



## SHAPE GRAMMAR ANALYSIS AND COMPARISON OF THE TRADITIONAL AND NEW URBAN TEXTURES IN SIVRIHISAR, ESKIŞEHİR

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### Abstract

This study was conducted in Sivrihisar District, where traditional and novel urban textures are present along side each other, and attempts to portray the urban texture of the District and to analyse how the relationships between public, semi-public and private spaces are formed. It is found that traditional and succeeding new textures were formed with differing priorities. The study aims to analyse and compare the foundative and formative setup of these two styles in terms of usage of space by using by shape grammar methods.

## 1. INTRODUCTION

Sivrihisar's position as a stop in important trade routes dates back to the Phrygian Era. The town has preserved the unique qualities of its urban texture until today. New developments in the local transportation network encouraged urban expansion which conformed to traditional urban texture. Sivrihisar's urban elements, form and setup are also distinctive and important. Analysis of traditional urban texture provides uncommon insight in the field of urban setup. As it encompasses traditional and new urban textures together, Sivrihisar also provides opportunities for comparison of the development and setup of two distinct urban areas. These seemingly continuous and directly related areas exhibit completely different priorities in their setup.

The traditional texture was set up using unwritten organic and cognitive rules. Daily life was the key driver of their formation, both through its direct effects and architectural reflections. This setup, affected directly by the period's social and cultural life precipitated, in accord with concerns of privacy and possession, the concepts of public, semi-public and private spaces.

Which are defined as;

- Public Spaces; Spaces of communal use-squares, streets
- Semi-Public Spaces; Spaces for socializing and meeting-Traditional House Courtyards
- Private Spaces; Spaces used for family/private life-Residences

This study aims to portray the urban texture of the District and to analyse how the relationships between public, semi-public and private spaces are formed, and to explain how the urban texture is organized moving upwards from its smallest building blocks: private spaces. To this end, the traditional and new urban textures present in the District of Sivrihisar were analysed in an attempt to formulate a series of architectural rules from the traditional texture which would then be compared with the new texture.

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During the study, shape grammar was used as a tool for rendering and the urban and spatial relationships of the two urban textures were examined architecturally. The shape-forming rules for traditional textures were formulated through shape grammar analyses. Analyses made on traditional and new textures resulted in different data sets, leading to the conclusion that the traditional settlement was ignored during and did not contribute informationally to the construction of the new settlement. Comparisons made then examined the formational priorities of the traditional urban texture and produced the differences it had with the new texture.

## 2. SHAPE GRAMMAR

Language is a tool that allows communication through the transfer of emotions and ideas. It accommodates continuous production within the limits of its ruling grammar, and can be examined in two groups: natural and artificial. Natural language is the vehicle for expressing thoughts and emotions, used in daily interactions. Its elements include letters, syllables, words and sentences. Natural language preserves its basic structure while it changes gradually over time; surviving, changing and developing (Raphael, 1976). Meanwhile, artificial languages are languages produced by mankind whose basic principles can be reconsidered and changed. Design languages, architectural language, computer languages and musical notation are examples of artificial languages. Lines, shapes, symbols and musical notes are the respective elements of these languages (Aksoy, 2001:12,13). Two rulesets regulate both natural and artificial languages. Semantic rules dictate the meanings of sentences while syntax rules dictate the way language elements are combined (Özbek, 2004: 5). Languages founded upon principles shaped by these rulesets can produce an infinite set of outputs by combining their elements.

The grammar of architectural language allow for an infinite number of alternatives to be produced from a finite set of shapes and rules. (Bökü, 2009:3)

Stiny ve Gips first defined shape grammar in the early 1970's as a means of describing and creating a design language that could form algorithmic structures of a ruleset-based nature (Aksoy 2001). Shape grammar employs an algorithmic structure, similarly to the usage of formal rules of lexicalization in Linguistics (Stiny, 1980). Shape grammars produce new shapes in "n" dimensions, using shapes in the architectural lexicon (Stiny, G.1977). Shape grammar is a set of shape rules where rules are applied sequentially to produce a design language and can be examined under two labels: Formal shape grammars, the way computers produce forms; and informal shape grammars, the way of producing forms using shapes (Özbek, 2004: 9).

Shape grammar is a system of rules used to render and characterise the design rules of languages. Uses of shape grammar (Figures 2.1-2.3) are as follows;

1. Examination of the present language, designs and architectural styles (analytical),
2. Formation of languages, types and styles by the designer himself (original),
3. Production of a new language from the old, combining analysis and synthesis (hybrid) (Tok, 2008: 12).

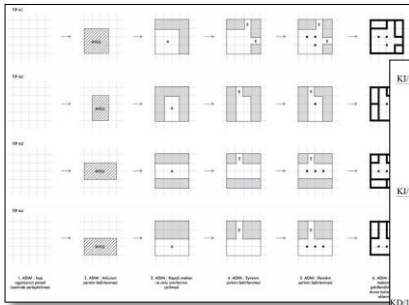


Figure 2.1

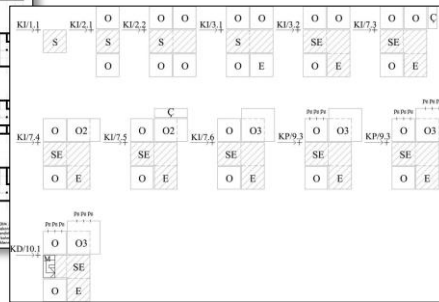


Figure 2.2

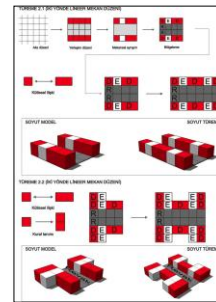


Figure 2.3

**Figure 2.1.** Examination of plan-type development in shape grammar (Özbek, 2004:78)

**Figure 2.2.** Producing house with anteroom using shape grammar (Güzelci, 2012:92)

**Figure 2.3.** Derivation using shape grammar (Tok, 2008: 87)

By repeating the set of definable rules, the textures produced in a small scale combine to form larger textures as set out by the rules. Analysis of urban architectural language can also be understood in the context of these rules (Özbek, 2004:7). This also explains the connections between the foundational grammars of the basic elements via analysis of the rules regulating formation of the urban texture. This is an application of the analytical aspect of shape grammar.

### 3. CASE STUDY

Urban spaces began to form through the desire of people to organize their habitat. The inadequacy of natural conditions led societies to construct building and form connected habitation elements such as squares, neighbourhoods and residential areas. Space, which formed the frame of human life became a part of it (Sedes, 1991:23).

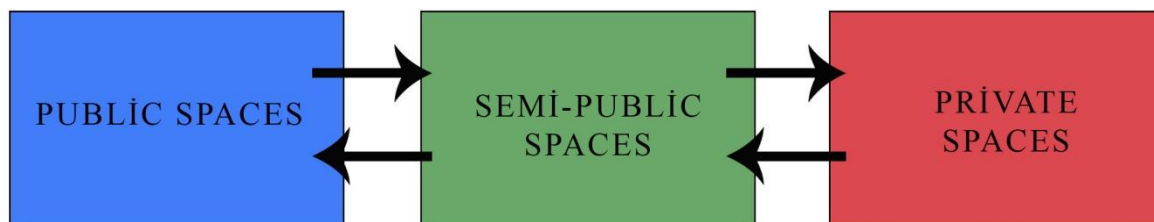


Map 3.1. Traditional urban settlement  
in Sivrihisar (1)  
and overview of the new city (2)  
(www.google.com/maps)

Picture 3.1. Traditional urban settlement  
in Sivrihisar and the new city  
(Öz,2017)

In Sivrihisar, the traditional and new urban textures form two distinct frames and allow us to compare their respective textures (Map 3.1-Picture 3.1). Urban elements are formulated within a set of rules, triggering the formation of each other. These rules are applied systematically to organized construction zones, while their counterparts in traditional settlements develop spontaneously based on individual, cognitive and pragmatic concerns. And cities developed under different rulesets eventually create different urban textures. To analyse the defining elements of spatial use in an urban environment using shape grammar, an analytical base was formed.

In contrast, residences in the traditional texture are private areas where secrecy is held to be most important. In the traditional texture, transitioning between public and private spaces occur via semi-public spaces such as courtyards, separated by back alleys and high walls. (Shape 3.1).



**Shape 3.1.** Transition spots in the Traditional Urban Texture

In this study, shape grammar was used as a tool for rendering in analysing the relationships between public, semi-public and private spaces in traditional and new urban textures. The two textures were analysed in their urban and spatial makeups and their shape formations were compared. In order to analyse the urban setup in this context, use of spaces was handled separately in layers such as transportation, formation of squares and functional differentiation.

From the analyses made in the traditional and new urban textures, the usage of space shape grammar analysis explored the setup of public, semi-public and private spaces; the transportation shape grammar



analysis explored the setup of roads and streets surrounding the urban center and secondary centers; the formation of squares shape grammar analysis explored the setup of public meeting spots; while the residential-commercial shape grammar analysis explored the setup private residential spaces, public spaces and the semi-public spaces separating them.

### 3.1. Usage of Space Shape Grammar Analysis

Differences between the traditional and new urban textures were observed in the analyses made. These differences, being mainly in regards to the conception of squares and neighbourhoods, the perception of the urban center, building placement, focal points and setup priorities can clearly be seen in the public, semi-public and private spaces' usage setups (Figure 3.2).

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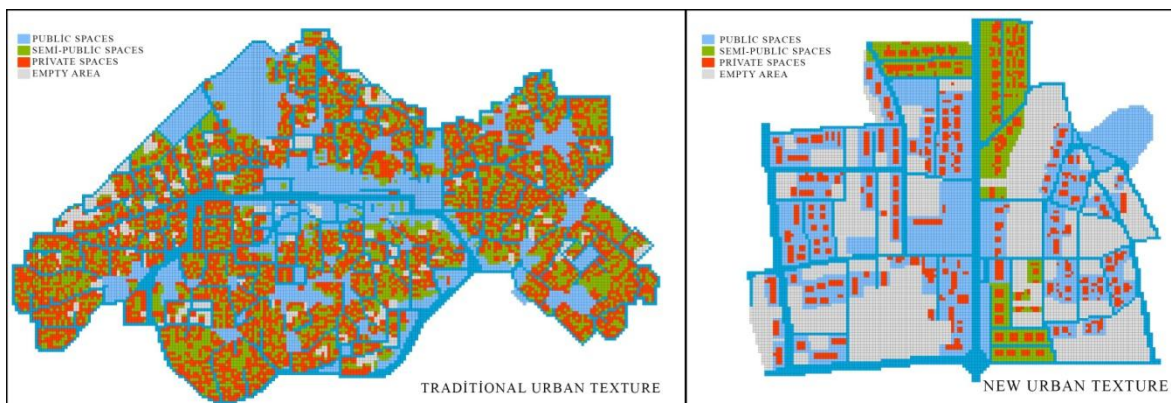


Figure 3.2. Usage of Space Shape Grammar Analysis

The urban centers and secondary centers of public spaces is readily apparent in the traditional texture. Public spaces function as meeting places for the community. Transitioning between public spaces and private spaces is possible through semi-public spaces, mainly the courtyards and gardens of buildings. Private spaces are residential areas, focused on nature-human interaction and with courtyards and gardens shaped in accordance with the daily routine of society (Figure 3.3).

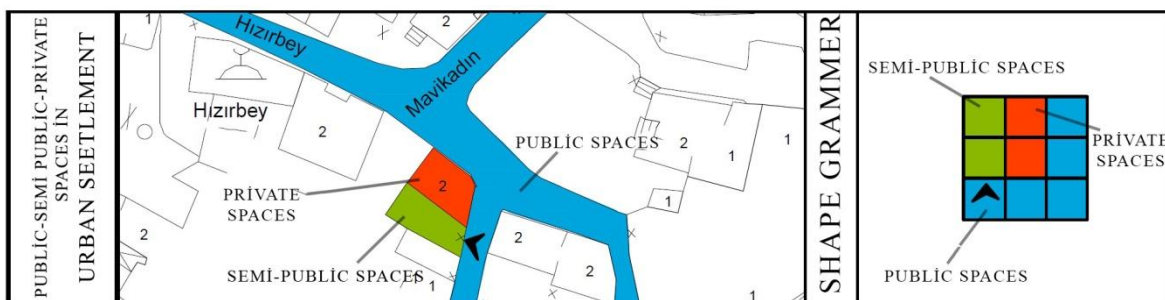
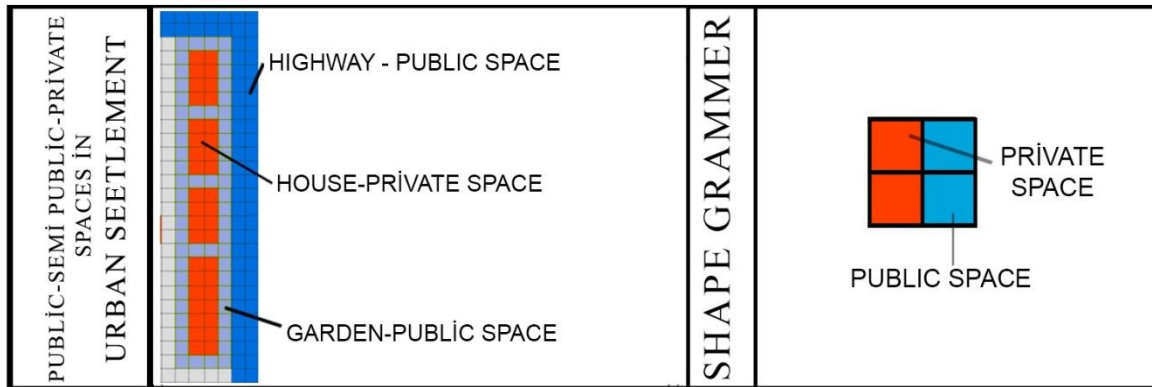
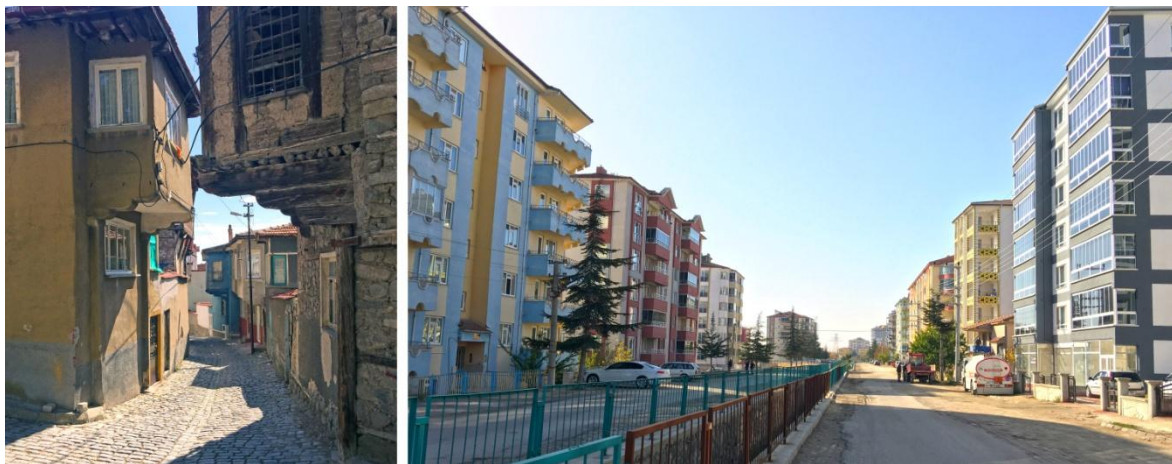


Figure 3.3. Rendering of transitions between space usage in the traditional urban texture



**Figure 3.4.** Rendering of transitions between space usage in the new urban texture

However, the same setup is missing from the new urban texture. Public spaces are disconnected, built based on rigid plans and scattered throughout roads incompatible with the local topography. Semi-public spaces have on occasion disappeared completely, making transitions between public and private spaces possible. Private spaces have lost immediate contact with nature and the organic, people-based setup that they enjoyed, instead being built alongside main roads. It can be clearly seen that the while people's priorities were the focus in the traditional texture, they have been replaced with proximity to roads in the new setup (Figure 3.4, Picture 3.2).





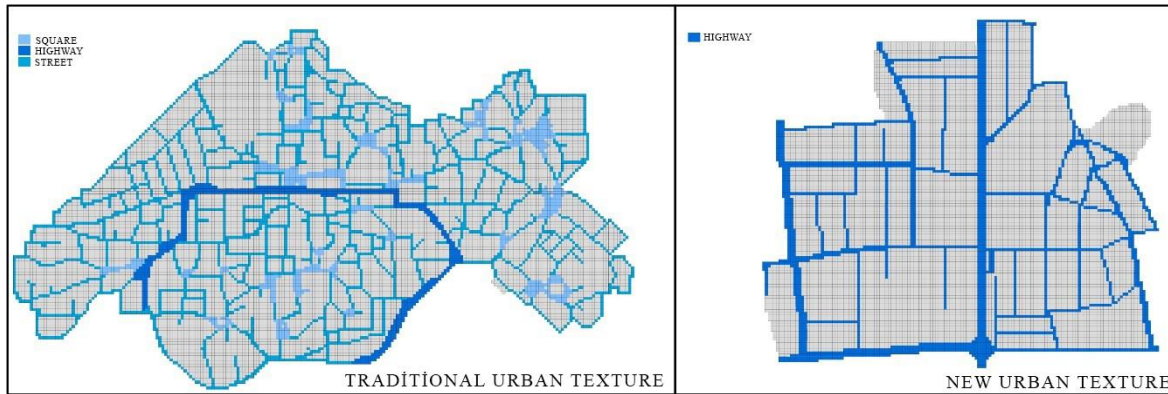


Figure 3.5. Transportation shape grammar analysis

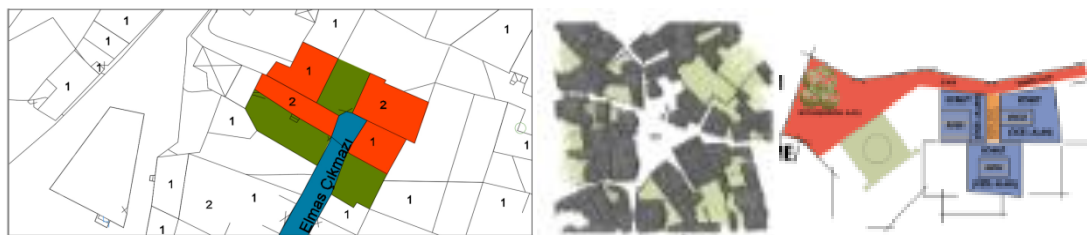


Figure 3.6. Dead end in the traditional urban texture (Imamoğlu, 1992- Yavuz, 2018)

### 3.3. Shape Grammar Analysis of Squares and Elements Affecting Square Formation

Meeting spots known as urban center and secondary centers are not merely the junction points of the transportation network. Spatial elements feeding into squares can be seen in the traditional urban texture. These are mainly religious buildings, official buildings, bath houses, fountains and the like. In the new urban texture, the concept of squares has lost its prominence and the aforementioned buildings are now placed in a scattered pattern. (Figure 3.7).

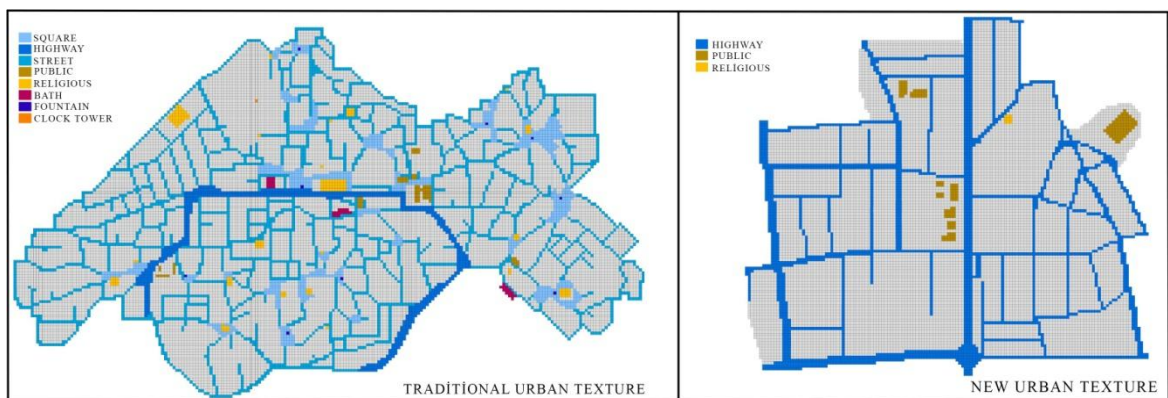


Figure 3.7. Shape grammar analysis of squares and elements affecting square formation

Squares, generally placed around mosques usually form the meeting points for society in the traditional urban texture, playing an important role in the formation of urban centers and secondary centers (Figure 3.8, 3.9). It is apparent that the town's focal points lie inside these squares. In the new setup however, squares are non-existent and roads are connected either by intersections or delineated by greenery such as parks and communal gardens.

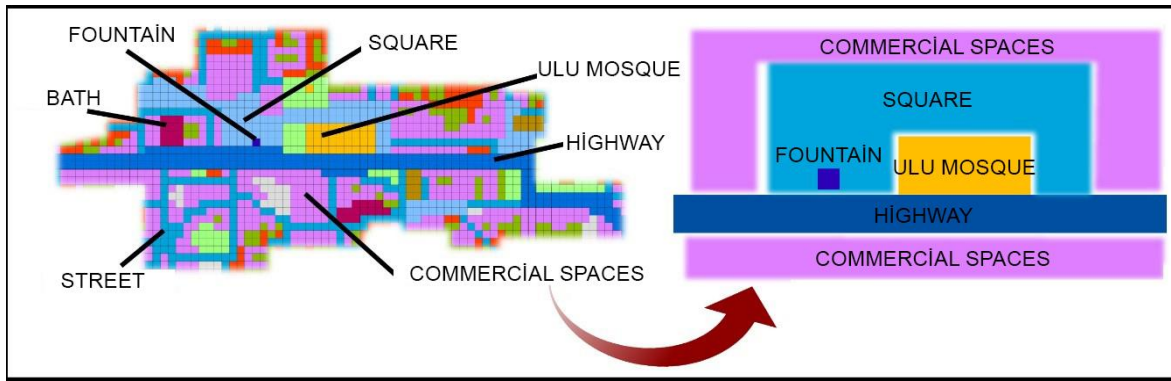


Figure 3.8. Rendering of the urban center's setup in traditional urban settlement

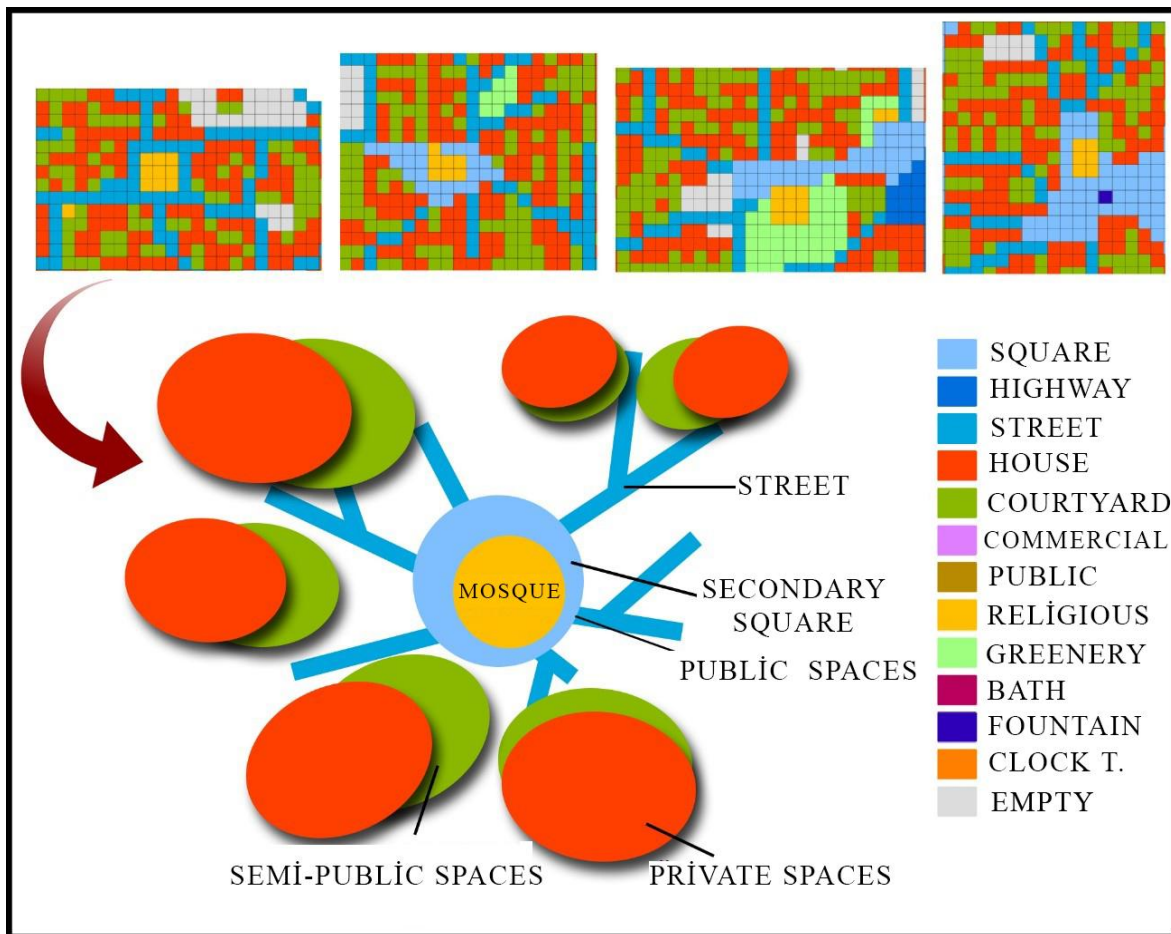


Figure 3.9. Rendering of a secondary center's setup in traditional urban settlement

### 3.4. Shape Grammar Analysis of the Town's Functional Breakdown

In traditional urban environments, residential and commercial zones tend to be separate. The settlement is constructed without a specific layout in mind, and grows in response to functional requirements (Sedes, 1991:81). Sivrihisar's present traditional layout also abides by this general rule (Figure 3.10). In the shape grammar analyses conducted, the commercial zone appeared to stretch around the urban centers and the secondary centers, while the residential areas formed groups with each other. However, the new urban texture has been designed as a solely residential zone and no commercial zones were envisaged.



Commercial activities in the new environment is limited to shops present in the ground floors of a few buildings lying alongside the main road.

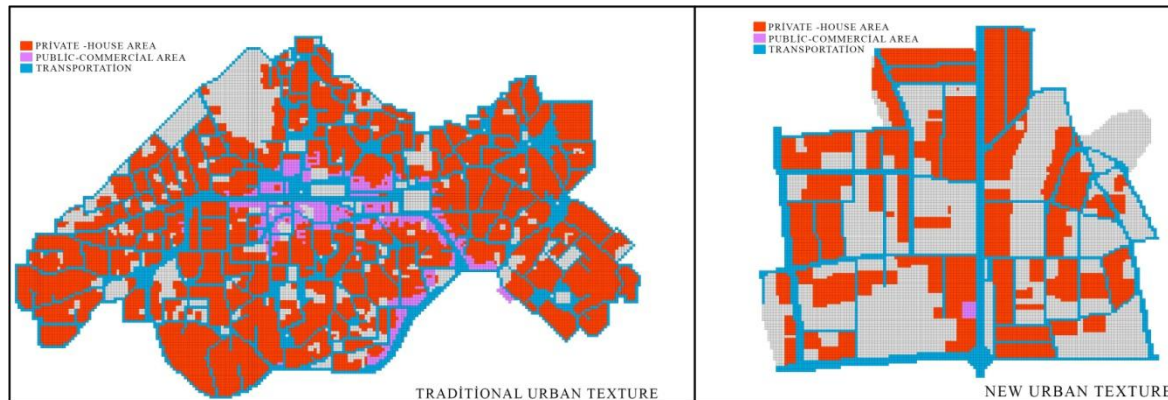


Figure 3.10. Shape grammar analysis of residential & commercial zones and transportation

### 3.5. Traditional and New Urban Texture Shape Grammar Analysis

Two differing textures in the town have been analysed architecturally using shape grammar. Inspected areas were divided into 5-6 meter wide identical squares and rendered in a grid. Roads, streets, squares, residences, commercial zones, religious buildings, bath houses, fountains and greenery affecting the urban setup were colour-coded and analyses were made with regards to public, semi-public and private spaces (Figure 3.11). Determination of the relationships between urban elements, formational rules and focus points was attempted using the renderings.

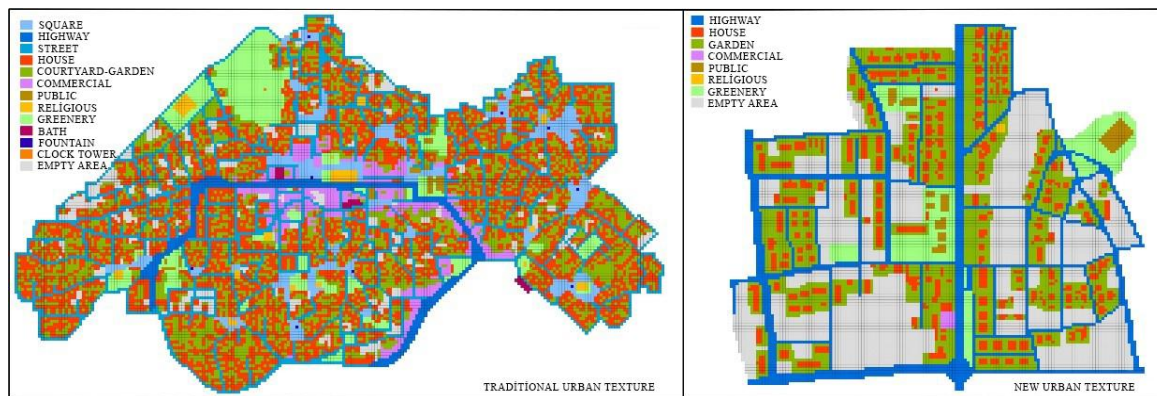


Figure 3.11. Shape grammar analysis of traditional and new urban textures

## 4. CONCLUSION AND COMMENTARY

Shape grammar analyses of the traditional and contemporary urban textures in Sivrihisar have led to the formulation of a ruleset for urban sprawl (Figure 4.1). This ruleset affects 3 main topics.

- A. Formation of the urban center;
  1. Urban center formation begins by placement of the mosque.
  2. A square forms around the mosque, providing communal association.
  3. The mosque is fed by social elements such as fountains, bath houses and greenery around it.
  4. This urban core is then connected to transportation through a main road.

5. The square acts as a market, with a commercial zone developing around the social elements.
6. Streets connected to the main road provide interconnectedness to the growing settlement.
7. Residences placed around the urban center and streets complete the urban center.

B. Formation of Secondary Centers and Neighbourhoods;

The same rules for urban center formation apply similarly to smaller secondary centers.

1. A mosque is the focal point of a secondary center.
2. A square lies around the mosque, fed by elements like fountains etc.
3. Streets form organically, observing topographic limitations. These streets radiate outwards from the mosque and are directed at the urban center.
4. Privat residential spaces and semi-public spaces such as courtyards and gardens are connected to the public spaces forming secondary centers via the organically sprawling streets. Formation of secondary centers and neighbourhoods is thus complete.

C. Urban Texture;

These rules, when applied at differing scales, produce urban centers and secondary centers. These centers then form an urban texture by connecting to each other and the main road through streets. Rulesets formulated in a human-nature based focus also create an urban texture complementing these.

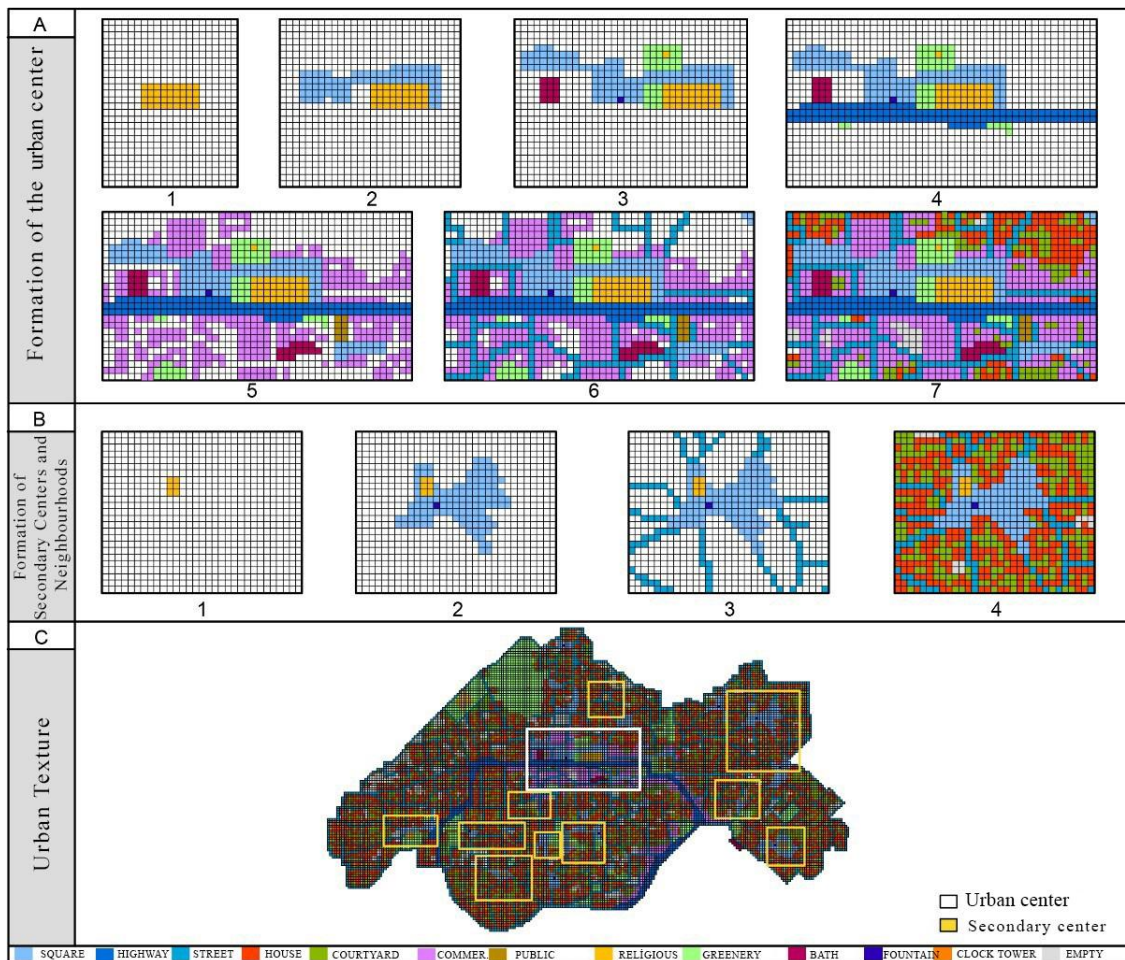


Figure 4.1. Analysis of urban texture formation rules

In conclusion, the analyses conducted show that; the traditional texture of Sivrihisar was formed within specific cognitive rules, with a human-nature based focus and by keeping the concepts of public, semi-public and private spaces in mind. In analyses conducted on the new urban texture, it was found that no rulesets existed to explain the location of urban elements and their connections and that the main road provided the focus point of the new urban texture. It was observed that the new urban texture did not inherit the rulesets for squares, neighbourhoods, central placement, building placement, focus point determination and the provision of secrecy and possession in public, semi-public and private spaces from its predecessor. It was further observed that the concept of neighbourhoods had been replaced with city blocks, divided by linear roads.

The usage of rulesets acquired through the analyses conducted in designing new urban settlements, in order to design new urban areas whose design focuses are compatible with traditional settlements was aimed for.

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