and *riwaq*;



*Figure 15. The classification of Tabriz house spaces by function, T03 Behnam House*

In the next step of the reviews, mean depth values, integration, isovist values and circularity values for spatial analysis of traditional houses were examined. Since each space in the buildings has a different syntactical value, the average of the syntactic value of the spaces with the same function can be compared between the buildings. As a result, according to the syntactic values, information about the social and cultural characteristics of places with the same function can be obtained. The plans and basic information about the spatial organization of the houses which constitute the focus of the work were obtained from the drawings. Later on, the examples of houses with *hayat* continued to provide information about the domestic use of the houses and the habits of the families.

According to Hillier and Hanson (1984), integration is a variable that shows how a space is connected to other spaces in its surroundings. It can be used to measure the presence of people in the space. Therefore, the higher the integration value, the more people use the space. On the other hand, depth value shows the numbers of steps to reach from one space to another. So higher values of depth show that one should cross many spaces to reach that space. The other tool, which shows the user's visibility in spaces is the isovist analysis. According to Benedikt (1979), the isovist value of a space means all the points that can be seen from a point of view in that place. In this context, the value obtained from the isovist analysis describes the area or perimeter of a field of view. Another concept of space syntax is the concept of circularity which reveals information about the geometry of the space. Benedikt (1979) and Batty (2001) define the compactness and circularity values as the ratio of perimeter of space to the area of environmental in the analysis of isovist. These values range from 0 to 1; the closer the value of the circularity is to 0, the more linear the space is; and the closer to 1, the more circular and more central the space is [24]. The analysis of circularity in Syntax 2D program also reveals the field of view and the perceivable location of the space in which the analytical space is located, in addition to the geometric information concerning the space [25]. Kaynar (2004) states that the value of circularity in a place is a sign of the narrower and longer field of view in that place [26].

The analysis results of all the samples handled in the traditional houses are seen together in Figure 16 and 17. Figure 16 represents the syntactic analysis and schemes of Qanjei house as a sample of Tabriz traditional houses which has two *hayats* and *riwaq*. The figure shows all the spaces of the house, its integration, mean depth and circularity values and isovist in plan schemes.

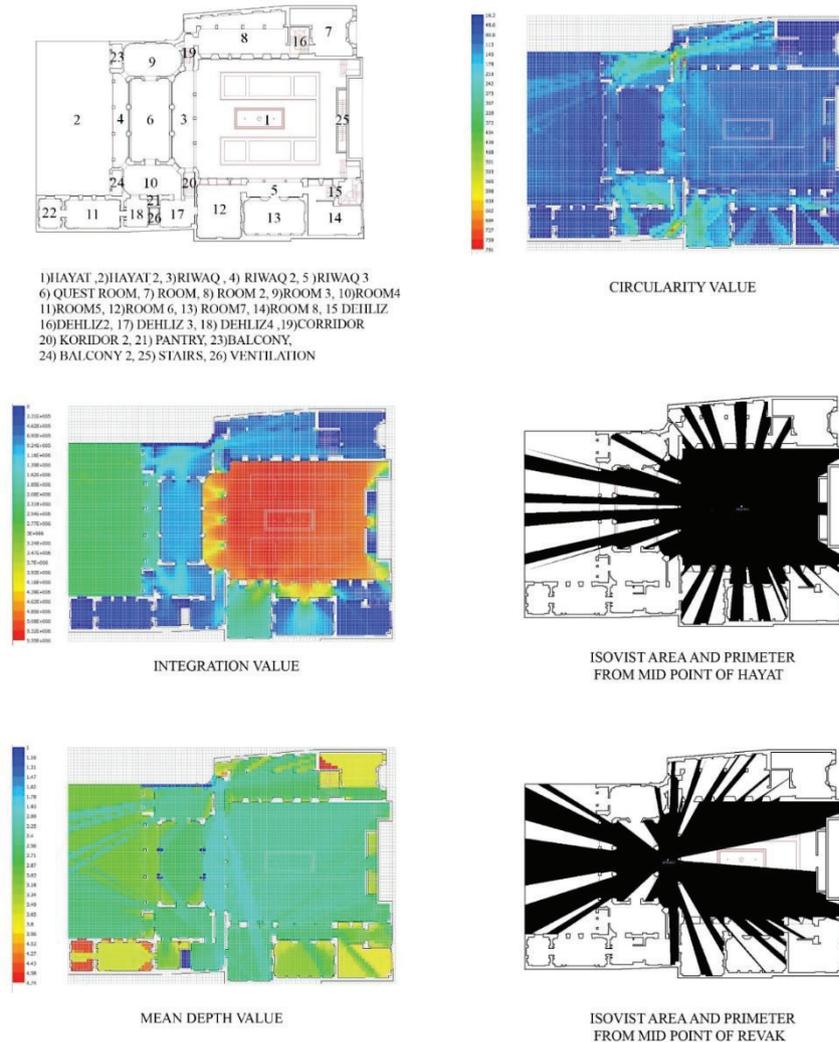


Figure 16. Syntactic analysis and representation schemes of Qanjei House (T01)

In Figure 17, the table is organized according to the functions of each example building, the guest and dining room, *hayat* as open transition space, closed transition spaces, bedrooms, bathrooms and toilets in six sections. Kitchens are both in service and in social zones. However, in traditional houses, kitchens are in basement floors, so they are not taken into account in our analysis. For each of these sections, integration, depth, and circularity analyses were applied, and the results were presented as both individual and mean values. In the last column on the right, the average analysis values of the entire building are given (Figure 17).

		T.01 Genjei	T.02 Alavi	T.03 Behnam	T.04 Haddad	T.05 Haj Sheykh	T.06 Kazemi	T.07 Nagshine	T.08 Nikdel	T.09 Rahimi	T.10 Bulurchiyan	MEAN
INTEGRATION VALUE	GUESTROOM&DINNIG	0,82	0,49	0,69	0,23	0,32	0,30	0,21	0,65	0,21	0,56	0,45
	HAYAT	3,52	2,13	27,66	7,37	1,53	2,04	1,51	17,40	1,01	5,89	7,01
	RIWAQ	4,05	2,21	21,33	7,17	1,46	1,26	1,45	17,30	0,73	4,13	6,11
	CORRIDORS	1,30	1,31	7,56	4,41	0,62	0,49	0,50	6,97	0,38	1,86	2,54
	BEDROOMS	0,97	0,26	2,42	0,18	0,26	0,23	0,18	2,13	0,20	0,76	0,76
	SERVICE & WC	0,11	0,36	1,71	1,15	0,24	0,26	0,35	1,86	0,09	0,42	0,66
	KITCHEN											
	MEAN	1,79	1,13	10,23	3,42	0,74	0,76	0,70	7,72	0,44	2,27	2,92
DEPTH VALUE	GUESTROOM&DINNIG	0,29	0,25	0,23	0,26	0,24	0,25	0,27	0,25	0,29	0,25	0,26
	HAYAT	0,24	0,19	0,15	0,15	0,18	0,21	0,20	0,16	0,27	0,18	0,19
	RIWAQ	0,23	0,19	0,17	0,16	0,21	0,25	0,20	0,18	0,31	0,22	0,21
	CORRIDORS	0,28	0,21	0,21	0,18	0,22	0,26	0,24	0,22	0,30	0,24	0,24
	BEDROOMS	0,31	0,25	0,26	0,29	0,25	0,29	0,27	0,26	0,33	0,28	0,28
	SERVICE & WC	0,30	0,24	0,28	0,27	0,24	0,28	0,27	0,28	0,36	0,32	0,28
	KITCHEN											
	MEAN	0,28	0,22	0,22	0,22	0,22	0,26	0,24	0,23	0,31	0,25	0,24
CIRCULARITY VALUE	GUESTROOM&DINNIG	0,07	0,05	0,06	0,04	0,08	0,08	0,04	0,05	0,05	0,05	0,06
	HAYAT	0,11	0,04	0,04	0,03	0,05	0,06	0,06	0,05	0,03	0,04	0,05
	RIWAQ	0,15	0,06	0,08	0,05	0,02	0,07	0,09	0,08	0,05	0,05	0,07
	CORRIDORS	0,19	0,07	0,11	0,08	0,09	0,11	0,09	0,13	0,08	0,10	0,11
	BEDROOMS	0,14	0,06	0,15	0,05	0,10	0,08	0,08	0,10	0,09	0,09	0,09
	SERVICE & WC	0,08	0,06	0,06	0,07	0,09	0,08	0,06	0,13	0,06	0,05	0,08
	KITCHEN											
	MEAN	0,12	0,06	0,08	0,05	0,07	0,08	0,07	0,09	0,06	0,06	0,08

Figure 17. Mean Syntactic Values of Traditional Tabriz Houses within separated functional zones from 1800 to 1960

It can be seen in the table above that the most integrated spaces of traditional houses are *hayats* and *riwaqs*. As these spaces have the minimum amount of depth value among other spaces, bedrooms and service zones are the deepest spaces. Corridors and bedrooms have the highest circularity values, and it shows the contrast between the narrow and long shape of these spaces and *hayat* and guest rooms, which are wide and rectangular in form. The mean values of traditional houses are given in Table 1.

Table 1. Syntactic analyses results and mean values of traditional Tabriz Houses

	Mean Isovist (Perimeter)	Mean Circularity	Mean Depth	Mean Integration
<b>HAYAT</b>	<b>2.59</b>	<b>0.05</b>	<b>0.19</b>	<b>7.01</b>
<b>RIWAQ</b>	<b>2.21</b>	<b>0.07</b>	<b>0.21</b>	<b>6.11</b>
<b>CORRIDOR</b>	<b>1.55</b>	<b>0.11</b>	<b>0.24</b>	<b>2.54</b>
<b>GUEST &amp; DINNING ROOM</b>	<b>2.84</b>	<b>0.06</b>	<b>0.26</b>	<b>0.45</b>
<b>BEDROOMS</b>	<b>1.94</b>	<b>0.09</b>	<b>0.28</b>	<b>0.76</b>

## 5. EVALUATION OF FINDINGS

Table 1 shows the average values of *hayats*, *riwaqs*, corridors, guest rooms and bedrooms from all examples. The highest mean isovist of the rooms are the guest room (2.84), followed by *hayat* (2.59) and *riwaq* (2.21). The lowest isovist value is that of the bedroom. Therefore, it can be assumed that users have the highest visibility in guest room and *hayat*, which are mostly used by guests. These spaces have large areas, and more openings to other spaces than others. In Table 1, when the distribution of the circularity values is taken into account, the highest mean value for the corridor is 0.11, bedrooms come as second, and *riwaq*, guestroom and *hayat* have the lowest values. This shows that closed transitional spaces have the highest value of circularity among all living spaces of houses.

The mean depth and integration values are also presented in Table 1. *Hayat* is the shallowest space with the lowest mean depth value. The value of depth increases in the passage from *hayat* to interior spaces. Thus, the deepest spaces are the bedrooms. This finding also confirms the common understanding that *hayat* is a semi-public space in the traditional Tabriz houses. At the same time, the transition from outside the house to the inside of the house confirms the passage from public to semi-public and from there to semi private and private areas. On the other hand, the integration values are expected to be in contrast with the depth values. As seen in Table 1, the spaces with the highest depth values have the lowest integration values. As a result, *hayat* and *riwaq* are the shallowest spaces, and they have the highest integration values. However, as shown in this table, the value of *hayat* is higher than that of *riwaq*, and it has the highest mean integration value (634). To explain this, it is necessary to pay attention to the geometry of *hayat*, and the examples with multiple *hayats*. This is because in some cases, such as the Alavi house, the entrance to *hayat* is provided by a long corridor, and this long corridor leads to a decline in the value of integration of *hayat*. On the other hand, houses with two courtyards such as Genjei, Behnam and Kazemi have a deeper second yard which serve as inner gardens. Thus, the bigger the yard in the entrance of the building the shallower it is, and this makes it the most integrated space. Therefore, in the analysis, instead of the average value of both *hayats*, the value of the first *hayat* is taken into account, and the integration value of the second courtyard is not added to calculations to normalize the comparisons between all plan types. It is considered that the mean depth value should be the highest in the bedrooms, and the mean integration value should be the lowest. However, the mean value of the guest

rooms is 7.60 and the bedrooms have the lowest value (4.27). This is because the number of bedrooms is higher than the single guestroom, so the number of cells that can be analyzed in bedrooms is higher than the number of cells in the single guest room. On the other hand, each bedroom is connected with more rooms than the guest room is, since they are located near the utility room, service areas and the corridor. As a result, it can be explained that the bedrooms have a higher mean integration value than the guest room. This reveals the spatial arrangement and syntactical characteristics of the traditional Tabriz houses and the connections between the spaces where life passes.

## **6. CONCLUSION**

The syntactic analysis of the traditional houses in the city of Tabriz from the early 19th century until the 1960s shows that the analyzed houses have a general concept of introverted and central spaces. In particular, it is understood that *hayat* and *riwaq* are the two essential elements that control and dominate the spatial relations in the house. They have an important role in the arrangement of the living spaces. This fact is supported by the syntactic analysis. One of the results of this paper shows that *hayat* and *riwaq* are the most integrated and central places in all Tabriz traditional houses. These areas are close to outside, and thus they are shallower spaces compared to the bedrooms and other private living areas. On the other hand, as a result of the analyses, *riwaq* is deeper than *hayat* and, the former's average integration value is lower than that of the latter. This shows that *hayat* and then the *riwaq* have social characteristics as well as functioning as transitional spaces. These spaces are the buffer spaces between social and private spaces. Finally, when the traditional houses of Tabriz are considered as spatial organization, *riwaq*, always located in the middle of *hayat*, is used in rectangular form along the facade in front of the main living and guest room of the house, and *hayat*, located in the heart of all spaces, has the vital role in the arrangement of living spaces of Tabriz traditional houses.

Beside transitional spaces that have main role in arrangement of home spaces, the analysis shows that social spaces and private spaces are located around *hayat*, and connected to each other by corridor and *dehliz*. Therefore, in order to reach social spaces and private rooms, users have to cross spaces step by step from outside to inside of house, and this hierarchy makes bedrooms more private than other spaces. As a result, it can be assumed that Tabriz traditional life style needs more privacy, and the arrangement of living spaces correspond these needs. For hosting guests in the best part of the houses, the guest room has the highest visibility to *hayat* and semi-open areas, which give a pleasure to the guest during their stay in traditional houses of Tabriz.

As this research is a part of an ongoing PhD thesis, further papers from the same research will focus on private spaces and main living spaces of traditional houses, and their evolution over the last two hundred years. In this paper, we see the importance of open and semi-open spaces in Tabriz traditional houses, which have the highest value of integration and circulation between all spaces. Syntactical analysis shows us that *hayat* can be considered as the core part of traditional houses of Tabriz.

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