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The Effect of Changing Ventilation Conditions after COVID-19 on Thermal Loads in Naturally Ventilated Higher Education Classrooms

Hasan Murat Çetin *
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Mustafa Özgünler ***

Abstract

It is difficult to control the recommended ventilation rates for infection control during the COVID-19 preriod by natural ventilation. While insufficient ventilation increases the risk of infection, excessive ventilation can cause problems in energy efficiency in buildings depending on climatic conditions. Therefore, in order to provide an easier infection control in naturally ventilated classrooms, the recommended ventilation scenarios after COVID-19 should be examined in terms of energy efficiency and the most suitable periods for natural ventilation should be determined. In this study, the effects of ventilation scenarios developed based on ventilation recommended by international organizations and ventilation scenarios developed based on infection risk during the COVID-19 period on heating-cooling energy demands were analyzed and the most suitable periods for natural ventilation were determined according to climates.Thus, for naturally ventilated classrooms located in different climate zones, the appropriate period in terms of thermal comfort and heating-cooling energy demand for the academic year's work schedule during the COVID-19 pandemic period can be determined.Ventilation rates based on infection risk were determined by two different mathematical models based on the modified Wells-Riley equation that was improved according to SARS-COV-2. The heating-cooling energy demands of the classrooms were calculated according to the heat balance method with the building energy simulation. The proposed method was applied to a naturally ventilated higher education building as a case study. The results show that the differences in the recommended ventilation scenarios after COVID-19 also cause differences in heating and cooling loads. It has been observed that the natural ventilation required after COVID-19 reduces the total energy demand for building heating and cooling between 25.54% and %27.48 in hot and temperate climates and can increase it by 69.59% in cold climates compared to before COVID-19. Other results have shown the importance of determining the Academic Work Year Schedule in terms of energy efficiency in airborne outbreaks such as SARS-COV-2 in line with the periods most suitable for natural ventilation depending on climatic conditions.

Keywords: *Classroom, Cooling energy, COVID-19 pandemic, Heating energy, Ventilation*

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1. INTRODUCTION

Transmission of SARS-CoV-2 can occur through direct contact with infected people or through infected secretions such as respiratory passage droplets (Tang & Wang, 2020). Respiration droplets and aerosol particles can move through the air, as well as stay suspended in the air for a certain distance and time period (Jarvis, 2020). Therefore, the spread of COVID-19 disease caused by the new SARS-CoV-2 virus usually occurs in indoor environments where virus transmission may occur easily (da Silva, 2020; Richardson & Lovegrove, 2021).

During the COVID-19 pandemic, many countries have had to implement some enforcements to ensure infection control in schools and public places with crowded indoor environments such as classrooms. One of these enforcements is closing down the schools temporarily and the development of distance education-work modules, and etc. The sudden and long-term transition to out-of-school learning during the COVID-19 process has had a negative effect on both the education of students and their state of mind (Zviedrite et al., 2021).

WHO (World Health Organization) considers inadequately ventilated places during the COVID-19 process as high-risk in terms of infection risk. Therefore, ventilation has been prioritized to prevent the spread of the SARS-COV-2 virus in learning spaces during the return to face-to-face education. One of the two primary approaches to ventilation is to provide the necessary fresh ventilation rates per person recommended by international organizations such as ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers), REHVA (European Federation of Heating, Ventilating and Air-Conditioning Associations) and WHO; the second approach is to provide ventilation rates based on the quantitative airborne infection risk in indoor spaces. For example, although ASHRAE did not specify a clear value for classrooms in its report published during the COVID-19 outbreak, it stated that more minimum ventilation is required compared to the pre-COVID-19 ANSI/ASHRAE 62.1 Standard (ASHRAE, 2021). REHVA recommends a minimum fresh ventilation rate of 8-10 L/s per person in classrooms (REHVA, 2021), while WHO recommends 10 L/s for naturally ventilated buildings other than residential buildings (WHO, 2021), These uncertainties cause contradictions both in terms of infection control in learning spaces and the heating and cooling energy demand required for indoor thermal comfort conditions. While the common point of these recommendations is to increase fresh ventilation rates compared to pre-COVID-19, there is still uncertainty about exactly how much is needed. This uncertainty causes contradictions in terms of both infection control in learning spaces and heating and cooling energy demand required for indoor thermal comfort conditions.

It is easier to apply the ventilation recommendations that emerged during the COVID-19 process in classrooms with mechanical ventilation in real-life conditions than in classrooms with natural ventilation. In classrooms with mechanical ventilation, air flow distribution and fresh

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air rate can be easily controlled by the automation system. In naturally ventilated classrooms, CFD (computational fluid dynamics) or tracer gas decay method is generally used in studies to control ventilation rates with airflow distribution strategies.

Ascione et al. (2021) investigated air distribution strategies with CFD in their study on safe classroom design in infectious diseases such as COVID-19 in a university building. Park et al. (2021) calculated the natural ventilation rates according to the conditions of opening the windows with the tracer gas decay method in a naturally ventilated school building and reported that the ventilation rates required for the classrooms to be safe in terms of the risk of infection during the COVID-19 process can be achieved by natural ventilation.

Previous studies have shown that the ventilation rate and ventilation strategies in naturally ventilated classrooms can be controlled in specific ways. Classrooms, which are usually kept closed due to drafts and external noise, are very vulnerable to virus infection. Moreover, even if natural ventilation rates are controlled, the impact of natural ventilation on indoor thermal comfort can be positive or negative depending on climatic conditions. The negative impact of the blowing sensation for students sitting by the window can be reduced by changing the seating arrangement in classrooms, taking into account social distancing conditions. However, in cases where natural ventilation is required to reduce the risk of infection, the indoor comfort temperature needs to be maintained to prevent thermal discomfort in classrooms. This will also directly affect building energy consumption. To create healthy interiors using low energy, it is vital to make adequate and effective natural ventilation decisions during the building design process. Therefore, it has become even more important to investigate the impact of natural ventilation on building energy performance during the COVID-19 period.

The current air conditioning system of most schools have been scaled according to the conditions before COVID-19. In schools with natural and mechanic ventilation, especially in very cold or hot climates, existing air conditioning systems may be insufficient to meet the demand for heating or cooling energy in changing required ventilation conditions during the COVID-19 period. Therefore, as Park et al. (2021) mentioned, if the ventilation required to reduce the risk of infection during the COVID-19 process is provided by natural ventilation, the effect of ventilation on building energy performance should also be investigated.

Up until today, studies have been conducted on the effect of changing conditions on energy demand in educational buildings during the COVID-19 period with building energy simulation and Monte Carlo method (Ascione et al., 2021; Orosa et al., 2020; Zhang et al., 2020). However, in these studies, ventilation rates were generally determined according to the values in international standards. Kurnitski et al. (2021) stated that fixed ventilation rates in classrooms are not sufficient under any circumstances and therefore a general ventilation criterion based on infection risk should be established with the Wells-Riley model calibrated

according to SARS-CoV-2. Yılmazoğlu (2020) developed and published a calculation tool for determining COVID-19 infection risk and required ventilation rates in indoor environments using the Wells-Riley equation. As in these examples, the Wells-Riley equation is now widely used in studies analyzing the relationship between the risk of airborne COVID-19 infection and ventilation strategy.

Sutherland et al.(2022) reviewed 142 articles from 4 search databases to examine the existing literature on the effect of natural ventilation on thermal comfort in winter months and found that most studies focused on the evaluation of ventilation conditions, especially in areas that are not naturally ventilated. He also emphasized that there is a significant gap in the existing relevant literature. To the best of our knowledge, no study has examined the effects of fixed ventilation rates recommended by international organizations and infection risk-based ventilation rates on heating and cooling energy loads in naturally ventilated schools. Comparing and analyzing these approaches may contribute to architects, engineers, pedagogues and pandemic researchers to determine energy efficiency strategies that differ according to climates during pandemic periods such as COVID-19 and to create a different working schedule for the academic year according to climates.

By studying the ventilation approaches that emerged throughout the COVID-19 process and reviewing the fundamental theories, formulations, and revisions of ventilation approaches per COVID-19, ventilation rates were calculated in this study according to the classrooms selected for the case study. The influence of ventilation approaches in the COVID-19 process on heating and cooling energy demand in naturally ventilated higher education classrooms in hot humid, hot dry, mild humid, mild dry, and cold climates was then studied. In the conclusion section, various proposals have been offered for the periods when natural ventilation is acceptable in terms of heating-cooling energy demand according to the climates in the COVID-19 process.

2. METHOD

This study has been prepared in order to fill the gap in the existing literature, to provide the most appropriate conditions in terms of energy while making the infection rate the healthiest in schools where ventilation is provided only by natural ventilation, taking into account the energy concept, which is one of the cornerstones of sustainability criteria. While preparing this study, the losses and gains in the energy connection of schools in different climate zones will be determined. In this way, it will be possible to determine the course hours or gaps between classes that can be created according to the climate zones in the new semester. In this way, both healthy, comfortable and the most efficient energy consumption will be realized. For this reason, a sample school was selected in the study and the most used classrooms in the school were examined and analyzed. The work flow diagram is given in Figure1.

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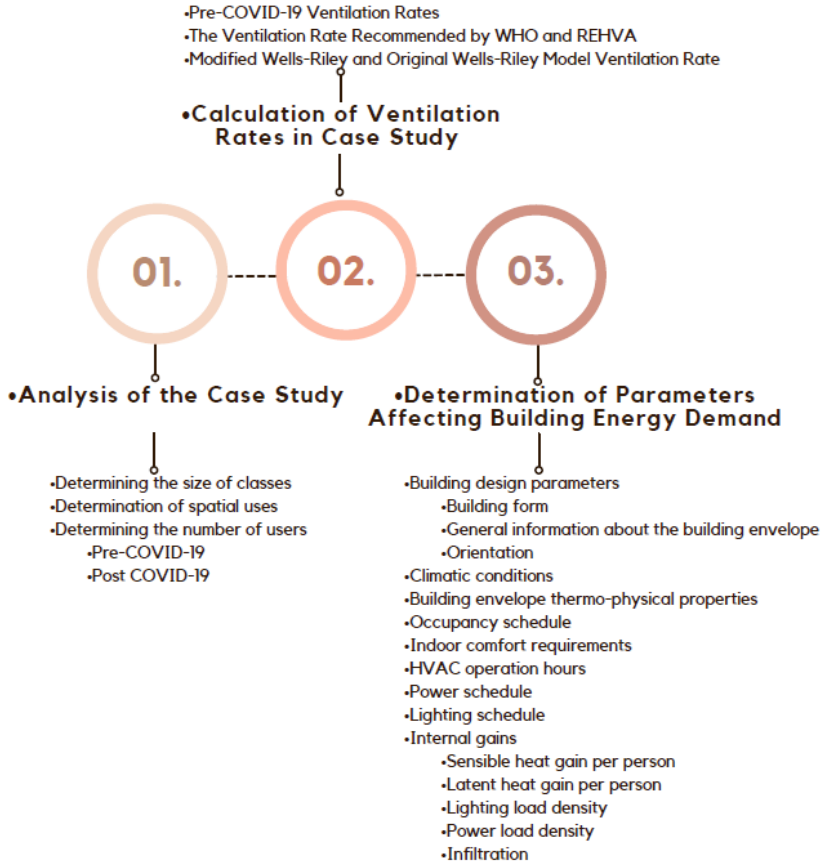


Figure 1. Workflow diagrams.

The proposed method consists of three stages. In the first stage, classrooms representing higher education learning spaces were determined for the case study and the analysis of the case study was performed. At this stage, the dimensions of the classrooms, their spatial use and the number of users were determined according to the social distancing rules for pre-COVID-19 and post-COVID-19.

In the second stage, outdoor air ventilation rates required for classrooms were calculated. The ventilation rates determined according to the fixed ventilation approach after COVID-19 were calculated with the ventilation approach recommended by WHO and REHVA (REHVA, 2021; World Health Organization, 2021). Based on the original Wells-Riley equation and the Wells-Riley equation developed by the COVID-19 Task Force of REHVA's Technology and Research Committee (REHVA, 2021) according to SARS-CoV-2, the ventilation rates determined based on the risk of infection were calculated by Kurnitski et al. (2021) with the equation derived to calculate the ventilation rates.

In the third stage, other parameters affecting the heating-cooling energy consumption of the sample classroom block determined for the case study (such as the design parameters of the classrooms, climatic conditions, thermo-physical properties of the building envelope, occupancy-operation parameters and internal heat gains) were determined. The energy model of the higher education classrooms determined for the case study was created and the heating and cooling

thermal loads were calculated for the academic work year schedule according to the ventilation scenarios determined before and after COVID-19. EnergyPlus, (EnergyPlus ™, 2010) an energy analysis and thermal load simulation program developed by the U.S. Department of Energy, was used to calculate thermal loads.

The accuracy of the EnergyPlus software has been previously validated by the Building Energy Simulation Test procedure (BESTEST) (Strand, 2005). EnergyPlus calculates heating-cooling loads (heating-cooling thermal loads) according to the heat balance method algorithm, which takes into account the transient heat conduction in the building envelope and all heat balances on the exterior and interior surfaces (Buratti et al., 2013; Eskin and Türkmen, 2008; Miyazaki et al., 2005). The "Heat Balance Method" is scientifically recognized as one of the most accurate methods for various heat transfer and thermodynamic processes (Pedersen et al., 1997; Yan et al., 2015). The heat balance calculation method is described in detail in the EnergyPlus 9.1.0 Documentation (EnergyPlus™, 2019). The accuracy of the EnergyPlus software has been previously validated by the Building Energy Simulation Test procedure (BESTEST) The steps of the proposed methodology are described in detail in the following sections.

2.1. Analysis of the Case Study

Case studies were conducted on actual room layouts to test recommended ventilation approaches based on infection risk. In this experiment, the classrooms in the Architecture classroom block of the Faculty of Architecture and Design of Erzurum Atatürk University were chosen for the case study. Since mechanical ventilation cannot be used actively in classrooms, the need for fresh ventilation is carried out by natural ventilation method by the windows.

The building consists of three main axes and has three floors. The number and order of classrooms in each axis is the same. There are 3 types of classrooms in each axis. These are architecture studio, small theoretical classroom and large theoretical classroom. The ground and 1st floor plans are the same and there are two architecture studios on each floor. On the 2nd floor, there are 2 large and 1 small theoretical classrooms on each axis. The study covers the classrooms of the 2 main blocks of the architecture department and the analysis was done for a total of 4 architecture studios, 4 large and 2 small theoretical classrooms. The general layout of the building is shown in Figure-2, the 3D visuals of the block and classrooms are shown in Figure-3 and the floor plans and sections of the classroom block are shown in Figure-4.

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Figure 2. Faculty building and its immediate surroundings

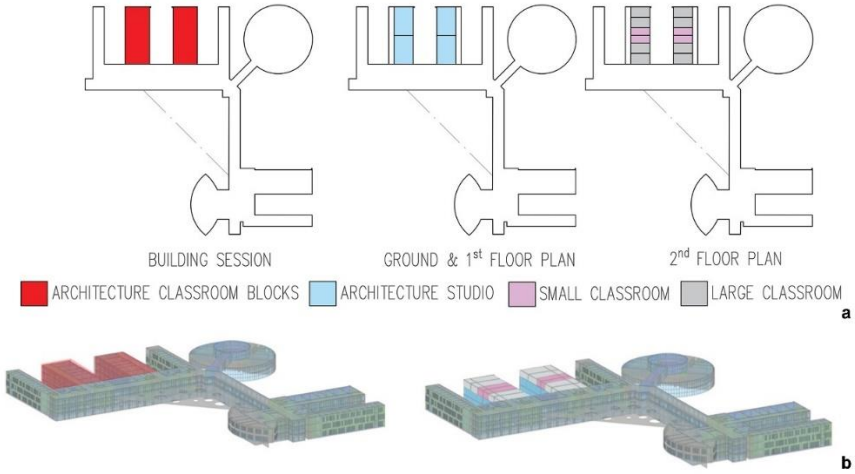


Figure 3. a) Location of blocks and classrooms in the plan b) Location of blocks and classrooms in 3D visual

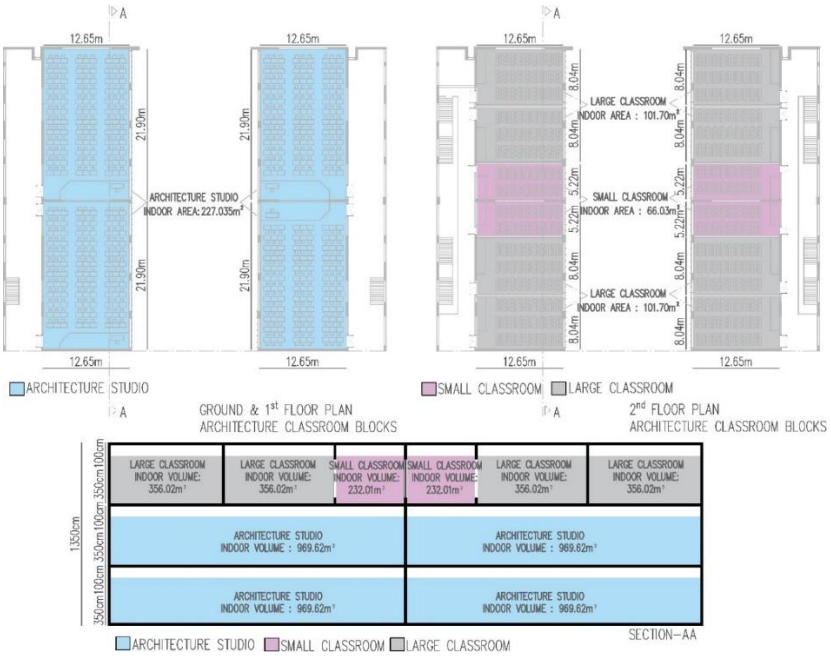


Figure 4. Floor plans and sections of the architecture classroom block

In terms of the risk of infection after COVID-19, the density of occupancy in classrooms varied compared to before COVID-19 due to social distancing rules. At this stage, while the capacity should be diluted by 50% for large and small theoretical classrooms, it was not necessary to dilute 50% thanks to the large internal volume resulting from the pedogical requirements in the architectural studio classroom. The user density and detailed information of the classrooms are given in Table 1.

Table 1. Location and user density information of classrooms

Classroom	Number of classrooms	Floor space (m^2)	Space Ceiling height (m)	Before COVID-19 conditions		After COVID-19 conditions (Social distancing)	
				Total number of people	Number of people per area (m^2)	Total number of people	Number of people per area (m^2)
Architectural Studio	4	277.035	3.50	108	2.65 m^2	72	3.84
Small Classroom	2	66.004	3.50	54	1.22	27	2.44
Large Classroom	4	101.200	3.50	81	1.25	40	2.54

2.2. Calculation of Ventilation Rates in Case Study Classrooms

In the calculation of the ventilation rates of the classrooms, the standards of the pre-COVID-19 periods, methods developed after-COVID-19, values and guidelines recommended by the institutions were taken into consideration.

2.2.1. Pre-COVID-19 Ventilation Rates

According to ASHRAE 62.1, the minimum air flow in the breathing zone can be 3.8 L/s for lecture theaters, while the minimum air flow according to ISO and EN standards should never fall below 4 L/s per person for health reasons (Khovalyg et al., 2020). In non-residential low polluted buildings, ISO 17772, EN 16798 and EN 15251 specify a value of 4 L/s for category 3 ventilation rates. In this study, 4 L/s per person was accepted as the miminum ventilation rate for pre-COVID-19. Accordingly, 1.55 L/(sm^2) in the architectural studio classroom; 3.27 L/(sm^2) in small theoretical classrooms; 3.19 L/(sm^2) in large theoretical classrooms are required to provide minimum ventilation rates for pre-COVID-19 in learning spaces of which capacity and spatial dimensions are given in the Table 1.

2.2.2. The Ventilation Rate Recommended by WHO and REHVA

The WHO and REHVA proposed the category I ventilation rate (10 l/s per person), which has a higher ventilation rate among 3 categories, referring to the EN 16798: 2019 standard as the minimum ventilation

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requirement in non-hospital and non-residential buildings during the COVID-19 process (WHO, 2021; REHVA, 2021). According to the ventilation approach proposed by WHO and REHVA, the minimum ventilation rate required for learning spaces after COVID-19 was calculated as 2.59 L/(sm²) in the architectural studio classroom; 4.09 L/(sm²) in small theoretical classrooms; 3.95 L/(sm²) in large theoretical classrooms.

2.2.3. Modified Wells-Riley and Original Wells-Riley Model Ventilation Rate

The original Wells-Riley model is shown in Equation (1) (Riley et al., 1978):

$$P_I = \frac{C}{S} = 1 - \exp\left(-\frac{Iqpt}{Q}\right) \quad (1)$$

where $P_ı$ is the probability of infection risk; S is the number of susceptible people; C is the number of cases that develop infection; I is the number of infectious persons; t is the duration of the occupancy; q is the quanta emission rate; p is the pulmonary ventilation rate and Q is the volume flow of pathogenic free air. In the original Wells-Riley model, the factors affecting the risk of infection are limited to the parameters specified in the equation.

Kurnitski et al. (2021) derived an equation that can be used directly for ventilation scaling, with the assumption of steady state. In this model, taking into account the surface deposition loss and virus decay of SARS-CoV-2, the external ventilation rate was determined as Q (m³/h) shown in Equation (2) derived by Kurnitski et al. (2021):

$$Q = \frac{qQ_bD}{ln\left(\frac{1}{1-p}\right)} - (\lambda_{dep} + k)V \quad (2)$$

Where D is the duration of the occupancy (h); Q_b is the volumetric breathing rate of an occupant (m³/h); q is the quanta emission rate per infected person (quanta/(h pers)); p is the probability of infection for susceptible persons; V is volume of the room (m³); λ_{dep} is deposition onto surfaces (1/h); k is virus decay (1/h).

As shown in Equation (3), the amount of inhaled quantum (n) depends on the length of time people stay in the area (D, h), the average of the quantum concentration (C_{avg}) and a person's volumetric respiratory rate (Q_b, m³/h).

$$n = C_{avg}Q_bD \quad (3)$$

The average concentration is determined as shown in Equation (4), Equation (5) and Equation (6):

$$E = Iq \quad (4)$$

$$C(t) = \frac{E}{\lambda V}(1 - e^{-\lambda t}) \quad (5)$$

$$C_{avg} = \frac{1}{D}\int_0^D C(t)dt = \frac{E}{\lambda V}\left[1 - \frac{1}{\lambda D}(1 - e^{-\lambda D})\right] \quad (6)$$

Where E is quanta emission rate (quanta/h); Λv is the outdoor air change rate (1/h); t is time (h). The first order loss amount coefficient (λ, 1/h) for quanta/h is determined according to Equation (7) (Yang & Marr, 2011) below:

$$\lambda = \lambda v + \lambda_{dep} + k \quad (7)$$

Quanta emission amount and volumetric respiratory rate value vary according to activities such as speaking aloud, coughing, and exercising. Therefore, the appropriate value should be determined by examining the studies analyzing the volumetric respiratory rate value and the quanta formation amounts for SARS-CoV-2 according to the activities. The number of susceptible people (S) in the classrooms and the volume of the classrooms (V) are shown in Table 1. The number of cases that develop infection (C or R) in classrooms was accepted as 0.99. The number of people infected with COVID-19 was accepted as one person in classrooms. The parameters in the Wells-Riley equation developed to determine the risk of infection and the references relevant to the values accepted in this study are shown in Table 2.

Table 2. Parameters and accepted values in the modified Wells-Riley model

Parameter	Units	Value	References
Virus decay (k)	h^{-1}	0.32	(Fears et al., 2020; van Doremalen et al., 2020)
Virus surface deposition loss rate (λ_{dep})	h^{-1}	0.30	(Buonanno, Morawska, et al., 2020; Chatoutsidou & Lazaridis, 2019; Diapouli et al., 2013; Miller et al., 2020; Thatcher et al., 2002)
Quanta emission rates (q)	quanta/ h	16.50	(Stabile, Pacitto, et al., 2021)
The volumetric breathing rate of an occupant (p or Qb)	(m^3/h)	0.80	(Adams et al., 1993; Binazzi et al., 2006)
The duration of the occupancy (t or D)	h	4	8 AM to 12 PM - 13 PM to 17 PM

Considering the parameters specified in Table 2, the minimum ventilation rates required for the acceptable infection risk level (R=0.99) according to the equation in the modified Wells-Riley model were calculated as: 2.94 L/(s m^2) in the architectural studio classroom; 5.07 L/(s m^2) in small classrooms; 4.89 L/(s m^2) in large classrooms. The minimum ventilation rates required for the acceptable infection risk level (R=0.99) according to the formula in the original Wells-Riley model were calculated as: 3.85 L/(sm^2) in the architectural studio classroom; 6.06

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L/(sm²) in small theoretical classrooms; 5.85 L/(s m²) in large theoretical classrooms.

2.3. Determination of Parameters Affecting Building Energy Demand

In order for the proposed study to give accurate results with different data and to be developed with other researches, the variables affecting thermal loads should be determined in detail. Parameters affecting heating-cooling energy demand: building design parameters (building form, general information about the building envelope, orientation, etc.), climatic conditions, building envelope thermo-physical properties, occupancy schedule, indoor comfort requirements, HVAC operation hours, power schedule, lighting schedule, etc. and internal gains (sensible heat gain per person, latent heat gain per person, lighting load density, power load density, infiltration, etc.) are discussed in detail within the scope of the study.

2.3.1. Building Design Parameters

Heat gains and losses in the building are mostly caused by the building envelope. Therefore, the thermo-physical properties of the components forming the building envelope, window wall ratio, building geometric form and orientation directly affect the energy need and energy consumption of the structures. The present classroom block, the classrooms are north oriented, while the corridor is south oriented. There are no windows on the facades in the other two directions. The section and plan showing the building geometry, classroom dimensions and classroom orientations are shown in Figure 1. According to the design parameters of the building, the information of the building shell is given in detail in Table 3.

Table 3. Building design parameters

Number of floors	Classroom block	Ground + 2 floors
Level floor area	Gross floor	44.7 m*18.85 m=842.595 m²
	Conditioned floor	794.535 m²
Height	Floor height	4.5 m
	Ceiling height	3.5 m
	Building height	13.5 m
Energy analytical model spaces	Total floor area	4096,45 m²
	Conditioned classroom floor area	1694,20 m²
	Unconditioned corridor floor area	707.45 m²
	Unconditioned ceiling floor area	1694.80 m²
Energy analytical model volume	Total volume	10110.68 m³
	Conditioned classroom	5761.71 m³

	Unconditioned corridor	3086.01 m^3
	Unconditioned ceiling floor	1262.96 m^3
Conditioned classroom facade surface area (North)	Opaque wall area	451.83 m^2
	Window opening area	297.64 m^2
	Window-wall ratio (%)	%68.15
Corridor facade surface area (South)	Gross wall area	573.51 m^2
	Conditioned gross wall area	0.00 m^2
	Window opening area	257.43 m^2
	Window-wall ratio (%)	%44.89
Conditioned other walls facade surface area	East opaque wall facade surface area	135.78 m^2
	West opaque wall facade surface area	132.58 m^2
Roof area	Conditioned roof area	795.69 m^2

2.3.2. Determination of Building Envelope Thermo-Physical Properties

Climate zones in Turkey are divided into 4 climate zones according to the heating degree day method with The Turkish Standard "TS 825 Thermal Insulation Requirements in Buildings" and standards have been introduced in thermal conductivity values for building envelope components (TS 825, 2008). In this study, the building envelope u-values specified in the standards were accepted according to the climate zones in TS 825 regulation. TS 825 heating degree day climate zones and building envelope u values are shown in Table 4.

Table 4. TS 825 Climate Zone and Building Envelope U-Value

TS 825 Climate Zone	Exterior Wall U-Value (W/m^2K)	Slabs on grade U-Value (W/m^2K)	Roof U-Value (W/m^2K)	Window U-Value (W/m^2K)
1. Region	0.70	0.70	0.45	2.4
2. Region	0.60	0.60	0.40	2.4
3. Region	0.50	0.50	0.30	2.4
4. Region	0.40	0.40	0.25	2.4

Solar heat gain coefficient (shgc) and visual light transmission (vlt) value are not specified for windows in TS 825. In this study, the solar heat gain coefficient value was accepted as 0.50 and the visual light transmission value was accepted as 0.71.

2.3.3. Determination of Representative Climate Zones

In studies dealing with the relationship between architecture and te in Turkey, climatic zones are generally classified as 5 different climates:

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hot-humid, hot-dry, moderate-humid, moderate-dry and cold (Ovali, 2020). Therefore, in this study, cities representing all climate types were also included. Other information about the climate servers and climatic characteristics in which the climate data of the selected cities were obtained is shown in Table 5 below. World Meteorological Organization (WMO) weather stations included in EnergyPlus were used to collect climate data for representative cities. EnergyPlus and the World Meteorological Organization both provide access to climate data.

Table 5. Climate data of selected cities and other information on climatic characteristics

City	Latitude (degree)	Longitude (degree)	WMO Weather Stations	Ashrae Climate Zone	TS 825 Climate Zone	Climatic Characteristics
Antalya	36.87	30.73	173000	2A	1	Hot humid
Şanlıurfa	37.13	38.77	172700	2A	2	Hot dry
İstanbul	40.98	28.82	170600	3A	2	Temparate humid
Ankara	39.95	32.88	171300	4A	3	Temperate dry
Erzurum	39.95	41.17	170960	6A	4	Cold

2.3.4. Occupancy and Operation Parameters

The heating-cooling energy demand of higher education institutions may vary periodically due to changing climatic conditions during the year with the building usage program in academic work year schedule for the year. In this study, the academic work year schedule accepted by REVIT AUTODESK for universities based on ASHRAE 90.1-2010, ASHRAE 90.2-2010, ASHRAE 62.1 and CBECS data for schools was taken as reference (*Help Occupancy Schedules Autodesk*). Only during the hours that the classrooms are in use is natural ventilation permitted. It was assumed that the classrooms were not used because there was a lunch break between 12:00 PM and 13:00 PM. It is assumed that the classrooms are used to their full capacity. Parameters affecting building energy loads, simulation input data determined based on ASHRAE 55 (ASHRAE, 2013), ASHRAE 62.1 (A. S. ASHRAE, 2019) and ASHRAE 90.1 (ASHRAE, 2013) standards are detailed in Table 6. The corridor in the classroom block was excluded from the study and its thermal loads were not calculated.

Table 6. Occupancy, lighting and power schedule and internal loads

Parameter		Value
Annual occupancy schedule	Spring semester	January 6 – April 5 and April 14 – June 8
	Fall semester	August 25 – December 15
Occupancy schedule on weekdays		8 AM to 12 PM - 13 PM to 17 PM
Lighting schedule		8 AM to 12 PM - 13 PM to 17 PM

Power schedule	8 AM to 12 PM - 13 PM to 17 PM
Sensible heat gain (per person)	73.27 W
Latent heat gain (per person)	58.61 W
Lighting load density	15.07 W/m^2
Power load density	10.76 W/m^2
Infiltration airflow per area	0.358 L/(s·m^2)
Heating set point	21.00 °C
Cooling set point	26.00 °C

3. RESULTS AND DISCUSSION

The annual heating and cooling loads of the classrooms were simulated for all 8760 hours in a 12-month period according to the heat balance method using EnergyPlus™ 9.1.0. Then, in this part of the study, the impact of ventilation approaches emerging after COVID-19 on the heating and cooling energy demand in different climates in the case of natural ventilation in higher education classrooms was analyzed.

3.1. The Effect of Post-COVID-19 Ventilation Scenarios on Heating-Cooling Energy Demand

Figure 5 shows the total annual thermal energy demand of the post-COVID-19 ventilation scenarios based on climates. The climate characteristics of Antalya are that winters are mild and summers are very hot and although rainfall is low, relative humidity is high.

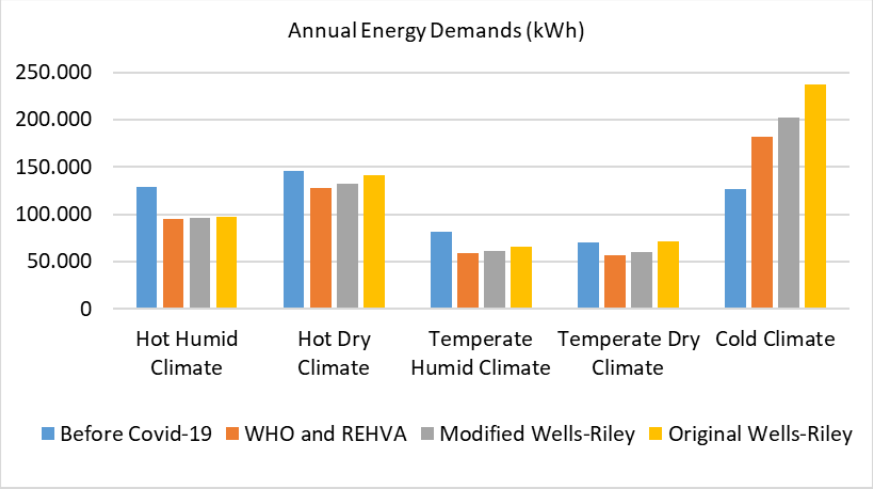


Figure 5. Annual thermal energy demand of ventilation scenarios

According to the figure, the ideal climate for energy demand following COVID-19 was temperate. The cold climate is the worst. The EN 16798-1 ventilation scenario recommended by WHO and REHVA is the most ideal scenario in terms of energy performance in hot and temperate climates. As a result of reducing the cooling load in hot and temperate climates, the increase in natural ventilation following COVID-19 has lowered the total

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energy demand. In cold climates, natural ventilation has been proven to increase energy demand by 86.84%.

3.2. Analysis of Annual Heating and Cooling Energy Demands According to Climatic

In the study, taking the classrooms of a university as an example, the annual heating and cooling energy demands in 5 different provinces with hot humid, hot and dry, temperate humid, temperate dry, cold climate types were analyzed and compared.

3.2.1. Heating and Cooling Energy Demands in Hot Humid Climate

Located in a hot humid climate, Antalya is in the 1st regions according to TS 825 heating degree day, while it is in the Csa (Mediterranean climate) climate type according to the Koppen climate classification. Antalya's climate characteristics are that it is mild in winters and very hot and dry in summers. In these climatic conditions, heating-cooling energy demands by months in naturally ventilated higher education classrooms according to the changing ventilation requirements before and after the COVID-19 period are shown in Figure 6.

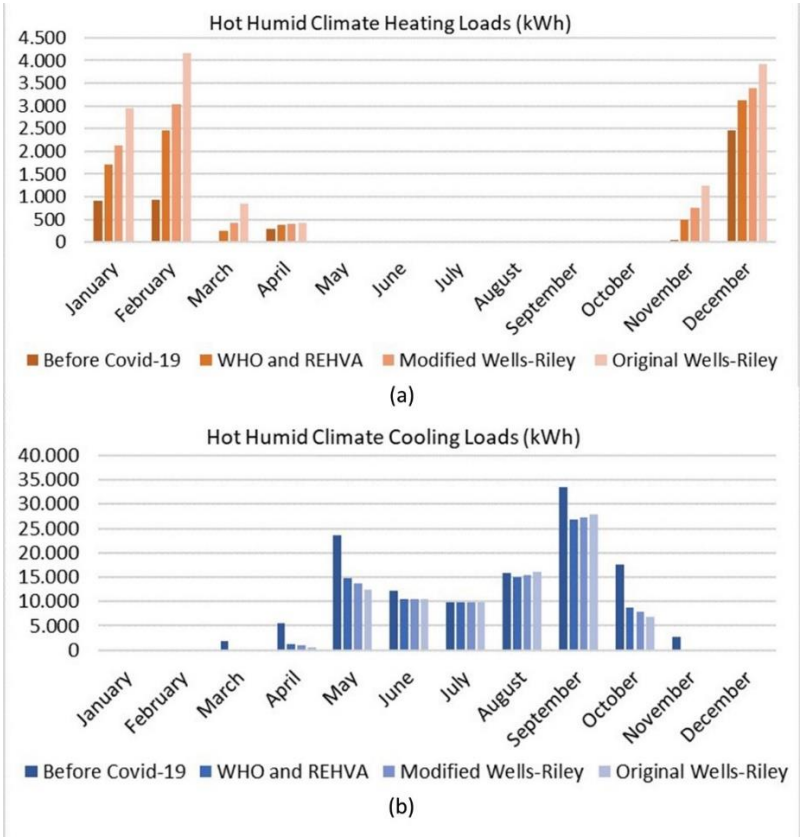


Figure 6. Annual thermal energy demand in hot humid climate; a) heating energy, and b) cooling energy

According to Figure 6, under minimum ventilation conditions before COVID-19, the heating-cooling loads were 75.75 m²/kwh per conditioned building area; 56.39 m²/kwh in the ventilation scenario proposed by WHO and REHVA; 56.59 m²/kwh in the ventilation scenario proposed with the modified Wells-Riley model; 57.70 m²/kwh in the ventilation

scenario proposed with the original Wells-Riley model. Increasing ventilation rates after COVID-19 caused a significant decrease in heating-cooling building energy demand compared to the pre-COVID-19 period. The findings showed that increased natural ventilation after COVID-19 may increase the annual heating energy demand by 188.97% with 8.861 kwh compared to the pre-COVID-19 period, and the annual cooling energy demand may decrease by 31.89% with 39.433 kwh. After COVID-19, the demand for heating and cooling energy was realized at least in the WHO ventilation scenario. In the WHO ventilation scenario, total energy demand decreases by 25.54% with 32.789 kwh compared to the pre-COVID-19 period.

In ventilation scenarios after COVID-19, it is seen that the building energy demand decreases depending on the cooling energy demand as the ventilation rate increases in April, May, June 1-9 and October. In the period between September and 26-30 August, it was observed that the increase in the ventilation rate after the WHO and REHVA ventilation scenarios increased the cooling load. Although the increase in natural ventilation rate after COVID-19 in March and November increases the heating load compared to the pre-COVID-19 period, it provides an advantage in terms of total heating-cooling energy demand since it reduces the cooling load more. In this climate, the periods with the lowest total heating-cooling energy demand after COVID-19 in the current academic year are March, November and April. The periods with the highest energy demand are May and September due to the cooling load.

3.2.2. Heating and Cooling Energy Demands in Hot Dry Climate

Şanlıurfa, which is located in hot dry climate, is in the 2nd region according to TS 825 heating degree day, while it is in the Cshk (Mediterranean climate) climate type according to the Koppen climate classification. Şanlıurfa's climatic character is stated as very hot in summer, cool in winter, and as subtropical dry summer climate. In these climatic conditions, heating-cooling energy demands by months in naturally ventilated higher education classrooms according to the changing ventilation requirements before and after the COVID-19 period are shown in Figure 7.

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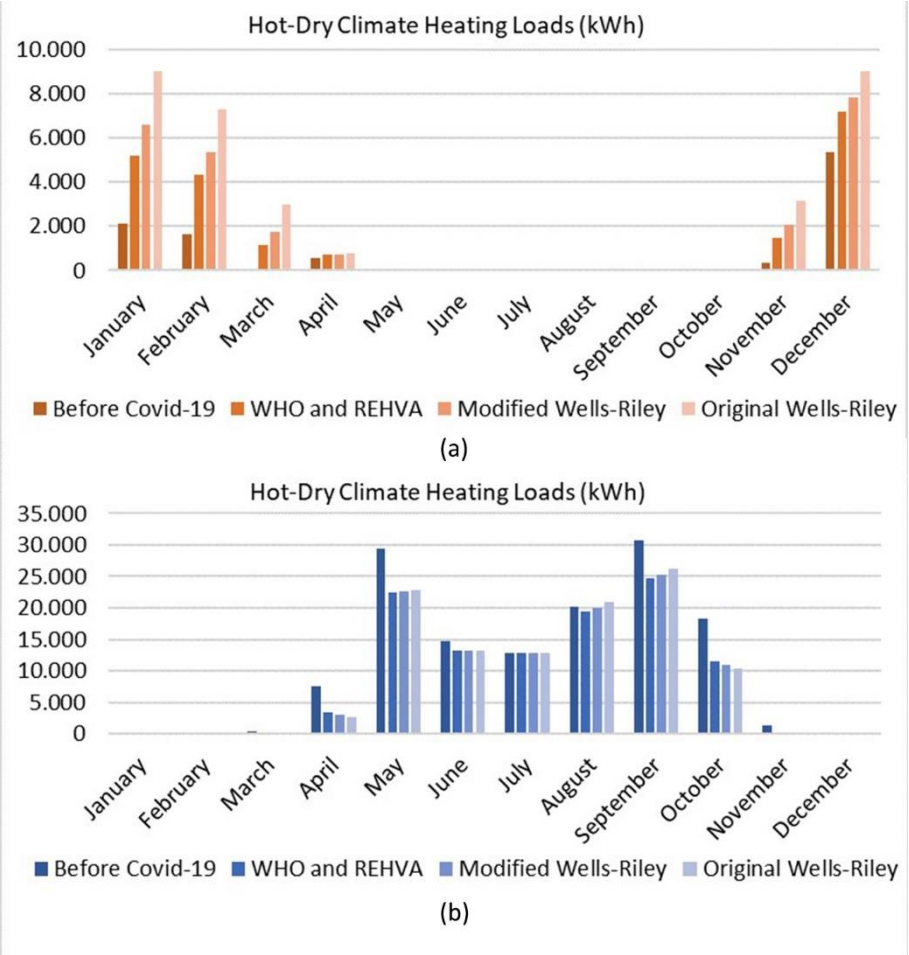


Figure 7. Annual thermal energy demand in hot dry climate; a) heating energy, and b) cooling energy

According to Figure 7, the total heating-cooling energy demand in the hot dry climate was 85.88 m^2/kwh per square meter area conditioned under minimum ventilation conditions before COVID-19; 75.38 m^2/kwh in the ventilation scenario proposed by WHO and REHVA; 78.14 m^2/kwh in the ventilation scenario proposed with the modified Wells-Riley model; and 83.49 m^2/kwh in the ventilation scenario proposed with the original Wells-Riley model.

The findings show that the heating-cooling total energy demand of Şanlıurfa, which is in the 2nd Region according to TS 825 climate class, was 13.38% higher in the pre-COVID-19 period compared to Antalya, which is in the TS 825 1st climate zone; and it has shown that it is 10.22% higher in the post-COVID-19 period. The WHO ventilation scenario was the most ideal ventilation scenario, resulting in a 12.22% decrease in building energy demand by 17,793 kWh compared to pre-COVID-19. From the WHO scenario with the least natural ventilation to the original Wells-Riley model with the most natural ventilation for post-COVID-19, the cooling load increased by 1.41% (1,528 kWh) as the ventilation rate increased and it was observed that the annual heating load increased by 60.86% (12,209 kWh).

The findings showed that increased natural ventilation rates after COVID-19 could reduce the cooling load by 63.14% in April; 23.40% in May; 19.23% in September; and 43.17% in October. In April and October, it is seen that as the ventilation rate increases in ventilation scenarios

after COVID-19, the building energy demand decreases depending on the cooling energy demand. In May and September, it was observed that the cooling load increased as the ventilation rate increased in ventilation scenarios after COVID-19. In the period between August 26-30, it is seen that the cooling load exceeded the pre-COVID-19 period in the ventilation performed with the original Wells-Riley. This shows that in May, June, August and September, when the outside temperature is high, natural ventilation can increase the cooling load after a certain point and therefore increase the building energy demand. In March and November, according to the natural ventilation rate after COVID-19, although the cooling load decreases compared to the pre-COVID-19 period, there may be a disadvantage in terms of total energy demand as the heating load may increase more. Since the cooling load is dominant in the hot dry climate, the most advantageous months in terms of total energy demand after COVID-19 are March, November, April, February, December and January, when the cooling need is low.

3.2.3. Heating and Cooling Energy Demands in Temperate Humid Climate

Istanbul city is in the 2nd region according to TS 825 climate class, however, according to the climate classification, it is considered in a temperate humid climate. In this climate, Figure 5 shows the heating-cooling energy demands and final energy use intensities in naturally ventilated higher education classrooms of which ventilation requirements changed before and after the COVID-19 period.

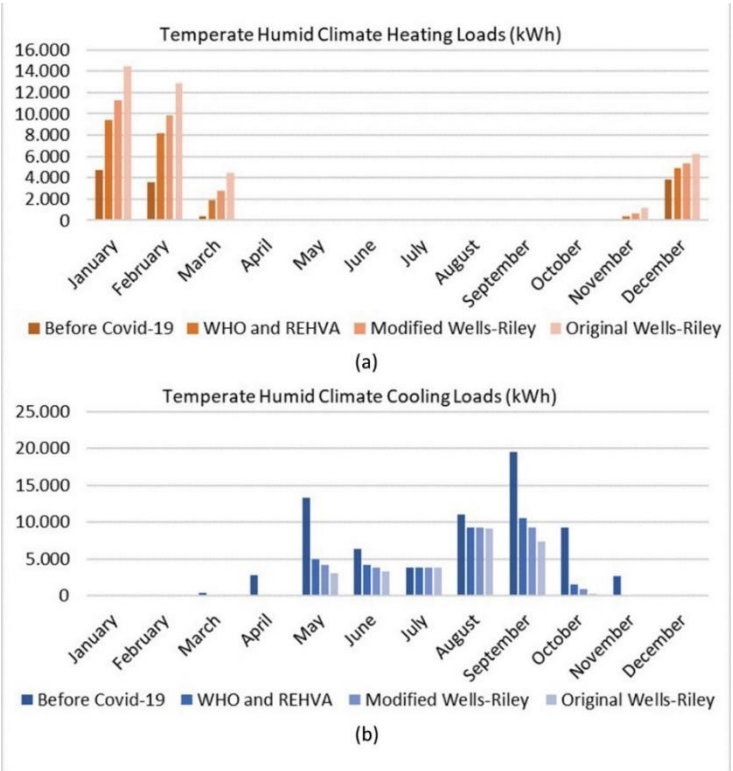


Figure 8. Annual thermal energy demand in temperate humid climate; a) heating energy, and b) cooling energy

According to Figure 8, in temperate humid climate, the total heating-cooling energy demand was 48.32 m²/kwh per square meter area conditioned under minimum ventilation conditions before COVID-19;

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35.03 m^2/kwh in the WHO and REHVA ventilation scenarios; 36.14 m^2/kwh in the modified Wells-Riley ventilation scenario; and 39.02 m2/kwh in the original Wells-Riley ventilation scenario. The WHO ventilation scenario was the most ideal ventilation scenario, resulting in a 27.48% decrease in building energy demand by 22.500 kWh compared to pre-COVID-19. Compared to hot humid and hot dry climate, the heating-cooling energy demand in all ventilation scenarios is less in temperate humid climate.

In ventilation scenarios after COVID-19, it is seen that the building energy demand decreases depending on the cooling energy demand as the ventilation rate increases in April, May, June 1-9, August 26-30, September and October. The continuous increase in natural ventilation during these periods has provided an advantage in terms of energy efficiency. In March and November, heating-cooling energy demand varies according to ventilation rates, as there is a need for both heating and cooling according to ventilation rates. For example, in Novembe, in all ventilation scenarios after COVID-19, although the cooling load decreases compared to the period before COVID-19, it is seen that as the ventilation rates increase, the heating load increases and the total building energy demand increases accordingly. In March, ventilation rates after COVID-19 increase the energy demand of the building as it increases the heating load similarly as in winter. In this climate, in the current academic year, the periods with the lowest total heating-cooling energy demand after COVID-19 are April, October and November. The periods with the highest energy demand are January, February, September and 26-30 August, depending on the ventilation scenarios.

3.2.4. Heating and Cooling Energy Demands in Temperate Dry Climate

Ankara, which is in this climate, is in the 3rd region according to TS 825. In this climate, Figure 9 showing the heating-cooling energy demands and final energy use intensities in naturally ventilated higher education classrooms of ventilation requirements changed before and after the COVID-19 period is given below.

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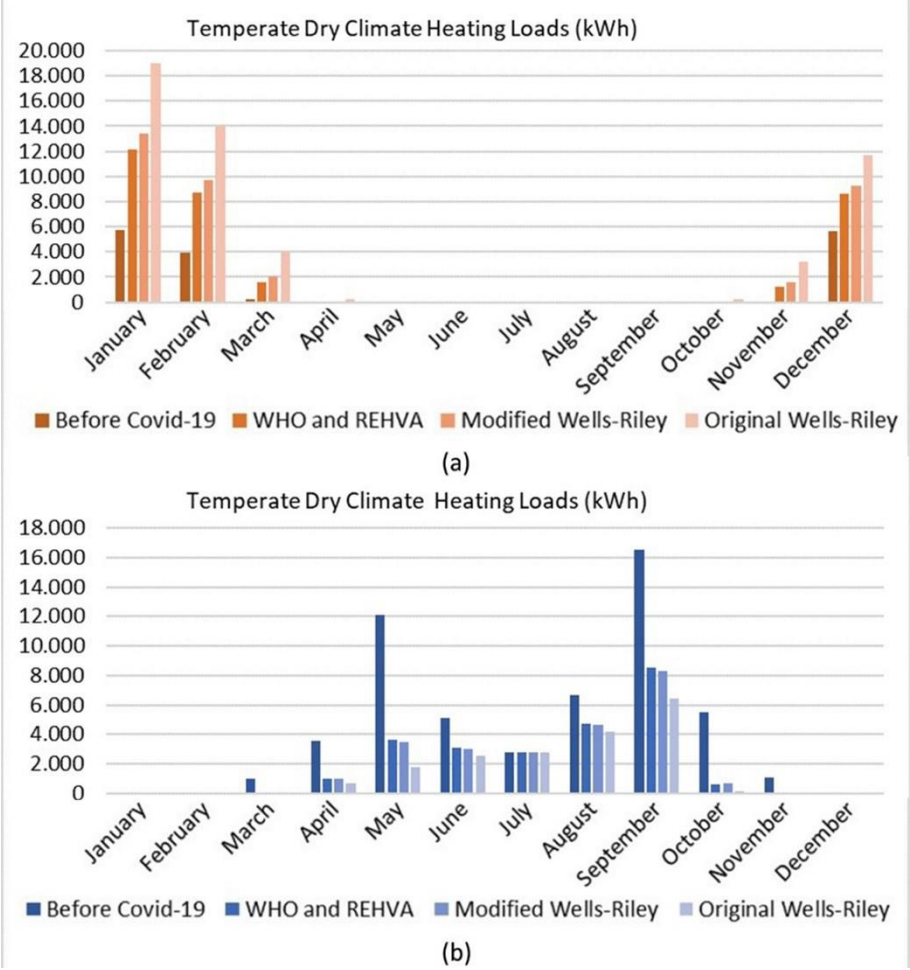


Figure 9. Annual thermal energy demand in temperate dry climate; a) heating energy, and b) cooling energy

According to Figure 9, in temperate humid climate, the total heating-cooling energy demand was 41.20 m²/kwh per square meter area conditioned under minimum ventilation conditions before COVID-19; 33.46 m²/kwh in the WHO and REHVA ventilation scenarios; 35.40 m²/kwh in the modified Wells-Riley ventilation scenario; and 41.81 m²/kwh in the original Wells-Riley ventilation scenario. The WHO ventilation scenario has been the most ideal ventilation scenario, resulting in a 18.77% decrease in building energy demand by 13108 kWh compared to pre-COVID-19. In temperate dry climate, total heating-cooling energy demand in all ventilation scenarios except the original Wells-Riley ventilation scenario was less than in other climates.

In temperate dry climate, ventilation rates significantly change the heating-cooling load. In the original Wells-Riley ventilation scenario, the heating load increased by 237.80% with 36.845 kwh compared to pre-COVID-19, while the cooling load decreased by 65.92% with 35.811 kwh compared to pre-COVID-19. In temperate dry climate, the original Wells Riley ventilation scenario increased the annual heating load, leading to an increase in building energy demand compared to before COVID-19. Unlike other climates, in temperate dry climate, there was an increase in a ventilation scenario for the first time after COVID-19 compared to the minimum ventilation conditions before COVID-19.

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In the post-COVID-19 scenarios in the Ankara climate, it is seen that the cooling load decreases as the ventilation rate increases in April, May, June 1-9, August 26-30, September and October, and this reduces the total building energy demand. In March and November, heating-cooling energy demand varies according to ventilation rates, as there is a need for both heating and cooling according to ventilation rates. In these months, the increase in ventilation rates after COVID-19 caused the total building energy demands to increase compared to before COVID-19, as the heating load increased. In this climate, the periods with the lowest total heating-cooling energy demand after COVID-19 in the current academic year are October, April, March, November and May. The periods with the highest energy demand are January, February, December and September.

3.2.5. Heating And Cooling Energy Demands in Cold Climate

According to TS 825, Erzurum province is in the 4th region, in the cold climate. In this climate, Figure 10 showing the heating-cooling energy demands and final energy use intensities in naturally ventilated higher education classrooms of ventilation requirements changed before and after the COVID-19 period is given below.

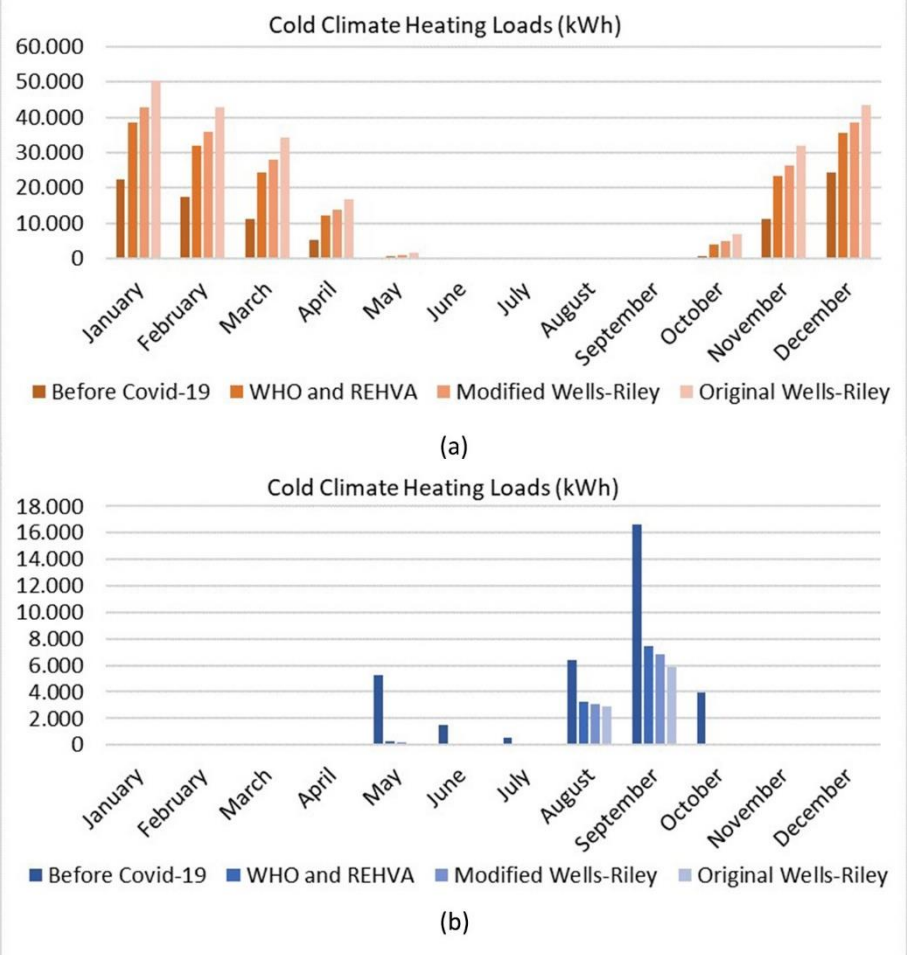


Figure 10. Annual thermal energy demand in cold climate; a) heating energy, and b) cooling energy

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According to Figure 10, in cold climate, the total heating-cooling energy demand was 82.51 m^2/kwh per square meter area conditioned under minimum ventilation conditions before COVID-19; 107.14 m^2/kwh in the WHO and REHVA ventilation scenarios; 119.10 m^2/kwh in the modified Wells-Riley ventilation scenario; and 139.94 m^2/kwh in the original Wells-Riley ventilation scenario. In the cold climate, unlike other climates, there has been a significant increase in building energy demands in all post-COVID-19 ventilation scenarios compared to pre-COVID-19. The who ventilation scenario after COVID-19 was the most ideal ventilation scenario, leading to an increase in building energy demand of 41,733 kWh by 29.85% compared to before COVID-19. In the modified Wells-Riley model ventilation scenario, the increase in building energy demand compared to before COVID-19 was 44.33%, while the original Wells-Riley model increased by 69.59%.

In the current academic calendar year, in the pre-COVID-19 minimum ventilation scenario, there was an energy requirement for cooling in May, June 1-9, August 26-30 and September. After COVID-19, there was a significant decrease in cooling loads with the increase in ventilation rates. Therefore, the least energy demand after COVID-19 occurred in June 1-9, May, August 26-30, October and September. The highest energy demand is in January, December, February, March and November, when the heating load is dominant.

4. FINDINGS AND DISCUSSION

As a result of the studies, in the 3 ventilation scenarios proposed after COVID-19, the highest ventilation rate for the classes in the case study was obtained with the original Wells-Riley model, while the lowest ventilation rate was obtained in the ventilation scenario proposed by WHO. In the 3 post-COVID-19 recommended ventilation scenarios, the highest ventilation rate for the classes in the case study was obtained with the original Wells-Riley model, while the lowest ventilation rate was obtained in the WHO recommended ventilation scenario. The results are shown in Figure 11. The surface deposition loss and virus decay parameters of the virus in the modified Wells-Riley model caused the natural ventilation rates required for the acceptable risk of infection to decrease by 16.33% to 23.63% in the modified Wells-Riley model compared to the original Wells-Riley model. This also showed that the parameters affecting the probability of infection (omicron, alpha, beta variant, etc.) will affect the building energy demand as they will change the ventilation rate.

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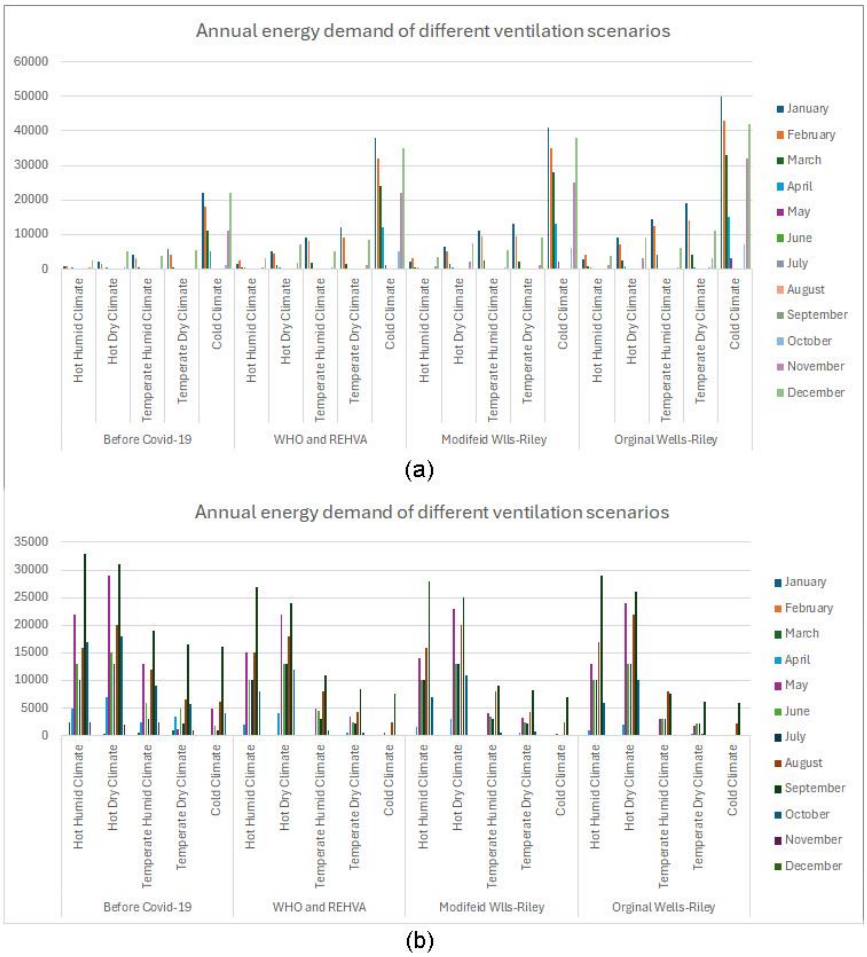


Figure 11. Annual energy different ventilation scenarious; a) heating energy, and b) cooling energy

Annual heating-cooling building energy demands, which were determined based on the ASHRAE, were calculated for 5 different climates according to the occupancy schedule of the classrooms between 6 January-5 April, 14 April - 8 June, 25 August - 15 December, according to the academic year work schedule. If the required outdoor airflow is provided by natural ventilation after COVID-19, the total heating-cooling building energy demand decreased between 23.82% (30,572 kwh) and 25.54% (32,789) in hot humid climate; between 2.78% (4,056 kwh) and 12.22% (17,793 kwh) in hot dry climate; and between 19.23% (15748 kwh) and 27.48% (22500 kwh) in temperate humid climate compared to the pre-COVID-19 period. In temperate dry climate, the demand for heating and cooling energy after COVID-19 decreased by 18.77% (13108 kwh) in the WHO ventilation scenario compared to the pre-COVID-19 period, and by 14.08% (9836 kwh) in the Modified Wells-Riley ventilation scenario, but increased by 1.48% (1034 kwh) in the original Wells-Riley ventilation scenario compared to the pre-COVID-19 period. In case of ventilation scenarios after COVID-19 in cold climate, heating-cooling energy demand increased by 29.85% (41733 kwh) and 69.59% (97292 kwh). Increased natural ventilation after COVID-19 can provide advantages in terms of both building energy demand and infection control in hot and temperate climates.

According to TS 825 climate classification, The heating-cooling energy demand in the hot dry climate, which is in the 2nd Region according to the TS 825 climate classification, is 13.38% higher in the pre-COVID-19 period than the heating-cooling energy demand in the hot humid climate, which is in the 1st Region according to TS 825 climate class, and in the post-COVID-19 period, it is 10.22% higher in the hot dry climate. This shows that the climatic classification in the TS 825 standard is not correct to divide it into zones only according to heating degree days. The TS 825 climate classification should be determined by reconsidering the heating and cooling degree the day, and the building envelope u values should be re-determined according to this climatic classification.

If the natural ventilation required after COVID-19 is carried out, the most suitable climate in terms of energy efficiency has been temperate dry and temperate humid climate. The most disadvantaged climate for the continuation of education was the cold climate. In the WHO ventilation scenario in temperate dry climate, the annual heating-cooling total energy demand was 56703 kwh, while it was 181,533 kwh with an increase of 220.14% in cold climate. Differences in energy demand arising according to climatic characteristics have shown that energy efficiency strategies should be addressed according to climates.

Since it is not easy to control the ventilation rates in naturally ventilated classrooms, the work schedule of the academic year in the COVID-19 pandemic period can be determined according to the periods when natural ventilation can be applied more easily in terms of thermal comfort and heating-cooling energy demand. In hot humid and hot dry climate, the most ideal months for energy demand after COVID-19 were March, April, November, January, February and December. In temperate humid and temperate dry climate, the most ideal months for energy demand after COVID-19 are April, November, October, March and May. In the cold climate, the most ideal months for energy demand after COVID-19 are May, October, September, June, July and August. While September provides an advantage in cold climate, it is disadvantageous in terms of energy efficiency as it increases the cooling load in hot and temperate climates. Appropriate periods for ventilation vary according to climates, so the work schedule of the academic year in the COVID-19 pandemic process should be determined separately according to climates.

5. CONCLUSION

This study examines and compares the annual thermal loads in hot humid, hot dry, temperate humid, temperate dry and cold climates if the ventilation recommended to reduce the transmission of SARS-COV-2 virus in indoor environments during the COVID-19 pandemic period is done with natural ventilation.

Today, many schools do not have mechanical ventilation systems, and in schools with air conditioning systems, the system capacity may be insufficient for increased energy demand in COVID-19 pandemic conditions, as the system capacity is determined according to the

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conditions before the COVID-19 pandemic. Since the installation and use of additional air conditioning systems to meet the increasing energy demands will be costly, especially in countries with limited resources, strategies to reduce energy demand should be developed according to the current design conditions and climatic conditions of the school. Therefore, schools with natural ventilation should be both safe in terms of infection and able to respond to changing energy demands in terms of thermal comfort for a sustainable education in extraordinary events such as pandemics. Therefore, it is necessary to develop building energy systems that can be adapted by reviewing energy demands according to existing systems.

Since it is not easy to control ventilation rates in naturally ventilated classrooms, or when there is no need to add an air conditioning system, the academic year's work schedule can be determined according to the periods when natural ventilation can be applied more easily in terms of thermal comfort and heating-cooling energy demand. Apart from the system change for this purpose, the work schedule of the academic year should be determined separately according to climates.

In order to improve the current study, since the amount of fresh air supplied to the indoor environment by natural ventilation cannot be easily calculated and is difficult to evaluate in real life conditions, the current method can be further improved with CFD simulations and tracer gas method and more comprehensive studies can be carried out.

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The Concept of Changeability Depending on User Preferences in Gated Housing Sites: The Case of Trabzon

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Abstract

The concept of changeability is explained by the ability of the existing space to carry new functions, its continuity, its ability to grow and to meet different needs. The concept of changeability, which is important for all building groups, is especially important in residences, which are spaces where different needs of the user are met, as well as their shelter needs. Within this framework, the study aims to investigate the spatial characteristics of changeability in existing gated communities, using the Armada Residence housing project in Trabzon as a case study, and to contribute to discussions on design strategies for future residential developments. The research process commenced with a comprehensive literature review. This was followed by a three-stage methodological approach for data analysis and evaluation. In the first stage, the original residential units were systematically examined through field observations. In the second stage, architectural drawings were analyzed in order to identify and synthesize spatial similarities and differences among the plan typologies. In the final stage, changes made to the original plan types were identified and evaluated by comparing the initial residential layouts with the revised plans incorporating pre-occupancy interventions. The research emphasizes the concept of changeability in housing, reveals the necessity of incorporating this concept into new housing designs, and presents the analysis results regarding the types of changes made in the examined houses and which areas were frequently changed/transformed. Considering the data obtained from the analysis made as a result of the study, the changes were evaluated in terms of usability of the space and changeable design suggestions for the new houses were included.

Keywords: *Changeability, Flexibility, Housing, User requirements, User satisfaction*

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INTRODUCTION

A house is a physically large environment where people safely meet their basic needs such as nourishment, clothing and shelter (Özkan, 1981). It is a spatial and socio-economic phenomenon for society, and when considered within the social order, it refers to the smallest scale spatial unit (Erata, 1998). Housing is a building order where an individual's physical and visible functions take place, and where their behaviour and values are shaped by culture and social conditioning (Ersoy, 2002). A house, which meets people's needs of shelter as a type of building, includes many different activities inside. These activities depend on the user's characteristics, needs, lifestyles, and socio-economic characteristics. It changes and diversifies depending on many factors (Zorlu, 2004).

Lifestyle and income disparities within society are increasing day by day, which reduces interaction between different social groups and leads to physical segregation. Over time, social polarization becomes spatially manifested, resulting in the formation of divided urban structures within the city (Brenner and Theodore, 2002). In the second half of the 20th century, under the influence of the Industrial Revolution, closed residential settlements were formed as a spatial reflection of the rupture and separation that occurred in cities as a result of economic changes. Housing settlements closed to the outside, emerging with the need for security and the demand for prestigious housing, are defined as housing communities with social activities, where public space is privatized and separated from the environment by limiting elements (Ercan, 2021). Determining user preferences in these types of residences, which are generally considered more luxurious residences, is important for user satisfaction. Meeting the user needs of the house and residential area and meeting the wishes and expectations of the users are important factors affecting user satisfaction.

User requirements in housing are the features expected by the user, and these requirements are the factors that determine the space organization inside the house. According to Atasoy (1973), user requirements are the conditions that must be met so that users can carry out their activities effectively. According to Ünügür (1973), user requirements are the essential conditions that the environment must have so that the user or users can perform certain activities. User needs are considered as economic, physical and psycho-social based needs. While psycho-social needs include behavioural, privacy and aesthetic needs, physical needs include requirements related to security, health, spatial and physical environmental conditions (Uzel, 2001). Although various classifications have been made regarding user needs, the common aspect in these classifications is that user needs include physiological, social and psychological aspects (İslamoğlu, 2022). Requirements change through life and so do the expectations of house, and this leads to other changes. Housing must be able to meet these

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changing requirements. In addition to meeting users' expectations, lifestyles, social and psychological needs, meeting their wishes and expectations is an important indicator of user satisfaction in the residence (İslamoğlu, 2022). When the necessary harmony between human needs and the environment is not achieved, various disorders arise and people solve these problems by adapting to the environment, or adapting the environment to their needs, or they leave the environment (Altaş and Özsoy, 1998).

As the needs and wishes of the users vary, it does not seem possible for the houses built to appeal to the average user profile to fully meet the wishes and satisfaction of the users (Süvari and Çeliktepe, 2023). In order to prevent this problem, the concepts of flexibility must primarily be handled in housing. The concept of flexibility, which entered architectural terminology in the early 1950s, has increasingly been recognized as a quality criterion in urban design, architecture, and planning in Western contexts (İslamoğlu, 2014). Today, it is defined through the capacity of space to expand, the ability of existing spaces to accommodate new functions, continuity, and the adaptability of technical systems. Furthermore, this concept is elaborated through related sub-concepts such as variability, adaptation, compatibility, and adaptability (Halu, 2024). According to Schneider and Till (2005, 2007), flexibility is associated with a range of issues concerning both the present and future needs of users. First, it anticipates diversity in the spatial organization of units within architectural design; second, it includes the capacity of these units to change and adapt over time. Finally, it enables buildings to accommodate new functions as user requirements evolve.

As the user changes over time, the house must have a changeable and free design approach for use (Hasgül and Özsoy, 2016). Assuming that the residential space is the most personal place where people live their lives, it crucial that individuals tend to change that space in accordance with their own needs and lifestyles and that the home can meet this expectation by being flexible (Yakın, 2022). Houses that can adapt to changing needs, time and situation, and where multiple functions occur in the same space, are defined as flexible housing. Adaptibility in a house refers to its functional flexibility, where functions can change without altering the volume of the space. Flexible housing refers to sustainable and transformable space housing that can take shape according to the changing wishes and needs of users over time and can meet different functions in the same space. These residences allow the space to grow or shrink vertically or horizontally, to personalize the space depending on the user's wishes, and to change the spatial interior arrangements (Diker, 2021).

The concepts of changeability and flexibility in space are provided by the ability of different users to shape the same space in accordance with their needs and make it a more useful space for themselves (Süvari and Çeliktepe, 2023). Thus, different users can produce many alternative

areas using the same volume according to their needs, without changing the building system (Zorlu, 2004). Particularly in residential areas, resolving living spaces in line with user demands is among the factors that increase the efficiency of its use. Efficient use of a building turns it into a building that addresses the comfort conditions of its user (Yüksel and Kariptaş, 2019). With its changeable and flexible design approach, the ability of the user to organize the space within the scope of their own needs and requirements ensures the useful life and efficient use of the building.

The term "changeability," often used in conjunction with flexibility in related definitions, can be conceptually derived from flexibility through its associated meanings and is commonly addressed under several subcategories. Changeability can be defined as the capacity to adapt to changing conditions within a given period, providing a response to evolving circumstances (Somer and Umur, 1978). A changeable product refers to the ability to accommodate change by reorganizing the existing space in response to content requirements or changing users, particularly through the availability of information before, during, and after production and use (Deniz, 1999). Changeability parameters include the capacity of space to respond to individual needs (Hesapçıoğlu, 2010), the system's ability to intervene in and modify conditions, and the potential to change elements, functions, and components within the built environment (Erata, 1998).

There are many factors which affect user satisfaction in housing design. These factors include adding users in house design, personalization, flexibility and multi-purpose areas of utilization. Therefore, the concept of changeability becomes prominent as a design factor. Thus, it is possible to increase user satisfaction with housing designs that can adapt to the changing needs of the user. Applying the user's ideas to the planning and design processes of the house by determining the principle of flexibility and changeability in design is the way to learn the needs and expectations of the users, and this increases user satisfaction (Estaji, 2017).

The concept of changeability has been accepted as one of the important features of satisfaction in housing use and multi-faceted studies have been conducted in this area. The studies have revealed that the concepts of changeability and flexibility increase the service life of residential buildings and the satisfaction of the user (Altaş and Özsoy, 1998; Üstün, 2000; Uzel, 2001; Gülaydın, 2004; Zorlu, 2004; İnal & Ünlü, 2009; Deniz, 2011; Buluklu, 2014; Gücesan, 2014; Çimşit Koş, 2015; Hasgül and Özsoy, 2016; Kızmaz and Çimşit Koş, 2015; Özçelik and Kaprol, 2017; Diker, 2021; Yakın, 2022; Süvari and Çeliktepe, 2023; Şuta and Akansel, 2023).

Housing study is important in terms of revealing the evaluations regarding the physical, social and psychological satisfaction of users in their living environments. The short-term benefit of these studies is to immediately solve the problems of the current project, the medium-

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term benefit is to provide information for the building cycle in future projects, and the long-term benefit is to provide forward-looking feedback to develop design criteria (Liu, 1999). Based on this, the study is based on the claim that the physical and psychosocial needs of the user in the house are different and their expectations from the house change accordingly. The main purpose of the study is to discuss changeable and flexible usage opportunities in existing gated housing sites and design strategies for new houses to be built. In this context, the study covers a research and analysis on changeability and flexibility opportunities in a sample area determined in Trabzon. In this project, which was built in 2014 and started to be resided in 2018, the plans of 40 houses were discussed before use and 12 house plans that were changed were analysed.

Within the scope of the study, the purpose is to reveal the changing needs of the users regarding their residences, to develop the usage possibilities of the residences depending on the new usage norms and to develop design suggestions for the new residences to be built. In accordance with this purpose, a literature review was first conducted on the concepts of housing, closed housing settlements, changeability and flexibility in housing. In the second stage, analyses were made to determine the changes made in the Armada Residence buildings in Trabzon. These analyses aimed to determine what kind of changes were made in the houses and which areas were frequently changed / transformed. In the last part of the study, based on the data obtained from the analysis, the changes were evaluated in terms of the usability of the space, and finally changeable design suggestions were provided for new houses to be built.

RESEARCH AND METHOD

Sampling Area Selection

Armada Residence is a housing project consisting of 14 blocks and 317 apartments, located in the Yıldızlı District of Akçaabat in Trabzon (Figure 1). The project area is distributed across two separate parcels, with 11 blocks located on the upper parcel and 3 blocks on the lower parcel. The project includes various social facilities such as outdoor and indoor swimming pools, a fitness center, Turkish baths for men and women, a sauna and steam room, animal shelters, a tennis court, a cafeteria, and extensive landscaped areas. Construction of the project began in 2014, and the 11 blocks on the upper parcel have been inhabited since 2018.

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Figure 1. Armada Residence Housing Project

Since its introduction, Armada Residence has emerged as one of the most prominent residential projects in Trabzon, attracting considerable attention. The project stands out due to its social facilities, diverse apartment layouts, exclusive services, dual-kitchen configurations in many units, and the quality of materials used (Figure 2).



Figure 2. Sample Interior Views of Residential Units

The residential units within the project are designed as duplexes and in 1+1, 2+1, 3+1, 4+1, and 5+1 typologies, exhibiting a differentiated distribution across residential blocks. In addition to this variation in housing layouts, significant differences are also observed among the residential blocks themselves. The blocks vary in terms of spatial scale, plan typologies, number of floors, social amenities, total number of dwelling units, and additional functional spaces (Table 1). Accordingly, the selection of the residential block to be examined in this study is of particular importance. In this selection process, criteria such as the number and characteristics of dwelling units, spatial size, location, and diversity of plan typologies were taken into consideration. This approach aims to enable a more comprehensive comparison and a more in-depth analysis of variations in plan typologies.

Table 1. General Features of Armada Residence Housing Project Blocks.

A Block	B1 Block	**B Block** (B2-B3)	**C Block** (C1-C2)	**D Block** (D1-D2)	**E Block** (E1-E2)	**F Block**	**G Block**	**H Block** (H1-H2)
23 flats	**22 flats**	**48 flats**	**50 flats**	**49 flats**	**45 flats**	**22 flats**	**21 flats**	**37 flats**
1+1 4+1 5+1	3+1 4+1	1+1 2+1 3+1 4+1 Dublex	1+1 2+1 3+1 4+1 Dublex	1+1 2+1 3+1 4+1 Dublex	1+1 3+1 4+1	3+1 4+1	3+1 4+1	1+1 2+1 3+1 4+1

This study aims to generate data for new approaches to residential design by examining the potential modifications that can be implemented within the units of the selected housing blocks and by revealing these modifications through spatial analysis methods. In this

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context, the primary objective is to identify the housing block to be studied and to obtain a wide range of different plan typologies for comparative analysis. We focused on Block C, which is a block that has diversity in terms of its plan type and will therefore allow more comparison and analysis. Block C was also included in the study because it is located in the center of the project and houses the project's social facilities and sample apartment. Block C has 13 floors and consists of 50 apartments, including 1+1,2+1,3+1,4+1 and duplex.

Method

The research process initially involved the development of a conceptual framework. Within this scope, a comprehensive literature review was conducted based on theses, journal articles, conference papers, and books addressing housing, gated residential communities, user requirements, user satisfaction, flexibility, and changeability, as well as changeability in housing. Subsequently, data related to the study area were collected. The Armada Residence housing project, selected as the case study, provided data regarding its project characteristics, housing typologies, user profile, construction materials, original floor plans, and modified floor plans. All collected data were supported through interviews with the contractor and residents, as well as on-site inspections and field observations.

After the data collection process, the sampled residential units were subjected to spatial analysis from an interior architecture perspective. A three-stage methodological approach was employed to analyse and evaluate the implemented modifications. In the first stage, examinations were conducted at the residential block level, and the plan typologies within the block were identified. It was determined that the residential block comprised a total of six different plan typologies (Table 2). During the research process, the basement floor units were excluded from the scope of the study, as their sales transactions had not been completed. The findings derived from the spatial analyses are presented in the findings section; These data are further interpreted and discussed in the subsequent sections of the study and constitute the basis for the proposed design recommendations.

Table 2. C Block Plan Types

Type-1 Original Plan Ground Floor	Type-2 Original Plan 1.2. and 3. Floor	Type-3 Original Plan 4. and 5. Floor
		
Type-4 Original Plan 6.Floor	**Type-5 Original Plan 7. and 8. Floor**	**Type-6 Original Plan 9. Floor**
		

1. Corridor, **2.** G. Bedroom, **3.** S. Facing Balcony-1, **4.** Living Room, **5.** Cold Kitchen, **6.** Hot Kitchen, **7.** N. Faced Balcony, **8.** Children's Room-1, **9.** M. Bedroom, **10.** En-Suite Bathroom, **11.** General Bathroom, **12.** WC, **13.** Laundry Room, **14.** Study Room, **15.** S. Balcony-2, **16.** Floor Garden, **17.** Dressing Room, **18.** Guest Bathroom, **19.** Children's Room-2.

After the study on the grouping of plan types, architectural projects were examined in the second stage and spatial differences and similarities within the plan types were determined. As a result of the examinations, it was seen that the living room, cold kitchen, hot kitchen, children's room-1, master bedroom, guest room, general bathroom, en-suite bathroom, north side balcony, south side balcony areas were included in all plan types. The differentiating areas in the apartments are those such as children's room-2, study room, dressing room, WC, laundry room, guest bathroom, floor garden and a second balcony facing the south side. Of these areas, children's room-2 is located in type-4 and type-5, WC is located in type-1 and type-2, and the study room is located only in type-3. It is seen that the dressing room and guest bathroom are located in type-4, type-5 and type-6, and the laundry room is also located in type-3 in addition to these types. The second balcony setup facing the south facade is seen in type-3 and type-4 housing plans. Floor garden areas are also located in type-1, type-5 and type-6, and are located in only one apartment (east or west apartment) on the floors of these types (Table3).

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Table 3. Spatial Distribution of Residential Block C by Typology

	Type-1	Type-2	Type-3	Type-4	Type-5	Type-6
Living Room	+	+	+	+	+	+
Cold Kitchen	+	+	+	+	+	+
Hot Kitchen	+	+	+	+	+	+
Children's Room-1	+	+	+	+	+	+
Children's Room-2	-	-	-	+	+	-
Master Bedroom	+	+	+	+	+	+
Guest Bedroom	+	+	+	+	+	+
Study Room	-	-	+	-	-	-
Dressing Room	-	-	-	+	+	+
Laundry Room	-	-	+	+	+	+
WC	+	+	+	-	-	-
General Bathroom	+	+	+	+	+	+
En-Suite Bathroom	+	+	+	+	+	+
Guest Bathroom	-	-	-	+	+	+
Floor Garden	+	-	-	+	+	-
N. Faced Balcony	+	+	+	+	+	+
S. Facing Balcony-1	+	+	+	+	+	+
S. Facing Balcony-2	-	-	+	+	-	-
Corridor	+	+	+	+	+	+

In the final phase of the study, the spatial adaptations made to the housing plan typologies in response to users' needs and preferences were identified. The alterations implemented within the residences were incorporated into the plans based on data obtained through on-site observations and interviews conducted with the residents. In light of the data derived from the analyses, the study sought to determine the areas in which users most frequently implemented spatial adaptations, the types of interventions most commonly carried out, whether users exhibited general tendencies regarding these interventions, and how the Armada Residence housing units responded to such spatial adaptations. Based on the findings, the spatial requirements most needed by users within their residences were identified, and design recommendations for future housing projects were proposed.

ANALYSIS AND FINDINGS

Within the scope of the research, 40 apartments in Block C of the Armada Residence housing project in Trabzon were examined within the scope of changeability. The changes identified in the residential units examined within the scope of the study encompass the modifications made during both the design and implementation phases of the project. The results of the analysis, interviews and evaluations revealed that only functional changes were made in some apartments, while in some apartments additions, deletions, combinations etc. were made. While no change was detected in 2 types (Type-1 and Type-6) among the 6 plan types, it was determined that changes were made in 12 houses in the other plan types.

These changes made by the users in the original plan type in line with their wishes and requirements before use are expressed in detail in the

figures by analyzing the architectural plans, on-site determinations and interviews (Figure 3-8). The tables prepared for the analysis of the spatial adaptations within the residential units include both the original floor plans and the revised plans illustrating the implemented spatial adaptations. In the sample of the C residential block, the spatial adaptations made to the plans were indicated by marking the adapted areas in red on the drawings.

There are a total of 4 Type-1 plan type apartments in C block. The original housing features of this type are given in Figure 3. The apartments are planned as 3+1 apartments. These apartments include a living room, kitchen (cold and hot kitchen), guest room, children's room, parent bedroom, and 3 wet areas: a general bathroom, an en-suite bathroom and a WC. There are also balconies and floor gardens facing the north and south facades. No changes have been made by the users in the apartments of this plan type.

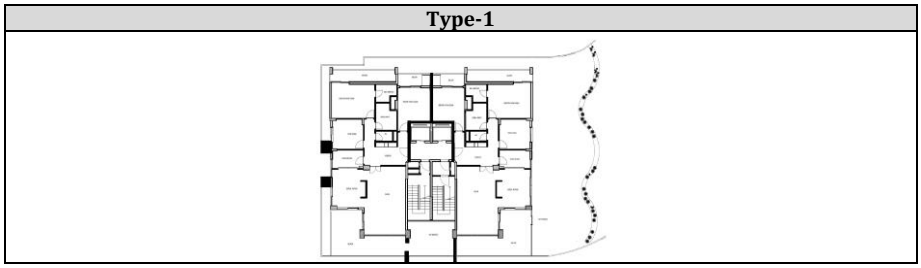


Figure 3. Type-1 original floor plan

Type-2' original housing features and the changes made are shown in Figure 4. There are a total of 12 apartments of this plan type in C block. The apartments are planned as 3+1 apartments. These apartments include a living room, a kitchen (2 cold and hot kitchens), a guest room, a children's room, a parent bedroom, and 3 wet areas: a general bathroom, an en-suite bathroom and a WC. While there is a balcony facing the north and south facades, there is no floor garden of this type. In this plan type, changes were made to a total of 3 apartments in block C.

The changes made: The hall was changed only in the residence belonging to plan 2. The common wall of the hall with the corridor was moved towards the hall, making the hall smaller and the corridor larger. The purpose of doing this is that the area allocated for the cloakroom in the original plan disappeared as a result of the change made in the WC and a new area for the cloakroom was wanted to be created. In the two residences, no enlargement or reduction was made in the original areas, only functional changes were made. As stated in plan 1, the change was to cancel the parent bathroom in one of the residences and use it as a dressing room. In the other house, the WC mentioned in plan 3 was cancelled and this area was used as a laundry room. In a residence, the master bedroom was enlarged and the children's room-1 was reduced. This change, mentioned in Plan 2, was realized by shifting the common wall of the two areas towards children's room-1. With the enlargement of the master bedroom, a new space was obtained for the user's

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wardrobe. The bathroom and corridor areas were narrowed and the WC area was expanded. The resulting new WC area was divided into two vertical areas, considering the minimum space requirements. A new WC has been designed in one of these two areas, and a laundry room in the other. These narrowing and expanding operations were carried out in Plan 2. These narrowing and widening operations in Plan 2 were made by shifting the common wall of the WC and corridor towards the corridor and the common wall of the bathroom and WC towards the general bathroom.

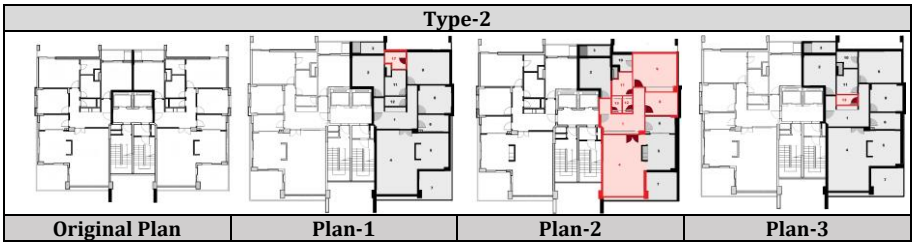


Figure 4. Changes made in Type-2 floor plans

Type-3' original housing features and the changes made are shown in Figure 5. There are a total of 8 apartments of this plan type in C block. The apartments are planned as 4+1 apartments. These apartments include a living room, a kitchen (2 cold and hot kitchens), a guest room, a children's room, a study room, a parent bedroom, and 4 wet areas: a general bathroom, an en-suite bathroom, a WC, and a laundry room. While there are a total of 3 balconies, 1 facing the north and 2 facing the south, there is no floor garden in this plan type. In this plan type, changes were made to a total of 3 apartments in block C.

The changes made are as follows: In three apartments, the laundry room was cancelled and the washing machine was placed in the general bathroom. WC was cancelled in all three modified apartments. In one of the apartments, the WC was combined with the laundry room as indicated in plan 1 and turned into an en-suite bathroom. The entrance to the new en-suite bathroom was given from the corridor where the guest room was in the original plan. In the other apartments, the WC was combined with the laundry room and the general bathroom. This area was transformed into a general bathroom and dressing room as shown in plan 2 and plan 3. During this transformation, the wall of the master bedroom, which was common with the corridor, continued horizontally and divided the new space into two different areas. While the area inside the bedroom was transformed into a dressing room by opening a door from the room, the area in the corridor was functionalized as a general bathroom. The cold-hot kitchen setup was changed to a single kitchen in one of the houses. While making this change shown in Plan 2, the common wall of the hot kitchen with the children's room-1 was kept constant. The sliding door between the warm kitchen and the cold kitchen was eliminated and these two areas were combined. The opening between this space and the living room was closed by extending the wall with the kitchen door towards the

balcony door. Thus, the living room and kitchen are designed independently from each other. The en-suite bathroom in one of the houses was combined with the master bedroom by eliminating the common wall as shown in plan 1. This new space has been functionalized as a library. With the conversion of the master bedroom in Plan 1 into a library, the guest room in the original plan was re-functionalized as a master bedroom.



Figure 5. Changes made in Type-3 floor plans

Type-4's original housing features and changes made are shown in Figure 6. There are a total of 4 units of this plan type in Block C. The apartments are planned as 4+1 apartments. These apartments include a living room, a kitchen (2 cold and 2 hot kitchens), a guest room, 2 children's rooms, a master bedroom, a dressing room, and 4 wet areas. The 4 wet areas consist of a general bathroom, en-suite bathroom, guest bathroom, and laundry room. There are three balconies in total, one facing north and two facing south. Only two of the apartments have a floor garden. This plan type has been modified in all four apartments in Block C.

The changes made in Type-4 are as follows: In 2 apartments, the double kitchen setup was changed and the kitchen area was designed as a single kitchen. While making these changes shown in plan 2 and plan 4; the common wall between the hot kitchen and the children's room-1 was kept constant, and the sliding door between the cold kitchen and the hot kitchen was cancelled. A part of the cold kitchen area was combined with the hot kitchen to create a new kitchen. Thus, the connection of the new kitchen with the living room was eliminated. The other area remaining from the cold kitchen was combined with the living room and the living room in these apartments was enlarged. In the houses belonging to plan 2, plan 3 and plan 4, the original en-suite bathroom was combined with the dressing room and the new space obtained was transformed into a larger dressing room. In 3 apartments, the overall bathroom area has been reduced. In plan 2, plan 3 and plan 4, the common wall between the general bathroom and the guest bathroom in the original plan was moved towards the general bathroom. As a result of this change, the guest bathroom, whose area expanded as a result of this change, was divided into two areas in the vertical direction considering the minimum space requirements. One of these areas was again designed as a guest bathroom and the other area was designed as a laundry room. In the houses belonging to plan 2, plan 3 and plan 4, the en-suite bathroom, which was cancelled by being included in the dressing room, was built in the place of the laundry

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room in the original plan. In the houses belonging to plan 2, plan 3 and plan 4, the door of the master bedroom was pulled towards the corridor and this area was widened and the corridor was narrowed. Only in the dwelling belonging to plan 1, the entrance to the en-suite bathroom was cancelled from the original plan and given from the dressing room. As a result of this change, a change in surface areas was detected. This change was in the form of an increase in the wall surface in the master bedroom and a decrease in the dressing room.

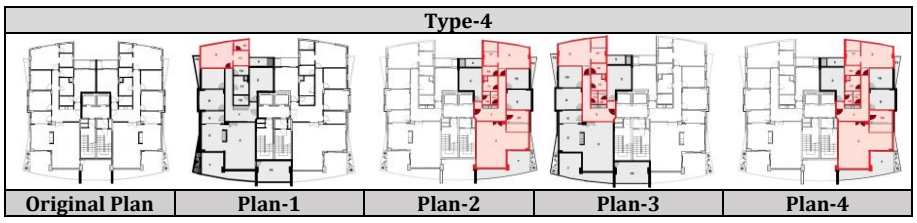


Figure 6. Changes made in Type-4 floor plans

Type-5's original housing features and changes made are shown in Figure 7. There are a total of 8 units of this plan type in Block C. The apartments are planned as 4+1 apartments. These apartments include a living room, a kitchen (It consists of 2 parts: cold and hot kitchen.), a guest room, 2 children's rooms, a master bedroom, a dressing room, and 4 wet areas. The 4 wet areas consist of a general bathroom, en-suite bathroom, guest bathroom, and laundry room. Each apartment has a balcony facing north and south. Only 4 of the apartments have a floor garden. In this plan type, a total of 2 apartments in Block C have been modified.

The changes made in Type-5 are that the dressing room and laundry room were combined in both apartments. In this case, the laundry room was cancelled, and the new space obtained was functionalized as a dressing room. As a result of this merger, a new laundry room was not designed instead of the cancelled laundry room and the washing machine was placed inside the general bathroom.

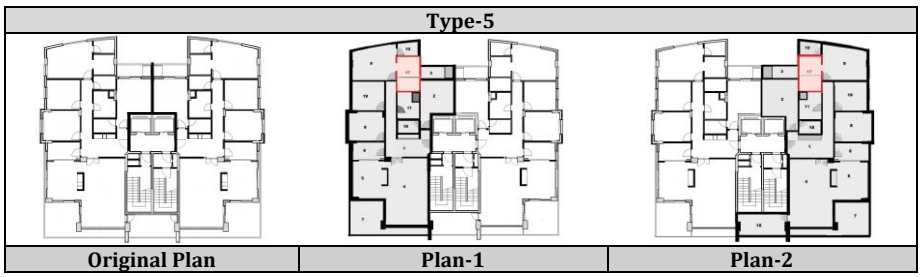


Figure 7. Changes made in Type-5 floor plans

There are a total of 4 units of Type-6 apartments in Block C. The original housing characteristics of this type are given in Figure 8. The apartments are planned as 3+1 apartments. These apartments include a living room, kitchen (2 cold and 2 hot kitchens), guest room, children's room, master bedroom, dressing room, and 4 wet rooms. The 4 wet areas consist of a general bathroom, en-suite bathroom, guest bathroom, and laundry room. Each apartment has a balcony facing the north and

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south facades, but there is no floor garden. No changes have been made by the users in this plan type.

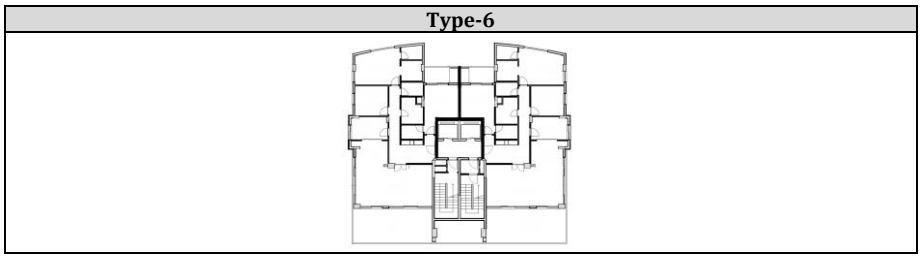


Figure 8. Type-6 original floor plan

In addition to all these changes, it has been determined that type-5 and type-6 are the same in terms of mass, but they are analysed differently in terms of planning. When type-5 is analysed, it is an apartment with a 4+1 plan type, while type-6, which has the same area, is analysed in a 3+1 plan type. While the master bedroom, dressing room, en-suite bathroom, laundry room, general bathroom, balcony facing the south facade, guest room and bathroom and children's room-2 are common solutions for both types, children's room-1 is cancelled in type-6. In addition, the living room, warm kitchen-cold kitchen and balconies facing the north facade are designed differently for these two types (Figure 9).

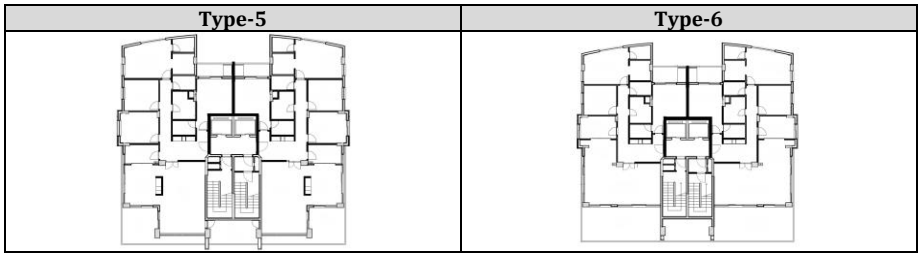


Figure 9. Type-5 and Type-6 original floor plans

When the spatial adaptations are examined, it is observed that some areas remained unchanged, while others were frequently subjected to modification. The findings regarding in which areas and in what manner these adaptations were implemented, which spaces were obtained as a result of these changes, and how they varied according to housing typologies are presented below:

•The findings indicate that the most frequently adapted spaces within the residential units are laundry rooms and dressing rooms, whereas the least frequently adapted spaces are children's room-1 and guest rooms. Additionally, no adaptations were observed in children's room-2 and study rooms across the examined floor plans.

•In laundry rooms, identified as the most frequently adapted spaces, spatial adaptations were observed in 10 out of 12 dwelling units. The interventions carried out in these areas include spatial addition, spatial reduction, and spatial removal.

•Following laundry rooms, dressing rooms constitute the second most frequently adapted spaces. Changes were observed in 9 out of 12 dwelling units, with interventions primarily involving spatial

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enlargement and the incorporation of dressing rooms into typologies where they were not originally included. This space was reduced in size in only one dwelling unit.

•Children's room-1 and guest rooms underwent adaptations in only one dwelling unit each. As a result of these interventions, the area of the children's room was reduced, while the guest room was removed.

•Adaptations related to WC areas were identified in 5 dwelling units. In 4 of these cases, the WC was removed and the space was repurposed to accommodate different spatial requirements. The remaining intervention involved the redesign of the space to meet minimum spatial requirements.

•Adaptations in kitchen areas were observed in only 3 dwelling units. In all plan types, kitchens were originally designed as two separate spaces: a hot kitchen and a cold kitchen. However, in these 3 units, this separation was removed and replaced with a single combined kitchen.

•Adaptations related to en-suite bathrooms were observed in 6 dwelling units. Among these, the space was completely removed in only one unit. In another unit, the bathroom entrance was relocated from the master bedroom to the dressing room. In the remaining 4 units, the original location of the en-suite bathroom was changed and the space was enlarged.

•Adaptations related to guest bathrooms were observed in 3 dwelling units. The changes indicate that these spaces were reduced in size in accordance with minimum spatial requirements.

•Adaptations related to general bathrooms were observed in 7 dwelling units. These changes involved a reduction in area in 5 units and an enlargement of the space in 2 units.

•Adaptations in the master bedroom were observed in 8 dwelling units. These changes involved both spatial reduction in some typologies and spatial enlargement in others.

•Adaptations in corridor spaces were observed in 4 dwelling units. These changes involved both spatial reduction in some typologies and spatial enlargement in others.

•Adaptations related to living rooms were identified in 4 dwelling units. In 2 of these units, the space was enlarged, while in 1 unit it was reduced. In the remaining case, the connection between the living room and the cold kitchen was eliminated by constructing a partition wall, which resulted in an increase in usable wall surface area.

Table 4 presents the data on spatial changes in the dwellings of Residential Block C. It shows which spaces were changed, which spaces were removed from the dwellings, which new spaces were added, and which areas were enlarged or reduced. It also indicates how many dwellings were affected by these changes according to each typology.

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Table 4. Analysis of Spatial Adaptations in Residential Block C According to Typologies

Plan Type	Spatial Adaptations	Spatial Units within the Residential Space										
		1	2	3	4	5	6	7	8	9	10	
TYPE-2	*Addition*											
	Removal										*	
	Expansion	*								*		
	Reduction				*				*			
		11	12	13	14	15	16	17	18	19	20	21
	Addition			**				*				
	Removal		*									
	Expansion											
	Reduction	*	*									
TYPE-3		1	2	3	4	5	6	7	8	9	10	
	Addition											
	Removal		*			*	*					
	Expansion				*							
	Reduction									***	*	
		11	12	13	14	15	16	17	18	19	20	21
	Addition							**			*	*
	Removal		***	***								
	Expansion	**										
	Reduction	*										
TYPE-4		1	2	3	4	5	6	7	8	9	10	
	Addition											
	Removal					**	**					
	Expansion				**					****	***	
	Reduction	***										
		11	12	13	14	15	16	17	18	19	20	21
	Addition										**	
	Removal											
	Expansion							***				
	Reduction	***		***				*	***			
TYPE-5		1	2	3	4	5	6	7	8	9	10	
	Addition											
	Removal											
	Expansion											
	Reduction											
		11	12	13	14	15	16	17	18	19	20	21
	Addition											
	Removal			**								
	Expansion							**				
	Reduction											

1. Corridor, **2.** G. Bedroom, **3.** S. Facing Balcony-1, **4.** Living Room, **5.** Cold Kitchen, **6.** Hot Kitchen, **7.** N. Faced Balcony, **8.** Children's Room-1, **9.** M. Bedroom, **10.** En-Suite Bathroom, **11.** General Bathroom, **12.** WC, **13.** Laundry Room, **14.** Study Room, **15.** S. Balcony-2, **16.** Floor Garden, 17. Dressing Room, **18.** Guest Bathroom, **19.** Children's Room-2, **20.** Kitchen **21.** Library

CONCLUSIONS AND RECOMMENDATIONS

There are some important approaches to ensure changeability in housing design. Within the scope of this study, according to the data obtained from the research conducted on 40 houses in Trabzon, it was found that in 12 houses during the planning and implementation process, users made various changes to their houses depending on their profile, wishes and needs. As a result of the research, the determinations and suggestions for housing design are given below, considering the changes made in these residences.

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•The findings indicate that laundry rooms are considered a significant spatial component in achieving flexibility within residential interior design, functioning primarily as auxiliary spaces. It is essential that such service areas, including laundry rooms, can be transformed in accordance with different user profiles, changing needs, habits, and everyday living practices. In this context, incorporating laundry rooms into housing floor planning in a flexible manner facilitates the adaptation of dwellings over time in response to users' evolving requirements.

•These findings clearly demonstrate users' need for dressing rooms. The spatial interventions observed in the examined sample indicate that the changes made to dressing rooms mainly result from the inadequacy of these spaces or from their exclusion during the initial planning stage of the housing design. In this context, dressing rooms should be regarded as an important component of the residential design process and should be incorporated into future housing projects through a flexible and user-oriented planning approach.

•Although living rooms are generally perceived by users as sufficiently large, the findings indicate that users tend to modify these spaces by adding extra volumes to expand them. This suggests a perceived need for larger living areas and highlights that living rooms should be considered not merely as seating areas, but as multifunctional environments that accommodate rest, social interaction, and guest reception. Furthermore, the observed modifications reveal that the connection between the living room and the cold kitchen is often eliminated, resulting in the separation of these two spaces. This indicates that integrating living rooms with cold kitchen areas is not considered functionally appropriate by users. Such interventions suggest that maintaining a rigid spatial connection between these areas is not always necessary, and, in some cases, may negatively affect spatial integrity. In this context, living rooms should be regarded as central and socially significant spaces within residential design in future housing projects. Their design should allow for flexibility in terms of expansion and integration with adjacent spaces, in accordance with users' needs and preferences. Moreover, spaces related to living rooms should be planned with sufficient flexibility to accommodate different usage scenarios based on evolving user requirements.

•The kitchens were designed as dual-function spaces (hot and cold kitchens), and in all observed interventions, these layouts were converted into single-kitchen configurations. In this regard, it is evident that some users do not prefer a dual-kitchen arrangement and instead favor a single, sufficiently sized and functional kitchen space over two separate units. Moreover, the absence of any intervention in certain cases suggests that some users either prefer or are willing to experience the dual-kitchen configuration and are open to alternative spatial design approaches. In this context, it is essential that kitchen areas in future housing designs offer flexible design strategies in accordance with users'

needs and preferences. Secondary spaces (such as cold kitchens), depending on user requirements, may either retain their original function or be reassigned to alternative uses, thereby contributing to spatial flexibility within the dwelling by providing users with alternative usage scenarios.

•Master bedrooms are planned differently across housing typologies; in some units they are accompanied by an en-suite bathroom, while in others they are designed in conjunction with both a bathroom and a dressing room. The findings indicate that these spaces have undergone change, particularly as a result of interventions in dressing rooms and en-suite bathrooms. In this regard, master bedrooms appear to adequately meet user requirements, and the auxiliary spaces designed in association with them play a significant role in the spatial organization of the unit. Accordingly, in future housing projects, master bedrooms should not be designed solely as individual rooms, but rather in integration with bathroom and dressing room units.

•The change observed in the children's room indicates that this space is reshaped in accordance with changing user needs and demonstrates a degree of spatial flexibility. The intervention involving spatial reduction are particularly associated with the transformability of the adjacent space. In this context, in future housing designs, children's rooms should be planned by taking into account their relationship with adjacent spaces and should be conceived as areas capable of accommodating spatial transformations when necessary.

•The changes observed in guest bedrooms demonstrate that these spaces can be integrated into different functional uses. Based on the findings, guest bedrooms in future housing designs should not be considered solely as spaces intended for guest accommodation, but should instead be planned in a manner that allows for alternative functional arrangements when required.

•The changes observed in general bathrooms primarily result from interventions carried out in adjacent spatial units where they are directly connected, such as guest bathrooms, dressing rooms, and laundry rooms. This situation clearly demonstrates that general bathroom areas exhibit flexibility and adaptability in relation to user needs. In this context, in future housing designs, general bathrooms should be planned in a way that allows for spatial enlargement or reduction when necessary. Additionally, their design should be based on a user-centered and flexible approach, taking into account wall positioning and infrastructural systems such as plumbing.

•The high rate of elimination observed in WC areas indicates that these spaces are not frequently utilized within residential units. In this context, the flexible planning of WC spaces in future housing designs, together with their capacity to accommodate different functional requirements, can contribute to increased spatial efficiency. This approach enables users to make appropriate spatial arrangements within the dwelling in response to alternative needs and highlights the

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importance of allowing these spaces to be utilized in accordance with changing user requirements and preferences.

•The observed adaptations demonstrate the necessity of incorporating en-suite bathrooms into residential planning and design processes. In this context, the dimensions of en-suite bathrooms in future housing projects should be designed with flexibility in order to accommodate diverse user needs. Furthermore, these spaces should allow for adaptable use, enabling spatial enlargement, subdivision, or reconfiguration when required.

•The changes observed in guest bathrooms indicate that users require access to these spaces even within limited spatial conditions. This finding highlights the necessity of integrating guest bathrooms into residential design while considering minimum spatial requirements. Accordingly, guest bathrooms should be included in future housing projects even at a minimal spatial scale and should be designed to allow functional flexibility, enabling adaptation to changing user needs and alternative spatial solutions when required.

•The changes observed in corridor spaces appear to be closely associated with interventions carried out in other spatial units. In this context, corridors should be considered not only as circulation areas, but also as functional transition spaces that enable spatial modifications within the dwelling. It is evident that corridors contribute to planning flexibility by facilitating interventions in adjacent spaces. Accordingly, in future housing designs, corridors should be conceived not only as elements ensuring spatial circulation, but also as flexible and transformable areas that support the reorganization of other spaces when necessary.

The analysis reveals several recurring patterns in the observed spatial interventions. In particular, the adjacency of functionally related spaces suggests that interventions in one unit often influence or facilitate changes in the adjacent one. In this regard, grouping spaces such as laundry rooms, WCs, dressing rooms, en-suite bathrooms, general bathrooms, and guest bathrooms within close proximity may enhance the flexibility and ease of spatial reconfiguration in future housing designs. Another notable finding is that, in some cases, the original spatial unit remains physically unchanged while only its function is redefined. This indicates that these spaces possess a high degree of functional adaptability without requiring any dimensional alteration, demonstrating their capacity for purely functional transformation. In this context, it is recommended that future housing designs ensure not only functional compatibility but also dimensional coherence among spatial units, allowing for more efficient and flexible spatial reorganization.

In the process of reshaping user requirements in housing, it is believed that the present study can contribute to both new projects or existing housing plans by evaluating the obtained data.

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Resume

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The Impact of Green Roof Conversion on Energy Efficiency: A Case Study of KTU Kanuni Campus

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Abstract

Green roofs are multi-layered systems constructed on a supporting structure, with the vegetation layer forming the uppermost layer. They contribute to ecological, economic, and social sustainability through functions such as rainwater harvesting, reduction of heat loss, mitigation of the urban heat island effect, and the creation of aesthetically appealing public spaces. University campuses—key environments for implementing sustainability principles—play a crucial role in energy management, circular resource utilisation, and water management. In this context, this study investigates the impact of converting the hard-surfaced roof of the "Surveying Engineering Canteen" at Karadeniz Technical University's Kanuni Campus into a green roof. Following field surveys and feasibility assessments, three inverted green roof alternatives (extensive, semi-intensive, and intensive) were modelled in DesignBuilder to evaluate energy performance, operational and embodied carbon, construction costs, and the additional structural load resulting from the soil's water retention capacity. The findings indicate that green roof applications reduce annual heating loads by 36–46%, improve indoor operative temperatures during winter months, and lower operational carbon emissions by 16–20%. However, embodied carbon and construction costs increase relative to the existing roof, particularly for semi-intensive and intensive systems. Structural load analysis revealed that while extensive roofs fall within acceptable limits, semi-intensive and intensive systems may exceed standard live-load thresholds due to their higher water retention loads, requiring reinforcement. Overall, the extensive system emerges as the most feasible option in terms of cost, embodied carbon, and structural compatibility, while still providing meaningful energy savings and environmental benefits.

Keywords:
Green roof, Sustainability, Energy efficiency, Carbon emissions, Water retention capacity

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INTRODUCTION

Roofs, one of the most critical structural elements that protect buildings from external influences, play a significant role in building energy consumption due to their exposure to climatic conditions and direct environmental effects (Orhan & Bektaş Ekici, 2022). Roof areas constitute 40-50% of the total impervious surface at an urban scale (Shafique et al., 2020; Stovin et al., 2012). Green roofs are systems installed on the roofs of new or existing buildings, providing a substrate for plant growth while also serving as a protective layer on the roof. Green roofs possess numerous sustainable features, including rainwater management, energy efficiency, noise reduction, and biodiversity support (Cook et al., 2024).

In this context, green roofs help mitigate the urban heat island effect and have the potential to reduce the risk of heat-related illnesses, while providing comfortable recreational spaces for urban residents (Imran et al., 2018). In the context of circular resource management, zero-waste programs and advanced recycling systems ensure the reuse of growing media used on green roofs for urban green waste and compost (Castleton et al., 2010). In terms of water management, intelligent irrigation systems, greywater recovery projects, and rainwater harvesting applications contribute to mitigating excessive rainfall and managing stormwater (Sangkakool et al., 2018; Law et al., 2017). In addition, green roofs can be integrated with other sustainable building strategies to enhance overall resource efficiency, such as through their potential synergy with greywater reuse or rainwater harvesting systems (Akkan Çavdar & Lakot Alemdağ, 2024).

Green roofs have been widely studied for their contributions to energy efficiency, thermal comfort, stormwater management, and urban heat island mitigation. However, most existing studies focus either on new building applications or on evaluating a single performance criterion, such as energy savings or thermal behaviour. Research that simultaneously assesses both energy performance and the additional structural load generated by soil water retention during retrofit applications remains limited. This gap is particularly notable for existing reinforced-concrete flat roofs in humid climates—such as those in the Eastern Black Sea region—where precipitation levels and soil moisture retention significantly influence structural feasibility.

Addressing this gap, the present study investigates the dual contribution of green roofs by evaluating both their energy performance and the additional structural load generated by rainwater retention. In this context, the study analyses the potential impacts of converting an existing hard-surfaced reinforced-concrete roof—specifically the low-slope roof above the canteen of the Department of Surveying Engineering at Karadeniz Technical University (KTÜ) Kanuni Campus, located in a temperate-humid climate—into a green roof. The assessment examines improvements in thermal insulation during winter, reductions in heat gain during summer, and the feasibility of the

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resulting structural loads, thereby linking building-scale performance outcomes with broader campus- and urban-scale environmental benefits. Based on the findings from this case study and supported by the literature, the study also aims to provide recommendations for the campus-wide implementation of green roof strategies, particularly with respect to energy efficiency and water management.

Green Roof Applications on University Campuses

University campuses play a crucial role in promoting and implementing the concept of sustainability in urban areas. Berardi (2016) investigated the benefits of green roof retrofits on the microclimate and their contribution to building energy savings through a field study conducted at a university campus in Toronto, Canada. The study found that green roofs mitigate the urban heat island effect, enhance indoor comfort, save energy, and provide a greater cooling effect at the roof level compared to the pedestrian level.

Bevilacqua et al. (2016) conducted an experimental analysis of a green roof on a building at the University of Calabria in Italy, situated in a Mediterranean climate region. The study's findings revealed that a green roof can reduce the temperature at the structural roof interface by an average of 12°C in summer compared to a black bituminous roof, while maintaining an average temperature 4°C higher in winter. Similarly, Zheng et al. (2023) demonstrated significant cooling and carbon-reduction benefits at the neighbourhood scale in Nanjing University's Xianlin Campus.

Nguyen Dang et al. (2022) at the University of Technology Sydney, who aimed to assess users' perceptions of a green roof, indicate that most users feel relaxed and engage in social activities on the green roof. Furthermore, the frequent use of green roofs has been shown to enhance social well-being and foster a sense of belonging among users, compared to those who use them less frequently. Sangita Mishra and Sakharle (2022) examined green roof systems at Amity University in Navi Mumbai, aiming to mitigate air pollution caused by the construction industry. He proposed extensive and intensive green roof designs for the three selected buildings, providing associated cost estimates. The study found that green roofs reduce water runoff by effectively retaining rainwater. It has been reported that water retained by green roofs can help lower temperatures and improve air quality in the surrounding area.

Nguyen Dang et al. (2023) conducted a survey with students and staff to explore users' perceptions of the extent to which a green roof on a university campus contributes to the Sustainable Development Goals. They found that participants perceived the social and environmental benefits of green roofs in different ways. The study found that students perceived social benefits to a greater extent, whereas the perception of environmental benefits varied according to participants' level of knowledge. Dogmusoz (2023) conducted a benefit–cost analysis (BCA)

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using the example of a comprehensive green roof installation at the Çiğli Campus of İzmir Kâtip Çelebi University, aiming to assess the economic feasibility of green roof projects in İzmir. The analysis results demonstrated that green roof projects are economically feasible. Azkorra-Larrinaga et al. (2023) proposed a comprehensive and environmentally sustainable green roof design for the Faculty of Engineering building in Bilbao. The primary objective of this study is to assess the solar energy efficiency of a sustainable green roof, evaluate its thermal performance, and examine the impact of its implementation on energy consumption and user thermal comfort. Analyses conducted in this context have shown that green roofs have a positive impact on energy efficiency, albeit to varying degrees, in both summer and winter, as well as under both rainy and dry weather conditions.

These studies indicate that the implementation of green roofs on university campuses has positive ecological, economic, and social impacts for all campus users, particularly students.

The contribution of green roofs to sustainability goals, through the enhancement of building energy efficiency, is being assessed using various software tools. These software tools, including DesignBuilder, EnergyPlus, TRNSYS, and THERB, are energy simulation programs that enable detailed analysis of the effects of green roofs on heat transfer, thermal comfort, and heating and cooling loads. These software tools estimate the effects on energy consumption by considering parameters such as roof layers, plant types, soil thickness, and moisture retention capacity under varying climatic conditions, and assist in identifying the most suitable design scenarios. Silva et al. (2016) compared the energy performance of dense, semi-dense, and extensive green roof types in Lisbon, Portugal, a city with a Mediterranean climate, using the EnergyPlus software for their evaluations.

Mahmoud et al. (2017) examined the energy efficiency and economic feasibility of green roof technology under the hot and humid climate conditions prevailing in Dhahran, Saudi Arabia. Within this scope, the current condition of a selected residential building and the proposed green roof scenario were modelled using DesignBuilder software. The findings indicate that green roofs offer significant potential for energy savings under the given climate conditions. He et al. (2020) aimed to investigate the differences in thermal and energy performance between green roofs and conventional roofs under the climate conditions of Shanghai during the summer and winter months. In this context, a modelling analysis was conducted on a selected public building using THERB software. The study results are suggested to serve as a guide for the optimisation and implementation of green roof and cool roof designs in the Shanghai region. Parker (2021) investigated the potential energy benefits of green roof applications in buildings in Hong Kong. Within this scope, a green roof scenario was created for a selected sample building, and its energy performance was analysed using EnergyPlus software. Orhan and Bektaş Ekici (2022) examined the performance of

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various roof types across different climate zones in terms of heating and cooling loads. Within this scope, five provinces (Hatay, Bursa, Elazığ, Sivas, and Kars) were considered for a sample building selected according to the TS 825 standard, and scenarios were created for pitched roofs, flat roofs, and green roofs. The heating and cooling energy loads for the scenarios were calculated using simulation methods with DesignBuilder software.

Recent studies have increasingly focused on adaptive performance under future climate scenarios. Hu et al. (2024) used EnergyPlus simulations to assess multilayer green roofs under projected warming conditions and found that advanced configurations provide superior thermal resistance and cooling potential, underscoring the importance of adaptive green roof design. Jia et al. (2024) compared green roofs and cool roofs across six global cities and reported that green roofs consistently reduce both heating and cooling loads, making them more reliable in mixed climates and under climate-change stressors. Ouldboukhitine et al. (2024) similarly demonstrated that green roofs outperform conventional roofing systems in regulating building energy consumption, particularly in warm and temperate climates.

Pragati et al. (2023) investigated the effect of green roofs on thermal comfort in multi-story commercial building blocks under the tropical climate of Chennai, India. According to the analysis results obtained using DesignBuilder software, green roof systems have a significantly positive effect on improving the urban environment in hot and humid tropical climates. Tseliou et al. (2023) investigated the potential cooling effects of green roof and green façade applications during the summer months in a residential area of Athens. As a result of numerical modelling performed using ENVI-met software, it has been determined that the combined application of green roofs and facades increases thermal comfort to a higher level. Yacob et al. (2024) recommended implementing green roofs to enhance thermal comfort in buildings in Batu Pahat, Malaysia, which experiences tropical climate conditions. Simulation analyses conducted using the IES-VE software revealed that green roofs have the potential to reduce indoor temperatures, highlighting their applicability in tropical regions.

In Mediterranean and temperate climates, systematic reviews and climate-oriented studies highlight the rising importance of multilayer green roofs. De Cristo et al. (2025) conducted a comprehensive review and reported that green roofs reduce outdoor temperatures by up to 7.4°C and achieve 10–34.7% annual energy savings, particularly when innovative multilayer configurations are used. Looking further into future warming conditions, Liu et al. (2025) showed that green roofs significantly reduce cooling loads and urban heat under climate-change scenarios, emphasizing their role as key adaptive strategies for resilient urban environments.

Literature confirms that green roofs on university campuses offer multifaceted benefits, including improved energy efficiency, enhanced

microclimate, improved stormwater management, and a positive user perception. Studies consistently show that green roofs reduce temperatures, mitigate the urban heat island effect, and decrease thermal loads across various climates, confirming a significant energy-saving potential. However, while most research focuses on new designs or single benefits, integrated studies that simultaneously assess energy efficiency and structural load feasibility due to rainwater retention during the retrofit of existing hard-surfaced roofs remain rare.

In this context, this study presents a novel approach by examining the potential conversion of hard-surfaced reinforced concrete roofs at Karadeniz Technical University through a case study. Differing from existing literature, it assesses not only the energy benefits but also the feasibility of the additional structural load resulting from rainwater retention. This integrated analysis allows for the development of comprehensive recommendations regarding the adaptability and structural safety of green roof implementation on existing buildings.

Green Roof Types, Garden Roofs, Layers and Materials

The determination of green roof layers depends on the type of roof, climate conditions, geographical location, cost, and material availability (Ampim et al., 2010). Although the types and sequence of materials forming the roof layers may vary, attention should be paid to key elements such as the drainage layer, waterproofing, and protection against root penetration.

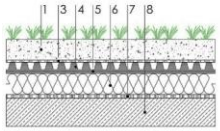
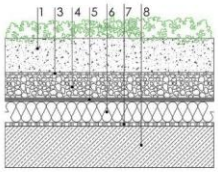
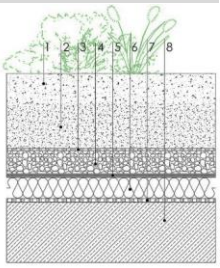
Existing buildings offer significant potential for green roof applications. The benefits, such as providing thermal insulation, enhancing rainwater utilisation, contributing to socialisation, and protecting the roof from sunlight, lead to cost savings over a 5-10 year period. Crucially, effective water management increases both economic and environmental sustainability (Dubbeling et al., 2017). Green roofs significantly minimise the summer-winter temperature difference (e.g., approximately 30°C), preventing the structural stress caused by the extreme fluctuations seen on conventional roof surfaces (which can reach 100°C) (Bokalders & Block, 2010). Furthermore, green roofs save energy and improve comfort conditions (Whittinghill & Rowe, 2011; Bocanegra et al., 2025; Karimian & Mahdizadeh, 2025), while also provides sound insulation and supports the spread of biodiversity (Bokalders & Block, 2010). Especially for green roofs intended for agricultural purposes, the selection and design of a suitable structural system capable of supporting the material layers and soil fill is also of vital importance (Kalkan et al., 2024).

In principle, green roofs consist of four main layers. In general, a green roof system is composed of four primary layers. Starting from the top layer, they are, in order: The vegetation layer, including plant cover and the substrate (growing medium), the drainage layer (filter felt, drainage system), the root protection layer (protective membrane), and the weather-resistant layer (waterproofing membrane, edge protection

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layers, leaf catchers, etc.) (Bokalders & Block, 2010). Table 1 provides a schematic representation of green roof types, the layers they contain, and their general characteristics.

Table 1. General characteristics and layers of green roof types (Seçkin & Seçkin, 2016)

Green roof layers	Extensive	Semi-intensive	Intensive
1-Plant 2-Planting layer 3-Felt filter 4-Drainage layer 5-Protective layer 6-Thermal insulation 7-Waterproof membrane 8- Reinforced concrete slab			
Planting layer thickness	15 cm or less	15-25 cm	25 cm or more
Roof slope	2-70%	2-10%	2-10%
Weight	60-240 kg/m²	180-350 kg/m²	350-1500 kg/m²
Plant type	Moss, Drought-resistant grass, Perennial wildflowers, Moss/Sedum, herbaceous plant	Meadow/Medicinal plants Perennial wildflowers Woody plants	All plants are suitable for local conditions
Drainage Layer		3-5 cm	At least 10 cm
Maintenance and Expenses	Easy maintenance - low cost	Maintenance required – costly	High maintenance – costly
Irrigation System	Not required	When necessary	Required
Fertilization	Not required	When necessary	Required

MATERIALS AND METHODS

The methodological framework of this study is organised into three main stages, consistent with the workflow presented in Figure 1: (i) Data Identification, (ii) Data Analysis, and (iii) Findings & Discussion. These stages collectively describe the process of collecting, modelling, analysing, and evaluating the performance of alternative green roof systems for an existing reinforced-concrete roof.

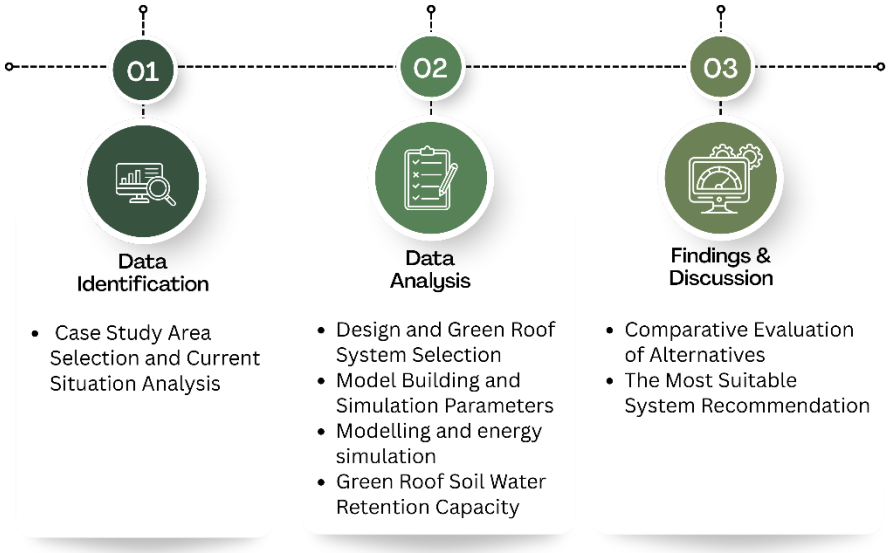


Figure 1. The methodological framework of the study

- *Data Identification:* In the first stage, the architectural, structural, and environmental characteristics of the case study area were documented. Field surveys, photographic observations, and project drawings obtained from the KTÜ Project Production Center (PÜM) were used to identify the existing roof layers, material properties, and thermal transmittance (U-values). Additionally, the current performance issues—such as heat loss during winter, summer overheating, water leakage, and mould formation—were recorded to inform the subsequent modelling process. Climatic boundary conditions were defined using the Typical Meteorological Year (TMY) file for Trabzon, and these data were prepared for use in the simulation environment. This stage provided all baseline inputs required for model creation and performance evaluation.
- *Data Analysis:* The second stage involved the modelling, simulation, and evaluation of three inverted green roof alternatives—extensive, semi-intensive, and intensive—defined according to literature, industry standards, and site-specific material data. The architectural, material, and structural characteristics of the cafeteria building beneath the study roof were first documented through on-site measurements, visual surveys, and project drawings obtained from the KTÜ Project Production Center (PÜM). Existing roof layers, construction materials, and thermal transmittance (U-values) were identified and incorporated into a detailed DesignBuilder model. For each green roof alternative, layer configurations, soil depths, drainage and insulation properties, thermal characteristics, and moisture-retention capacities were specified and encoded into the software's construction library, with soil density and water-retention parameters informed by recent regional findings (Yüksek et al., 2024). The building energy model integrated occupancy schedules, internal gains, natural ventilation (0.5 ach/h), heating setpoints (22°C / 18°C), and the Typical Meteorological Year (TMY) file for Trabzon to ensure realistic climatic representation. Annual hourly simulations were conducted using the EnergyPlus engine to generate monthly and annual heating loads, operative temperature values, operational CO_2 emissions, and construction and embodied carbon estimates for the existing roof and the three alternatives. In parallel, structural load analysis was performed by calculating substrate volume, dry soil mass, water-retention-induced load, and saturated substrate weight for each system, with results expressed in kg/m^2 and kN/m^2 and compared against reinforced-concrete slab capacity limits reported in the literature (Cascone, 2019), enabling an assessment of structural feasibility for existing campus buildings.
- *Findings & Discussion:* In the final stage, the energy and structural performance results from all scenarios were comparatively evaluated. Heating-load reduction, operational carbon savings, embodied carbon, and structural feasibility were analysed together to determine the suitability of each system. Based on this comparative assessment, the most feasible green roof type was identified considering

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the specific climatic, environmental, and structural conditions of the case study area. Finally, recommendations were developed for campus-scale implementation of green roofs in similar existing buildings.

Data Identification

Case study area selection and current situation analysis

Karadeniz Technical University Kanuni Campus is a complex that not only hosts scientific research but also houses numerous faculties and institutes, making significant contributions to the cultural and social life of the city of Trabzon. In particular, the demands of campus users for socialising and spending time in landscaped areas align with the campus's sustainability vision. The view of the study area from the central pedestrian axis is shown in Figure 2, and its location on campus is shown in Figure 3.

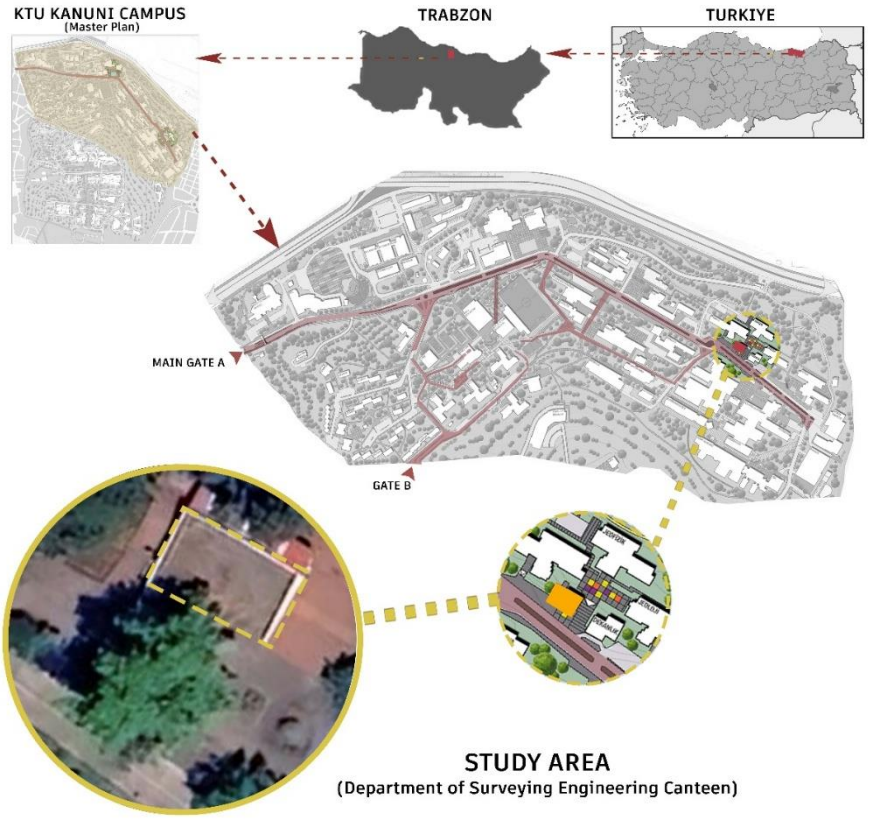


Figure 2. Study Area (KTU site plan and Google Earth image of the areas access date: 26.05.2024)

The study area is located on the campus pedestrian axis. The departments of Cartography Engineering, Geophysical Engineering, and Geological Engineering, as well as the Dean's Office of the Faculty of Engineering, are located in the immediate vicinity of the area. The enclosed space under this selected roof area is actively used as a cafeteria. Images of the current state of the area are provided in Figure 4. A survey was conducted to determine the current situation. The survey drawings are provided in Figure 5-6.

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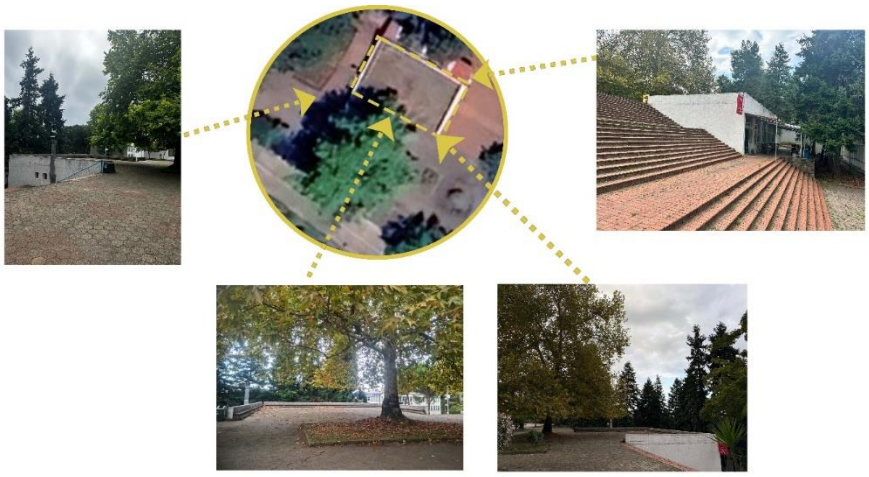


Figure 3. Study Area baseline visuals (arrow directions indicate the viewpoint)



Figure 4. Unused area (right) identified as suitable for green roofs and plane tree (left)

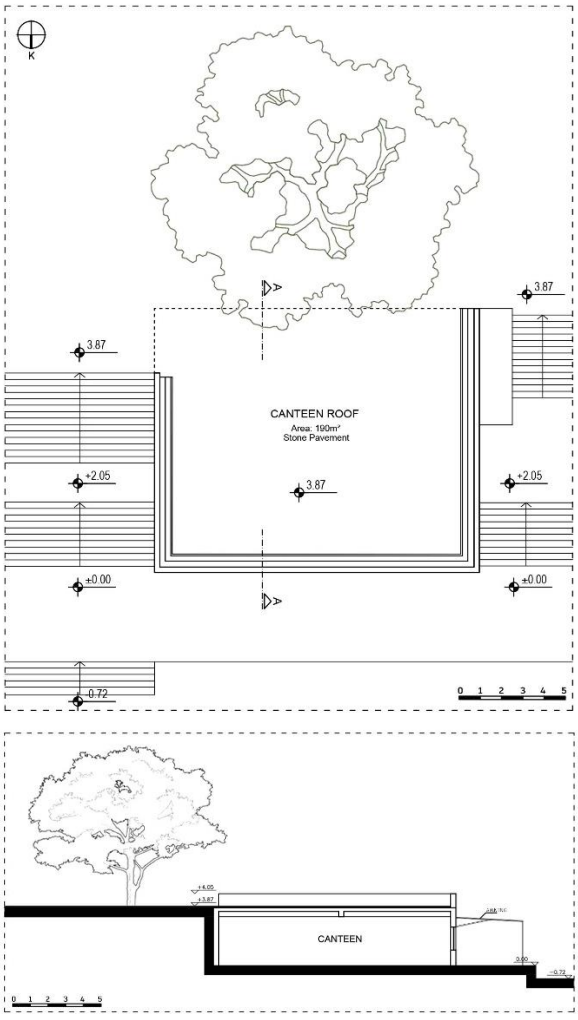


Figure 5. Survey drawings– Plan (top) and AA Section (bottom)

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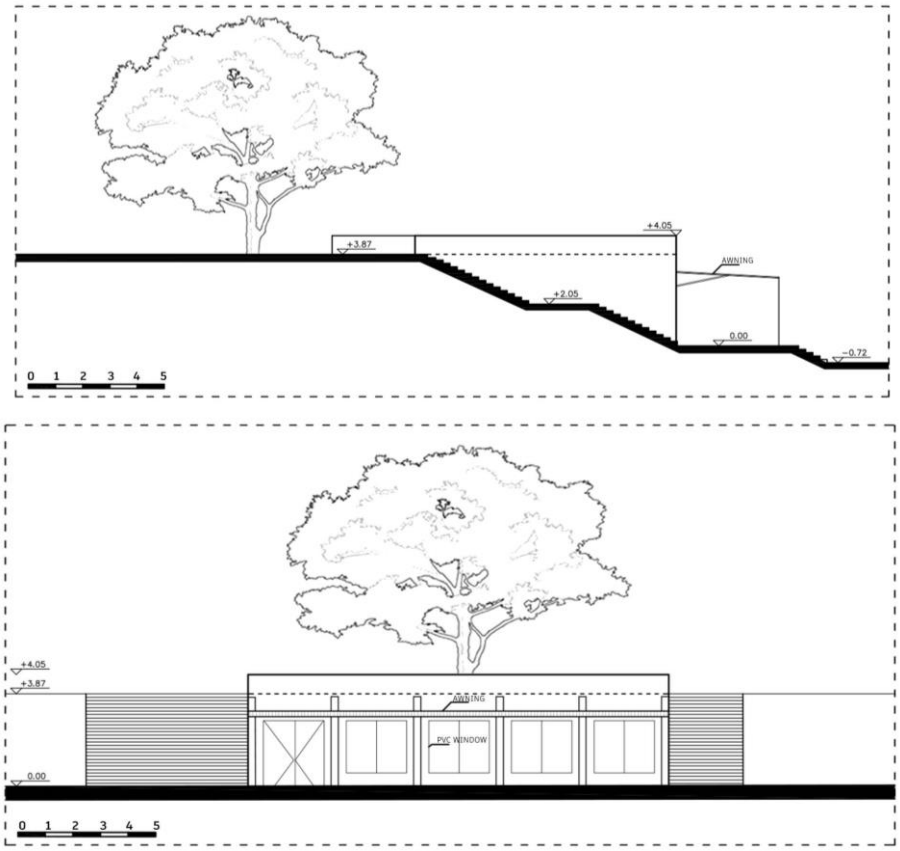


Figure 6. Survey drawings- East Elevation (top) and North Elevation (bottom)

Data Analysis

Design and green roof system selection

During the preliminary assessment of the study site, several performance issues were identified in the interior spaces located beneath the roof areas selected for potential green roof enhancement. These assessments were informed by the authors' on-site observations as well as practical insights shared by the staff working in the canteen located under the study roof. The identified issues include:

- The space is very cold, especially in winter months,
- Problems such as mold and mildew are seen at the ceiling and wall joints,
- Water leaks from the ceiling into the interior space,
- The roof area is very hot, especially in summer months, making it uncomfortable for sitting and relaxing,
- It is not considered an alternative recreation area for users.

Within the scope of this study, the energy efficiency and structural suitability of the existing hard-surfaced roof area will be evaluated to strengthen the sustainability of the campus and provide solutions to the problems mentioned above.

The selection of an inverted green roof system and the three alternative configurations (extensive, semi-intensive, and intensive) was based on the specific climatic, structural, and functional conditions of the study area. The temperate-humid climate of Trabzon requires a roof system that can withstand high annual precipitation while protecting

the waterproofing membrane; therefore, inverted roofs were prioritised due to their superior performance in moisture resistance and long-term durability. Additionally, the problems observed in the cafeteria below—such as heat loss in winter, overheating in summer, water leakage, and mold formation—necessitated roof solutions that provide enhanced thermal insulation and effective rainwater management. For this reason, the study included extensive, semi-intensive, and intensive green roof types, allowing a comparative evaluation of soil depth, weight, water-retention-induced load, cost, and energy performance to determine the most feasible option for existing campus buildings.

This space, which features a reinforced concrete column-beam system, has been proposed for a green roof application. Part of the flooring system is designed as an extensive vegetation cover, while another part is designed as a walkable roof with wood cladding (Figure 7-9).

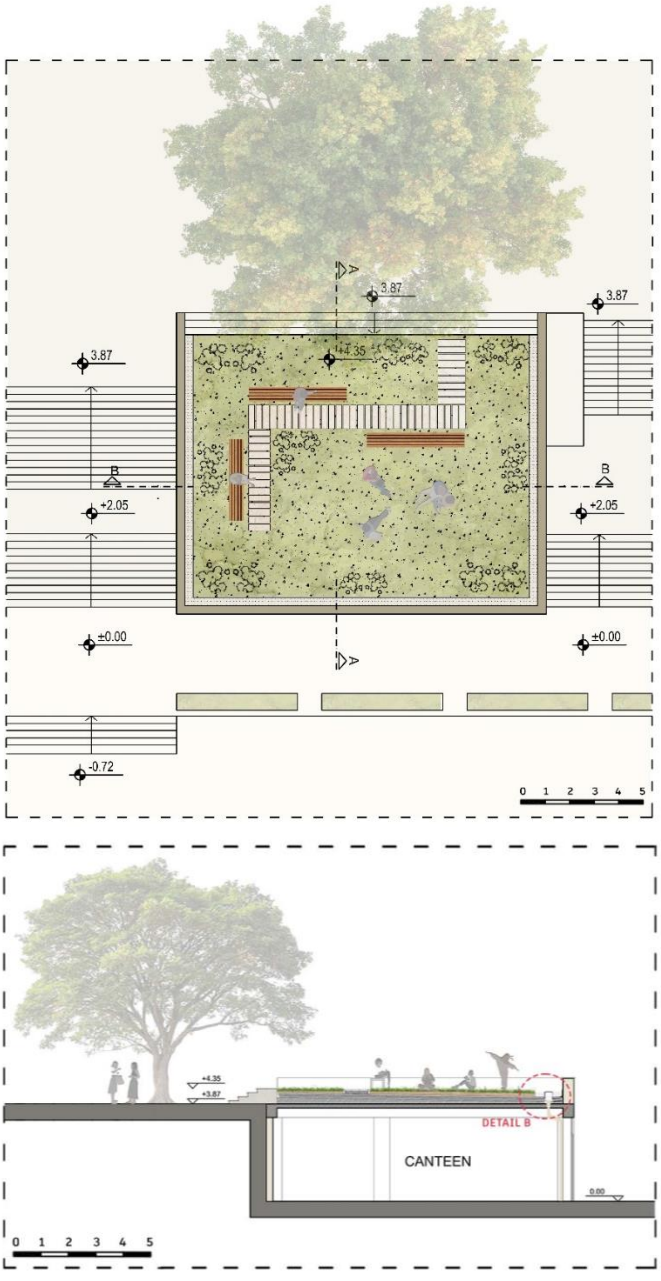


Figure 7. Proposed green roof design - Green Roof Plan (top) and AA Section (bottom)

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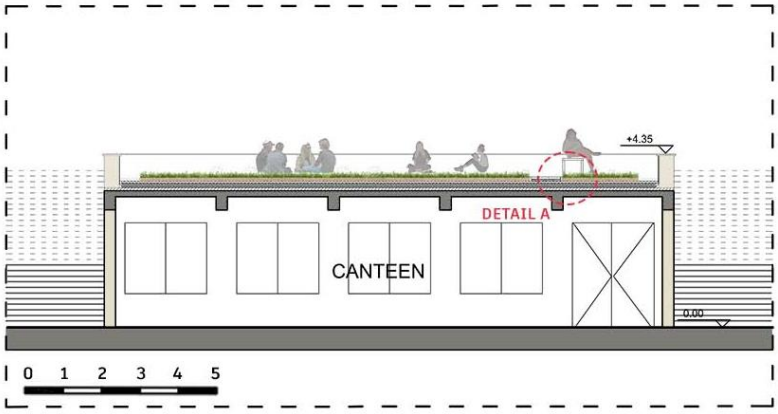


Figure 8. Proposed green roof design - Green Roof BB Section

The layering details for the three different types of green roofs, referred to as extensive, intensive, and semi-intensive, are provided below as the roof layering principle (Figure 9).

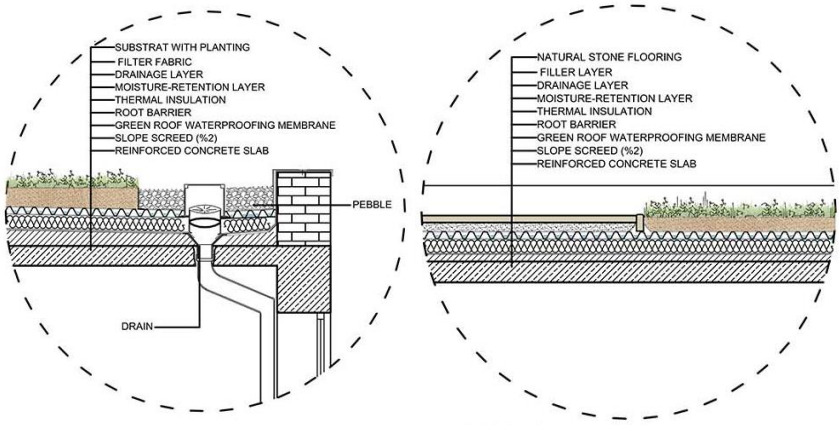


Figure 9. Proposed green roof design– BB Section A Detail (left), AA Section B Detail (right)

Model building and simulation parameters

Karadeniz Technical University (KTÜ) is situated in Trabzon Province, on the Black Sea coast, and experiences the region's characteristic humid and rainy climate conditions. Due to the influence of the Eastern Black Sea climate, high levels of rainfall and humidity are observed throughout the year. According to data from the General Directorate of Meteorology (MGM, 2024), the region's average maximum temperature is 18.2°C, while the minimum temperature is 11.8°C, with rainy days occurring 37.6% of the year. These climatic characteristics create a favourable environment for sustainable landscape and building practices.

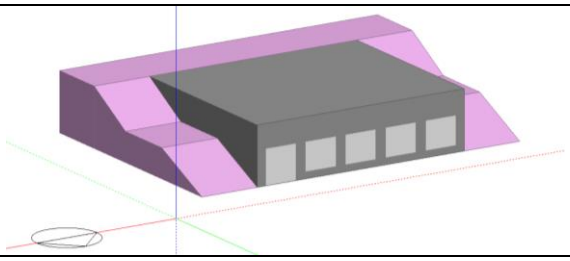
Currently, the roof is covered with traditional hard surface materials and has limited performance in terms of thermal insulation and rainwater retention performance. With the green roof proposal, various plant species and a layer of soil will be applied to the roof, aiming to improve the microclimate and reduce energy consumption.

Modelling and energy simulation

The energy simulation for the existing and proposed green roof systems was performed using the DesignBuilder software, which utilized the T-MY (Typical Meteorological Year) weather file for Trabzon. This file, which was sourced in EPW (EnergyPlus Weather) format from the Ladybug Tools database and imported directly into the simulation program, ensures that all energy calculations reflect realistic, long-term regional climatic conditions, thereby enhancing the reliability of the comparative analysis.

The technical specifications and U-values of the existing building elements were entered into the program (Table 2). Architectural and technical information about the building was obtained through the KTU Project Production Center (PÜM). The cafeteria building is heated by a central system and does not contain any active cooling system. The indoor air change rate for natural ventilation was set at 0.5 ach/h (Conceição et al., 2019), which represents a typical value for naturally ventilated spaces without mechanical systems. This rate approximates the real operating conditions of the cafeteria, where ventilation occurs through infiltration and occasional window opening. The 'Food Preparation Area' was selected from the program library for building activities. The setback temperature (18°C) represents the minimum allowable indoor temperature during unoccupied hours; the heating system activates only when the indoor temperature falls below 18°C, and during occupied hours it heats the space up to the setpoint temperature of 22°C (Manning et al., 2007).

Table 2. Surveying Engineering canteen building model, components, and materials



Elements	Layers	Material Thickness	Total thickness	U-Value
Exterior Wall	Gypsum plastering Brick Cement plaster	0,020 m 0,200 m 0,030 m	0,250 m	1, 714 W/m²K
Ground Floor	Ceramic/clay tiles Cement mortar Cast concrete Reinforced concrete Brick slips Clay underfloor	0,015 m 0,020 m 0,010 m 0,010 m 0,025 m 0,500 m	0,580 m	1,042 W/m²K
Windows/Door	Painted wood frame Single clear 6 mm	0,006 m	0,006 m	5,718 W/m²K
Roof	Basalt Cement mostar Cast concrete Felt sheating Cast concrete Reinforced concrete Gypsum plastering	0,040 m 0,030 m 0,010 m 0,005 m 0,015 m 0,015 m 0,020 m	0,135 m	1,947 W/m²K

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The DesignBuilder output variables used for the subsequent analysis included monthly and annual heating loads (for energy efficiency), indoor operative temperatures (for thermal comfort), operational CO2 emissions (for environmental impact), and initial construction cost estimates (for economic feasibility).

Heating loads were generated directly by the EnergyPlus simulation engine as hourly sensible heating energy outputs. Indoor operative temperature values were also calculated automatically by EnergyPlus using its built-in formulation, which combines air temperature and mean radiant temperature. Operational carbon emissions were obtained from DesignBuilder's automated post-processing tools, which multiply annual heating energy consumption by the national grid emission factor. Construction cost estimates and embodied carbon values were likewise computed internally by DesignBuilder using its material database, which includes predefined cost coefficients and life-cycle emission factors. The model was simulated on an hourly basis for a full year, and monthly results were automatically aggregated from hourly outputs by EnergyPlus. No parameters were modified on a monthly basis; observed monthly variations arise solely from the climatic differences contained in the TMY weather file.

In the simulation study, three alternatives were proposed to compare the performance of the hard roof: extensive, semi-intensive, and intensive green roofs.The characteristics of the green roofs, with soil thicknesses of 10 cm, 25 cm, and 50 cm, respectively, and the layering defined within the program are shown in Table 3.

Table 3. Proposed green roof alternatives and thermal transmission properties

Alternatives	Layers	Material Thickness	Total thickness	U-Value
Alternative 1: Extensive roof	Soil Filter fabric Drenage layer Felt sheating XPS Waterproofing mem. x2 Reinforced concrete Cast concrete Gypsum plastering	0,150 m 0,005 m 0,030 m 0,005 m 0,050 m 0,030 m 0,150 m 0,150 m 0,020 m	0,585 m	0, 418 W/m²K
Alternative 2: Semi-Intensive roof	Soil Filter fabric Drenage layer Felt sheating XPS Waterproofing mem. x2 Reinforced concrete Cast concrete Gypsum plastering	0,250 m 0,005 m 0,030 m 0,005 m 0,050 m 0,030 m 0,150 m 0,150 m 0,020 m	0,685 m	0, 401 W/m²K
Alternative 3: Intensive roof	Soil Filter fabric Drenage layer Felt sheating XPS Waterproofing mem. x2 Reinforced concrete Cast concrete Gypsum plastering	0,350 m 0,005 m 0,030 m 0,005 m 0,050 m 0,030 m 0,150 m 0,150 m 0,020 m	0,780 m	0, 386 W/m²K

Green roof soil water retention capacity

The water retention capacity of green roofs plays a critical role in urban stormwater management by reducing flood risk, decreasing runoff volume, and filtering pollutants (Burszta-Adamiak, 2012; Fang, 2010). Research has shown that green roofs maintain high retention rates in different climates and seasons, and that vegetation and substrate types affect this capacity (Krebs et al., 2016; Todorov et al., 2018). Furthermore, green roofs help restore the disrupted natural hydrological cycle by gradually releasing rainwater, contributing to air quality and biodiversity (Knappe et al., 2023). Yüksek et al. (2024) stated that soil samples taken from a forested area in a spruce forest in Trabzon-Maçka, with a bulk density of 0.92 (g/cm3), had a water retention capacity of up to 43%. This value drops to 31% in landslide-affected soil. It was decided that the soil water retention capacity to be used in the study would be taken as an average value of 35%.

Table 4 summarizes the total load imposed on the existing 190 m^2 roof by the saturated substrate layer for each green roof type. As the soil depth increases from extensive (15 cm) to semi-intensive (25 cm) and intensive (35 cm), both the dry soil weight and the water-retention-induced load rise significantly. This demonstrates that the water holding capacity directly influences the structural load, with extensive roofs adding approximately 190 kg/m^2, while semi-intensive and intensive roofs increase the load to about 318 kg/m^2 and 445 kg/m^2, respectively.

Table 4. Total roof weight by green roof type

	Unit Weight	Vol.	Soil Weight	Water Retentio n Cap.	Water Volume	Water Weight	TOTAL
Extensive	0.92 (g/cm³)	28.5 m³	26.220 kg	35%	9.975 m³	9975 kg	36.195 kg
Semi-intensive		47.5 m³	43.700 kg		16.625 m³	16625 kg	60.325 kg
Intensive		66.5 m³	61.180 kg		23.275 m³	23275 kg	84.455 kg

These results are critical for evaluating the structural feasibility of green roof retrofits, since they indicate that although extensive systems generally fall within common live-load limits reported in the literature, semi-intensive and intensive systems may require additional reinforcement. Thus, the table links water retention capacity to practical structural constraints and supports the selection of the most appropriate green roof type for existing buildings.

FINDINGS AND DISCUSSION

This section presents the findings of the energy performance simulations and the structural load analysis conducted for the three green roof alternatives. The results are evaluated in terms of heating load reduction, indoor operative temperature, operational carbon emissions, embodied carbon, and the additional load generated by the water-retention capacity of the substrate. In this regard, energy

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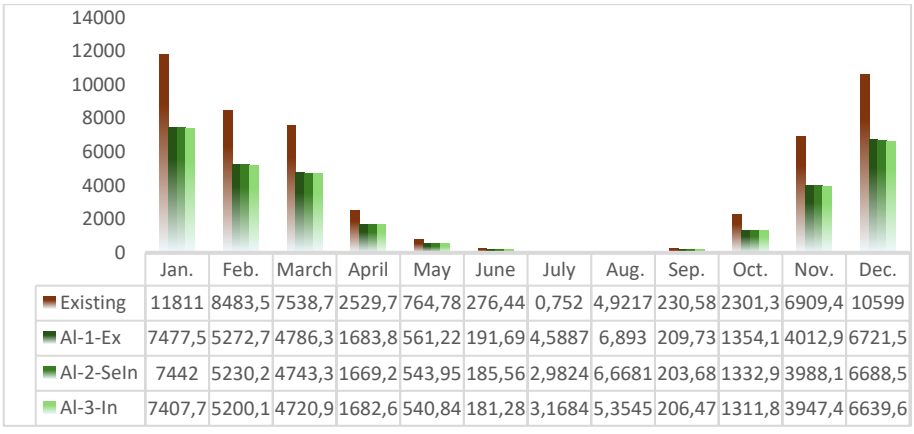
efficiency and roof load issues were examined in the methodology of the study and in the related headings given in the table below (Table 5).

Table 5. Stages defined for energy efficiency and structural loads

Modeling and Simulation for Energy Efficiency	✓	The existing roof structure and the alternative green roof systems (extensive, semi-intensive, and intensive) were modeled using DesignBuilder software.
	✓	Annual and monthly energy consumption, heating loads, and indoor temperatures were simulated for the modeled roof systems.
	✓	The operational carbon emissions and embodied carbon of the alternative systems were calculated.
	✓	The total cost increase, construction cost, and roof cost for each alternative were calculated.
Load Analysis on the Roof (water retention capacity)	✓	The water retention capacity of the green roof substrate layers and the total roof load were calculated.
	✓	The suitability of different green roof types for existing roof conversions was evaluated based on the load-bearing capacity of a 200 m^2 reinforced concrete roof slab.

Results Related to Energy Efficiency

According to the results of the numerical analysis, the extensive (Al-1-Ex), semi-intensive (Al-2-SeIn), and intensive (Al-3-In) green roof systems proposed as alternatives to the existing flat roof provide significant advantages in heating loads for most of the year (Figure 10). Specifically, in January, February, March, October, November, and December, all alternative roofs offer similar rates of heating load reduction compared to the existing flat roof (approximately 36%-43%). In spring and summer months (April, May, June), the reduction in heating loads is more pronounced, with the lowest values observed in May (approximately 26%-29%). Negative values are notable in July and August; during these months, green roof systems appear to create a disadvantage in terms of heating load. In September, the beginning of autumn, positive values are observed again, providing a heating load advantage. Overall, it can be said that alternative green roof applications offer significant contributions to energy efficiency compared to existing flat roofs during winter and transitional seasons.



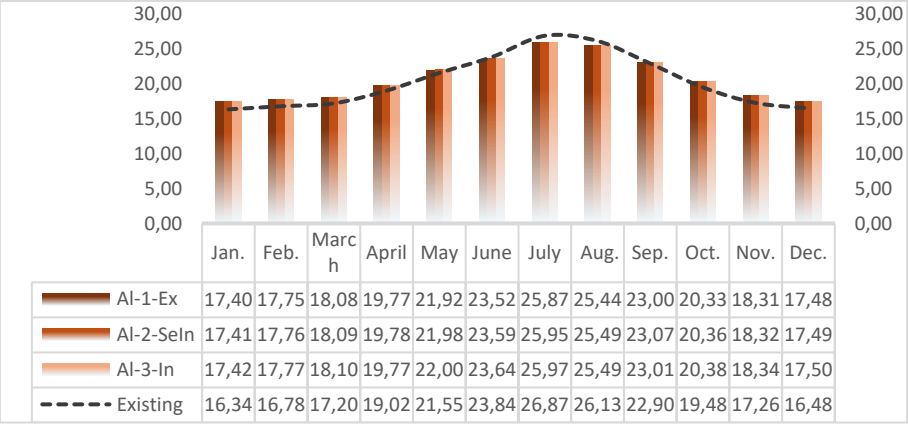
	Jan.	Feb.	March	April	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
Existing	11811	8483,5	7538,7	2529,7	764,78	276,44	0,752	4,9217	230,58	2301,3	6909,4	10599
Al-1-Ex	7477,5	5272,7	4786,3	1683,8	561,22	191,69	4,5887	6,893	209,73	1354,1	4012,9	6721,5
Al-2-SeIn	7442	5230,2	4743,3	1669,2	543,95	185,56	2,9824	6,6681	203,68	1332,9	3988,1	6688,5
Al-3-In	7407,7	5200,1	4720,9	1682,6	540,84	181,28	3,1684	5,3545	206,47	1311,8	3947,4	6639,6

Figure 10. Building heating loads for existing roof and alternative green roof systems

When examining its impact on operational carbon emissions, a significant reduction is observed for most of the year. Particularly during winter and transitional seasons (October-March and November-December), all alternative roofs offer carbon emission reductions of approximately 16% to 20% compared to the existing flat roof. This reduction drops to lower levels in spring and summer, while in July and August, there is almost no change in operational carbon emissions, or it is shallow. At the beginning of autumn (September), a slight advantage is observed again. These results show that green roof applications are effective in reducing energy consumption and associated carbon emissions, especially during periods of high heating demand.

When alternatives are considered, the intensive green roof system (Al-3-In) stands out as the most successful alternative for most of the year. Al-3-In provided the highest reduction rates, particularly in winter and transition months (October-March and November-December). In September, the semi-intensive roof (Al-2-SeIn) was the most successful scenario. Overall, Al-3-In was also considered the most effective alternative for reducing carbon emissions from heating loads in most months.

When evaluating the effect of alternative green roof systems on indoor operative temperature compared to existing flat roofs, it is observed that they increase indoor temperature for most of the year (Figure 11). Specifically, during winter and transitional seasons (October-March and November-December), all alternative roofs resulted in an increase in operative temperature of approximately 4% to 6%. While this increase is more moderate in the spring and autumn months, it reaches negative values in the summer months (June, July, and August), indicating that an increase in indoor operative temperature is observed. This increase is highest in July (approximately 3.3%–3.7%). These results indicate that green roof applications contribute to warmer indoor spaces, particularly in winter, while slightly increasing indoor temperatures in summer.



	Jan.	Feb.	March	April	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
Al-1-Ex	17,40	17,75	18,08	19,77	21,92	23,52	25,87	25,44	23,00	20,33	18,31	17,48
Al-2-SeIn	17,41	17,76	18,09	19,78	21,98	23,59	25,95	25,49	23,07	20,36	18,32	17,49
Al-3-In	17,42	17,77	18,10	19,77	22,00	23,64	25,97	25,49	23,01	20,38	18,34	17,50
Existing	16,34	16,78	17,20	19,02	21,55	23,84	26,87	26,13	22,90	19,48	17,26	16,48

Figure 11. Operative temperatures of zones for alternative green roof systems

In the cost assessment, three different green roof alternatives increased the total building cost compared to the existing flat roof. The

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lowest cost increase occurred in the extensive green roof (Al-1-Ex), with a 32% increase in roof cost, a 21% increase in construction cost, and a 14% increase in total building cost. The semi-intensive green roof (Al-2-SeIn) caused a 52% increase in roof cost, a 0.34% increase in building cost, and a 23% increase in total building cost. The highest cost increase was observed in the intensive green roof (Al-3-In) scenario, with a 71% increase in roof cost, a 46% increase in building cost, and a 32% increase in total building cost (Figure 12). In conclusion, although green roof applications increase costs, the most economical alternative is the extensive system.

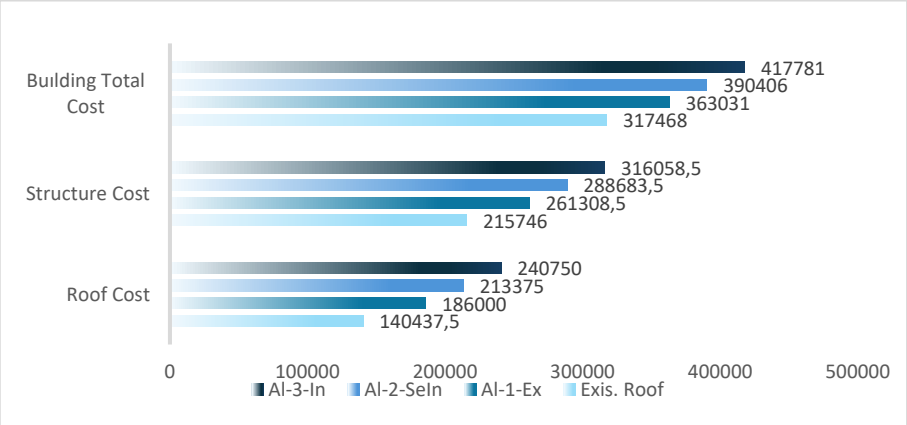


Figure 12. Building structure costs (GBP) for alternative green roof systems

When evaluated in terms of embodied carbon, green roof alternatives are found to increase both the roof and total building embodied carbon compared to the existing flat roof. The extensive green roof (Al-1-Ex) increased the roof's embodied carbon by 49% and the total building's embodied carbon by 16%. For the semi-intensive green roof (Al-2-SeIn), these rates were 50% and 16%, respectively, while for the intensive green roof (Al-3-In), they were 52% and 17% (Figure 13). The main reason for this increase is that additional structural elements used in green roof systems, primarily insulation materials, drainage layers, filter layers, and vegetation, increase the total amount and variety of materials. As a result, the lowest increase in embodied carbon was observed in the extensive system, while the highest increase was observed in the intensive system.

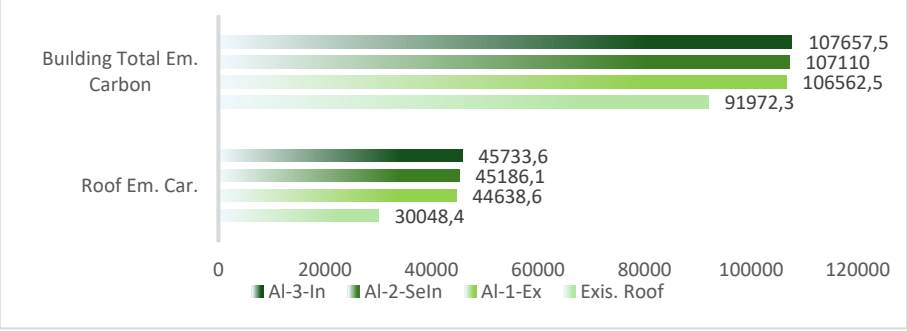


Figure 13. Building operational carbon (CO2 kg) for alternative green roof systems

Water Retention Performance

In the analysis of the water retention capacity of the green roof soil layer and the loads on the roof, for the existing 190 m^2, with a density of 0.92 g/cm^3 and a water retention capacity of 35%, the following values were obtained: approximately 36.2 tons (190.5 kg/m^2, 1.87 kN/m^2) for an extensive (15 cm) roof, 60.3 tons (317.5 kg/m^2, 3.12 kN/m^2) for a semi-intensive (25 cm) roof, and 84.5 tons (444.5 kg/m^2, 4.36 kN/m^2) for an intensive (35 cm) roof. Although a comprehensive structural analysis is required to determine the load-bearing capacity of a 190 m^2 roof deck, Cascone (2019) emphasises that in many European countries, the live load limit for flat roofs on residential buildings is approximately 200 kg/m^2, which corresponds to approximately 2 kN/m^2. These values indicate that extensive green roofs may be feasible in most structures. However, semi-intensive and intensive systems may require reinforcement or special design depending on the capacity of the existing flooring and structural system.

Evaluation of Suitable Green Roof Type

All three green roof alternatives provide measurable improvements in heating load reduction and operational carbon savings compared with the existing flat roof. However, their feasibility varies when cost, embodied carbon, and additional structural load are taken into account. While the intensive system demonstrates the highest performance, its high cost and water-induced load limit its applicability. The semi-intensive option offers balanced performance but may still require structural reinforcement. The extensive system, with its lower cost, lower embodied carbon, and acceptable load levels, emerges as the most feasible solution for existing buildings on campus (Table 6).

Table 6. Comparative Assessment of Green Roof Alternatives (Summary)

Criteria	Extensive (Al-1-Ex)	Semi-Intensive (Al-2-SeIn)	Intensive (Al-3-In)
Heating Load Reduction	36–43%	37–45%	38–46% (Highest)
Operational Carbon Reduction	16–18%	17–19%	18–20% (Highest)
Indoor Temperature Effect (Winter)	✓	✓✓	✓✓✓
Summer Overheating Risk	Low	Moderate	Higher
Construction Cost Increase	Low (Most economical)	Medium	High
Embodied Carbon Increase	Lowest	Medium	Highest
Water Retention Load	~190 kg/m² (Feasible)	~318 kg/m² (May require reinforcement)	~445 kg/m² (Generally requires reinforcement)
Structural Suitability for Existing Buildings	High	Medium	Low
Overall Feasibility	Most feasible & sustainable	Feasible with structural checks	Performance-oriented but structurally demanding

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The extensive system is identified as the most suitable alternative for existing campus buildings due to its favourable balance of energy benefits, cost, embodied carbon, and structural load. The heating-load reduction (36–46%) and operational carbon savings (16–20%) obtained in this study align with the quantitative findings of previous research. For example, Silva et al. (2016) found that dense and semi-dense green roofs in Lisbon reduced annual energy demand by 6–15%, depending on roof configuration. Mahmoud et al. (2017) demonstrated that green roofs in the hot–humid climate of Dhahran yielded up to 25% cooling-energy savings. He et al. (2020) showed that green roofs in Shanghai reduced summer roof surface temperatures significantly and improved indoor thermal stability during winter.

In contrast to most campus-based investigations that focus on microclimate, user perception, or energy performance alone, the present study additionally quantifies the structural implications of rainwater-induced substrate loads and relates them to commonly cited live-load limits, thereby extending the predominantly energy- and comfort-oriented literature with an integrated energy–structure perspective for retrofit applications on existing reinforced-concrete roofs.

CONCLUSIONS

The use of green roofs provides ecological, economic, and social benefits, particularly in densely built environments, such as university campuses. In this study, the walkable hard-surface roof above the canteen of the Department of Surveying Engineering at Karadeniz Technical University's Kanuni Campus was selected, and a proposal was developed to repurpose it as a green roof. The building was modelled using simulation software, and data for three types of green roof designs—extensive, semi-intensive, and intensive—were incorporated into the program for the roof. General evaluations based on the results obtained are presented below.

- Green roofs reduced heating loads by 36–46% and operational carbon emissions by 16–20%, particularly during winter and transitional seasons. Although energy savings were highest in May, the systems provided little to no advantage in July and August due to the absence of heating demand and increased indoor temperatures.
- The intensive system demonstrated the best overall performance in energy and carbon reduction, while the semi-intensive system performed best in September. The extensive system offered more limited performance but remained advantageous due to its lower structural load and maintenance needs.
- All alternatives improved indoor operative temperatures in winter; however, summer analyses showed the highest temperature increases—especially in July—indicating a potential overheating tendency.

- The intensive roof resulted in the highest construction and embodied carbon increases, whereas the extensive system remained the most economical and environmentally modest option.
- Extensive roofs met typical European live-load limits, while semi-intensive and intensive roofs imposed higher water-retention loads, often requiring structural reinforcement. High retention capacity supports stormwater management, but feasibility largely depends on load-bearing capacity.

Overall, the evaluated green roof systems offer varying strengths and weaknesses in terms of sustainability. The extensive system is economically and structurally advantageous due to its low cost and lightweight nature. However, its energy and carbon reduction benefits are limited, making it suitable for buildings with low load-bearing capacity. The semi-intensive system offers a balanced performance in terms of energy savings, carbon reduction, and structural load, making it ideal for campus-scale applications. The intensive system delivers the highest environmental benefits but also incurs higher costs, embodied carbon, and added structural loads. Therefore, selecting a green roof system at the campus scale should align with environmental and economic sustainability goals.

In interpreting these findings, it should be noted that this study has certain limitations. The results are based on simulation outputs rather than on-site experimental measurements, and cooling performance could not be assessed due to the absence of an active cooling system in the existing building. In addition, structural load evaluations relied on literature-based thresholds rather than a detailed engineering analysis of the existing slab. These limitations should be taken into account when evaluating the applicability of the proposed systems.

Future research may focus on developing hybrid solutions that combine the advantages of different systems to further enhance performance.

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Mapping the Evolution of Interior Architecture and Interior Design: A VOSviewer-Based Bibliometric Analysis

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Abstract

This study conducts a comprehensive bibliometric analysis to explore the academic evolution of interior architecture and interior design literature from 1975 to 2024 using the Web of Science (WoS) database. A total of 3,695 articles were analyzed through VOSviewer software to visualize and interpret research trends, citation networks, co-authorship clusters, and thematic keyword occurrences. The findings indicate a steady growth in publications, particularly after 2006, coinciding with the increasing emphasis on digitalization and sustainability in design. Prominent research themes include biophilic design, adaptive reuse, and the psychological effects of color and space. The dominance of English-language publications is evident, though contributions in Turkish, French, and Spanish are also recognized. Citation analyses identify influential studies that link technical developments with social and psychological perspectives in design. Thematic clustering highlights the interdisciplinary expansion of the field, integrating insights from environmental psychology, ergonomics, and emerging digital technologies such as virtual and augmented reality. This study contributes to the literature by offering a clear roadmap for future research, promoting international collaboration, and strengthening the link between academic inquiry and design practice.

Keywords: *Bibliometric analysis, Interior architecture, Interior design, VOSviewer, Web of Science database*

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INTRODUCTION

In today's rapidly evolving world, interior architecture plays a highly significant and multifaceted role in shaping not only the aesthetic and functional qualities of spaces but also in addressing user-oriented needs and enhancing overall spatial experience. The discipline of interior design seeks to elevate the quality of life by establishing a harmonious balance between visual appeal and practical usability, ensuring that spaces are both beautiful and efficient. Over the years, numerous academic studies and scholarly contributions have enriched the understanding of the foundational concepts, diverse application areas, and methodological frameworks that define the discipline of interior architecture (Adıgüzel & Ciravoğlu, 2013; Evcil & Yalçın Usal, 2019). In this academic context, bibliometric analysis emerges as a powerful and systematic research tool that enables scholars to comprehensively examine the evolution of scientific literature within a specific field. It allows for the detailed analysis of research trends, collaboration patterns among scholars and institutions, and the overall distribution and structure of accumulated knowledge (Öztürk Akbıyık & Arslan Selçuk, 2023).

Bibliometric analysis is particularly effective in revealing the intellectual structure of a field by identifying influential authors, commonly studied topics, research gaps, and emerging themes.

Within the domain of interior architecture, academic literature demonstrates a rich variety of research methodologies and interdisciplinary perspectives, integrating insights from fields such as environmental psychology, architecture, industrial design, and user experience studies. The present study aims to explore and interpret the current research landscape in interior architecture by analysing bibliographic data obtained from the Web of Science (WoS) database. Through this approach, the study seeks to present a broad and detailed perspective on the academic development and evolution of the field.

To achieve this, advanced bibliometric mapping and network analysis techniques were applied using the VOSviewer software, which allows for the visualization of citation relationships, keyword co-occurrence networks, and the mapping of intellectual connections between publications. The present study primarily focuses on identifying the distribution patterns of scholarly articles, citation frequencies, keyword linkages, and the most influential academic publications within the scope of interior architecture research.

The findings of this research are expected to provide valuable insights into prevailing research themes and trends, as well as to highlight the dominant areas of interest and scholarly collaboration within the field. Ultimately, the results aim to support a deeper understanding of the academic trajectory of interior architecture and to offer guidance for future research directions and strategic academic planning in this dynamic and interdisciplinary discipline.

Despite the growing body of literature on interior architecture and design, comprehensive bibliometric analyses in this field remain scarce.

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Most existing studies focus on theoretical or case-based perspectives, while systematic mapping of publication patterns, collaborations, and thematic evolution is still limited. Therefore, the present study fills a significant gap by offering a long-term, data-driven overview of the discipline's academic development.

Accordingly, this study aims to contribute to the understanding of how interior architecture and interior design have evolved as academic disciplines by examining their publication trends, research collaborations, and thematic structures.

The present study seeks to answer the following research questions:

- How has interior architecture and interior design research evolved between 1975 and 2024 in terms of publication trends and productivity?
- What are the dominant thematic clusters and emerging research topics in interior architecture and interior design literature?
- How have interdisciplinary collaborations and co-authorship networks developed within this field over time?
- Which countries, institutions, and authors have played a leading role in shaping the intellectual structure of interior architecture and design research?

For example, bibliometric analysis allows researchers to identify which authors, institutions, or themes are most influential in a field.

MATERIALS AND METHODS

Within the scope of this comprehensive study, a detailed bibliometric analysis of academic publications in the field of interior architecture was conducted in order to better understand the intellectual structure, thematic focus areas, and scholarly development of the discipline. The data used for the bibliometric analysis were systematically gathered from scientific articles published in the Web of Science (WoS) database, which is widely recognized as one of the most reliable and authoritative sources for academic research. WoS is frequently preferred by researchers for bibliometric studies due to its extensive indexing of high-quality, peer-reviewed, and internationally acknowledged journals. Its credibility and comprehensive coverage make it an essential tool for assessing academic output and trends across disciplines. (Ay, Bekler, et al., 2024a; Ay & Dal, 2026; Donthu et al., 2021).

In the data collection process, a targeted search was carried out in the WoS database using specific keywords: "interior architecture" and "interior design." These keywords were chosen to ensure the inclusion of relevant literature that directly addresses the core topics of the study. In order to maintain a high level of academic rigor and consistency, the search was restricted to include only articles published in peer-reviewed academic journals, excluding conference proceedings, editorials, book chapters, and other non-peer-reviewed content. As a result of this filtering process, a total of 3,695 articles were identified and included in the analysis. For each of these publications, key bibliographic data such as author names, article titles, abstracts, keywords, citation counts, and

publication years were collected and systematically organized for further analysis.

Once the bibliographic data were compiled, they were transferred into VOSviewer software for in-depth bibliometric mapping and scientific network visualization. VOSviewer, developed by van Eck and Waltman (2010), is a specialized and widely used tool for creating, analyzing, and visually representing bibliometric networks. Its intuitive interface and powerful capabilities make it especially effective in revealing hidden structures within large datasets. VOSviewer enables researchers to create meaningful visualizations of relationships between various bibliographic elements, such as co-authorship networks, keyword clusters, and citation patterns (Ay et al., 2025; Ay, Tekin, et al., 2024; Bekler et al., 2025; Özmen Halis et al., 2025).

In this study, four primary types of bibliometric analyses were performed using VOSviewer:

- **Citation Analysis:** This analysis focused on identifying the most cited academic articles and the most influential authors within the field. By examining citation frequencies, the study was able to highlight seminal works that have shaped the academic discourse in interior architecture.
- **Keyword Analysis:** The frequency and co-occurrence of keywords used in the examined articles were analyzed to identify commonly explored themes and to form thematic clusters. This allowed for a clearer understanding of the dominant and emerging research topics within the discipline.
- **Author Collaboration Analysis:** This part of the analysis aimed to visualize the collaborative relationships between different authors. By mapping co-authorship networks, the study provided insights into patterns of academic cooperation and knowledge exchange across institutions and geographical regions.
- **Co-Citation Analysis:** This analysis identified pairs of studies that were frequently cited together in the same articles, revealing underlying conceptual connections between them. Co-citation mapping is a valuable method for uncovering the intellectual structure of a research field and determining how foundational studies are interconnected.

The findings of these analyses were systematically mapped and interpreted using the features provided by VOSviewer. To ensure transparency and reproducibility, a detailed methodological workflow was developed and systematically implemented throughout the analysis process (Figure 1). The workflow comprised six key stages:

- **Database Selection:** The Web of Science (WoS) Core Collection was chosen for its rigorous indexing standards, structured metadata, and extensive coverage of peer-reviewed journals. Although databases such as Scopus and Google Scholar were considered, WoS was preferred due to its superior filtering capabilities and citation consistency.

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- **Search Strategy:** The terms "interior architecture" and "interior design" were searched within the Topic field (title, abstract, and keywords) for the period between 1975 and 2024.
- **Data Filtering:** To maintain academic rigor, the document type was limited to journal articles. From an initial dataset of 5,100 records, 3,695 were identified as relevant articles.
- **Data Cleaning and Normalization:** Duplicate records and inconsistencies in author names were standardized (e.g., "Yildirim K." and "Yıldırım Kemal" were merged), and synonymous or variant keywords were unified to ensure data integrity.
- **Analysis and Visualization:** Bibliometric mapping was conducted using VOSviewer (version 1.6.20). Specific thresholds were applied to enhance the reliability and relevance of the results—for example, only keywords appearing at least ten times and publications with a minimum of five citations were included. This approach enabled a focused examination of the most influential elements while reducing noise from less significant data points.
- **Limitations and Data Accessibility:** While the study utilized only the WoS database, future research may integrate multiple databases to achieve broader coverage. The cleaned dataset and processing scripts are available upon request to facilitate transparency and reproducibility.

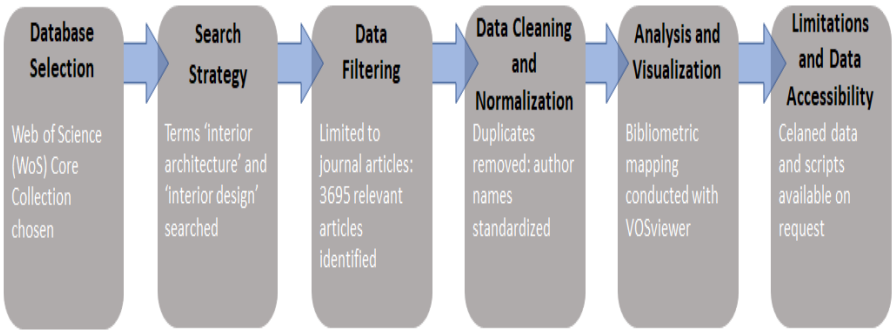


Figure 1. Methodological workflow of the study

Using these procedures, the study systematically mapped and interpreted the intellectual structure of the interior architecture literature. The analysis revealed the field's thematic composition, dominant research trends, and potential directions for future investigation. These insights provide a valuable foundation for researchers, educators, and practitioners seeking to deepen their understanding of interior architecture and contribute to its continued academic and professional advancement.

VOSviewer software, for instance, visualizes citation and keyword networks as interconnected clusters, making it easier to interpret relationships between studies.

FINDINGS AND DISCUSSION

The Web of Science (WoS) database was searched on 16 August 2024 using the keywords "interior architecture" and "interior design". The search yielded 5,100 documents, of which 3,695 were peer-reviewed journal articles included in the present study. Figure 2 illustrates the annual distribution of these articles between 1975 and 2024. Publication activity remained modest until the mid-2000s, after which it showed a steady increase. A sharp rise was recorded after 2006, reaching a peak in 2022 with 204 articles.

It was observed that the first article studies indexed in WoS on the subject of the study were written in 1975 and the prominent study was Ryder, S. (1975), *"2 BY 4-Interior Architecture"*.

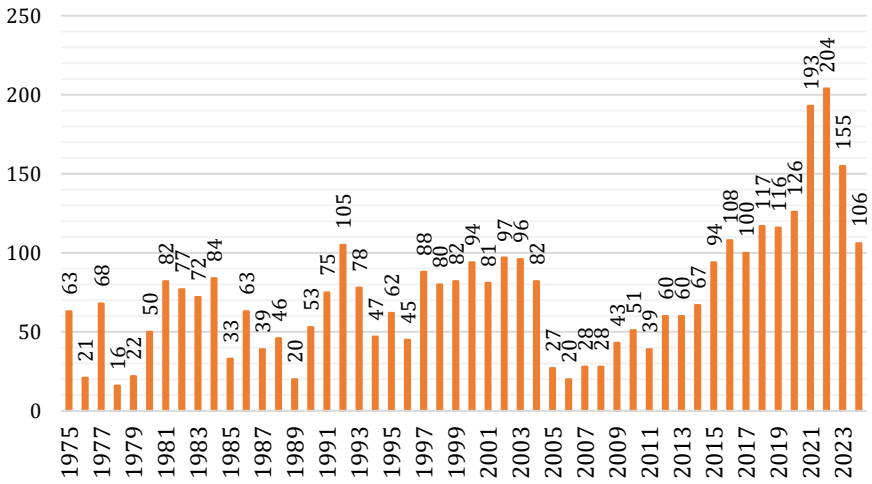


Figure 2. Number of articles by years

Figure 3 shows the document types of the publications retrieved from the WoS database. Articles account for 72.45 % of all documents, followed by proceedings papers (22.06 %) and a small number of reviews and book chapters. This distribution indicates the field's increasing academic orientation, as research in interior architecture and design is now predominantly disseminated through peer-reviewed journals rather than conference papers (Ay, Bekler, et al., 2024b; Bekler et al., 2024).



Document Types	Count	Rate (%)
Article	3695	72,45
Proceeding Paper	1015	19,90
Book Review	115	2,25
Review Article	77	1,51
Editorial Material	61	1,20
Book Chapter	61	1,20
Others	76	1,49
TOTAL	5100	100,00

Figure 3. Document type

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Figure 4 presents the distribution of publication languages. English clearly dominates the literature, accounting for over 85 % of all publications, followed by Turkish, Spanish, and French. This dominance reflects the increasing internationalisation of academic publishing and the influence of Anglo-Saxon scholarship in the field. At the same time, the presence of other languages indicates a growing effort to include diverse cultural and regional perspectives within interior architecture and design research (Ay, Tekin, et al., 2024; Tekin et al., 2024).



Languages	Count	Rate (%)
English	3411	92,31
French	84	2,27
Turkish	47	1,27
Spanish	46	1,24
Russian	25	0,68
German	21	0,57
Croatian	10	0,27
Others	51	1,38
TOTAL	3695	100,00

Figure 4. Languages of articles

The studies written in Turkish and indexed in the WoS database are shown in Table 1.

Table 1. Studies by Turkish authors indexed in WoS database on interior architecture or interior design

Author(s), Year	Article Name	Source
Yıldırım et al., (2005)	Farklı Sosyo-Ekonomik Düzeye Sahip Blok-Konut Kullanıcılarının Sabit İç Donatım Elemanlarından Memnuniyeti	Journal of Polytechnic-Politeknik Dergisi
Yıldırım, Aras, et al., (2005)	Orta Sosyo-Ekonomik Düzeye (SED) Sahip Kullanıcıların Konut Banyolarının İç Mekan Çözümlemesi	Journal of Polytechnic-Politeknik Dergisi
Yıldırım & Muslu (2006)	Poliklinik Bekleme Alanlarında Çevresel Faktörlerin Kullanıcıların Fonksiyonel ve Algı-Davranışsal Performansına Etkisi: Gazi Hastanesi Çocuk Polikliniği	Journal of Polytechnic-Politeknik Dergisi
Yıldırım et al., (2007)	Farklı Mimari Biçimlerdeki Kafe/Pastane Mekânlarının Kullanıcıların Algı-Davranışsal Performansı Üzerine Etkisi	Journal of Polytechnic-Politeknik Dergisi
Yıldırım, Aras, et al., (2007)	Birbirlerinin Satışını Destekleyen Hizmet ve Ürünlerin Bir Arada Sunulduğu Ticari Mekânlar: Kitap Evi-Kafe Örneği	Journal of Polytechnic-Politeknik Dergisi
Yıldırım, Akalın et al.,(2007)	Konut Mutfaklarının Mekân Kalitesinin Kullanıcıların Fonksiyonel ve Algısal Performansına Etkisi: TOKİ Eryaman 7. Etap Konutları	Journal of Polytechnic-Politeknik Dergisi
Fitoz et. al.,(2007)	Aydınlatma Tasarımı Laboratuvarı	Megaron

Table 1. Studies by Turkish authors indexed in WoS database on interior architecture or interior design (continued)

Author(s), Year	Article Name	Source
Yıldırım et al., (2008)	Otel Yatak Odalarının İç Mekân Tasarımının Kullanıcıların Algı-Davranışsal Performansı Üzerine Etkisi	Journal of Polytechnic-Politeknik Dergisi
İnan & Yıldırım (2009)	Mimari Tasarım Sürecinde Disiplinlerarası İlişkiler ve Eşzamanlı - Dijital Ortam Tasarım Olanakları	Gazi Üniversitesi Mühendislik Mimarlık Fakültesi Dergisi
Yıldırım et al., (2009)	İki Farklı Kültürel Bölgede Bulunan Apartman Konut Yaşama Mekânlarının Kullanım Sürecinde Değerlendirilmesi	Journal of Polytechnic-Politeknik Dergisi
Yıldırım, Çağatay, et al., (2009)	Farklı Sosyo-Ekonomik Düzeye (SED) Sahip Kullanıcıların Mutfaklarındaki Havalandırma Sistemleri Üzerine Bir Araştırma	Journal of Polytechnic-Politeknik Dergisi
Ayalp, (2011)	Alvar Aalto: Villa Mairea İç Mekan Analizi	Sanat ve Tasarım Dergisi
Demirarslan (2011)	Eski Bir Bektaşi Yerleşimi: Yörük Köyü'nde Evler ve Odanın Oluşumu	Türk Kültürü ve Hacı Bektaş Veli Araştırma Dergisi
İbrahim et al., (2013)	Machaerium Scleroxylona Bağlı Kontakt Dermatit: Olgu Serisi	Turkish Journal of Emergency Medicine
Gündoğdu (2014)	Mekân Dizimi Analiz Yöntemi ve Araştırma Konuları	Art-Sanat
Aras (2014)	Bir Mimarlık Bilinmeyeni: Postmodern Gündelik Yaşamda 'Konut' Tükendi mi?	Megaron
Uzunoğlu & Özer (2014)	Mimarlık Eğitiminde Mimari Psikoloji Formasyonunun Geliştirilmesi İçin Bir Model	Megaron
Manav, (2015)	Renk-Anlam-Mekân İlişkisi	Turkish Online Journal of Design Art and Communication
Kutlu, (2015)	Tasarımda Disiplinlerarası Yaklaşım-Mekân ve Grafik Tasarım İlişkisi	Turkish Online Journal of Design Art and Communication
Erdemir, (2015)	İç Mimaride Loft Tasarımı	Turkish Online Journal of Design Art and Communication
Çağatay et al. (2016)	Genç Odası Mekânı ve İç Donatım Elemanlarının Tasarım Kriterlerinin Belirlenmesi	Kastamonu University Journal of Forestry Faculty
Erten Bilgiç, (2016)	Okul Öncesi Eğitim Kurumlarında Uygulanan Eğitim Sistemlerinin Mekan Biçimlenişine Etkisi Ve Reggio Emilia Eğitim Sisteminin Mekan Tasarımı Üzerine Denemeler	Megaron
Nalçakan et al., (2017)	Televizyon Dizileri Yoluyla Türkiye'de İç Mekan Tasarımında Kültürel Kodların Değerlendirilmesi ve Değişen Konut Algısı	Sanat ve Tasarım Dergisi

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Table 1. Studies by Turkish authors indexed in WoS database on interior architecture or interior design (continued)

Author(s), Year	Article Name	Source
Koca, (2017)	Tasarım Yoluyla Araştırma: Üniversite Kurumsal Kimlik Oluşumunda İç Mekan ve Mobilya Tasarımı	Turkish Online Journal of Design Art and Communication
Karamanoğlu & Ulay (2017)	Deprem Riski Yüksek Bölgelerde İç Mekân Düzenlemelerinin İncelenmesi (Tosya Örneği)	Kastamonu University Journal of Forestry Faculty
Özkan & Mutdoğan (2018)	Erasmus Programı'nın Tasarım Öğrencilerinin Yaşam ve Eğitimlerine Katkısı	Turkish Online Journal of Design Art and Communication
Gürdağ et al., (2018)	Tasarım Eğitiminde Alterantif Mekan Olarak Sosyal Medya	Turkish Online Journal of Design Art and Communication
Onur & Zorlu (2018)	Tasarım Eğitiminde Duyusal Farkındalık ve Yaratıcılık İlişkisi Üzerine	METU Journal of the Faculty of Architecture
Özdemir Işık & Sayitoğlu Taş (2018)	Mimarlık Eğitiminde Peyzaj Tasarımı	Journal of History Culture and Art Research
Adıgüzel Özbek & Usta (2018)	İç Mimarlık Proje Stüdyosunda Yaratıcılık Odaklı Tasarım Çalışmaları	Turkish Online Journal of Design Art and Communication
Adıgüzel Özbek (2018)	Beden Etkileşimli Mekan Tasarımı	Turkish Online Journal of Design Art and Communication
Bekar et al. (2018)	İnformal Eğitim Süresince Öğrencilerin Teknolojiye Dayalı Kazanımlarının Belirlenmesi	Journal of History Culture and Art Research
Gürdallı & Keten (2019)	Barbie Bebek Evlerindeki İç Mekân Tasarımının Toplumsal Rollerin Gelişimi Üzerindeki Etkisi	Journal of History Culture and Art Research
Bilge (2019)	Pasif Yangın Güvenlik Önlemleri Kapsamında İç Mekan Tasarım Yaklaşımı – Yeniden İşlevlendirilen Tarihi Bandabuliya Binası Kaçış Yolları Değerlendirmesi	Megaron
Özgen (2020)	Hastane İç Mekan Tasarımında Malzeme Kullanımı	Sanat ve Tasarım Dergisi
Önal & Köşklü (2020)	Trabzon'da Geç Dönem Osmanlı Camilerinde Ahşap Mihraplar	Sanat Tarihi Dergisi
Yavuz Öden (2020)	Çocuk Müzelerinde İç Mekân Tasarımları: Atatürk ve Çocuk Müzesi İncelemesi	Art-Sanat
Garip (2020)	Sergileme mekânlarında tasarım başarımının artırılmasına yönelik kriterlerin belirlenmesinde analitik bir yaklaşım	Journal of Polytechnic-Politeknik Dergisi
Ünver (2021)	Temel Tasarım Stüdyosunda Yapılandırmacı Öğrenme Deneyimi: Beden-Mekân Çalışmaları Üzerinden Bir Değerlendirme	Sanat Tarihi Dergisi

Table 1. Studies by Turkish authors indexed in WoS database on interior architecture or interior design (continued)

Author(s), Year	Article Name	Source
Aras (2021)	Sınırları Bulanıklaştırmak: Mimarlık ve İç Mimarlık Öğrencileri İle Deneysel Bir Konut Tasarımı	Sanat Tarihi Dergisi
Karaoğlu Can (2021)	Kalite Parametrelerinin İç Mekân Tasarımı Özelinde Yorumlanması ve Barselona Tasarım Müzesi Üzerine Bir Değerlendirme	Megaron
Baysal & Önkol Ertunç (2021)	Mevlânâ Türbesi Kalemişlerinde Ortaya Çıkartılan Resimlerin Eflatun ve İşrakilik Bağlamında Bir Analiz Denemesi	Art-Sanat
Muslu (2022)	İç Mekânda Kullanılan Bazı Ahşap Esaslı Kompozit Levha Türlerinde Ses Yutma Katsayısının Belirlenmesi	Journal of Polytechnic-Politeknik Dergisi
Bezci (2022)	Tasarım Tescilinde İç Mekan Tasarımlarına İlişkin Görsel Anlatımlara Yönelik Bir Analiz	Sanat Tarihi Dergisi
Çavuş & Kaptan (2022)	Tasarım Düşüncesi Bileşenleri ve İç Mimarlık Eğitimi Çerçevesinde Değerlendirilmesi	Sanat Tarihi Dergisi
Çobanlar & Kaptan (2022)	Uzaktan Eğitim Sürecinde İç Mekan ve Mobilya Tarihi II ve Perspektif Dersi Kapsamında Öğrenme Çıktıları ve Öğrenci Motivasyon Değerlendirmesi: ESTÜ İç Mimarlık Örneği	Sanat Tarihi Dergisi
Adıgüzel Özbek & Melikeoğlu Eke (2022)	Pandemi ile Evde Yaşam: Covid-19 Süreci ve Sonrası için Konut Tasarım Stratejileri	Megaron

Citation/Documents analysis was performed through the VOSviewer analysis programme to determine the effectiveness of the studies on interior architecture and interior design indexed in the Web of Science database in the field according to the citations they received and to present the most cited and most effective articles on the subject to the researchers. Through VOSviewer, the most influential 1000 articles (items) among the 3095 articles constituting the sample of the study were visualised as 533 clusters. The analysis output, in which only the first author's name is indicated, is shown in Figure 5.

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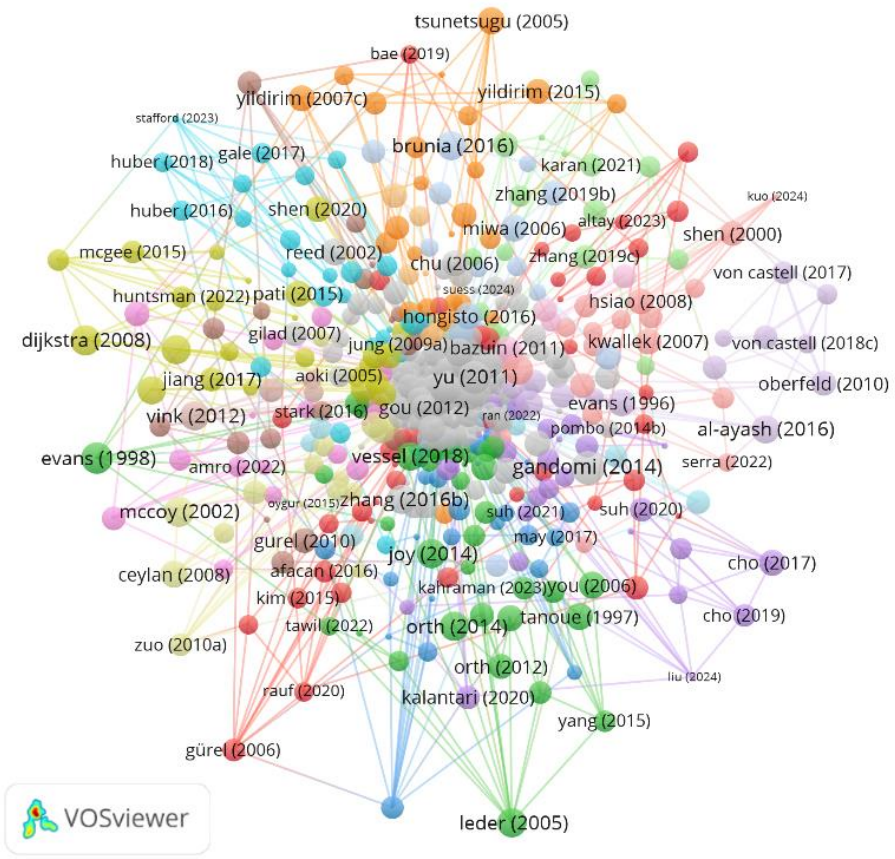


Figure 5. Visualization of the 1000 most effective article network analysis

The 3695 articles constituting the sample of the study were reduced to 273 articles with the condition of receiving at least 15 citations, and 21 related articles (items) were visualised by the program as 4 clusters and shown in Figure 6.

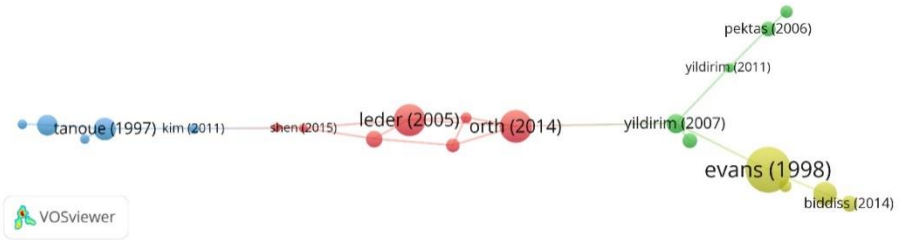


Figure 6. Network analysis visualization of the 21 most effective interrelated articles

Cluster 1, represented in red, was formed by the authors Karlsson et al. (2003), Leder & Carbon (2005), Orth et al. (2012), Orth & Wirtz (2014), Orth et al. (2016), Reuding & Meil (2004), Shen et al. (2012), while the most effective article study was the study *"Consumer Processing of Interior Service Environments"* by Orth & Wirtz (2014), which received 128 citations.

Cluster 2, shown in green, includes the studies of Cho & Cho (2014), Pektaş & Erkip (2006), Yıldırım, Akalın Başkaya et al. (2007), Yıldırım et al. (2011), Yıldırım et al. (2015) and the most influential article study of the cluster is the article study of Yıldırım, Akalın Başkaya et al. (2007) *"Effects of indoor colour on mood and cognitive performance"*.

It was observed that the 3rd cluster represented in blue consisted of Ersal et al. (2011), Kang et al. (2007), Kim et al. (2011), Tanoue et al. (1997) and You et al. (2006). It was determined that the most effective article study in the cluster was Tanoue et al. (1997) *"Kansei engineering: A study on perception of vehicle interior image"* with 73 citations.

Cluster 3, symbolised by yellow, was found to consist of Biddiss et al. (2014), Evans & McCoy (1998), Hosseini et al. (2020), Leather et al. (2003). The dominant element of the cluster is Evans & McCoy (1998)'s article *"When Buildings Don't Work: The Role of Architecture in Human Health"*, which received 219 citations.

The 10 most effective articles according to the number of citations of 3695 articles subject to the study are shown in Table 2.

Table 2. Most effective articles by number of citations

Author(s), Year	Article Name	Source	Citation
Gandomi, (2014)	*Interior search algorithm (ISA): a novel approach for global optimization*	ISA Transactions	327
Yu et al. (2011)	*Make it home: automatic optimization of furniture arrangement*	ACM Transactions on Graphics	236
Evans & McCoy (1998)	*When buildings don't work: The role of architecture in human health*	Journal of Environmental Psychology	219
Zacher & Rosing (2015)	*Ambidextrous leadership and team innovation*	Leadership & Organization Development Journal	185
McCoy & Evans (2002)	*The potential role of the physical environment in fostering creativity.*	Creativity Research Journal	174
Dijkstra et al. (2008)	*Stress-reducing effects of indoor plants in the built healthcare environment: The mediating role of perceived attractiveness*	Preventive Medicine	149
Küller et al. (2009)	*Color, arousal, and performance—A comparison of three experiments.*	Color Research & Application	141
Orth & Wirtz (2014)	*Consumer processing of interior service environments*	Journal of Service Research	128
Harris et al. (2002)	*A place to heal: environmental sources of satisfaction among hospital patients*	Journal of Applied Social Psychology	126
Leder & Carbon (2005)	*Dimensions in appreciation of car interior design*	Applied Cognitive Psychology	124

When the articles on interior architecture or interior design were analysed, it was seen that the most cited article was Gandomi (2014) with 327 citations. Yu et al. (2011) with 236 citations ranked second, while Evans & McCoy (1998) was found to be the third most effective article with 219 citations.

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Citation/Sources analysis was conducted to determine the most effective sources used according to the number of citations in the articles indexed in the WoS database on interior architecture or interior design. It was determined that 911 sources were used in 3695 articles analysed in the study, and visualization was made and shown in Figure 7.

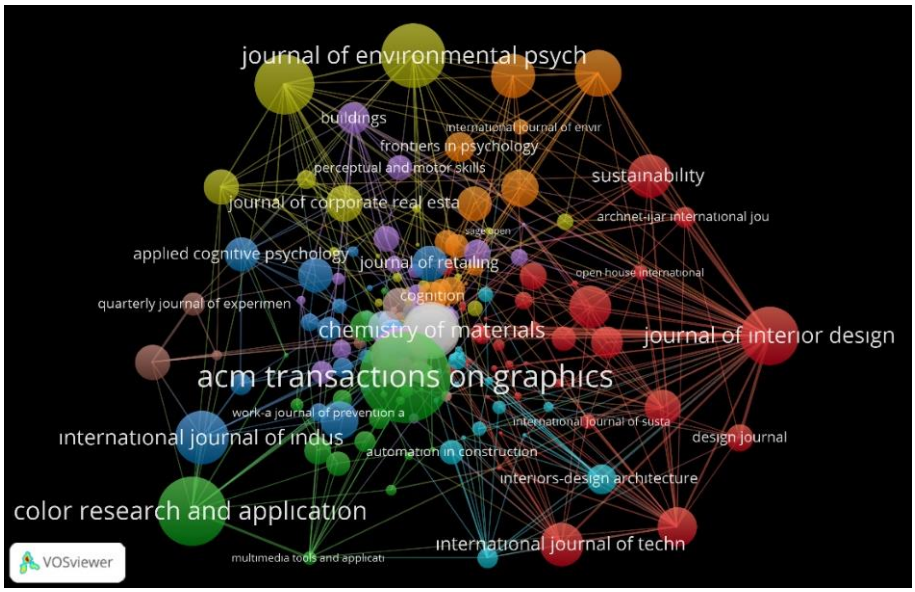


Figure 7. Visualization of the most efficient source network analysis by citation count

In order to identify the most effective resources related to each other and to present the relationship between them to the reader, 911 resources were reduced to 18 resources (items) with the restrictions of publishing at least 10 documents and receiving at least 10 citations, and visualised as 3 clusters in Figure 8.

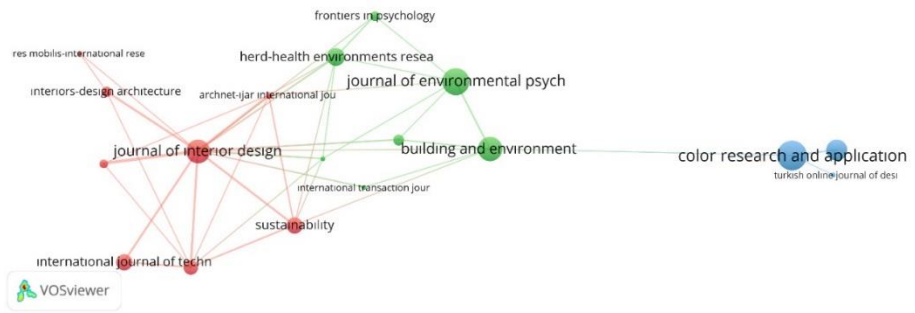


Figure 8. Visualization of the most efficient network analysis of associated resources

Journal of Interior Design with 371 citations in the red cluster (cluster 1), Journal of Environmental Psychology with 458 citations in the green cluster (cluster 2) and Colour Research and Application with 536 citations in the blue cluster (cluster 3) are the most effective journals of the clusters.

When 911 references in the bibliography of 3695 articles constituting the sample of the study are evaluated according to the number of citations, the 10 most cited references are shown in Table 3.

Table 3. Most effective sources by number of citations

Source Name	Document	Citation	Total Link Strenght	Journal Impact Factor 2023
ACM Transactions on Graphics	10	949	0	7.8
Color Research and Application	23	536	5	1.2
Journal of Environmental Psychology	11	458	8	6.1
Building and Environment	16	393	9	7.1
Journal of Interior Design	81	371	52	1.2
International Journal of Industrial Ergonomics	10	314	3	2.5
HERD: Health Environments Research & Design Journal	24	235	9	1.7
Sustainability	33	205	13	3.3
International Journal of Technology and Design Education	12	204	8	2.0
International Journal of Art & Design Education	28	167	15	1.1

When the most effective sources of the study were analysed, it was seen that the most effective source according to the number of citations was ACM Transactions on Graphics with 949 citations. ACM Transactions on Graphics is followed by Colour Research and Application with 536 citations and Journal of Environmental Psychology with 458 citations.

Citation/Authors analysis was performed to identify the most influential authors in the field. It was observed that the same authors were indexed under different names in the WoS database and the authors were combined under the same name by data cleaning. After data cleaning, it was determined that there were 4767 authors in 3695 articles constituting the sample of the study and the most influential 1000 authors were mapped by VOSviewer and shown in Figure 9.

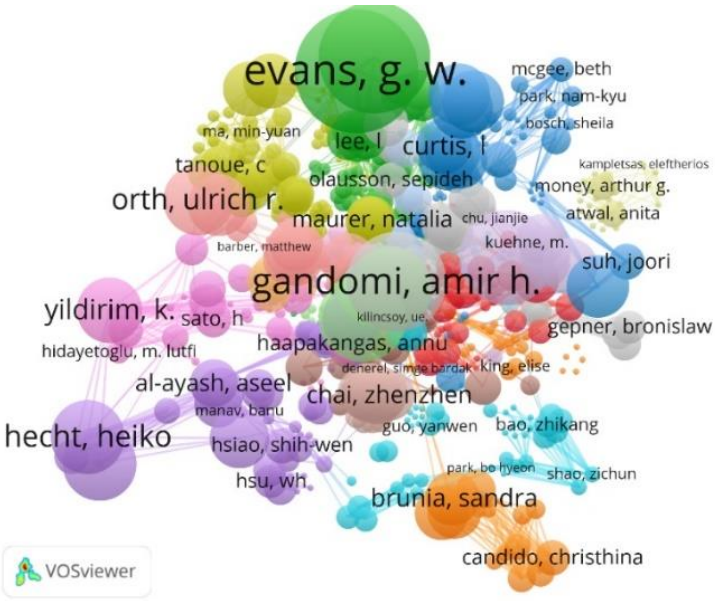


Figure 9. Network visualization of the 1000 most effective authors by citation count

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The authors identified in the study were reduced to 19 authors with the restriction of publishing at least 5 documents and 5 citations. The 10 authors (items) with collaboration between them were mapped as 3 clusters by the programme and shown in Figure 10.

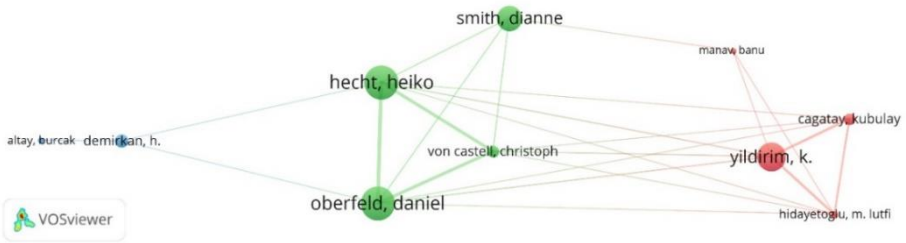


Figure 10. Network visualization of the most effective authors related to the number of citations

The authors forming the 1st cluster (red) are Çağatay, Kubulay; Yıldırım, Kemal; Hidayetoğlu, M. Lutfi and Manav, Banu. With 165 citations, Yıldırım, Kemal was seen as the most active author of the cluster.

Cluster 2 (green) was formed by Hecht, Heiko; Oberfeld, Daniel; Smith, Dianne and Von Castell, Christoph and the most cited author in the cluster was Hecht, Heiko, with 201 citations.

The 3rd cluster (blue) is represented by Altay, Burçak and Demirkan, Halime and the most influential author in the cluster is Demirkan, Halime with 66 citations.

The 5 authors with the highest number of citations among the most frequently cited authors related to the research topic are shown in Table 4.

Table 4. Most effective authors according to the number of citations

Author Name	Citation	Average Citation	Ave. Publication Year	Documents	Total Link Strenght
Hecht, Heiko	201	25,12	2015,12	8	61
Yildirim, Kemal	165	7,86	2011,57	21	33
Cho, Ji Young.	154	11,85	2018,69	13	14
Smith, Dianne	143	28,60	2013,60	5	7
Afacan, Yasemin	89	12,71	2018,14	7	1

The most cited author on the research topic is Hecht, Heiko, who received 201 citations with 8 documents. Yıldırım, Kemal received 165 citations with 21 documents, while Cho, Ji Young was cited 154 times with 13 documents.

Co-occurance/Author keywords analysis was carried out in order to determine the most effective keywords of the field by revealing the conceptual structures of the studies in which interior architecture or interior design subjects were investigated together, to determine the most effective keywords of the field, and to present the subject contents in which the study subjects intensified and evolved to the reader. It was seen that the key concepts were included in the key concept list with different spellings and the same key concepts were combined under a

common name by data cleaning. After data cleaning, it was determined that 5536 key concepts were used and shown in Figure 11.

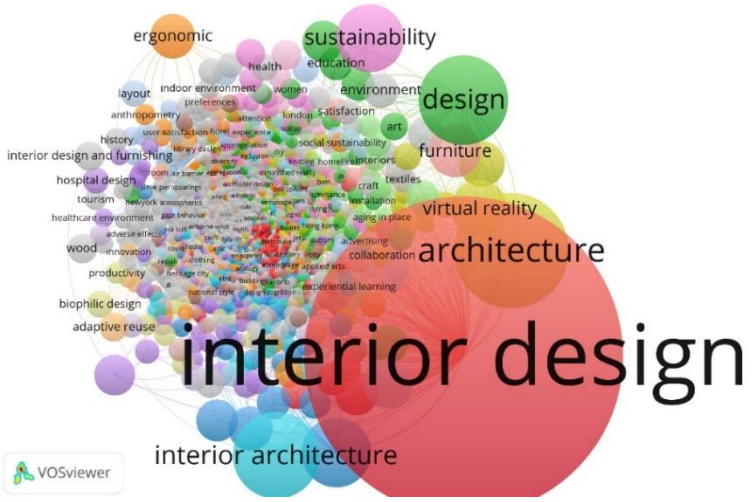


Figure 11. Most efficient keyword network visualization

In order to determine the most effective key concepts of the study and to identify the areas where the field has evolved, the number of keywords was reduced to 31 key concepts (items), provided that a key concept was repeated at least 10 times, and visualised as 7 clusters and shown in Figure 12.

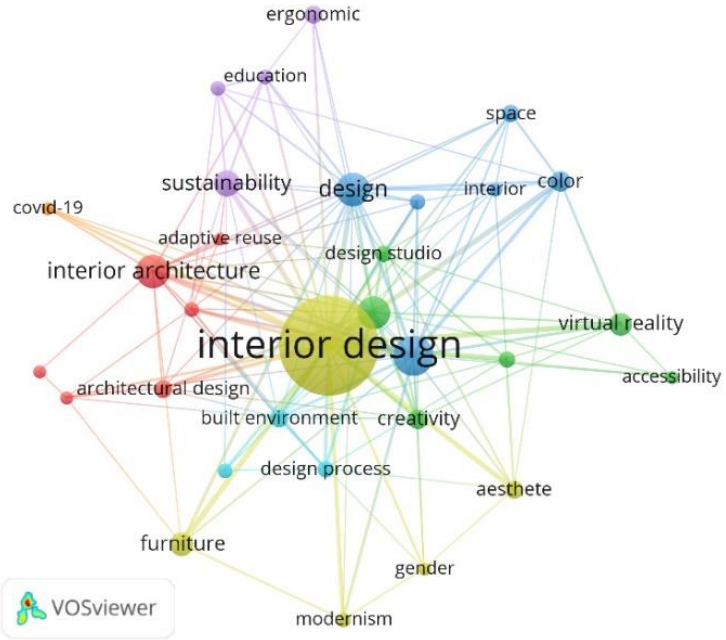


Figure 12. The most effective keywords is network visualization

Cluster 1 (red) was found to contain the key concepts adaptive reuse, architectural design, biophilic design, China, interior architecture, sustainable design. The dominant concept of the cluster is interior architecture, which contains 57 occurrences. Cluster 2 (green) was found to include the keywords accessibility, creativity, design education, design studio, perception, virtual reality. The most effective concept of the green

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cluster is design education with 56 occurs connections. Cluster 3 (blue) was found to consist of the key concepts architecture, colour, design, interior, pedagogy, space. The most important element of the cluster was found to be architecture with 81 occurrences. Cluster 4 (yellow) was found to group the keywords aesthete, furniture, gender, interior design, modernism. The most effective element in the cluster is interior design with 429 occurrences. In the 5th cluster (purple), education, environment, ergonomic, sustainable keywords were found and it was determined that the most effective concept in the cluster was sustainable with 36 occurrences. Cluster 6 (turquoise) contains the keywords built environment, design process, evidence- based design and the most effective element in the cluster was found to be built environment with 18 occurrences. Cluster 7 (orange) was found to consist of the keyword COVID-19 with only 11 links.

The 5 keywords of the field with the highest co-occurrence power are shown in Table 5.

Table 5. Most effective keywords by co-occurrence strength

Keywords	Co-occurance	Total Link Strenght	Ave. Publication Year	Average Citation
Interior design	429	996	2017,79	7,90
Architecture	81	283	2017,31	7,95
Design	57	174	2017,53	3,91
Interior architecture	57	113	2017,28	5,37
Design education	56	130	2014,87	7,14

When the co-ccurences ranking of the key concepts of the study was examined, it was seen that the keyword Interior design ranked first with 429 occurrences. The average publication year of the word is 2017,79 and the average number of citations is 7,90. It was observed that the keyword architecture ranked 2nd with 81 co-occurrences and the concept had an average publication year of 2017,31.

Citation/Countries analysis was carried out to determine the most effective countries according to the number of citations they received with their studies on interior architecture or interior design.

When the outputs of the data obtained from the WoS database were analysed, it was found that the same countries were written in different ways and data cleaning was performed. After data cleaning, it was determined that there were 78 countries conducting studies on the subject and visualised with the help of VOSviewer program and shown in Figure 13.

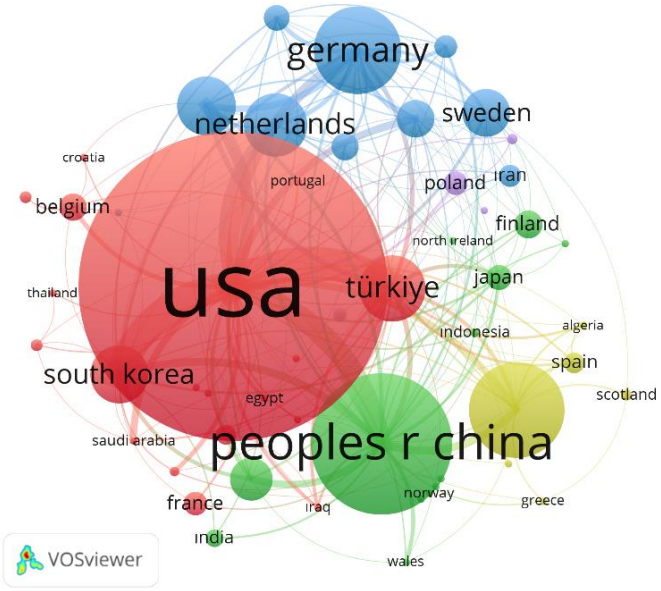


Figure 13. Most efficient countries network analysis

As it was determined that the same countries were included in the study with different spellings, data cleaning was performed and the same country data with different spellings were merged. As a result of data cleaning, it was determined that there were 78 countries working on the subject, and with the condition of publishing at least 10 documents and receiving 150 citations, it was reduced to 24 countries (items) and mapped as 3 clusters and shown in Figure 14.

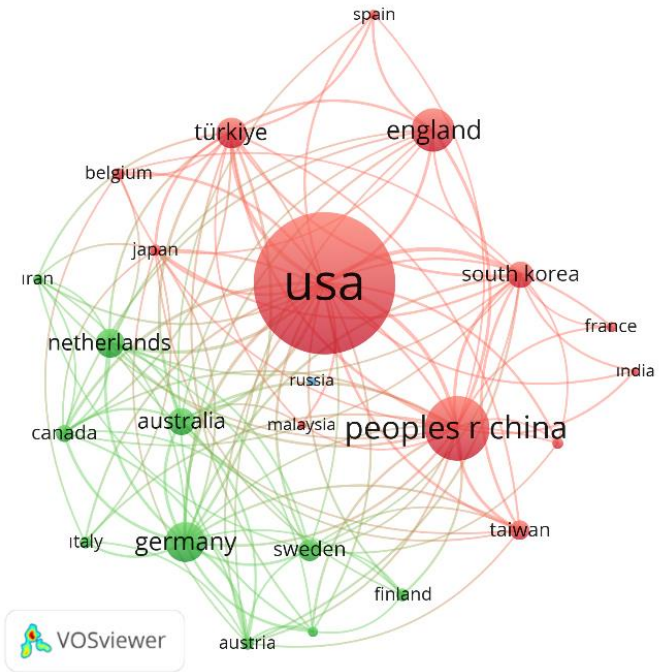


Figure 14. Network analysis of the most efficient interrelated countries

Cluster 1 (red) was found to include Belgium, England, France, India, Japan, Malaysia, People's Republic of China, Poland, South Korea, Spain, Taiwan, Turkey and USA. Turkey was found to be in the cluster with 957 citations. Cluster 2 (green) consists of Australia, Austria, Canada, Finland, Germany, Iran, Italy, Netherlands, Singapore and Sweden and the most

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effective country of the cluster is Germany with 1324 citations. Cluster 3 (blue) was formed by Russia, which received 157 citations.

These thematic clusters not only reveal academic research patterns but also reflect how interior architecture increasingly aligns with real-world design practices focusing on sustainability, wellbeing, and technological innovation.

When the countries conducting studies on the research topic are evaluated, the 10 most effective countries according to the citations they received are shown in Table 6.

Table 6. Most effective countries by number of citations

Country Name	Citation	Documents	Average Citation	Total Link Strenght	Ave. Publication Year
USA	5934	403	14,72	305	2015,21
China	2342	219	10,69	142	2020,39
England	1468	124	11,84	58	2016,15
Germany	1324	75	17,65	93	2016,49
Türkiye	957	193	4,96	128	2017,54
Netherlands	906	34	26,65	48	2015,15
Australia	835	72	11,60	63	2016,53
South Korea	822	79	10,41	96	2017,66
Sweden	647	29	22,31	23	2014,93
Taiwan	565	46	12,28	33	2015,46

It was observed that the most cited country with the publications on the subject of study was USA with 5934 citations. USA has been the most active country according to the number of documents by publishing 403 documents. In the country with a total link strength of 305, the average publication year of the documents was 2015,21. While China was the second most effective country with 2342 citations, England was the third most effective country with 1468 citations. Turkey, which published 193 documents and received 957 citations, is the 5th most active country according to the number of citations.

CONCLUSION AND SUGGESTION

This study offers an integrative overview that bridges bibliometric analysis with design-oriented interpretations, providing novel insights into the evolution of interior architecture literature. Rather than reiterating numerical findings, the conclusion focuses on how bibliometric trends reflect the disciplinary transformation and methodological diversification of interior architecture research.

Furthermore, citation analyses conducted as part of this research have identified certain landmark studies that stand out for their influence and contribution to the field. For instance, Gandomi's (2014) study, which focuses on algorithmic optimization in interior design, has emerged as the most cited work, underscoring the increasing integration of computational and data-driven methods in the discipline. The present study demonstrates the potential for technological innovation to

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transform traditional design approaches. Similarly, the influential work by Evans and McCoy (1998), titled *"When Buildings Don't Work,"* examines the impact of interior environments on human health and well-being, establishing a strong connection between interior architecture and social sciences, particularly environmental psychology.

The thematic analyses based on the WoS database reveal that certain topics have gained prominence in recent years, indicating evolving priorities within the field. Concepts such as sustainable design, biophilic design, and the psychological effects of color have emerged as key themes, reflecting a shift towards more user-centered, environmentally conscious, and emotionally responsive design practices. These trends suggest that the discipline of interior architecture is maturing into a field that values not only aesthetics and spatial efficiency but also user well-being and ecological sustainability.

This study aims to offer a broad and structured framework for understanding the academic development of the disciplines of interior architecture and interior design. Through the analysis of 3,695 articles and a total of 5,100 academic documents published between 1975 and 2024, the research provides critical insights into the historical progression, thematic evolution, and scholarly dynamics of the field. These findings contribute to identifying the position of the field within the global scientific landscape and reveal changing areas of focus and intellectual inquiry over time.

Publication Trends and Scientific Development: A detailed analysis of publication trends shows a significant increase in scholarly output after 2006, highlighting a turning point in the recognition and expansion of the field. This rise is closely linked to the growing relevance of contemporary themes such as digitalization, ecological awareness, and biophilic approaches. Notably, a substantial peak in publication volume was observed in 2022, with a growth rate of 204%, indicating a heightened interest in applying interior design knowledge to emerging societal and environmental challenges.

Language and Cultural Distribution: The dominance of English in the academic literature highlights both opportunities and challenges. While English facilitates access to global scholarly discourse, it also marginalizes valuable contributions published in other languages. The presence of 47 Turkish-language articles (1.27%) reflects a modest but important body of work within the national context, underscoring the need for better integration of local research into international publication platforms. Enhancing multilingual inclusivity can lead to a more diverse and enriched academic ecosystem.

Citation Analyses and Influential Studies: Citation metrics have revealed seminal works that have shaped the direction of research in interior architecture. Gandomi's (2014) *"Interior Search Algorithm"* article, cited 327 times, represents a significant advancement in the application of optimization algorithms to design problems. Meanwhile, Evans and McCoy's (1998) study, by focusing on how interior

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environments affect human health, reinforces the relevance of interdisciplinary research involving psychology and behavioral sciences. These studies serve as reference points for both technological and human-centered inquiries in interior design.

Current Themes and Emerging Issues: The growing prominence of themes such as sustainability, biophilic design, digital transformation, and post-pandemic living conditions indicates a paradigm shift in design thinking. Interior architecture is increasingly being recognized as a field capable of addressing not just spatial aesthetics, but also broader environmental and social challenges. The emphasis on topics such as design education, adaptive reuse, and the circular economy suggests that interior design is evolving to support long-term ecological and societal resilience.

Contributions of the Literature to the Field: This bibliometric analysis provides a strategic roadmap for researchers seeking to navigate and contribute to the academic landscape of interior architecture. By identifying influential articles, citation networks, and frequently used keywords, the study offers a guide to emerging research opportunities and existing knowledge gaps. These insights can inform future studies, foster collaboration, and support a more nuanced understanding of the field's trajectory.

The contributions of the present study to the academic and practical development of interior architecture are expected to be significant. The results serve as a foundational reference point for future studies and offer a multidimensional view of the field. Based on the findings, several key recommendations can be made:

Language Diversity and Internationalisation: Academic studies written in Turkish and other local languages should be translated into English and submitted to internationally recognized journals to enhance visibility. National academic journals can also work towards inclusion in major indexes to increase international engagement.

Exploration of New Research Areas: Researchers should focus more intensively on emerging topics such as biophilic design, sustainability, and adaptive design strategies in the context of post-pandemic life. Studies examining the transformation of interior spaces in response to global health crises can make meaningful academic and practical contributions.

Strengthening Interdisciplinary Collaborations: Collaborative research that brings together interior architecture with fields like psychology, ergonomics, environmental science, and digital technologies will enrich the understanding of how interior environments influence human behavior, performance, and well-being.

Bridging Theory and Practice: Strengthening the connection between academia and professional practice through joint projects between universities and design firms can facilitate the application of theoretical findings in real-world contexts. Encouraging the practical use of highly cited research will help ensure its relevance and impact.

Educational Improvements: Interior architecture education should increasingly integrate sustainability, digital technologies, and innovation-focused content into design studio curricula. Utilizing tools such as virtual reality (VR) and augmented reality (AR) can help students develop creative, future-oriented solutions and better prepare them for evolving industry demands.

While the study focuses on data retrieved from the Web of Science (WoS) database, this scope was intentionally chosen to ensure data reliability, citation accuracy, and consistency across journals. Future studies could expand the dataset by incorporating sources such as Scopus or Google Scholar to capture a broader range of regional and non-English publications. Moreover, the identified themes—such as sustainability, biophilic design, and digitalization—carry strong implications for the professional practice of interior architecture, as they highlight the growing importance of user-centered, environmentally responsible, and technology-integrated design approaches.

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Identifying and Prioritizing Disaster-Oriented Urban Transformation Areas Using GIS–AHP: The Case of Akşehir

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Abstract

The occurrence of material damage and loss of life due to disasters in human settlements has underscored the necessity of an integrated disaster management system that encompasses pre-disaster risk management. Within such an integrated framework, pre-disaster risk management primarily aims to identify disaster risks and to eliminate or minimize these risks as far as possible. Particularly in areas exposed to a high likelihood of severe economic losses and human casualties following potential disasters, risk identification constitutes a fundamental prerequisite for both the development of damage prevention strategies and the delineation of urban transformation areas and interventions. This article aims to identify and prioritize urban transformation areas under disaster risk in Akşehir, which is located in a first-degree seismic zone, to develop intervention strategies for disaster risk reduction. In the conceptual phase, the study focuses on key criteria and priorities used in determining urban transformation areas in earthquake-prone regions in Türkiye and constructs a matrix consisting of four main criteria and eighteen sub-criteria. The criteria included in this matrix were classified in the ArcGIS environment using the reclassification method based on existing condition analyses and expert opinions and subsequently weighted through pairwise comparisons using the Analytic Hierarchy Process (AHP). A weighted overlay analysis was then performed in ArcGIS to generate a spatial map of urban transformation necessity. Urban areas requiring transformation were prioritized according to expert assessments. As a result of the analysis, 23.1 ha were identified as first-priority, 8.8 ha as second-priority, and 62.2 ha as third-priority disaster risk-oriented urban transformation areas within the city center of Akşehir. The study demonstrates the applicability of GIS and AHP in identifying and prioritizing urban transformation areas in earthquake-prone regions, particularly in Türkiye, and is expected to serve as a methodological reference for the development of disaster-oriented urban transformation strategies.

Keywords: *Analytic hierarchy process (AHP), Akşehir, Disaster-oriented urban transformation, Geographic information systems (GIS)*

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INTRODUCTION

The Disasters have historically exerted profound impacts on the physical, economic, and social structure of societies. As a disaster-prone country, Türkiye has experienced its most severe and devastating consequences primarily as a result of earthquakes (Şenol Balaban, 2016). For this reason, the present study focuses on the identification of urban transformation areas based on seismic risk. Major earthquakes in Türkiye include the 1939 Erzincan, the 1999 Gölcük, and the 2023 Kahramanmaraş-centered events. In the Erzincan earthquake, 116,720 buildings were severely damaged, and 32,962 people lost their lives. Similarly, the Marmara earthquake caused damage to 328,113 buildings and resulted in 17,480 fatalities (Ministry of Environment, Urbanization and Climate Change, 2023). Following the Kahramanmaraş-centered earthquake, approximately 227,027 buildings were identified as urgently demolishable or heavily damaged (Ministry of Environment, Urbanization and Climate Change, 2023), and 53,537 fatalities were reported (Ministry of Interior, 2023).

The primary cause of the extensive human and material losses observed in these earthquakes has been identified as the prevalence of unhealthy, low-quality, and aging building stock produced through unplanned, illegal, and fragmented urbanization processes. The magnitude of these losses has brought urban transformation projects to the forefront as a strategic instrument for prioritizing the renewal and structural strengthening of urban building stock in order to ensure safe and resilient living environments (Serdaroğlu Sağ, 2023).

Cities, due to their high concentration of population and economic activities, have become increasingly vulnerable to natural hazards, as disasters tend to amplify social and economic impacts in urban settings (Johnson & Blackburn, 2014). In this context, enhancing resilience in disaster-prone areas by reducing hazard exposure and strengthening adaptive capacity has emerged as a central paradigm across multiple disciplines. Universal policy goals, such as building disaster-resilient cities (UNISDR, 2012), require the integration of disaster risk management, disaster risk reduction, sustainability in human settlements, and community-based approaches. Countries are gradually shifting from reactive disaster response and recovery-oriented cultures toward proactive risk reduction and safety frameworks characterized by resilience-building mechanisms (Güzey, 2016).

Urban transformation functions as both a pre-disaster risk mitigation strategy and a post-disaster recovery mechanism. In Türkiye, particularly after the 1999 Marmara Earthquake, disaster risk became the dominant conceptual driver of urban transformation, and disaster-oriented urban transformation gained legal recognition with the enactment of Law No. 6306 in 2012 (Ertürk & Topal, 2020). However, as evidenced by the aftermath of the 6 February 2023 earthquake, preparedness efforts have yet to achieve the goals of creating resilient communities and ensuring sustainable recovery and redevelopment (Özcevik et al., 2009). Disaster

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risk criteria should therefore be more systematically incorporated as the core rationale for urban transformation, and disaster risk reduction strategies must be addressed within an integrated planning framework alongside economic and social vulnerabilities (Güzey, 2016).

Urban transformation projects are inherently long-term and capital-intensive processes. Given that it is not feasible to initiate transformation simultaneously across all risky areas, the most effective approach is to prioritize interventions by sequencing them from the highest-risk areas toward those with relatively lower levels of risk (Dişkaya & Emir, 2021). Based on this premise, the present study aims to identify and prioritize urban transformation areas under disaster risk in order to develop targeted intervention strategies for reducing disaster-related vulnerabilities in urban contexts.

The literature encompasses a wide range of studies focusing on site selection and implementation challenges of urban transformation projects conducted under the Law on the Transformation of Areas Under Disaster Risk (Bektaş, 2014; Adıgüzel, 2019), risk identification and risk-based prioritization (Özcevik et al., 2009; Güzey, 2016; Dişkaya & Emir, 2021), the sustainability of urban transformation projects (Haghighi Fard & Doratlı, 2022), and post-disaster redevelopment strategies (Özcevik et al., 2009; Ertürk & Topal, 2020). A common conclusion derived from these studies is the necessity of developing urban transformation models that aim to create sustainable and disaster-resilient living environments and to determine priority intervention areas accordingly.

Numerous studies in the literature have employed GIS, AHP (Zhou & Zhou, 2015; Dişkaya & Emir, 2021; Thammaboribal et al., 2025), and fuzzy methods (Zhou & Zhou, 2015) for identifying and prioritizing risk areas. Given the complex and multidimensional nature of urban transformation processes, the evaluation of such interventions through spatially explicit analytical frameworks is of critical importance. By synthesizing previous studies, this article proposes a comprehensive criteria matrix for the identification and prioritization of disaster-prone areas and empirically tests it through GIS and AHP-based spatial analysis. In this respect, the study contributes as a theory-informed and practice-oriented framework.

The study area, Akşehir city center in Konya Province, represents one of the settlements located within Türkiye's first-degree seismic risk zone. Identifying earthquake-prone areas and prioritizing them within the urban transformation process provides an opportunity to generate transferable knowledge and methodological insights applicable to other high-risk settlements across the country.

CONCEPTUAL FRAMEWORK: CRITERIA FOR IDENTIFYING DISASTER-ORIENTED URBAN TRANSFORMATION AREAS

Disaster risk is defined as the probability of potential disaster-related losses in life, health, livelihoods, assets, and services that may occur within a given society or community over a specified future period

(UNISDR, 2012). According to Johnson and Blackburn (2014), resilience in disaster studies refers to the capacity of a system to prevent, absorb, and recover from losses and damages caused by natural hazards. Urban disaster resilience is therefore directly associated with disaster risk management. Currently, the most widely adopted approach to achieving effectiveness in disaster risk management is the integrated disaster management system. This framework supports the use of urban transformation as both a pre-disaster risk mitigation strategy and a post-disaster risk reduction, recovery, and rehabilitation instrument (Adıgüzel, 2019).

In this study, the main and sub-criteria employed for identifying disaster oriented urban transformation areas are derived from existing legal regulations in Türkiye, planning documents, and commonly used criteria in planning research, analysis, and synthesis processes. Accordingly, the first step involves examining the criteria used in legal frameworks for the designation of disaster-prone areas.

Law No. 6306 on the Transformation of Areas Under Disaster Risk, enacted in 2012, constitutes the primary legislative framework governing urban transformation in Türkiye. The main objective of this law is the renewal of buildings located in disaster-prone areas. Article 5 of the Implementing Regulation of this law sets forth provisions regarding the identification of risky areas. Areas characterized by inadequate planning and infrastructure services, where public order or safety is disrupted to an extent that daily life is interrupted, and where at least 65% of the building stock consists of illegal or unlicensed structures are submitted to the President for approval to be declared as risky areas (Official Gazette, 2012, No. 28498). Upon approval, such areas are officially designated as urban transformation areas.

In parallel, the Ministry of Environment, Urbanization and Climate Change issued principles and guidelines in 2012 for the preparation of urban transformation strategy documents. According to this framework, areas subject to transformation are determined based on comprehensive urban analyses and synthesis studies, and are subsequently prioritized by considering potential loss of life, environmental impacts, and economic losses, as well as the anticipated economic and social benefits of transformation, residents' expectations, and financial requirements (Ministry of Environment, Urbanization and Climate Change, 2021). These regulations indicate that the condition of the building stock, together with the presence of risky structures and risky areas, constitutes one of the most fundamental criteria in urban transformation processes (Öcal & İnce, 2012). Accordingly, the Building Risk Analysis was identified as a primary criterion for determining urban transformation areas in this study.

Pala and Şaşmaz (2019) emphasize that in densely populated urban areas, high-rise and attached buildings constructed to maximize land use tend to collide during earthquakes, resulting in severe structural damage. In this respect, Building Height (Number of Storeys) Analysis and

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Building Layout (Building Typology) Analysis were considered critical for assessing structural performance and seismic behavior, and were therefore defined as sub-criteria under the building risk analysis.

In urban transformation assessments, evaluating buildings typically begins with examining building permits and occupancy certificates. Following the Regulation on Buildings in Disaster Areas, design standards were significantly revised after 1999, and the regulation was most recently updated in 2007 as the Regulation on Buildings in Earthquake Zones (Öcal & İnce, 2012). Empirical evidence suggests notable differences in structural integrity between buildings constructed before and after 2000. Consequently, Building Construction Year Analysis was identified as a key criterion for assessing the necessity of urban transformation.

From an architectural perspective, building physics deficiencies can be classified into five categories: physical-chemical problems, water and moisture problems, mechanical problems, heating problems, and acoustic problems (Güler et al., 2010). In accordance with the performance requirements stipulated in the Earthquake Regulation (Official Gazette, 2007, No. 26454), Problematic Building Analysis was incorporated as a sub-criterion under building risk analysis to assess structural performance deficiencies.

Urban transformation legislation also introduces criteria such as ground conditions, building height and density, and area size as justifications for declaring risky areas. The Ministry of Environment and Urbanization's Circular No. 10337 (2008) mandates the preparation of updated geological and geotechnical survey reports to reduce disaster risks and to provide a basis for disaster-sensitive spatial planning (Chamber of Geological Engineers, 2021). In this context, Settlement Suitability Analysis, defined as a synthesis study that integrates area classifications and necessary mitigation measures guiding planning decisions, was identified as another major criterion in urban transformation.

Earthquake characteristics, including location, magnitude, and frequency, constitute essential inputs for hazard mapping. A review of urban transformation practices in Türkiye and worldwide indicates that floodplains, fault lines, and steep slopes are among the most critical determinants of transformation areas due to high hazard exposure (ADB, 2016). Considering Türkiye's disaster profile, spatial positioning on hazard maps, and legislative provisions, Geographical Risk Analysis—encompassing landslide risk, flood risk, slope, fault proximity, and settlement suitability—was adopted as a primary criterion for identifying urban transformation areas.

Urban transformation projects aim to regenerate deteriorated and overcrowded urban areas by addressing physical, infrastructural, environmental, cultural, and economic deficiencies in line with contemporary needs (Çelik, 2017). In this context, urban transformation offers a strategic opportunity to compensate for deficiencies in public

service and amenity provision. Given their function as evacuation and refuge spaces during disasters, Urban Facilities Analysis was included as a key criterion.

Emergency assembly areas play a critical role in minimizing loss of life, meeting urgent needs, ensuring effective disaster management, and facilitating rapid recovery (Aydın et al., 2020). Therefore, Emergency Assembly Area Analysis constitutes another essential criterion. Key parameters include accessibility, road connectivity, functional adequacy, and spatial capacity. Accordingly, the combined evaluation of facilities and emergency assembly areas was operationalized as the Accessibility to Facilities and Assembly Areas Analysis, encompassing sub-criteria such as education facilities, health facilities, green spaces, and designated emergency gathering areas.

As stipulated in national legislation, areas where at least 65% of buildings are illegal or unlicensed are declared risky, making Illegal Building Density Analysis a relevant sub-criterion. Density is measured by the number of people within a unit area. In high-density urban contexts, insufficient service provision reduces quality of life and necessitates transformation (Çelik, 2017). Therefore, Illegal Building Density and Population Density Analyses were incorporated under the Density Risk Analysis criterion.

Kul (2018) identifies building condition, amenity needs, planning deficiencies, property ownership, and building stock characteristics as primary drivers of urban transformation. Özyeğit Altun and Öğdül (2021) highlight damaged buildings, risky areas, unsuitable settlements, building and population densities, open spaces, and strategic planning inputs as key variables.

Based on this synthesis, the main and sub-criteria adopted in this research for identifying disaster-oriented urban transformation areas are defined as follows:

- Building Risk Analysis (BRA) main criterion:
  Building Construction Year Analysis (BCYA),
  Building Height Analysis (BHA),
  Building Layout Analysis (BLA),
  Problematic Building Analysis (PBA).
- Geographical Risk Analysis (GRA) main criterion:
  Settlement Suitability Risk Analysis (SSRA),
  Landslide Risk Analysis (LRA),
  Flood Risk Analysis (FRA),
  Slope Analysis (SA).
- Facilities and Assembly Areas Analysis (FAAA) main criterion:
  Urban Facilities Analysis (UFA),
  Education Facilities Analysis (EFA),
  Primary School Accessibility Analysis (PSAA),
  Secondary School Accessibility Analysis (SSAA),
  High School Accessibility Analysis (HSAA),
  Health Facilities Analysis (HFA),

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Green Spaces Analysis (GSA),
Emergency Assembly Area Analysis (EAAA).

- Density Risk Analysis (DRA) main criterion:
  Illegal Building Density Analysis (IBDA),
  Population Density Analysis (PDA).

These criteria collectively constitute the analytical framework for the spatial identification and prioritization of disaster-oriented urban transformation areas in this study.

RESEARCH METHOD

This study employs a mixed-method research design integrating a comprehensive literature review with an empirical field study. The literature review on disaster-oriented urban transformation was conducted through systematic screening of academic theses, journal articles, books, and scientific databases. The empirical component draws on official reports, planning documents, photographs, spatial datasets, and survey forms obtained from public institutions concerning Akşehir. The field study covers approximately 1,400 ha within the built-up urban boundary of Akşehir district in Konya Province, excluding agricultural lands. The methodological workflow was structured as follows:

1. Relevant criteria were identified based on the literature review.
2. Existing conditions were analyzed in accordance with the identified criteria. Spatial datasets corresponding to four main criteria and eighteen sub-criteria were mapped and converted into thematic layers. All analytical maps were generated in raster format using GIS. These maps were subsequently reclassified using the Reclassify method by assigning categorical values to each pixel.
3. Disaster risk analyses were produced. Existing condition layers were classified in ArcGIS using the reclassification method based on expert judgments. The criteria were weighted through pairwise comparisons using the Analytic Hierarchy Process (AHP), and a weighted overlay analysis was conducted in ArcGIS to generate a composite urban transformation necessity map scaled between 0 and 100.
4. Following the determination of weight vectors, all analytical layers were overlaid to produce a final composite map. Areas exceeding threshold levels of transformation necessity, as defined by expert evaluations, were aggregated and designated as urban transformation areas and subsequently prioritized.

GIS-Based Disaster Risk Analysis

Within the scope of the study, spatial analyses were conducted using ArcGIS software. Statistical Clustering, Kernel Density Estimation, Buffer Analysis, and Weighted Overlay techniques were applied, all of which were based on raster datasets. These methods enabled the spatial quantification and visualization of disaster risk patterns across the study area.

Analytic Hierarchy Process (AHP)

The Analytic Hierarchy Process (AHP) is a multi-criteria decision-making method that enables the hierarchical structuring of factors and alternatives toward a defined objective and facilitates the systematic derivation of priorities at each level (Thammaboribal et al., 2025). The AHP procedure adopted in this study follows the standard methodological steps proposed in the literature (Saaty, 1990; Özbek, 2017; Thammaboribal et al., 2025):

Step 1: Problem definition. At this stage, criteria and sub-criteria are defined and their relevance is established.

Step 2: Hierarchy construction. The overall objective is placed at the top of the hierarchy, followed by criteria and sub-criteria at lower levels (Thammaboribal et al., 2025).

Step 3: Pairwise comparisons. Criteria at the same level are compared pairwise with respect to their influence on the upper-level factor using Saaty's (1990) 1–9 scale. Diagonal elements are assigned a value of 1, and reciprocal values (1/value) are assigned symmetrically across the matrix (Alkay et al., 2014).

Step 4: Normalization. Each element in the pairwise comparison matrix is divided by the column total to obtain a normalized matrix. Criterion weights are calculated by averaging the values across each row (Özbek, 2017; Alkay et al., 2014).

Step 5: Priority vector estimation. Row averages of the normalized matrix represent the relative importance of each criterion and are defined as the priority vector (Özbek, 2017).

Step 6: Consistency assessment. The consistency ratio (CR) is calculated to evaluate the logical consistency of the pairwise comparisons. A CR value below 0.10 indicates acceptable consistency; otherwise, the comparisons must be revised (Saaty, 1990).

Step 7: Pairwise comparison of alternatives. Alternatives are evaluated with respect to each criterion using pairwise comparison matrices, and consistency ratios are again assessed (Özbek, 2017).

Step 8: Aggregation of weights. Weighted scores are obtained by multiplying the global weight of each criterion by the preference values of the alternatives. The sum of these weighted scores determines the final ranking of alternatives (Özbek, 2017).

AHP Expert Survey Form

Within the scope of this study, a two-level AHP hierarchical model was developed, consisting of main criteria at the first level and sub-criteria at the second level. Expert judgments were obtained through an AHP questionnaire administered to professionals from diverse disciplines working in public institutions related to disaster management and urban transformation, all of whom had strong familiarity with the study area.

After data collection, the four main criteria and eighteen sub-criteria were classified and analyzed based on expert evaluations. Pairwise comparison matrices were constructed using expert-assigned values

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ranging from 1 to 9. The relative influence of sub-criteria on their corresponding main criteria was first assessed, followed by comparisons among the main criteria to determine their importance within the overall decision-making framework.

Table 1. Types of interviewed stakeholders and their numbers.

		Institutional and Professional Distribution of Actors					
Actors	Institution	Urban Planner	Architect	Civil Eng.	Geological Eng.	Geomatic Eng.	Number
Administrative Actors	District Municipality	1	1	1	1	1	5
	Metropolitan Municipality	1	1	1	1	1	5
	Ministry of Environment, Urbanization and Climate Change	1	1	2	1	1	6
	University	2	2	1	1	1	7
Social Actors	Professional Chambers	1	1	1	1	1	5
Financial Actors	Private Sector	1	1	1	1	1	5

Each urban transformation initiative encompasses a unique set of actions characterized by context-specific processes. This process is inherently multi-dimensional and multi-actor in nature. The actors involved in urban transformation processes can be classified as follows (Hague, 2004):

- Administrative actors (central government, local authorities, universities and other academic institutions, public agencies and organizations),
- Social actors (local and national voluntary organizations, non-governmental organizations, professional chambers, and associations),
- Financial actors (real estate development companies, construction firms, private sector stakeholders, architectural and design offices),
- Beneficiaries, affected groups, and local communities within the transformation area.

Since the primary objective of this study is to evaluate expert judgments, local residents were excluded from the scope of the analysis. Accordingly, a total of 33 semi-structured interviews were conducted with disaster and urban transformation experts representing different actor groups during 2022 (Table 1).

FINDINGS: FIELD STUDY

General Characteristics of Akşehir

Akşehir district is a historical settlement located approximately 135 km northwest of Konya Province, with origins dating back to the Neolithic period. The city is situated on sloping terrain along the northeastern foothills of the Sultan Mountains (Figure 1).

Akşehir is located within a first-degree seismic zone (AFAD, 2018). Considering a 40 km radius centered on Akşehir, a total of 28 earthquakes

Figure 2. Residential complex plan

has occurred since 1900, of which seven exceeded magnitude 5.0 and two exceeded magnitude 6.0 (AFAD, 2021). Following the Mw 5.8 Bolvadin-centered earthquake that occurred northwest of Akşehir in 2000, revisions were introduced in the 2003 zoning plan, limiting building heights to a maximum of five storeys. This regulatory approach was maintained in the subsequent revision plans of 2010 and 2018. Furthermore, the 2017 microzonation report classified the city center as a precautionary area and mandated parcel-based geotechnical surveys (Akşehir Municipality, 2017).



Figure 1. Location of Akşehir (generated using Google Earth)

Within the scope of Law No. 6306, no area in the city center of Akşehir has yet been officially as a disaster-risk area; however, the application submitted by Akşehir Municipality to the Ministry of Environment, Urbanization and Climate Change is currently under evaluation. Following the official designation of the proposed risky area, the initiation of urban transformation interventions is planned.

Weighting of Criteria through Pairwise Comparisons Using AHP

Pairwise comparison matrixes reflecting the relative importance of the criteria were constructed, and AHP evaluations were conducted based on expert scores. The resulting tables present average values, normalized scores, and percentage weights of the criteria. Consistency analysis was performed for all pairwise comparison matrices, and the consistency ratios were found to be below the acceptable threshold of 0.10 (Table 2 = 0.07, Table 3 = 0.06, Table 4 = 0.07, Table 6 = 0.08, Table 7 = 0.04, Table 8 = 0.06, Table 12 = 0.04).

Table 2. Normalized weight percentages of the building construction year sub-criterion

Criterion	Pre-2000	2000-2010	Post-2010	Mean Value	Weight (%)
Pre-2000	0,75	0,80	0,62	0,72	72
2000-2010	0,15	0,16	0,31	0,21	21
Post-2010	0,10	0,04	0,07	0,07	7
Total	1,00	1,00	1,00	1,00	100

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Table 3. Normalized weight percentages of the building layout sub-criterion

Criterion	Attached (Row) Development	Semi-Detached Development	Detached Development	Mean Value	Weight (%)
Attached (Row) Development	0,73	0,76	0,62	0,70	70%
Semi-Detached Development	0,18	0,19	0,31	0,23	23%
Detached Development	0,09	0,05	0,07	0,07	7%
Total	1,00	1,00	1,00	1,00	100%

Table 4. Normalized weight percentages of building risk main criterion

Criterion	BCYA	BHA	BLA	PBA	Mean Value	Weight (%)
BCYA	0,29	0,48	0,31	0,25	0,33	33%
BHA	0,07	0,12	0,23	0,16	0,15	15%
BLA	0,07	0,04	0,08	0,10	0,07	7%
PBA	0,57	0,36	0,38	0,49	0,45	45%
Total	1,00	1,00	1,00	1,00	1,00	100%

Table 5. Normalized weight percentages of the settlement suitability sub-criterion

Criterion	PA.2.1	PA.5.1	Mean Value	Weight (%)
PA.2.1	0,20	0,20	0,20	20%
PA.5.1	0,80	0,80	0,80	80%
Total	1,00	1,00	1,00	100%

Table 6. Normalized weight percentages of the geographical risk analysis main criterion

Criterion	SLRA	LRA	FRA	SA	Mean Value	Weight (%)
SLRA	0,62	0,73	0,48	0,43	0,56	56%
LRA	0,16	0,18	0,38	0,36	0,27	27%
FRA	0,12	0,05	0,09	0,14	0,10	10%
SA	0,10	0,04	0,05	0,07	0,07	7%
Total	1,00	1,00	1,00	1,00	1,00	100%

Table 7. Normalized weight percentages of the public facilities sub-criterion

Criterion	EFA	HFA	GSA	Mean Value	Weight (%)
EFA	0,40	0,50	0,33	0,41	41%
HFA	0,20	0,25	0,33	0,26	26%
GSA	0,40	0,25	0,33	0,33	33%
Total	1,00	1,00	1,00	1,00	100%

Table 8. Normalized weight percentages of the education areas sub-criterion

Criterion	PSAA	SSAA	HSAA	Mean Value	Weight (%)
PSAA	0,63	0,69	0,50	0,61	61%
SSAA	0,21	0,23	0,38	0,27	27%
HSAA	0,16	0,08	0,13	0,12	12%
Total	1,00	1,00	1,00	1,00	100%

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Table 9. Normalized weight percentages of the facilities and assembly areas main criterion

Criterion	UFA	EAAA	Mean Value	Weight (%)
UFA	0.50	0.50	0.50	50%
EAAA	0.50	0.50	0.50	50%
Total	1.00	1.00	1.00	100%

Table 10. Normalized weight percentages of the density risk main criterion

Criterion	IBDA	PDA	Mean Value	Weight (%)
IBDA	0.83	0.83	0.83	83%
PDA	0.17	0.17	0.17	17%
Total	1.00	1.00	1.00	100%

Table 11. Normalized weight percentages of the main criteria

Main Criterion	BRA	GRA	FAAA	DRA	Mean Value	Weight (%)
BRA	0.65	0.74	0.50	0.59	0.62	62%
GRA	0.13	0.15	0.29	0.24	0.20	20%
FAAA	0.09	0.04	0.07	0.06	0.06	6%
DRA	0.13	0.07	0.14	0.12	0.12	12%
Total	1.00	1.00	1.00	1.00	1.00	100%

Following data analysis, the criteria and their corresponding weights used in the weighted overlay analyses were determined based on expert judgments. Building Risk Analysis was assigned a weight of 62%, Geographical Risk Analysis 20%, Facilities and Emergency Assembly Areas Analysis 6%, and Density Risk Analysis 12% (Table 12). The findings indicate that Building Risk Analysis has the highest weight in the identification of urban regeneration areas.

Table 12. Comparison of thermal loads in different thicknesses

Main Criteria	Weight (%)	Sub-Criteria	Weight (%)				
BRA	62	BCYA	33				
		BHA	15				
		BLA	7				
		PBA	45				
GRA	20	SSRA	56				
		LRA	27				
		FRA	10				
		SA	7				
FAAA	6	UFA	50	EFA	41	PSAA	61
						SSAA	27
						HSAA	12
				HFA	26		
				GSA	33		
		EAAA	50				
DRA	12	IBDA	83				
		PDA	17				

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Generation of Risk Analyses

Building Risk Analysis

The inputs of the Building Risk Analysis consist of building construction year, number of storeys, building layout type, and problematic buildings analyses. The building risk map was generated through the weighted overlay of raster maps produced using the Statistical Clustering method in the ArcGIS environment for the preparation of the identified sub-criteria layers.

The data for the Building Construction Year map were derived from the base maps prepared in 2010 for the study area, supplemented by the examination of building permit files obtained from the Akşehir Municipality Directorate of Development and Urban Planning in order to identify buildings constructed after 2000. Structures built after 2010 were additionally identified through Google Earth, and thus the building construction year analysis layer was produced. In this analysis, buildings were classified into three categories: pre-2000, between 2000–2010, and post-2010. It was determined that approximately 80% of the building stock was constructed in or before 2000. This indicates the predominance of structures built prior to the implementation of contemporary regulations such as the earthquake code and compulsory earthquake insurance (DASK). According to expert judgments, the assigned weight scores were 72% for buildings constructed before 2000, 21% for those built between 2000–2010, and 7% for buildings constructed after 2010 (Table 2). The buildings constructed after 2010, represented in blue on the map, are predominantly located in the northwestern part of the city. In contrast, the city center and its immediate surroundings are largely dominated by pre-2000 buildings shown in red, while buildings constructed between 2000–2010, shown in green, are mainly distributed along the urban fringe (Figure 2a).

The data for the Building Height Analysis were also obtained through the examination of the base maps. In the weighting of this analysis layer, 1–2 storey buildings were assigned a weight of 25%, 3–4 storey buildings 50%, 5–6 storey buildings 75%, and 7–8 storey buildings 100%. The map indicates that 1–2 storey buildings, shown in yellow, are primarily located within the old urban settlement area and along the urban periphery. The 3–4 storey buildings, depicted in orange, are mostly situated along the immediate edge of the historic urban core and to the northwest of Akşehir Stream. The 5–6 storey buildings, represented in pink, are predominantly concentrated around the main urban corridors and newly developing areas (Figure 2b). The 7–8 storey buildings, shown in blue, constitute a relatively small proportion of the total building stock.

In the Building Layout Analysis, buildings were classified as detached, semi-detached, and contiguous. It was determined that within the urban core of Akşehir, 50% of the buildings are detached, 35% are contiguous, and 15% are semi-detached. In the weighting of the building layout type map, weight scores of 70% were assigned to contiguous buildings, 23% to semi-detached buildings, and 7% to detached buildings (Table 3).

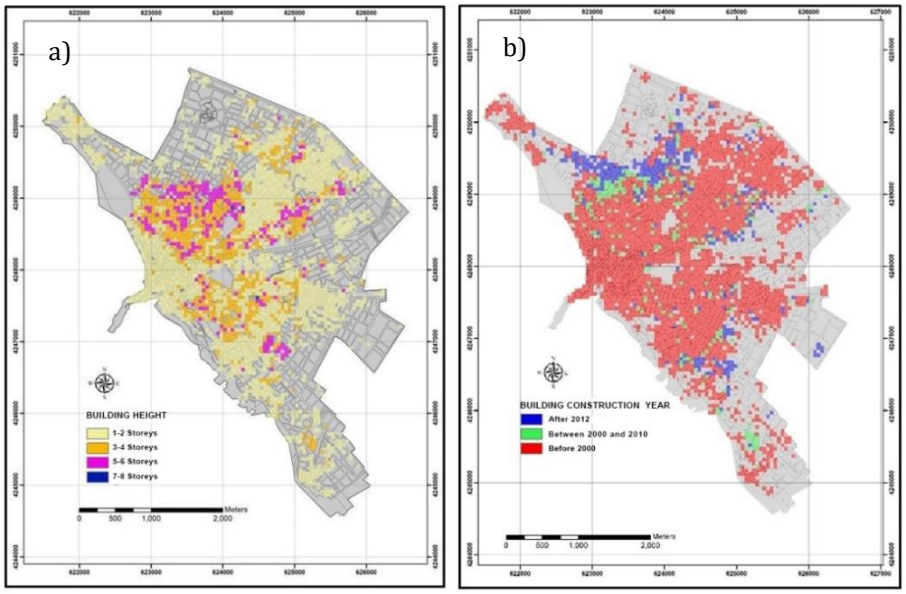


Figure 2. a) Building construction year analysis, b) Building height analysis

According to the map, contiguous buildings, represented in red, are predominantly located in the historic urban fabric, small industrial areas, and zones characterized by irregular or non-compliant development. Semi-detached buildings, shown in turquoise, are generally distributed along the periphery of contiguous building areas, whereas detached buildings, represented in yellow, are dispersed more widely across the study area (Figure 3a). Based on the structural performance requirements defined in the Turkish Earthquake Code (Official Gazette, 2007, No. 26454), data obtained from the Building Unit of the Directorate of Development and Urban Planning, together with on-site observational assessments, were used to generate the Problematic Buildings Analysis.

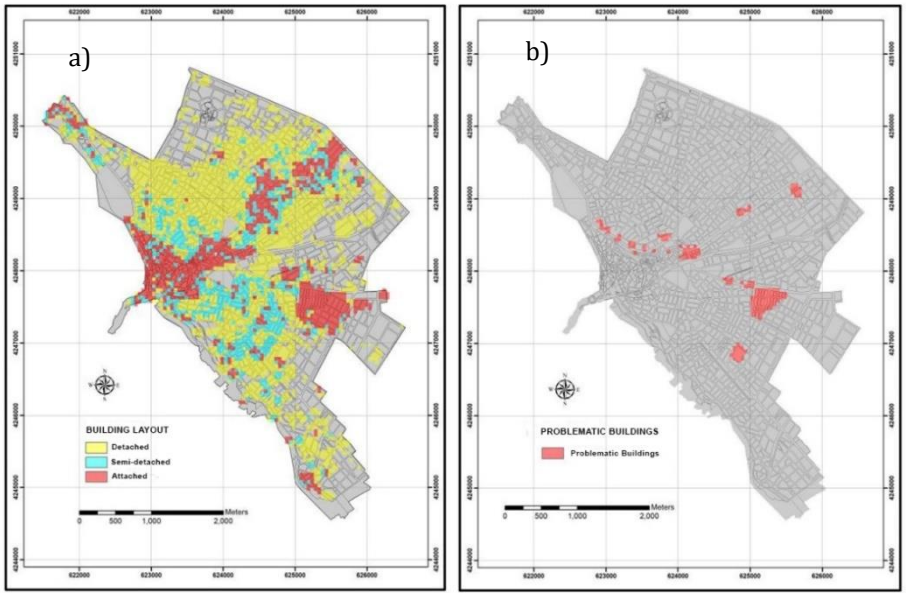


Figure 3. a) Building layout analysis, b) Problematic building analysis

In the weighting of the Problematic Buildings Map, problematic buildings were assigned a score of 100%. The problematic buildings,

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shown in red on the map (Figure 3b), are mainly concentrated in the city center and in the small industrial area.

According to expert judgments, weight scores of 33% were assigned to Building Construction Year, 15% to Building Height, 7% to Building Layout Type, and 45% to Problematic Buildings (Table 4). The sub-criteria—Building Construction Year Analysis, Building Height Analysis, Building Layout Analysis, and Problematic Buildings Analysis—were overlaid using the weighted overlay method to generate the Building Risk Analysis map (Figure 4). In this map, building risk levels are visualized using a color gradient from green to red. Based on the expert-based weighting, the building risk values range between 0% and 85%. The highest-risk zones, represented in red, correspond to areas where problematic buildings are densely concentrated (Figure 4).

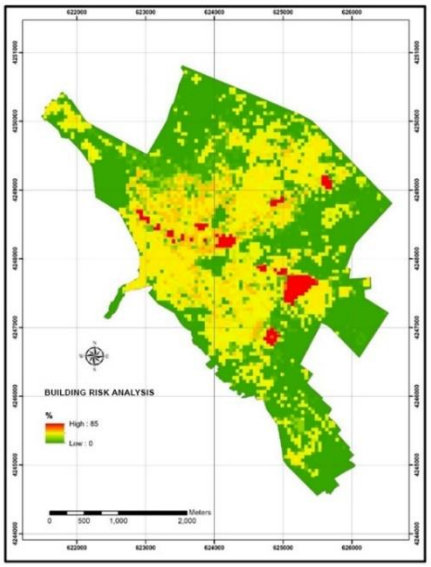


Figure 4. Building risk analysis

Geographical Risk Analysis

The Geographical Risk Analysis was produced through the weighted overlay of the following maps: Settlement Suitability Analysis, Landslide Risk Analysis, Flood Risk Analysis, and Slope Analysis. The data for the Settlement Suitability Analysis were derived from the Settlement Suitability Map of the Geological and Geotechnical Survey Report for Development in Akşehir (2017), which identifies geologically suitable areas for urban development.

Precautionary Area 2.1 (PA2.1) refers to areas requiring mitigation measures due to mass movement hazards and high slope-related stability problems. Precautionary Area 5.1 (PA5.1) denotes areas requiring engineering precautions due to geotechnical constraints. In the weighting of the settlement suitability analysis, expert evaluations assigned a weight of 20% to PA2.1 and 80% to PA5.1 (Table 6).

In the map, areas designated as PA5.1, shown in red, cover a large proportion of the urban settlement, whereas PA2.1 areas, shown in green, represent zones that require precautionary measures due to mass

movement hazards and steep slope conditions (Figure 5a). The landslide-prone areas indicated in red are located in the southwestern part of the historic city center, as well as along the foothills of the Sultan Mountains (Figure 5b). The Landslide Risk Analysis was generated based on data obtained from Disaster and Emergency Management Authority (AFAD) and the archives of the Directorate of Development and Urban Planning of Akşehir Municipality. Landslide areas were assigned a weight score of 100%.

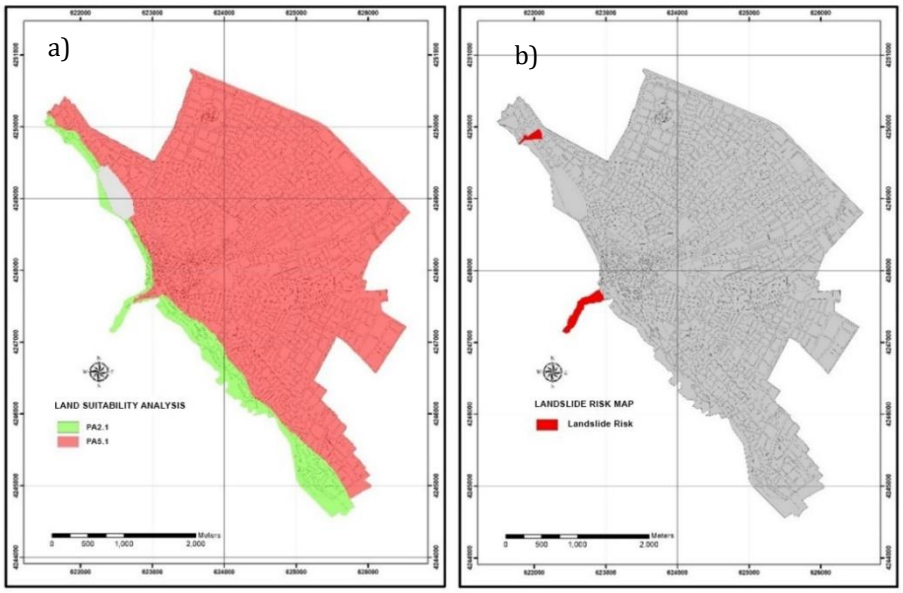


Figure 5. a) Settlement suitability analysis, **b)** Landslide risk analysis

The Flood Risk Analysis was produced by assigning a score of 100% to flood-prone areas, based on expert evaluations. In the map, the blue zones correspond to the floodplains of Kuru Creek, Kızılpınar Creek, and Kurtini Creek, as delineated by the State Hydraulic Works (DSİ) (Figure 6a). The Slope Analysis was generated using slope data obtained from "earthexplorer.usgs.gov". Scores ranging from 0 to 100 were assigned from low to high slope values. The slope increases toward the Sultan Mountains extending along the southeastern and northwestern parts of the city, with the color gradient shifting from green to red accordingly (Figure 6b).

In the construction of the Geographical Risk Analysis, expert judgments assigned weight scores of 56% to Settlement Suitability Risk, 27% to Landslide Risk, 10% to Flood Risk, and 7% to Slope Analysis (Table 6). In the resulting map, geographical risk levels are visualized using a color gradient from green to red. The geographical risk values range between 1% and 83%. The highest-risk areas are ranked respectively as landslide zones, flood-prone areas, PA5.1 areas, and PA2.1 areas (Figure 7).

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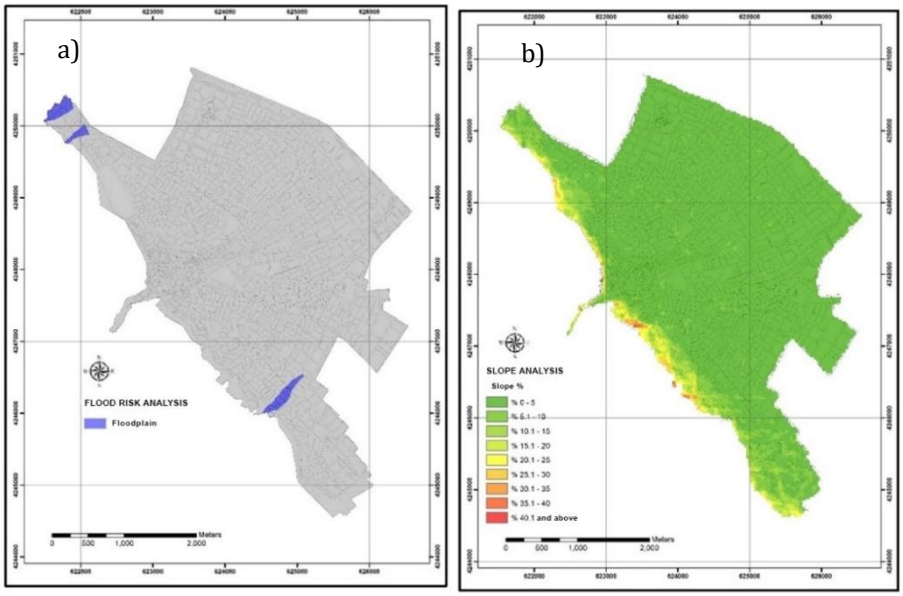


Figure 6. a) Flood risk analysis, **b)** Slope analysis

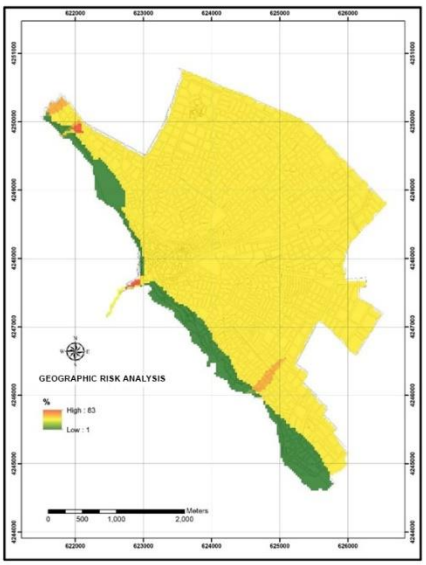


Figure 7. Geographical risk analysis

Distance to Facilities and Assembly Areas Analysis

The Distance to Facilities and Assembly Areas Analysis consists of two sub-criteria: Facilities Risk Analysis and Educational Facilities Areas Analysis. In accordance with the provisions of the Spatial Plans Construction Regulation (Official Gazette, 2014, No. 29030), service catchment areas were calculated using buffer distances of 500 meters for primary schools, 1,000 meters for secondary schools, 2,500 meters for high schools, and 500 meters for healthcare facilities. Areas within the service catchment zones were assigned a score of 100, while areas outside these zones were assigned a score of 0.

The Facilities Risk Analysis was subdivided into three main sub-criteria: education, healthcare, and green space. Within the education criterion, educational facilities were further classified into primary schools, secondary schools, and high schools. Areas not served by

primary school catchment zones correspond mainly to undeveloped areas (Figure 8a).

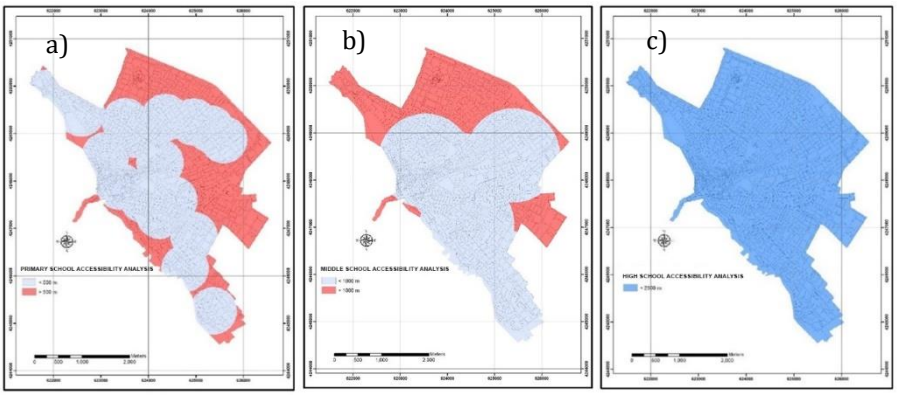


Figure 8. a) Primary school accessibility analysis, **b)** Middle school accessibility analysis, **c)** High school accessibility analysis

For secondary schools, areas within the service catchment are indicated in light blue, while areas outside are shown in red. The zones not served by secondary schools consist largely of already developed and newly developing areas (Figure 8b). The service catchment areas of high schools are shown in blue, and there are no areas outside the service range, indicating full coverage across the study area (Figure 8c).

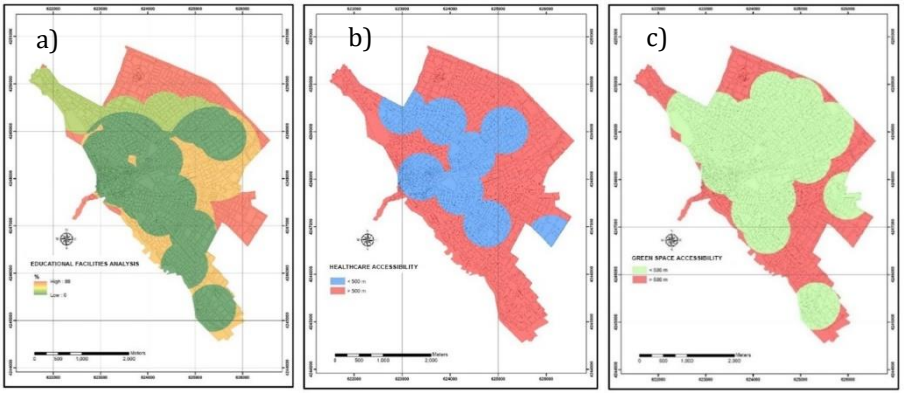


Figure 9. a) Educational facilities **b)** Healthcare accessibility **c)** Green space accessibility

Primary schools were assigned a weight of 61%, secondary schools 27%, and high schools 12%. Based on the weighted overlay of these criteria (Table 8), the Educational Facilities Analysis was generated (Figure 9a). The map was symbolized from green to red according to the level of access risk. Red and orange zones indicate areas with limited accessibility to educational facilities (Figure 9a). According to expert-based weighting, the results of the educational facilities weighted overlay analysis range between 0% and 88% (Table 8).

In the Health Facilities Analysis, areas within the service catchment were assigned a score of 100, while areas outside were assigned a score of 0. The service areas of health facilities are indicated in blue, whereas areas outside the service range are shown in red. Areas not served by health facilities are mainly located around the periphery of the city center (Figure 9b).

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In the Green Areas Analysis, a walking distance threshold of 500 meters was adopted. Areas within the service catchment were assigned a score of 100, while those outsides were assigned a score of 0. Service areas are shown in green, and non-served areas in red. Areas lacking access to green spaces are generally characterized by low levels of development and industrial land uses (Figure 9c).

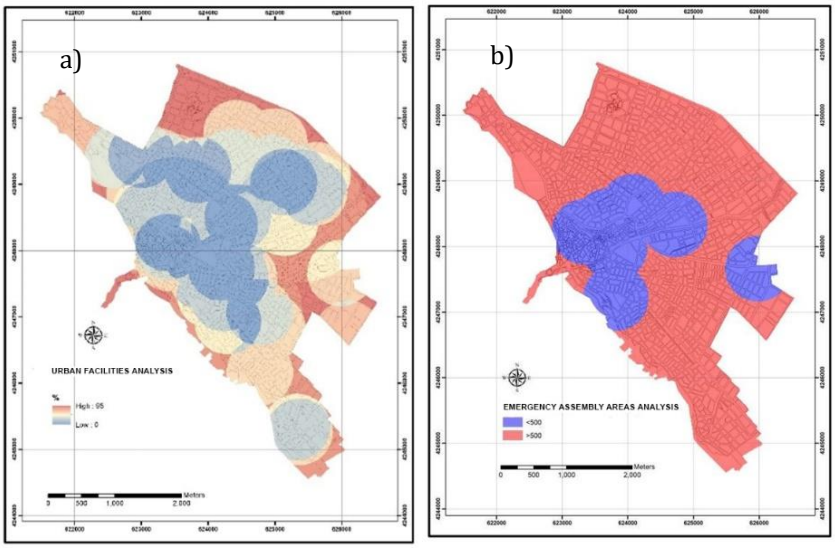


Figure 10. a) Weighted overlay analysis of urban facilities, **b)** Emergency assembly areas

Based on expert judgments, educational facilities were weighted at 41%, health facilities at 26%, and green areas at 12%. Through the weighted overlay of these sub-criteria, the Facilities Areas Analysis map was generated (Table 9). The Distance to Facilities and Emergency Assembly Areas Analysis was visualized from blue to red according to weighted risk levels. The results range between 0% and 95% across the study area (Figure 10a).

In the Emergency Assembly Areas Analysis, areas located outside a 500-meter radius of officially designated assembly points proposed by Akşehir Municipality and approved by AFAD were assigned a score of 100. Red zones represent areas with poor accessibility to assembly areas (Figure 10b). Based on expert evaluations, equal weights of 50% were assigned to the Facilities Areas Analysis and the Emergency Assembly Areas Analysis. The weighted overlay of these two layers produced the Distance to Facilities and Emergency Assembly Areas Analysis (Table 10). In the resulting map, red indicates the most unfavorable conditions (Figure 11).

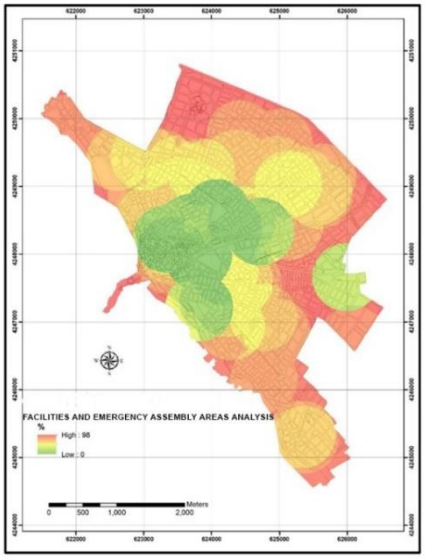


Figure 11. Distance analysis to urban facilities and emergency assembly areas analysis

According to expert-based weighting, the urban facilities and assembly areas analysis values range between 0% and 98% across the study area.

Density Risk Analysis

The Density Risk Analysis was generated through the weighted overlay of two sub-criteria: population density and density of illegal constructions. In the Illegal Construction Density Analysis, areas with 65% or more illegal buildings were assigned a score of 100, while all other areas were assigned a score of 0. Areas exceeding the 65% threshold are indicated in red (Figure 12a). These areas are mainly located in the northeastern part of the city, between İstasyon Street and Cumhuriyet Street, as well as in the Beşkavak district in the northwestern part of Akşehir.

The Population Density Analysis was derived from building-based population data obtained from the Konya Metropolitan Municipality Urban Information System. Using the Kernel Density method in ArcGIS, settlement areas were classified from low to high density and assigned scores ranging from 0 to 100. The results show that population density increases from blue to red, with the highest concentrations observed in the city center and northern parts of the urban area (Figure 12b). Population density decreases progressively towards the urban periphery.

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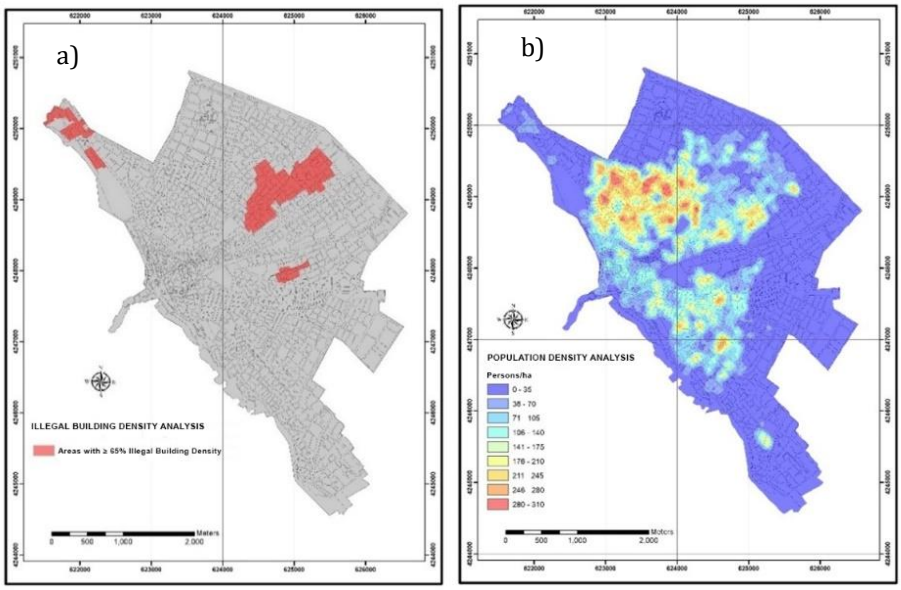


Figure 12. a) Analysis of illegal building density analysis, **b)** Population density analysis

In line with expert judgments, a weight of 83% was assigned to the Illegal Building Density Analysis and 17% to the Population Density Analysis (Table 10). Based on the weighted overlay of these two layers, the Density Risk Analysis map was generated. The map was symbolized from green to red according to the weighted risk levels. The results of the weighted overlay range between 0% and 93% in terms of density-related risk (Figure 13). Areas with the highest density risk are concentrated in the northeastern part of the city, between İstasyon Street and Cumhuriyet Street, as well as in the Beşkavak district located in the northwestern part of Akşehir.

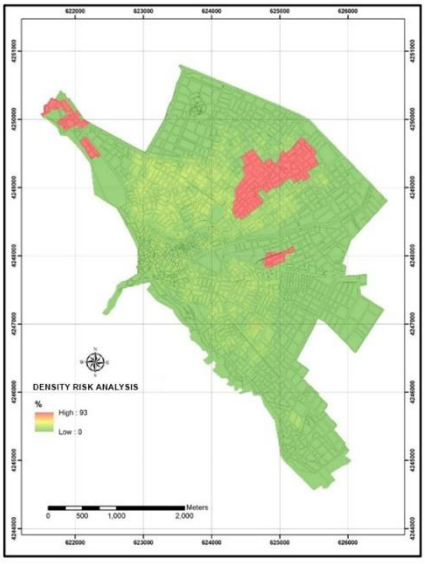


Figure 13. Density risk analysis

DISCUSSION: IDENTIFICATION AND PRIORITIZATION OF URBAN TRANSFORMATION AREAS

According to expert evaluations, the main criteria were weighted as follows: Building Risk Analysis (62%), Geographical Risk Analysis (20%),

Distance to Facilities and Emergency Assembly Areas Analysis (6%), and Density Risk Analysis (12%) (Table 11). Using these weights, a composite weighted overlay map was generated in ArcGIS (Figure 14a).

The resulting map displays weighted values representing disaster risk and urban transformation need, ranging from 3% to 70% and symbolized from green to red. The highest-risk zones correspond to areas with dense concentrations of problematic buildings. Expert assessments and overlay results indicate that areas exceeding a 40% weighted value can be designated as urban transformation zones. For prioritization, phased implementation may be structured in 10% intervals above this threshold.

Accordingly, areas with values between 60.1% and 70% were classified as First-Priority Areas (23.1 ha), those between 50.1% and 60% as Second-Priority Areas (8.8 ha), and those between 40.1% and 50% as Third-Priority Areas (62.2 ha) (Figure 14b).

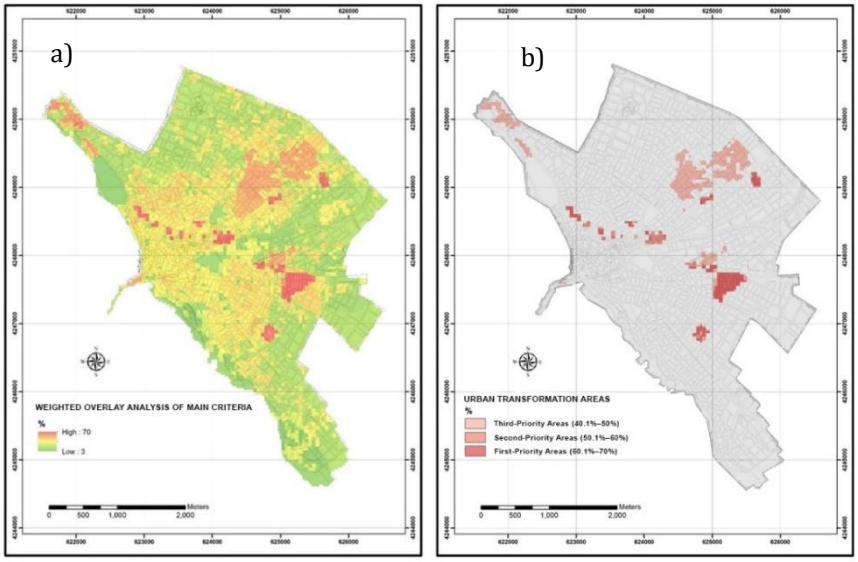


Figure 14. a) Weighted overlay analysis of main criterion maps, **b)** Urban transformation areas and prioritization map

The first-priority urban transformation areas are distributed across five key locations. The first is situated in Seyran Neighborhood, southeast of Mustafa Kemal Paşa Street, where the Bağkur Housing Estate is located. This area consists of 12 five-storey blocks comprising 120 housing units constructed prior to 2000. It is characterized by high population density and a large number of problematic buildings. Field observations indicate advanced physical deterioration, including visible structural damage to columns, indicating a high level of seismic risk. The second area is also located in Seyran Neighborhood, within the small industrial zone. It contains contiguous buildings constructed before 2000, most of which are physically obsolete and have exceeded their economic lifespan. The third area is located in İstasyon Neighborhood, where the Çavdarkent housing estate is situated. It is dominated by five-storey pre-2000 buildings, includes structurally problematic units, and has high population density with evident physical degradation. The fourth area, also in İstasyon Neighborhood, where the Bağkent housing estate is

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located. Similar to the third area, it consists of pre-2000 five-storey buildings, includes problematic structures, and exhibits high density and visible deterioration. The fifth area comprises fragmented zones along 24 August Street in the northwestern part of the city center, dominated by old, five-storey, and structurally deficient buildings. These findings indicate that disaster-oriented urban transformation in Akşehir should primarily focus on areas located close to the city center. These findings suggest that, in Akşehir, disaster-oriented urban transformation should primarily focus on areas located in close proximity to the city center.

Second-priority areas are located around the Central Business District and extend intermittently along 24 August Street. These zones are characterized by contiguous four- to five-storey buildings constructed before 2000. Field observations indicate that buildings receiving engineering services prior to 2010 exhibit notable physical deterioration.

Third-priority areas are distributed across four locations. The first is in Çimenli Neighborhood, within the Tekke Boğazı area, which is affected by landslide risk, steep slopes, and rockfall hazards. Ongoing interventions involve the expropriation of old buildings and their conversion into green and recreational spaces. The second area is located in the Beşkavak locality of Yarenler Neighborhood, in the northwestern part of the city. It is exposed to both landslide and flood risks, with illegal construction exceeding 65%. The steep topography contains residential buildings and a primary school. The third area is situated in Yeni Neighborhood, south of the D-300 highway, and is characterized by over 65% illegal construction, contiguous pre-2000 buildings, and limited access to social and technical infrastructure, facilities, and assembly areas. The fourth area is located in Seyran Neighborhood, and similarly exhibits more than 65% illegal construction, contiguous pre-2000 buildings, and inadequate social and technical infrastructure.

CONCLUSION

This study presents an applied example of disaster-oriented urban transformation in Akşehir city center (Konya Province) through the integrated use of GIS and AHP for the identification and prioritization of urban transformation areas. In particular, the initiation of transformation strategies in the first-priority areas is considered urgent. The findings and evaluations presented in this study are expected to provide guidance for the preparation of an Urban Transformation Strategy Document for Akşehir.

The methodological framework employed in this study enables rapid and reliable decision-making and effective problem-solving. A key contribution of the study is the adoption of a participatory approach, in which criteria formulation and weighting were based on expert opinions from multiple disciplines. This approach facilitated the integration of diverse professional perspectives and resulted in more comprehensive and balanced outcomes.

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Given Türkiye's high vulnerability to natural hazards, studies focusing on risk identification and delineation of risk-prone areas are of critical importance for ensuring the protection of life and property. Unlike past practices, disaster management should not be limited to emergency response but should also encompass pre-disaster risk management. Risk reduction plays a central role in the disaster management process. This requires, first, the identification of potential risks, followed by the mitigation or minimization of these risks through sound urban planning and development practices.

In this context, risks and priorities should be clearly defined, and multidimensional projects tailored to local physical, economic, and social conditions should be developed. Achieving healthy and sustainable urbanization is possible through the implementation of preventive measures and the formulation of strategic interventions that transform risks into opportunities. Within this framework, urban transformation practices represent one of the most significant opportunity areas for building resilient and sustainable cities.

NOTES

This article is derived from the master's thesis titled "Determination and Prioritization of Urban Transformation Areas within the Scope of Disaster-Oriented Urban Transformation: The Case of Akşehir" completed by Murat Ferit Altun in 2022 at Konya Technical University, Graduate Education Institue, Department of Urban and Regional Planning.

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Resume

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Assessing Local Climate Impact on Energy and Emission Performance in Türkiye's Standardized Post-Disaster Housing

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Abstract

Designing energy-efficient buildings for reconstruction in disaster areas is essential for mitigating environmental challenges and supporting sustainable recovery. However, in Türkiye, standardized mass housing is often implemented following disasters for rapid reconstruction, frequently overlooking local climatic conditions. The Housing Development Administration of Türkiye (TOKİ) has initiated standardized mass housing projects across 11 provinces in the disaster area of the 2023 Türkiye-Kahramanmaraş earthquake. This study conducts a comparative analysis of heating and cooling energy consumption and CO_2 emissions for a reference TOKİ housing using DesignBuilder simulations across the 11 impacted provinces, to show the environmental impact of standardized material selection. The evaluated archetype features a rectangular geometry with a symmetrical floor plan, comprising 20 dwelling units and a fixed façade configuration governed by orientation. The façade consists of reinforced concrete shear walls, vertically perforated brick walls, and PVC-framed double-glazed windows. The analysis utilized the updated climate zoning of the Turkish Standard for Thermal Insulation in Buildings (TS 825), which recently expanded from four to six climate zones. Findings indicate significant variations: intra-zone annual heating and cooling energy consumption differed by up to 184.85% and 52.84%, respectively. CO_2 emissions showed relatively limited differences, with a maximum of 12.35% intra-zone. These findings show that energy consumption varies significantly both between and within climate zones, highlighting the limitations of relying solely on generalized climate zone data for building design and material selection. Moreover, an evaluation of the latest TS 825 revision shows that the updated classification does not yield consistent heating and cooling energy outcomes for certain provinces. The study concludes that province-specific climatic data should be integrated into post-disaster housing design, particularly during material selection, to improve energy efficiency, reduce emissions, and support sustainable recovery.

Keywords: *Climate-based design, CO_2 emissions, Energy efficiency, Standardized housing, TOKİ.*

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INTRODUCTION

The earthquakes centered in Kahramanmaraş on February 6 of 2023, affected 11 provinces, including Adana, Adıyaman, Diyarbakır, Elazığ, Gaziantep, Kahramanmaraş, Malatya, Hatay, Kilis, Osmaniye, and Şanlıurfa, resulting in one of the most devastating disasters in the history of Türkiye. As a result of the disaster, 20.662 buildings collapsed, and 105.794 buildings were severely damaged (Turkish Ministry of Environment, Urbanization, and Climate Change, [MoEUCC], 2023). That means at least 12.73% of the building stock in this region will be reconstructed. The severe level of destruction caused by the earthquake has led to a prolonged and costly reconstruction process. In particular, urgent housing construction was required to immediately resolve the housing problems in the disaster area.

The strategic planning of this large-scale transformation and new construction in the disaster area is of great importance for the preservation of resources and the achievement of environmental sustainability. It is well established that the construction industry's negative environmental impacts stem largely from high levels of energy and natural resource consumption (Najjar et al., 2019). Approximately 40% of global energy consumption originates from buildings (Sun et al.,2018; Javid et al., 2019; Ebrahimi-Moghadam et al., 2020). Housings are responsible for more than 65% of the total primary energy supply consumption of buildings (Harkouss et al., 2018). Designing new housing in the disaster area with consideration not only for structural integrity but also for environmental factors holds crucial potential for optimizing energy consumption, which is one of the critical challenges of our era.

The Housing Development Administration of Türkiye (TOKİ), a leading institution in post-disaster housing production (Begen, 2020), continues to play a significant role in the reconstruction process following the 2023 Kahramanmaraş earthquake, as it has in past events. However, TOKİ implements mass housing projects going into uniformity in terms of the spatial organizations and material selections across different climate zones, thereby disregarding the necessity for climate-based design (Çiçek, 2019). Whereas climate is the primary environmental parameter that determines a building's energy consumption (Özüer, 2012).

Numerous studies have assessed how standardized TOKİ mass housing projects affect the buildings' energy performance in various climate zones. Table 1 provides a summary of the scope of the 13 studies that were identified in the literature between 2010 and 2026. According to Table 1, the variation in annual cooling and heating energy consumption of typical housing projects in provinces representing different climate zones of Türkiye is largely analyzed; this is followed by lighting energy consumption and CO_2 emissions assessments. Notably, climate zones are typically represented by data from a single province, and provinces within the same climate zone are expected to exhibit similar performance. Meanwhile, according to climate classification

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systems from the Turkish Ministry of Environment, Urbanization, and Climate Change General Directorate of Meteorology (MoEUCC, 2025), it has been determined that the climate zones of provinces can vary depending on the classification system. For example, while Adana province is classified as semi-humid under the Aydeniz and Erinc classifications, it is categorized between semi-arid and humid in the DeMartonne classification and is identified as having a very hot climate based on the Turkish Standard for Thermal Insulation in Building (TS 825). This variation is due to differences in parameters such as precipitation, temperature, and evaporation used in different climate classification systems (MoEUCC, 2024).

Table 1. Analysis of studies published between 2010 and 2026 evaluating the effects of implementing standardized TOKİ mass housing projects across different climate zones on building energy performance.

Reference	TOKİ Project Type	Evaluated City / Climate Zone	Compared Data	Simulation Tool
Tuna et al., 2010	Sample project	Ankara and Antalya. According to TS 825, representing two distinct climate zones	Heating, cooling, lighting, and other energy consumption	Energy-10
Ünsal, 2012	Type C housing project	İzmir, Ankara, Erzurum, İstanbul and Diyarbakır. According to TS 825, representing four distinct climate zones	Heating and cooling energy	DB
Bektaş, 2013	Tarımköy housing project	Balıkesir, Mersin, Muğla, and Bolu, representing four distinct wind zones	Heating, cooling, lighting and total energy	DB
Mangan and Oral, 2013	A housing project completed in Istanbul, 2008	İstanbul, Antalya, and Erzurum. According to TS 825, representing three distinct climate zones	Heating and cooling energy, CO_2 emissions	DB and PV*SOL Expert
Sümen-gen and Yener, 2015	Sample project	İstanbul (41°N 28°E), Kayseri (38°N 35°E), and Antalya (36°N 30°E), representing three distinct climate zones	Lighting energy	-
Çetintaş and Yılmaz, 2019	Type C housing project	İstanbul (temperate-humid), İzmir (hot-humid), and Erzurum (cold), representing three distinct climate zones	Heating, cooling, lighting and domestic hot water energy	DB
Çiçek, 2019	Type C housing project	Ankara, İzmir, Erzurum, İstanbul and Gaziantep. According to TS 825, representing four distinct climate zones	Heating and cooling energy	DB
Taştemir, 2020	Type Y housing project	Ankara, Erzurum, İzmir and Antalya, İstanbul and Diyarbakır. According to TS 825, representing four distinct climate zones	Heating and cooling energy	DB

Table 1 (continued). Analysis of studies published between 2010 and 2026 evaluating the effects of implementing standardized TOKİ mass housing projects across different climate zones on building energy performance.

Reference	TOKİ Project Type	Evaluated City / Climate Zone	Compared Data	Simulation Tool
Haydar-aslan, 2021	Type A, B, C, D, K, R and Y housing projects	Representing two provinces from each of Antalya, Ardahan, Bayburt, Bilecik, Çanakkale, Gaziantep, İzmir, Isparta, Kırıkkale, Kütahya, Malatya, Sivas, Şanlıurfa, and Trabzon. Selected based on the highest and lowest average annual outdoor temperatures in Türkiye's seven geographical regions.	Heating, cooling, and lighting energy, and CO_2 emissions	DB
Arslan et al., 2014	Reference 2+1 TOKİ housing project	Gaziantep (hot-dry), Karaman (temperate-dry), Van (cold), Mersin (hot-humid), and Balıkesir (temperate-humid), representing five distinct climate zones in Türkiye	The effect of natural ventilation and wind on heating and cooling energy loads	Solidworks Flow Simulation
Cengiz et al., 2024	Sample project	Istanbul (temperate-humid) and Diyarbakır (hot-dry)	Cooling energy and cost	DB
Aşıkoğlu Metehan et al., 2025	Typical TOKİ building	Istanbul, Ankara, Antalya, Hakkari, and Erzurum. According to TS 825, representing five distinct climate zones in Türkiye	Heating and cooling energy consumption	TRNSYS
Kavuran et al., 2026	Reference TOKİ housing project	Adana, Adıyaman, Diyarbakır, Elazığ, Gaziantep, Kahramanmaraş, Malatya, Hatay, Kilis, Osmaniye, and Şanlıurfa. According to TS 825, representing three distinct climate zones in Türkiye	Electricity performance, energy-related decision framework	DB / AI-supported decision framework

DB: DesignBuilder; TRNSYS: Transient System Simulation Tool

In TS 825, which is frequently used as a reference for the climate classification of provinces, Türkiye was divided into four degree-day (climate) zones based on heating energy demand in the initial 1998 report (Turkish Standards Institute [TSE], 1998). In the 1999 revision, while the climate zone categories remained the same, the climate zones of Şırnak, Düzce, and Bartın provinces were changed. Additionally, with this revision, adjustments were made for the first time to include certain districts in climate zones different from those of their respective provinces, based on microclimatic conditions (TSE, 1998; TSE, 2008). Most recently, in October 2024, the standard was revised to incorporate both heating and cooling energy demands into design calculations, and the number of climate zones increased from four to six degree-day

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(climate) zones (TSE, 2024). This revision resulted in significant changes in the climate zone classifications of many provinces (Table 2).

Table 2. Changes in the climate zones of Turkish provinces in the context of TS 825 revisions (adapted from TSE, 1998; TSE, 2008; TSE, 2024).

Provinces	1999 and 2008 Climate Zones	2024 Climate Zones
Adana, Antalya, İçel (Mersin)	1st Degree-Day Zone (Hot-Humid Climate Zone)	1st Degree-Day Zone (Very Hot Climate Zone)
Aydın, Hatay, İzmir, Osmaniye	1st Degree-Day Zone (Hot-Humid Climate Zone)	2nd Degree-Day Zone (Hot Climate Zone)
Adıyaman, Batman, Denizli, Gaziantep, Kahramanmaraş, Kilis, Manisa, Mardin, Siirt, Şanlıurfa	2nd Degree-Day Zone (Temperate Climate Zone)	2nd Degree-Day Zone (Hot Climate Zone)
Adapazarı (Sakarya), Balıkesir, Bursa, Çanakkale, Giresun, İstanbul, Kocaeli, Muğla, Ordu, Rize, Samsun, Sinop, Tekirdağ, Trabzon, Yalova, Zonguldak	2nd Degree-Day Zone (Temperate Climate Zone)	3rd Degree-Day Zone (Temperate Climate Zone)
Amasya, Diyarbakır, Edirne	2nd Degree-Day Zone (Temperate Climate Zone)	4th Degree-Day Zone (Cold Climate Zone)
Afyon, Aksaray, Ankara, Artvin, Bilecik, Bingöl, Bolu, Burdur, Çankırı, Çorum, Düzce, Elazığ, Eskişehir, Iğdır, Isparta, Karabük, Karaman, Kırıkkale, Kırklareli, Kırşehir, Konya, Kütahya, Malatya, Nevşehir, Niğde, Tokat, Tunceli, Uşak	3rd Degree-Day Zone (Cold-Dry Climate Zone)	4th Degree-Day Zone (Cold Climate Zone)
Erzincan, Kayseri	4th Degree-Day Zone (Very Cold-Continental Climate Zone)	4th Degree-Day Zone (Cold Climate Zone)
Bayburt, Bitlis, Gümüşhane, Hakkâri, Kastamonu, Muş, Sivas, Van, Yozgat	4th Degree-Day Zone (Very Cold-Continental Climate Zone)	5th Degree-Day Zone (Very Cold Climate Zone)
Ağrı, Ardahan, Erzurum, Kars	4th Degree-Day Zone (Very Cold-Continental Climate Zone)	6th Degree-Day Zone (Extremely Cold Climate Zone)

Climate is established to be the primary environmental parameter determining a building's energy consumption. However, as explained above, since provinces are located in different climate zones within different climate classifications, and due to the changes in the climate zones of provinces over the years, as in TS 825, the approach of designing buildings solely within the context of their climate zones, without considering the microclimate characteristics of the provinces, is also open to debate. As far as the conducted review is concerned, no study has been found in the literature that comparatively analyzes the variations in the energy performance of standardized housing projects across provinces located within the same climate zones. Whereas, identifying the potential energy performance differences of standardized housing projects among provinces within the same climate zone and different climate zones would greatly contribute to understanding the impact of microclimatic variations on building energy performance.

In the context of the problems outlined above, this study aims to conduct a comparative analysis of how the energy consumption and environmental impact performance of a standardized TOKİ housing project planned for construction in 11 provinces affected by the 2023 earthquake centered in Kahramanmaraş, differ among provinces located within the same and different climate zones according to the TS 825 classification. Since TS 825 classifies climate zones according to heating and cooling energy, heating and cooling energy consumption was used to determine the energy performance, and CO_2 emission data was used to determine the environmental impact. These data were obtained on a provincial basis, both annually and monthly, through the modeling and simulation of the standardized housing project using the DesignBuilder software. CO_2 emissions, heating and cooling energy consumption values were examined separately on a monthly and annual basis, and the difference between the province with the lowest values and the other provinces was calculated as a percentage, so that the range in which the data varied between provinces located in the same and different climate zones was analyzed.

The characteristics of the selected reference housing project, the climatic data of the provinces, and the methods used for modeling and simulating the project are presented in Section 2; the analysis of the province's annual and monthly heating and cooling energy consumption as well as CO_2 emission data based on climate zones is provided in Section 3; the comparative analysis of the data in the context of climate zones is discussed in Section 4. The findings indicate that both macroclimatic and microclimatic differences among provinces play a decisive role in energy consumption and CO_2 emissions. Accordingly, it has been demonstrated that adapting housing projects to the local climatic conditions of provinces, and even districts, is crucial for both energy efficiency and environmental sustainability.

MATERIAL AND METHOD

This section details the methodological framework used to analyze the study's reference project. First, the structural and spatial characteristics of the reference TOKİ housing project are defined. Next, the climatic profiles of the 11 provinces affected by the 2023 Kahramanmaraş earthquakes are categorized according to TS 825:2024 standard. Finally, the digital modeling and simulation process is explained, outlining the parameters used to generate the energy and environmental dataset.

Reference TOKİ Housing Project

Due to being one of the first settlements built in the disaster area following the 2023 Kahramanmaraş earthquake, and its project was made available by TOKİ, the mass housing settlement constructed in the Yeşilyurt district of Malatya province was analyzed within the scope of this study (Fig. 1). The settlement utilizes two block types, Type-1 and Type-2 (Fig. 2). Each block type was evaluated individually with respect

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to its structural and material characteristics, spatial organization, spatial dimensions, number of units, and orientation factors. The settlement was established on sloped terrain, and both block types were designed with a basement and four stories above the ground floor. There are 4 flats per floor in both block types. Type-1 was selected as the reference because its rectangular form makes its energy performance more sensitive to orientation. According to information obtained from TOKİ officials, since this block type will continue to be implemented in all earthquake-affected cities, the reference project represents the housing typology commonly constructed in the disaster area.

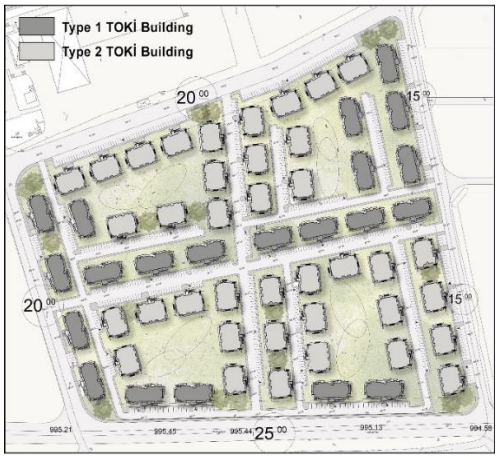
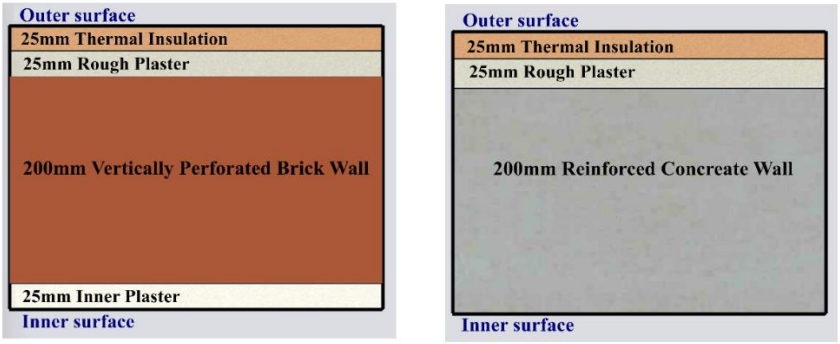


Figure 1. Malatya, Yeşilyurt mass housing settlement constructed by TOKİ (Adapted from the drawings provided by TOKİ).



Figure 2. (a) Block Type -1 and (b) Block Type -2 ground floor plans (Adapted from the drawings provided by TOKİ).

The reference block measures 35.10 m in width and 17.80 m in length. Each floor contains four symmetrically arranged apartments, totaling 20 apartments in a single block. The apartments with a net usable area of 105.16 m^2 consist of three bedrooms, a living room, a kitchen, and wet areas. The block was designed and constructed using the tunnel formwork construction system. According to this construction technique, the façade wall structure consists of two different types: vertically perforated brick walls and reinforced concrete shear walls (Fig. 3). Local stone cladding was used on the ground floor, and acrylic-based exterior paint was used on the upper floors as finishing of the façade walls. Windows feature PVC frames and 4+16+4 mm double glazing with heat-control coating on the first glass.



Exterior Wall Type-1
U-value: 0.641 (W/m²K)

Exterior Wall Type-2
U-value: 1.009 (W/m²K)

Figure 3. Reference building's façade wall types, their layers, and U-values.

Window-to-wall ratio (WWR) is the variable with the most significant impact on energy consumption (Elgohary et al., 2023). It is also the most important passive façade design parameter affecting both total energy consumption and daylight levels (Abdou et al., 2022). In this context, the WWR values have a critical importance in terms of building energy performance. For the reference block, WWR values were calculated as 29.1247% on the front (entrance), 25.9949% on the rear, and 11.1483% on the side façades.

The building typology and envelope details used in this study were derived from the construction documents of the TOKİ mass housing settlement constructed in the Yeşilyurt district of Malatya province, which were accessible within the scope of the research. This project was used as a representative reference scenario for the comparative simulations conducted across 11 provinces. However, this does not imply that identical construction details are applied in all TOKİ projects or in all provinces. TOKİ implementations may vary depending on local climatic conditions, material availability, construction practices, and project-specific design decisions.

The building envelope properties were defined based on the architectural and technical drawings obtained from TOKİ, including section details, material layers, material types, thicknesses, and material item numbers specified in the tender documents. During the DesignBuilder modelling process, the closest corresponding materials available in the software's material library were selected to represent these components as realistically as possible. Therefore, the calculated U-values and envelope characteristics reflect the accessible construction documents' details rather than idealized or optimized standard solutions.

In this study, the same reference building geometry, envelope configuration, and system assumptions were kept constant across all provinces to isolate the effect of climatic variability on heating and cooling energy consumption and CO_2 emissions. Therefore, the model should be interpreted as a standardized analytical reference scenario, while possible differences between project documents and actual on-site construction practices should be acknowledged as a limitation of the study.

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Climatic Characteristics of the Provinces

Since the reference TOKİ housing project examined in this study is going to be implemented in all provinces affected by the 2023 Kahramanmaraş-centered earthquake, the climatic characteristics of the relevant 11 provinces were examined. The relevant provinces span three of Turkey's six climate zones as defined by TS 825:2024 (Fig. 4). Some districts of these provinces may exhibit different climatic characteristics from the province's primary climate zone (Fig. 4). However, within the scope of this study, the provinces were evaluated based on their primary climate zone, and variations at the district level were disregarded.

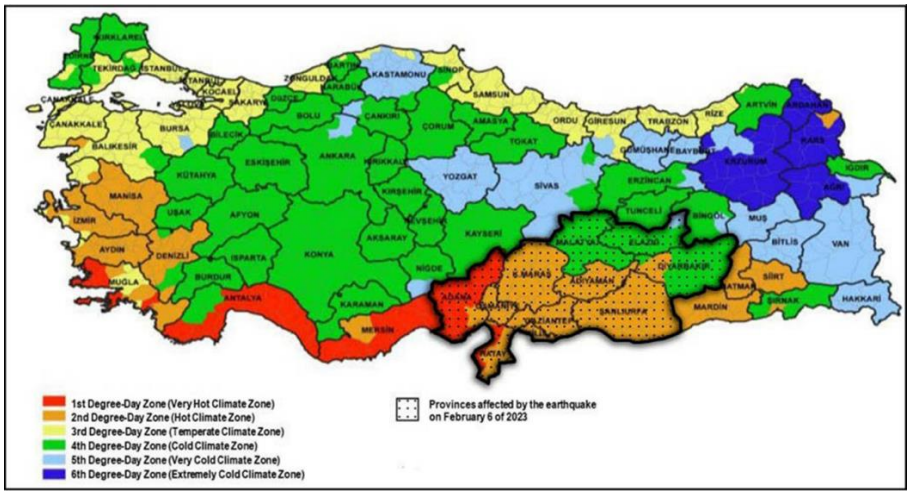


Figure 4. Location of the provinces affected by the 2023 Kahramanmaraş earthquake is shown at TS 825:2024 climate zones map of Türkiye (adapted from İZODER, 2025).

In the energy simulations, the climatic data of the provinces in the EnergyPlus Weather (EPW) format were utilized. The dataset includes monthly values of the following meteorological parameters for each province: outdoor dry-bulb air temperature (°C), outdoor dew-point temperature (°C), wind speed (m/s), wind direction (°), solar altitude angle (°), solar azimuth angle (°), atmospheric pressure (Pa), direct normal irradiance (kWh/m^2), and diffuse horizontal irradiance (kWh/m^2) (Climate One Building, 2025). Since these values vary from one province to another, it is expected that the energy performance of the reference project will likewise differ across provinces.

Modelling and Simulation Methodology

This study utilized DesignBuilder v7.3.1.003 for dynamic building energy simulations to analyze the impact of diverse climatic conditions on the energy performance of reference housing project. Built on the EnergyPlus simulation engine, this software is preferred for obtaining reliable and detailed building energy simulation data. Its simulation results show only minor differences from the actual values when evaluated by considering the building envelope properties and air conditioning system parameters of the comparative model (Liu et al., 2023). Furthermore, the software is validated by the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE)

Building Energy Simulation Test as a highly accurate diagnostic tool (Mousav, et al., 2023). Unlike other software, DesignBuilder enables a holistic assessment of multiple parameters, allowing energy-focused decisions to be integrated directly into the design process (Crawley et al., 2008).

In the DesignBuilder software, the modeling and simulation process was conducted in several stages. First, a mass model was developed by importing 2D AutoCAD drawings, including basement, ground, typical floor, and roof plans, to serve as the architectural basis. The exterior and interior walls were drawn, window and door openings were created, and the floor model was divided into zones. In the modeling process, slabs are automatically defined when the mass is created by following the exterior wall lines. Floor openings for zones such as ventilation shafts, service ducts, and stairwells were created and incorporated into the model. Fig. 5 illustrates the mass model of a typical floor.

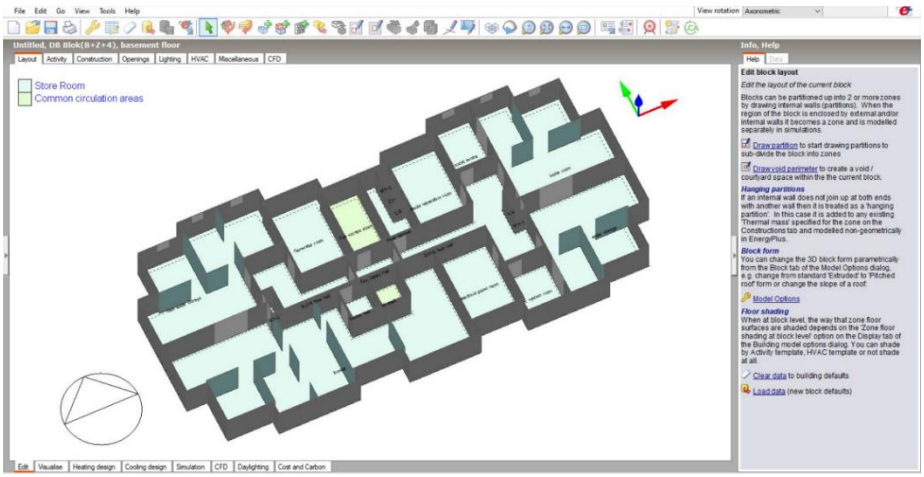


Figure 5. Typical floor mass model of the reference housing project created in DesignBuilder.

The second stage involved defining zone activity types to specify space functions. Activity definitions specify the occupancy rates of the zones and the parameters regarding the days and hours of their use. Accordingly, the activity information for each space within the building's individual units (such as living room, kitchen, bedroom, and bathroom) was defined separately by selecting the appropriate template under the 'Residential Spaces' section available in the software.

Another crucial stage is defining the layers and their materials for all wall, floor, roof, door, and window elements. For this purpose, the relevant building element for which the material is to be defined was selected; the material types, layers, thicknesses, and U-values of each element were entered into the software. The energy model, developed by creating the mass model and defining the materials and activities, is given in Fig. 6.

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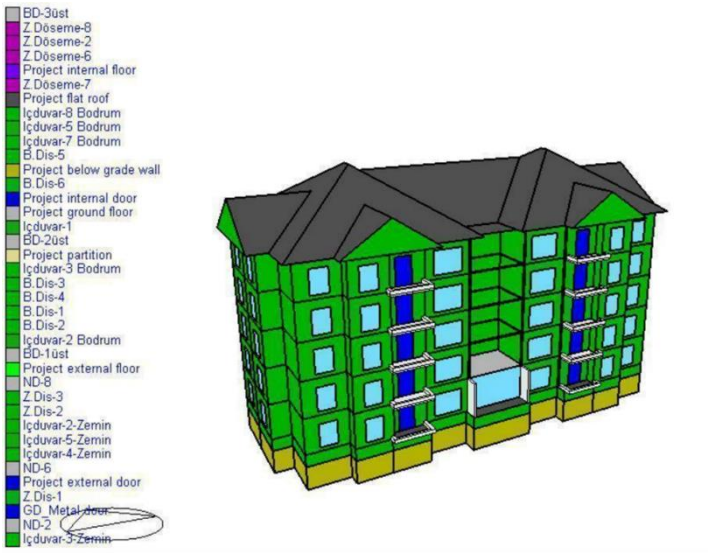


Figure 6. The building energy model obtained by the modelling and simulation process.

The HVAC system used in this study was considered as a standardized system definition to enable a comparable analysis of building energy performance. In this context, the "four-pipe fan coil system supported by an air-cooled chiller" template available in DesignBuilder was used in the model. This system was selected to allow heating and cooling loads to be analysed in a balanced and controllable manner. Although it is known that centralized cooling systems are not commonly used in TOKİ housing, the system was adopted as a fixed reference HVAC assumption to compare the energy performance of the building envelope across different climatic regions. Therefore, this HVAC-related assumption should be regarded as a modelling convention introduced to ensure comparability of the analysis results. Accordingly, the results should be interpreted as relative performance comparisons rather than absolute energy consumption values.

In the simulation model, indoor conditions were defined based on the reference values of the EnergyPlus (EP) calculator. Accordingly, the indoor and outdoor reference temperatures for heat transfer calculations were accepted as 21 °C and −18 °C, respectively. In terms of thermal comfort and system control, heating and cooling set points are defined according to specific temperature values. For the heating system, the indoor set temperature is defined as 21 °C, and 12 °C (setback temperature) during nighttime or off-peak hours. For the cooling system, the indoor set temperature is defined as 25 °C, and 28 °C when not in use. These set points were determined to represent residential use scenarios and were kept constant across all simulations to enable comparable and controlled analysis of building energy performance.

Finally, province-specific climatic data were integrated into the software. Since DesignBuilder operates using the EnergyPlus simulation engine, the climatic data must be in EnergyPlus Weather (EPW) format. The accuracy of building energy simulations is directly dependent on the extent to which the climatic data used in the model reflects actual environmental conditions. In this study, Typical Meteorological Year

(TMY) weather files in EPW format were used to represent the climatic conditions of the selected provinces. TMY datasets are standard climate files derived from multi-year observations and statistically represent long-term climatic behaviour; therefore, they are widely used in building energy simulations. These data enable simulations to be conducted by considering outdoor climatic conditions throughout the year. TMY weather files in EPW format contain numerous meteorological parameters, including hourly outdoor air temperature, relative humidity, solar radiation, wind speed and direction, and barometric pressure.

Although DesignBuilder includes a built-in climatic data library for various cities around the world, the climatic data for the provinces examined in this study were not available in the software's existing database. Therefore, the meteorological data used in this study were obtained from the Climate One Building (2025) repository, which provides EPW files for building energy simulations. In this context, for each of the 11 earthquake-affected provinces, EPW files were downloaded from the Climate One Building (2025) database and manually imported into DesignBuilder.

Using the model prepared with the method described above, energy simulations were conducted for each province based on their respective climatic data. Since the reference TOKİ project was built in 2023, the energy simulations were set to run from January 1 to December 31 of this year. As a result of these simulations, monthly heating and cooling energy consumption as well as CO_2 emission data were obtained for each province. This approach allowed the effects of local climatic conditions on building energy performance to be comparatively evaluated.

As actual energy consumption data for the examined post-disaster housing units were not available at the time of the study, a measurement- or monitoring-based calibration process could not be conducted. Some of the newly constructed housing units in the earthquake-affected provinces had only recently been occupied, while many others were still under construction or in the planning stage. Therefore, the reliability of the simulation model was addressed through simulation-based comparisons and consistency checks, as commonly applied in building energy performance studies when monitored data are unavailable. In this context, the same reference building geometry, envelope configuration, HVAC assumptions, operational schedules, and indoor temperature setpoints were kept constant across all provinces, allowing the effects of climatic variation to be isolated and compared systematically.

FINDINGS

This section presents the monthly and annual data of heating and cooling energy consumption and CO_2 emission, generated by simulating the reference TOKİ housing project across 11 earthquake-affected provinces, and their analyses according to each province's specific climate zone.

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Heating Energy Consumption

The monthly and annual heating energy consumption (kWh/gas) data of the reference TOKİ housing project for the 11 provinces are given in Table 3. The monthly consumption data is visualized as a graph in Fig. 7 to allow faster and more straightforward identification of consumption tendencies and outliers.

Table 3. Heating energy consumption (kWh/gas) by month for 11 earthquake-affected provinces.

City	Adana	Osmaniye	Hatay	Kilis	Gaziantep	Kahramanmaraş	Şanlıurfa	Adıyaman	Malatya	Diyarbakır	Elazığ
January	10279,3	17369,2	14859,6	19226,3	27996,5	24755,7	18868,4	23892,3	29266,2	25916,2	30591,5
February	8090,04	10391,6	9742,12	10382,1	25223,2	17011,5	14439	17090,1	20427	18438,4	23062,6
March	6986,9	5787	3418,8	5865,9	18713	11103	6292,6	9197,6	13048	11515	15017
April	4029,81	1219,64	653,33	1152,09	5880,99	2889,59	914,36	2246,45	3798,44	2856,75	6243,55
May	38,07	111,92	73,24	151,18	370,14	325,8	131,13	346,37	472,6	338,95	634,8
June	3,76	14,21	0,16	3,08	42,62	36,69	0,11	13,06	70,46	24,14	76,12
July	0	0,95	0	0	1,91	8,63	0	0,01	36,87	0	8,3
August	0	0	0	0,03	0	0,4	0	0,49	7,83	0,05	4,18
September	16,16	4,92	6,5	13,95	50,86	28,39	1,56	22,39	80,95	31,75	111,84
October	148,98	108,46	108,77	74,71	2772,7	215	91,78	234,14	2294,6	447,35	955,77
November	4766,3	1820,84	1957,7	3594,32	16104,51	7930,82	36,53	6926,86	9279,14	8938,82	12776,93
December	13843,42	11155,17	9849,67	11715,57	18693,53	17996,02	12175,97	17451,96	20371,95	22152,63	26239,83
Total	48202,67	47983,96	40669,85	52179,23	115849,8	82301,7	52951,42	77421,78	99154,09	90659,64	115722,2

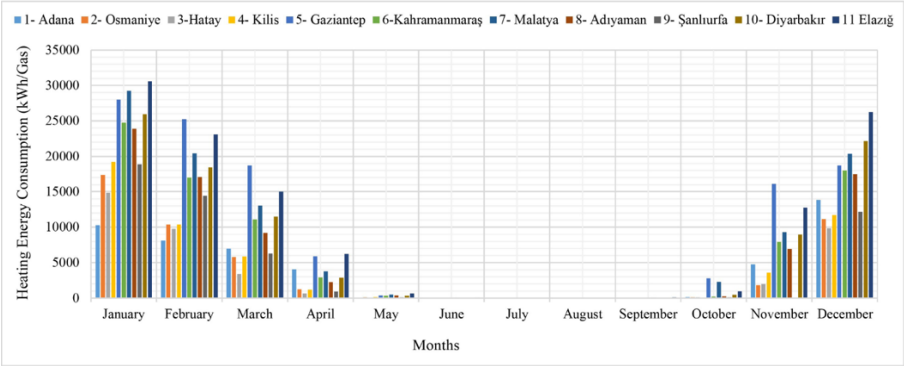


Figure 7. Heating energy consumption graph by month and 11 provinces.

On a monthly basis, the highest heating energy consumption was observed in January. In January, the highest consumption was recorded in Elazığ (4th climate zone), while the lowest consumption was observed in Adana (1st climate zone). The consumption difference between these two provinces is 197,60%. Gaziantep, Malatya, and Diyarbakır, where consumption also exceeded 25.000 kWh/gas in January, became the provinces that consumed the most heating energy after Elazığ. Supporting these high consumption values, Elazığ, Malatya, and Diyarbakır are located in the cold, 4th climate zone, and the consumption difference within this climate zone was limited to 18,4%. However, it is noteworthy that Gaziantep, located in the 2nd climate zone, consumes heating energy at a similar level to the provinces located in the cold climate zone. In January, the difference in heating energy consumption between the highest and lowest consuming provinces in the 2nd climate zone, Gaziantep and Osmaniye, reached 61,18%.

In February, the highest heating energy consumption was recorded in Gaziantep (2nd climate zone), while the lowest consumption was observed in Adana (1st climate zone), representing a 211,78% difference. The highest and lowest consumption in March, with a difference of 447.36%, were recorded in Gaziantep and Hatay, which are both in the 2nd climate zone. As of April, a significant decrease in energy consumption was observed across all provinces. The highest heating energy consumption for the month was observed in Elazığ (4th climate zone), while the lowest consumption was recorded in Hatay (2nd climate zone).

During June, July, and August, heating energy consumption across all provinces remained below 80 kWh/gas, and even dropped to zero in some provinces, representing the lowest values of the year. Therefore, the values for these months are represented in the graphs as being close to zero. In September, heating energy consumption also remained relatively low, staying below 100 kWh/gas in all provinces except Elazığ (4th climate zone). By October, heating energy consumption began to rise again, exceeding 2.000 kWh/gas in Gaziantep (2nd climate zone) and Malatya (4th climate zone). The highest and lowest heating energy consumption of this month were observed in provinces in the 2nd climate zone: Gaziantep at 2.772,70 kWh/gas and Kilis at 74,71 kWh/gas. In

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November, the highest and lowest heating energy consumption of the month were recorded in the 2nd climate zone respectively as 16.104,51 kWh/gas in Gaziantep and 36,53 kWh/gas in Şanlıurfa. In December, a significant increase in consumption values was detected across all provinces. The highest consumption was recorded in Elazığ (4th climate zone), while the lowest consumption was observed in Hatay (2nd climate zone), with a difference of 166,40%.

The annual heating energy data of the provinces were also analyzed and visualized as presented in Fig. 8 and Table 4. In Fig. 8, the climatic zones of the provinces were indicated by color codes, and provinces were presented in ascending order based on their annual heating energy consumption. The provinces were classified according to the climate zones specified in TS 825:2024, and the heating energy consumption differences among the provinces were expressed as percentages based on the province with the lowest consumption, in Table 4.

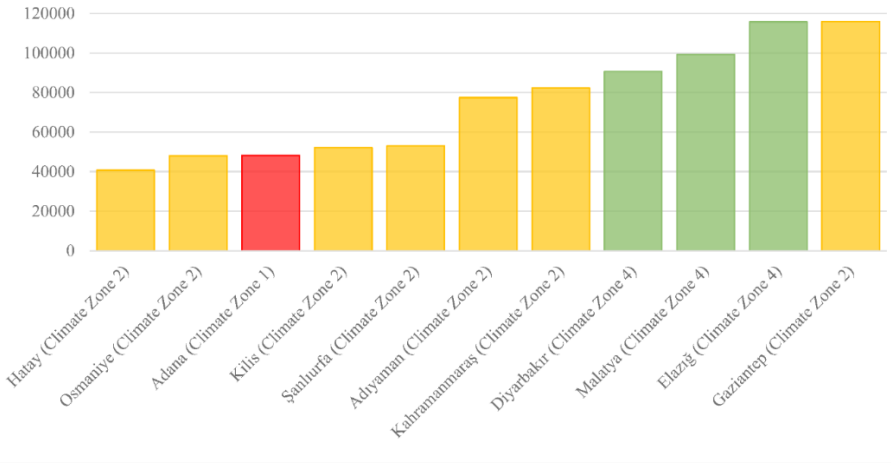


Figure 8. Annual heating energy consumption ranking of the 11 provinces

Table 4. Annual heating energy consumption comparison of the 11 provinces with percentage values.

TSE 825 Climate Zones	**Percentage Values of Heating Energy Consumption Differences of Provinces (Low → High)**	**Percentage Values of Heating Energy Consumption Differences of Provinces Within The Same Climate Zone (Low → High)**
1.Climate Zone (Very Hot)	Adana (18,5%)	Adana (N/A)
2.Climate Zone (Hot)	Hatay (base-point) → Osmaniye (17,98%) → Kilis (28,29%) → Şanlıurfa (30,19%) →Adıyaman (90,36%) → Kahramanmaraş (102,36%) → Gaziantep (184,85%)	Hatay (base-point) → Osmaniye (17,98%) → Kilis (28,29%) → Şanlıurfa (30,19%) →Adıyaman (90,36%) → Kahramanmaraş (102,36%) → Gaziantep (184,85%)
4.Climate Zone (Cold)	Diyarbakır (122,91%) →Malatya (143,80%) → Elazığ (184,74%)	Diyarbakır (base-point) → Malatya (9,37%) → Elazığ (27,64%)
Note: N/A (non-applicable)		

According to simulation data, the lowest annual consumption was observed in Hatay, which is in the 2nd climate zone. Hatay is followed by Osmaniye (2nd climate zone), and Adana (1st climate zone), with

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respectively 17,98% and 18,5% more consumption. The highest annual heating energy consumption values were observed in Gaziantep, followed by Elazığ and Malatya. It is noteworthy that Gaziantep, located in the 2nd climate zone with hot climate conditions, requires 0.11% and 16.84% more heating energy than Elazığ and Malatya, both located in the 4th climate zone with cold climate characteristics.

Significant differences were also identified when comparing the annual heating energy consumption of provinces within the same climatic zone (Table 4). Considering the 2nd climate zone (hot climate), there was a difference of 184.85% between the highest and lowest annual heating energy consuming provinces, Gaziantep and Hatay. In Kahramanmaraş, which is also in the same climate zone, consumption was predicted to be 102,36% higher than Hatay and 28,98% lower than Gaziantep. Comparing the provinces located in the 4th climate zone, Elazığ is expected to consume 16.71% more heating energy than Malatya and 27.64% more than Diyarbakır. Based on these data, it can be clearly stated that provinces within the same climatic zone do not exhibit similar heating energy consumption performance.

Cooling Energy Consumption

The monthly and annual cooling energy consumption (kWh/electricity) data for the reference TOKİ housing in the 11 provinces are presented in Table 5. To facilitate the identification of consumption trends and outliers, monthly consumption data are visualized in Figure 9.

Table 5. Cooling energy consumption (kWh/electricity) values by month for 11 earthquake-affected provinces.

City	January	February	March	April	May	June	July	August	September	October	November	December	Total
Adana	1109,03	1125,58	771,71	891,5	5914,9	10821	16894	21946,1	10554,9	4090,7	1325,29	847,07	76291,8
Osmaniye	1235,68	1151,54	1388,7	1546	3068	7559,2	13968	17290,5	11614,48	5269,1	2152,96	1319,54	67563,7
Hatay	1277,04	1309,64	1430,8	1553	3249,1	9335,5	15846	17189,7	13540,3	6019	1986,77	1246,52	73983,3
Kilis	983,23	1163,26	1233	1516	2524,5	7626,7	12779	13473	10106,0	5611,9	1883,33	1301,14	60201,1

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Table 5 (continued). Cooling energy consumption (kWh/electricity) values by month for 11 earthquake-affected provinces.

City	January	February	March	April	May	June	July	August	Septembe	October	Novembe	Decembe	Total
Gaziantep	596,62	306,71	375,04	750,8	1133,8	6290,4	11263	16197,9	8241,85	1945,5	864,04	952,1	48917,76
Kahramanmaraş	1104,77	1120,78	1184	1320	1391,5	6744	12544	13340,4	8623,03	4268,4	1486,8	1090,84	54218,52
Şanlıurfa	1183,22	1285,11	1520,1	1763	2944,1	10905	16373	16398	12510,86	6607,9	1946,63	1329,83	74766,75
Adıyaman	1029,37	1069,65	1332,8	1386	1526,2	8488,5	14755	15117,8	10421,28	5074,7	1506,9	1116,25	62824,45
Malatya	1330,75	1171,63	1577,7	1272	1215,1	5510,9	8951,7	9105,91	5927,6	2305	1480,05	1172,27	41020,6
Diyarba	1063,14	1081,58	1225,5	1325	2256	8736,6	14168	14767,2	8760,89	3640,1	1395,57	1088,67	59508,2
Elazığ	917,37	1070,49	1291,3	1036	1000,2	4754,5	9782,6	11572,9	6209,8	3398,2	1390,58	988,58	43412,5

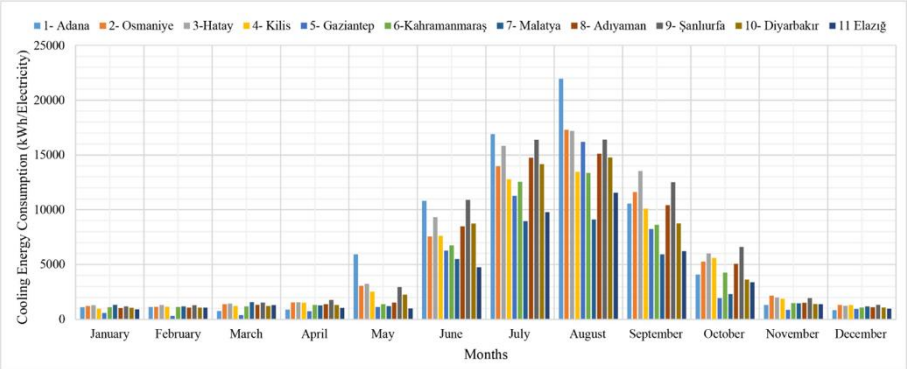


Figure 9. Cooling energy consumption graph by month and 11 provinces.

On a monthly basis, the lowest cooling energy consumption was observed in December, January, February, March, and April. In December, the highest cooling energy consumption was recorded in Şanlıurfa, (2nd climate zone), while the lowest consumption was observed in Adana (1st

climate zone), with a difference of 56,99%. In January, the highest cooling energy consumption was recorded in Malatya (4th climate zone), while the lowest consumption was observed in Gaziantep (2nd climate zone), with a difference of 123,05%. In February, the highest and lowest cooling energy consumption, differing by 327%, were recorded in Hatay and Gaziantep, both located in the 2nd climate zone. In March, the highest cooling energy consumption was recorded in Malatya (4th climate zone), while the lowest consumption was observed in Gaziantep (2nd climate zone), with a difference of 320,68%. In April, the highest and lowest cooling energy consumption, differing by 134,82%, were recorded in Şanlıurfa and Gaziantep, both located in the 2nd climate zone. As of May, the lowest cooling energy consumption exceeded 1.000 kWh/electricity in Elazığ (4th climate zone), and the highest cooling energy consumption was recorded in Adana (1st climate zone) with 5.914,9 kWh/electricity. The consumption difference reached 491,37%.

Starting in June, a considerable, gradual increase in cooling energy consumption began across all provinces and continued through July and August. In June, the highest cooling energy consumption was recorded in Şanlıurfa (2nd climate zone), while the lowest consumption was observed in Elazığ (4th climate zone), with a difference of 129,36%. In July, the highest cooling energy consumption was recorded in Adana (1st climate zone), while the lowest consumption was observed in Malatya (4th climate zone), with a difference of 88,72%.

The highest cooling energy consumption of the year was observed in August. That month, the highest consumption was recorded in Adana (1st climate zone), while the lowest consumption was observed in Malatya (4th climate zone). The consumption difference between these provinces is 141,01%. In August, consumption in Osmaniye, Hatay, Gaziantep, Şanlıurfa, and Adıyaman also exceeded 15.000 kWh/electricity, making them the provinces with the highest cooling energy use after Adana. The fact that each of these provinces is in the 2nd climate zone, while Adana is in the 1st climate zone, supports this observation.

A gradual decrease in cooling energy consumption was again observed across all provinces in September, October, and November. In September, the highest cooling energy consumption was recorded in Hatay (2nd climate zone), while the lowest consumption was observed in Malatya (4th climate zone), with a difference of 128,43%. In October, the highest and lowest cooling energy consumption, differing by 239,65%, were projected in Şanlıurfa and Gaziantep, both located in the 2nd climate zone. In November, the highest and lowest cooling energy consumption, differing by 149,17%, were determined in Osmaniye and Gaziantep, both located in the 2nd climate zone.

The annual cooling energy data of the provinces were also analyzed and visualized as presented in Fig. 10 and Table 6. In Fig. 10, the climatic zones of the provinces were indicated by color codes, and provinces were presented in ascending order based on their annual cooling energy consumption. In Table 6, the provinces were classified according to the

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climatic zones specified in TS 825:2024, and the cooling energy consumption differences among the provinces were expressed as percentages based on the province with the lowest consumption.

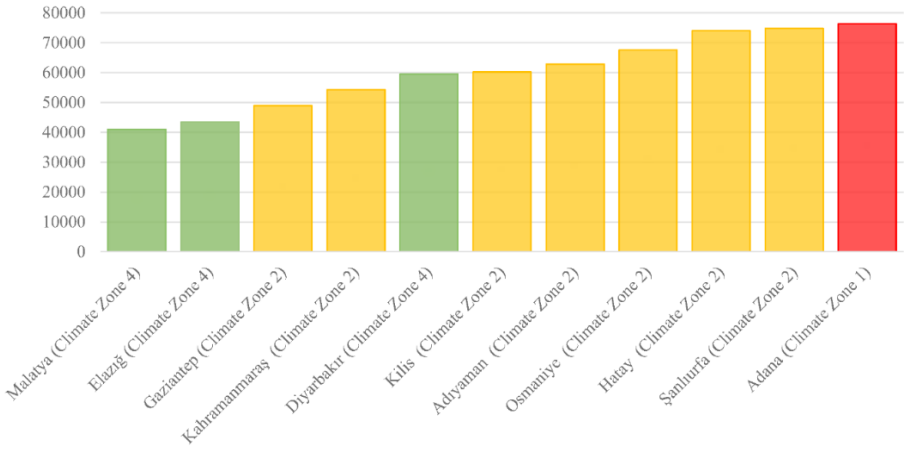


Figure 10. Annual cooling energy consumption ranking of the 11 provinces.

Table 6. Annual cooling energy consumption comparison of the 11 provinces with percentage values.

TSE 825 Climate Zones	**Percentage Values of Cooling Energy Consumption Differences of Provinces (Low → High)**	**Percentage Values of Cooling Energy Consumption Differences of Provinces within the Same Climate Zone (Low → High)**
1.Climate Zone (Very Hot)	Adana (85,98%)	Adana (N/A)
2. Climate Zone (Hot)	Gaziantep (19,25%) → Kahramanmaraş (32,17%) → Kilis (46,76%) → Adıyaman (53,15%) → Osmaniye (64,71%) → Hatay (80,36%) → Şanlıurfa (82,27%)	Gaziantep (base-point) → Kahramanmaraş (10,84%) → Kilis (23,07%) → Adıyaman (28,43%) → Osmaniye (38,12%) → Hatay (51,24%) → Şanlıurfa (52,84%)
4. Climate Zone (Cold)	Malatya (base-point) → Elazığ (5,83%) → Diyarbakır (45,07%)	Malatya (base-point) → Elazığ (5,83%) → Diyarbakır (45,07%)
Note: N/A (non- applicable)		

According to the simulation data, the lowest annual consumption was recorded in Malatya, located in the 4th climate zone. Malatya is followed by Elazığ and Gaziantep, located in the 4th and 2nd climate zones, with 5,83% and 19,25% higher consumption, respectively. Remarkably, Diyarbakır located in the 4th climate zone, has higher cooling energy consumption than Gaziantep and Kahramanmaraş, located in the 2nd climate zone. It is observed that Diyarbakır exhibits 45,07% and 37,08% higher cooling energy consumption compared to Malatya and Elazığ, located in the same 4th climate zone, and 21,65% and 9,76% higher consumption compared to Gaziantep and Kahramanmaraş, located in the 2nd climate zone.

In terms of annual cooling energy consumption, Adana recorded the highest value, which is consistent with its classification in the 1st Climate Zone (very hot). Following Adana, the highest consumption was

recorded in Şanlıurfa and Hatay, both located in the 2nd climate zone. Cooling energy demand among these three provinces is relatively uniform, with Adana requiring 2.04% more energy than Şanlıurfa and 3.12% more than Hatay. In contrast, an 85.98% difference was observed between Adana, the highest consumer, and Malatya, the lowest.

Significant differences were also identified when comparing provinces within the same climate zones (Table 6). Considering the 2nd climate zone, there is a 52,84% difference in annual cooling energy consumption between the province with the highest consumption, Şanlıurfa, and the lowest, Gaziantep. Considering the 4th climate zone, there is a 45,07% difference between the highest consumer, Diyarbakır, and the lowest, Malatya. The analysis demonstrates that provinces within the same climate zone can exhibit notable differences in cooling energy demand; while these variations are smaller than those observed for heating energy, they remain statistically significant.

CO_2 Emission Performance

Designbuilder calculates CO_2 emission values based on the energy demands of heating, cooling, lighting, and ventilation systems, user-sourced equipment and device energy consumption, the energy required for domestic hot water production, and the energy demands of auxiliary mechanical systems such as fans and pumps. The CO_2 emission data obtained from the simulations are presented in Table 7 by showing both monthly and annual total emissions for each province. To facilitate a more immediate identification of monthly emission patterns and outliers, these data are also visualized graphically in Figure 11.

Table 7. CO2 emission (kg) values by month for 11 earthquake-affected provinces.

City	January	February	March	April	May	June	July	August	September	October	November	December	Total
Adana	5683,93	4967,92	4798,43	4219,3	6473,96	9313,79	13167,65	16183,96	9331,11	5576,52	4646,05	6252,83	90615.45
Osmaniye	7097,58	5422,34	4924,14	4028,15	4676,62	7280,28	11335,26	13292,73	9930,8	6286,45	4599,94	6031,05	84905.34
Hatay	6648,67	5393,15	4503,49	3924,59	4780,81	8355,53	12471,64	13230,28	11096,7	6740,24	4522,78	5739,11	87407.01
Kilis	7291,54	5425,28	4843,69	4004,76	4363,87	7324,28	10618,74	10985,15	9021	6488,14	4768,62	6123,6	81258.67

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Table 7 (continued). CO2 emission (kg) values by month for 11 earthquake-affected provinces.

City	January	February	March	April	May	June	July	August	September	October	November	December	Total
Gaziantep	8701,66	7709,36	6747,47	4488,99	3626,8	6577,1	9757,74	12714,83	7954,57	4768,15	6491,81	7213,85	86752.33
Kahramanmaraş	8395,21	6635,49	5797,56	4212,92	3705,04	6792,81	10476,83	10901,83	8125,82	5700,26	5343,44	7176,6	83263.81
Şanlıurfa	7343,05	6258,62	5099,41	4137,93	4618,25	9314,75	12801,84	12737,28	10481,5	7095,06	4817,87	6226,26	90931.86
Adıyaman	8196,79	6628,52	5530,03	4142,31	3758,68	7850,75	11819,45	11954,84	9193,55	6189,5	5165,97	7089,18	87519.57
Malatya	9374,08	7305,59	6374,64	4366,58	3591,82	6019,19	8271,96	8312,34	6507,21	4899,96	5590,36	7669,29	78283.02
Diyarbakır	8597,18	6889,02	5892,76	4211,99	4207,03	7970,64	11434,8	11755,36	8195,31	5364,89	5476,42	7955,76	87951.16
Elazığ	9374,68	7740,27	6584,83	4702,91	3538,32	5564,1	8773,39	9815,29	6663,09	5309,83	6194,85	8662,68	82924.24

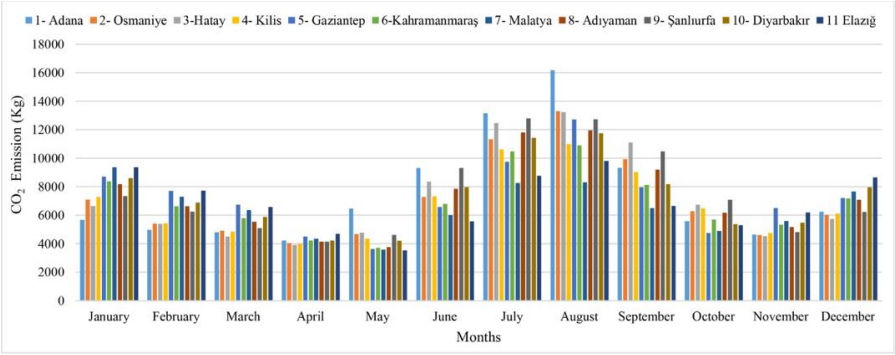


Figure 11. CO2 emission graph by month and 11 provinces.

Analysis of the monthly total CO_2 emissions of the 11 provinces reveals a gradual increase across all provinces during the summer months, rising from 82.363 kg in June to 120.929 kg in July and reaching 131.884 kg in

August, the highest emission level of the year. In June, the highest emissions were recorded in Şanlıurfa (2nd climate zone), while the lowest occured in Elazığ (4th climate zone), representing a difference of 67,41%. In July, Adana (1st climate zone) yielded the highest emissions and Malatya (4th climate zone) the lowest, with a 59.18% variance.

The peak monthly CO_2 emission for a single province was recorded in August within Adana (1st climate zone). In contrast, the lowest emission during the same month was observed in Malatya (4th climate zone). The 94,7% difference in CO_2 emissions between these two provinces is remarkable.

By September, the total CO_2 emissions across all provinces decreased to 96.501 kg, beginning a gradual decline that continued until November. In September, the highest CO_2 emission was recorded in Hatay (2nd climate zone), and the lowest was observed in Malatya (4th climate zone), with a difference of 70,53%. In October, the highest and lowest CO_2 emissions were recorded in Şanlıurfa and Gaziantep, respectively, both located in the 2nd climate zone, with a 48,80% difference. Similarly, in November, Gaziantep and Hatay (both in 2nd Climate Zone) recorded the highest and lowest values, with a 43,54% variance.

In December, the total CO_2 emissions trended upward again due to increased heating energy consumption. Total emissions, which stood at 76.140 kg in December, rose to 86.704 kg in January before dropping to 70.375 kg in February. Throughout the winter months (December–February), the highest emissions were consistently recorded in Elazığ (4th Climate Zone). The variance between these extremes ranged from 50.94% to 64.93%. In March, Gaziantep and Hatay (both in 2nd Climate Zone) again showed the greatest disparity at 49,83%.

The lowest total CO_2 emission was observed in April (46.440,4 kg), marking the transitional spring period when demand for both heating and cooling is minimized. During this month, Elazığ (4th climate Zone) and Hatay (2nd climate Zone) showed the highest and lowest emissions, respectively, with a narrow difference of only 19.83%. Notably, the single lowest monthly emission for any province was recorded in May in Elazığ (4th climate zone). In this province, moderate climatic conditions minimize mechanical system requirements. Conversely, the highest emissions in May occurred in Adana (1st climate Zone), driven by peak cooling energy consumption, resulting in a 82,97% gap between the two provinces.

Annual CO_2 emission data are visualized as shown in Fig. 12 and analyzed in Table 8. Figure 12 presents the 11 provinces in ascending order of annual emissions, using color codes to denote climate zones. In Table 8, the provinces were classified according to TS825:2024 climate zones, and the differences in CO_2 emissions among the provinces were expressed as percentages relative to the province with the lowest emissions.

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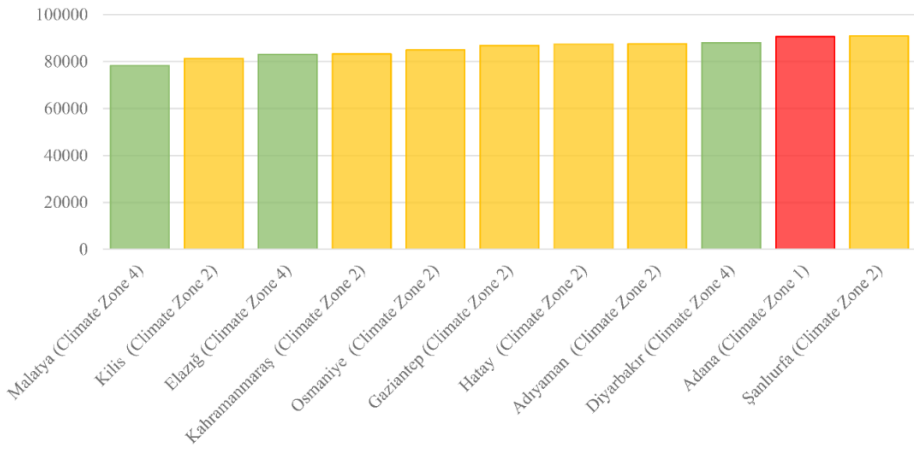


Figure 12. Annual CO2 emission ranking of the 11 provinces.

Table 8. Annual CO2 emission comparison of the 11 provinces with percentage values.

TSE825 Climate Zones	Percentage Values of CO_2 Emission Differences of Provinces (Low → High)	Percentage Values of CO_2 Emission Differences of Provinces within the Same Climate Zone (Low → High)
1.Climate Zone (Very Hot)	Adana (15,75%)	Adana (N/A)
2.Climate Zone (Hot)	Kilis (3,80%) → Kahramanmaraş (6,36%) → Osmaniye (8,46%) → Gaziantep (10,82%) → Hatay (11,66%) → Adıyaman (11,80%) → Şanlıurfa (16,16%)	Kilis (base-point) → Kahramanmaraş (2,47%) → Osmaniye (4,49%) → Gaziantep (6,76%) → Hatay (7,57%) → Adıyaman (7,70%) → Şanlıurfa (11,90%)
4.Climate Zone (Cold)	Malatya (base-point) → Elazığ (5,93%) → Diyarbakır (12,35%)	Malatya (base-point) → Elazığ (5,93%) → Diyarbakır (12,35%)
Note: N/A (non- applicable)		

According to the simulations, the lowest annual CO_2 emission was recorded in Malatya (4th climate zone), which also recorded the lowest annual cooling energy consumption. The highest annual CO_2 emissions were recorded in Şanlıurfa (2nd climate zone) and Adana (1st climate zone), respectively. A negligible difference of 0,35% exists between the emission values of these two provinces. The difference between the provinces with the highest and lowest annual CO_2 emissions remained at 16,16%. Within the 2nd climate zone, the lowest CO_2 emissions were recorded in Kilis and the highest in Şanlıurfa, with a difference of 11.90%. Among the provinces located in the 4th climate zone, the lowest CO_2 emissions were recorded in Malatya and the highest in Diyarbakır, with a 12.35% disparity. The analysis demonstrates that while variations in annual CO_2 emissions are relatively limited, provinces within the same climate zone can still exhibit slight differences.

DISCUSSION

The monthly heating energy consumption data revealed that the projected results for the provinces did not fully align with the conditions within their respective climate zones. Monthly consumption expectations

indicate that the lowest consumption should occur in Adana, which is located in the 1st degree-day zone characterized by very hot climatic conditions. However, the lowest values were recorded in Adana only in January, February, May, July, and August. Meanwhile, the highest heating energy consumption is expected to be recorded in Elazığ, Malatya, or Diyarbakır, the provinces located in the 4th degree-day zone, which is characterized by cold climatic conditions. Accordingly, the highest monthly heating energy consumption was recorded in Elazığ during January, April, May, June, September, and December, while in July and August, it was measured in Malatya. However, Gaziantep, located in the 2nd degree-day zone with hot climatic characteristics, unexpectedly required more heating energy than all other provinces during February, March, October, and November, when colder weather typically prevailed. It is also remarkable that in March, October, and November, both the highest and lowest consumption occurred in provinces within the 2nd degree-day zone (hot climate) with substantial differences, clearly demonstrating the significant variability in heating energy consumption that can exist among provinces within the same climate zone.

When evaluating annual data in terms of heating energy consumption, it was also observed that the provinces did not reflect the projected outcomes within the context of their climate zones. While the lowest annual consumption was expected in Adana, located in the 1st climate zone with very hot climatic characteristics, it actually occurred in Hatay, located in the 2nd (hot) climate zone. Although the highest annual consumption was expected in one of the provinces located in the 4th climate zone with cold climatic characteristics, it was actually observed in Gaziantep, located in the 2nd (hot) climate zone. The fact that the highest and lowest annual heating energy consumption occurred in provinces within the 2nd climate zone, with a very significant difference of 184,85% provides a clear indication of how much heating energy consumption can vary among provinces within the same climate zone.

It is also important to note that Hatay and Osmaniye, two provinces with the lowest annual heating energy consumption, were classified within the 1st climate zone with very hot climatic characteristics, along with Adana, prior to the October 2024 revision of TS 825. In terms of heating energy consumption, it can be stated that the previous climate classification provided more consistent results for these provinces. One of the other climate zone changes introduced by the 2024 revision of TS 825 was the reclassification of Diyarbakır from the 2nd climate zone, characterized by temperate climate conditions, to the 4th climate zone, characterized by cold climate conditions. Similarly, Elazığ and Malatya were reclassified from the 3rd climate zone, characterized by cold-dry climate conditions, to the 4th climate zone, characterized by cold climate conditions. Diyarbakır, Malatya, and Elazığ exhibited performance consistent with their newly assigned climate zones. However, this irregularity in Gaziantep, the province that consumes the most heating energy despite

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having the characteristics of a hot climate zone, could not be explained by the TS 825 revision, as it was classified in the 2nd climate zone in both.

When monthly data were evaluated in terms of cooling energy consumption, it was determined that the provinces partially showed the predicted consumption trend in the context of climate zones. The lowest cooling energy consumption is expected to be recorded in Elazığ, Malatya, or Diyarbakır, all of which are located in the 4th climate zone with cold climate characteristics. Accordingly, the lowest cooling energy consumption occurred in Elazığ during May and June; in Malatya during July, August, and September. Although in small amounts, cooling energy consumption was also recorded during the shoulder and winter months. This low level of cooling energy consumption observed during the cool or cold months results from the combined effect of internal and external heat gains. In particular, high solar gains and constant internal loads, including lighting, occupants, and equipment, may cause indoor temperatures to exceed the comfort range during certain hours of the day. In January, February, March, April, October, and November, the lowest cooling energy consumption was recorded in Gaziantep, located in the 2nd degree-day zone with hot climatic characteristics; and in December, it was observed in Adana, located in the 1st climate zone with very hot climatic characteristics.

In terms of the highest monthly cooling energy consumption, it is expected to occur in Adana, located in the 1st climate zone, characterized by very hot climatic conditions. This expectation was met only in May, July, and August, when consumption generally increased. In April, June, October, and December, the highest cooling energy consumption was recorded in Şanlıurfa, located in the 2nd climate zone with hot climatic characteristics; in January and March, it was observed in Malatya, located in the 4th climate zone characterized by cold climatic conditions. The highest cooling energy consumption was recorded in Osmaniye in November and in Hatay in February and September. The climate zones of these two provinces have changed from the 1st climate zone, which shows hot-humid climate characteristics, to the 2nd climate zone with the 2024 revision of TS 825. In this context, it can be understood that both cities behave similarly to the characteristics of a very hot climate zone. Another noteworthy finding is that in February, April, October, and November, both the highest and lowest consumptions occurred in provinces located within the 2nd climate zone, with substantial differences between them.

When evaluating annual data in terms of cooling energy consumption, it was observed that the provinces largely reflected the projected outcomes within the context of climate zones. The highest annual consumption was recorded in Adana, located in the 1st degree-day zone with very hot climatic characteristics, while the lowest annual consumption was observed in Malatya, located in the 4th degree-day zone with cold climatic characteristics, showing a significant difference of 85,98%. The only anomaly observed is that Diyarbakır, located in the 4th

climate zone with cold climatic characteristics, consumed more cooling energy than Gaziantep and Kahramanmaraş, which are located in the 2nd climate zone with hot climatic characteristics. It should also be noted that prior to the 2024 revision of TS 825, Diyarbakır was located in the 2nd climate zone with hot climatic characteristics. When heating and cooling energy consumption are evaluated together, it is observed that Diyarbakır's performance was closer to the provinces in the 2nd climate zone. In terms of annual cooling energy consumption, a maximum difference of 52.84% was detected among the provinces located in the 2nd climate zone, and a maximum difference of 45.07% was found among the provinces located in the 4th climate zone. Although this difference is not as remarkable as the heating energy consumption, it represents a significant value worth noting.

The energy consumption of heating and cooling systems constitutes a significant component of total carbon emissions. Heating energy is supplied through fossil fuels such as natural gas, coal, and fuel oil, or by electricity. Cooling systems generally operate by electricity. The combustion of fossil fuels directly releases large amounts of CO_2, whereas electricity consumption causes indirect CO_2 emissions depending on the source of electricity generation. In this regard, the magnitude of emissions is directly related to the share of fossil fuels in electricity generation supplied to the grid.

Analysis of monthly CO_2 emission values showed a seasonal cycle, increasing in summer and winter, and decreasing in autumn and spring. The main peak was in August when cooling energy consumption was at its highest, and the other peak was in January when heating energy consumption was at its highest. The highest heating energy consumption in January was recorded at 30.591,5 kWh/gas, while the highest cooling energy consumption in August was 21.946,1 kWh/electricity. Even the heating energy consumption was 39,39% higher than the cooling energy consumption; the CO_2 emission was 72,63% higher in August than in January. This indicates that the electricity consumption for cooling has a greater impact on CO_2 emissions than gas consumption for heating. In August, September, and October, the provinces with the highest and lowest CO_2 emissions were the same with the highest and lowest cooling energy consumption. In December, January, and March, the provinces with the highest and lowest CO_2 emissions were the same with the highest and lowest heating energy consumption. In March, October, and November, the highest and lowest CO_2 emissions were recorded in the provinces located in the 2nd climate zone, with a difference between 49,83-43,54%. In conclusion, the monthly simulations revealed that CO_2 emissions vary widely between and within climate zones seasonally. However, annual CO_2 emission values demonstrated a different pattern. The difference between the highest and lowest annual CO_2 emissions in provinces located in different climate zones was limited to 16.16%. The difference between the lowest and highest CO_2 emissions remained at 11,90% among the provinces in the 2nd climate zone and at 12,35%

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among the provinces in the 4th climate zone. Considering the significant differences in annual heating and cooling energy consumption among the provinces, it could be stated that the variation in annual CO_2 emissions was relatively limited.

CONCLUSION

The 2023 Kahramanmaraş-centered earthquakes in Türkiye necessitated expedited reconstruction efforts, primarily within the housing sector. Constructing new buildings based on energy efficiency principles in these disaster-affected areas offers a critical opportunity to mitigate contemporary energy and environmental challenges. As the lead institution in post-disaster housing, TOKİ plays a pivotal role in this process; however, its reliance on standardized mass housing projects frequently overlooks site-specific environmental data and energy-efficient design strategies.

While existing literature examines the energy consumption of TOKİ's standardized housing using various reference provinces, there is a notable absence of comparative studies investigating the influence of microclimatic conditions on energy performance among provinces within the same climatic zone. Furthermore, the October 2024 revision of TS 825, which increased the number of climate zones from four to six and integrated both heating and cooling requirements, significantly reclassified most provinces. This regulatory shift raises critical questions regarding whether design adjustments based solely on assigned climate zones are sufficient for optimizing energy performance, or to what extent a given province's microclimatic data influences overall building performance.

To address this knowledge gap, this study conducted a comparative analysis to determine how the heating and cooling energy consumption, as well as CO_2 emissions, of a standardized TOKİ project varied across 11 provinces situated within three climate zones under the revised TS 825 classification. A constructed TOKİ block from the Yeşilyurt district of Malatya was selected as the reference building, characterized by a rectangular shape, a symmetrical floor plan, a fixed façade orientation, defined window-to-wall ratios, and a representative building envelope system consisting of reinforced concrete shear walls, vertically perforated brick walls, and PVC-framed double-glazed windows. It was modeled in detail using DesignBuilder to obtain monthly and annual data. The findings revealed substantial performance disparities: annual heating energy consumption varied by up to 184.85% within the same climate zone. For cooling energy, differences reached 85.98% across zones and 52.84% within the same zone. In contrast, annual CO_2 emissions showed less volatility, with a maximum variance of 16.16% across different zones and 12.35% within the same zone.

This research was conducted within the framework of a hypothetical model developed based on typical details belonging to a specific project group to comparatively reveal the effect of different climatic conditions

on building energy performance. In this context, rather than serving as an exact representation of real-world applications, the study aims to provide an analytical approach and prediction by isolating and evaluating the effects of design parameters. This approach may not fully reflect the design and construction variations that may arise in actual applications, depending on local conditions. Therefore, the findings should be interpreted within the scope of a specific reference design scenario.

A primary limitation of this study is the absence of field-based energy consumption data for the examined post-disaster housing units. Since many of these housing projects are newly occupied, under construction, or still in the planning stage, actual operational data could not be collected during the study period. Consequently, the simulation model could not be calibrated or validated using measured energy consumption data. Therefore, the results should be interpreted as comparative simulation-based performance assessments rather than direct representations of actual operational energy use. Once field-based monitoring data become available, the model should be recalibrated, and the simulation results should be reassessed to improve the accuracy and robustness of the findings.

Overall, these results confirm that implementing standardized projects in different climate zones leads to significant discrepancies in energy consumption. Crucially, this study demonstrates that even within the same climate zone, microclimatic variations exert a profound influence on heating and cooling demands. Furthermore, it was observed that the revised TS 825 classification does not consistently predict energy outcomes for certain provinces, such as Gaziantep.

While rapid solutions are essential in post-disaster construction, these findings reveal that standardized designs, developed without consideration of local climate conditions, present significant disadvantages regarding energy efficiency and environmental impact. Integrating microclimatic data into the design process is vital for optimizing energy consumption, resource management, and economic efficiency. Most significantly, the findings suggest that tailoring the thermal and physical properties of façade materials is a highly effective strategy for enhancing building performance. Therefore, the development of computational models that analyze site-specific environmental datasets to generate optimized façade configurations is essential to mitigate the environmental footprint of rapid reconstruction while ensuring climate-responsive outcomes.

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Resume

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An Examination of The Use of Courtyard in Traditional Turkish Houses from The Perspective of Yarenlik and ICH: The Case of Kula

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Gizem Özer Baş **

Abstract

This study examines the courtyard space, a significant architectural element in traditional Kula houses, and analyzes the spatial requirements of the traditional Yarenlik ritual in relation to this space. Courtyard-based residential architecture in Anatolia is comprehensively analyzed with respect to climate, privacy, and typology. Additionally, the socio-spatial role of the courtyard is considered within the framework of the Yaren phenomenon and intangible cultural heritage (ICH). The spatial concept is grounded in Henri Lefebvre's definition, which characterizes space as a cyclical phenomenon produced by social life and generating social relations. Accordingly, the courtyard is interpreted not only as a product of climatic and formal considerations but also as a space shaped by social interaction. To substantiate the conceptual framework, a spatial analysis was conducted on three traditional courtyard houses from the 18th century in Kula, which exemplify courtyard-based ground floor plans. This spatial analysis examined the architectural reading, spatial usage ratios, mapping related to action-space-ritual, identification of communal seating areas, spatial identification of the spaces used by the Yaren during their activities (performance, food service, show, service), mobile or seated uses, group seating, central performance, hierarchical positioning, and the documented services of Yaren gatherings. The findings indicate that there is both spatial and action-related compatibility between the courtyard typology and ritual actions. Yarenlik is still being kept alive and sustained today, even outside of courtyard houses that are no longer in use. This research, which seeks to reveal the reciprocal relationship between built form and intangible values, contributes to the assertion that traditional courtyard houses are not only tangible architectural works but also the primary requirement for the realisation of social intangible cultural heritage values.

Keywords: *Yaren, Traditional Turkish house, Atrium, Kula, Architectural heritage*

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INTRODUCTION

Traditional courtyard-style Turkish houses have long been examined in the literature on architectural history and housing studies in the context of climatic factors, typological formations, and spatial organisation. In the context of Anatolia, extensive and multi-layered analyses have examined the formal characteristics of this housing typology, its spatial hierarchy, and its strategies for adapting to environmental conditions. Nevertheless, the role of courtyard morphology as both a physical organisational element and a spatial infrastructure that facilitates the production, continuity, and transmission of intangible cultural heritage has received limited theoretical attention in the literature and remains insufficiently addressed in academic studies. This gap necessitates a reassessment of the courtyard within the framework of the relational dynamics between spatial organisation and cultural practices.

According to UNESCO's 2003 Convention for the Safeguarding of the Intangible Cultural Heritage, intangible cultural heritage (ICH) comprises practices, representations, expressions, knowledge, skills, and associated cultural domains transmitted from one generation to the next (Unesco, 2003). Such cultural practices shape spatial relationships and derive meaning as they emerge within architectural structures. However, architectural research often treats the built environment and cultural practices as parallel domains, rather than as interdependent systems that co-produce and transform one another. This perspective limits discussion of the complex interplay between spatial form and social practices.

Kula, a historic settlement in Western Anatolia, offers a dynamic context for exploring this relationship. The region features a vibrant range of intangible cultural heritage, such as courtyard house architecture, music, cuisine, folk performances, and the Yarenlik tradition. Rooted in domestic settings, Yarenlik consists of communal seating, musical performances, hierarchical arrangements, food preparation, and ritualized social interactions.

Despite this spatial proximity, the relationship between courtyard typology and Yarenlik has not been systematically analysed. This study argues that the courtyard morphology of traditional Kula houses functions as a socio-spatial infrastructure that enables and structures the continuity of Yarenlik as an intangible cultural practice. Rather than treating courtyard houses solely as architectural works, the research interprets them as activity environments that facilitate ritual gatherings and collective embodiment. In other words, the space provides a suitable environment for activities and sets certain boundaries.

Furthermore, the relocation of Yaren gatherings to spaces designed for multiple rituals, such as wedding halls, is a consequence of the abandonment of courtyard houses. The disuse of traditional courtyard structures and the emergence of new houses with different techniques, materials, and forms significantly contribute to the loss of intangible

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cultural heritage. The failure to establish a relationship between space and intangible heritage is a major factor in the decline of the yaren tradition today. Lifestyles have changed, and consequently, spatial forms have changed, producing new spatial-social life frameworks.

Accordingly, this study addresses the following research question:

How did the courtyard typology of traditional Kula houses spatially enable and structure the tradition of yarenlik, and what does the displacement of this tradition today reveal about the relationship between built form and intangible heritage?

Through a qualitative comparative analysis of representative plan typologies and documented ritual requirements, this research contributes to discussions on the spatial impact of architecture in the continuation of cultural practices.

THE SPATIAL PRODUCTION OF RITUAL PRACTICES

Architecture is not merely the result of the regular movements of social life; rather, social life, interaction, and all activities are constantly and actively shaping each other in a reciprocal manner. Henri Lefebvre's concept of socially produced space provides a critical framework for understanding this reciprocal relationship. *In his work The Production of Space*, Lefebvre argues that space is both a product of social relations and a tool for reproducing these relations (Lefebvre, 2014). According to Lefebvre, the mode of production of social space indirectly and continuously influences the outcome, cause, and justification (Lefebvre, 2014, 25). Therefore, the relationship between space and people is cyclical. Furthermore, Lefebvre states that in order to discover a society's spatial practice, space must be deconstructed (Lefebvre, 2014, 67). Consequently, analysing the courtyard-Yarenlik relationship practice will also enable us to understand society through the tradition of social space. Thus, space is neither neutral nor passive; it is structured by practice and, in turn, structures practice.

When we adapt this perspective to local traditional architecture, the courtyard emerges not only because of climate and geography but also as a result of social life. Spatial parameters such as enclosure, adjacency, thresholds, and degrees of privacy reveal the results of how social life comes together, circulates, and moves.

Intangible cultural practices, especially ritualised gatherings, require specific spatial requirements. These include collective visibility, acoustic containment, circulation continuity, and accessibility. These conditions do not arise by chance; they are shaped by the cyclical structure of the architectural order, which is reconfigured according to feedback and needs. Consequently, ritual practices and their structure cannot be fully understood without examining the historical spatial infrastructures that support them.

Ritual theory further strengthens this link between spatial structure and abstract cultural heritage practice. Catherine Bell emphasises that ritualisation structures bodies within space, producing arrangements

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and relational hierarchies through spatial positioning (Bell, 1992). While the impact of ritual and space is easier to understand when examined from a religious perspective, it can be more difficult to find traces of the ritual approach brought about by social life. However, space provides the most important source for interpreting ritual.

Within this theoretical framework, the courtyard of traditional Kula houses can be understood as a socially produced space shaped and structured by social practices such as Yarenlik. This study approaches architecture and ritual not as separate analytical categories, but as systems that condition each other reciprocally. The courtyard becomes a spatial area where social interaction is organised, authority is expressed, and collective identity is reinforced.

LITERATURE REVIEW

The Regarding the literature, it was deemed appropriate to describe the concept of Yarenlik as a value of Intangible cultural heritage (ICH) in the Kula region before discussing the basic courtyard and ICH. Intangible cultural heritage can be explained, from one perspective, as the formation of culture specific to people in different regions (Tezcan, 1990, 337). One of these intangible cultural values that emerged in the district of Kula with the values brought by history is Yarenlik. Yarenlik is known as the plural of the Persian word yar. Yar means friend, beloved, acquaintance (Oğuz, 2013, 7). Yaren conversations are friendships, that is, pleasant gatherings between friends. Yarenlik and Yaren conversations play important roles in the social fabric of the Kula district and are evidence of a deep-rooted tradition (Tezcan, 1990, 337). The purpose of Yarenlik is to instil good behaviour in its members. This includes teaching appropriate sitting and standing rules when communicating with elders and children, norms for communal eating, communal singing, resilience training, and facilitating competitive activities. Furthermore, these organisations emphasise the expression of thoughts and feelings and the development of personal and environmental hygiene by offering lessons on communication. They encourage abstinence from harmful habits such as smoking and excessive alcohol consumption and instil values of respect and calmness within the community.

In the Kula system, a Yaren leader known as the Yarenbaşı is responsible. This person is also called the Yiğitbaşı or Kızanbaşı. While every individual in the Yaren is called a Kızan, those participating in the games are called Efe. The Yarenbaşı is responsible for the behaviour of the team. In the event of a complaint, it is reported to the Yarenbaşı, who imposes an appropriate punishment. The existence of similar organisations in many regions of Anatolia, such as the Çankırı Yaran Organisation, the Safranbolu Seymen Organisation, the Kula Yaren Organisation, and the Simav Yaren Organisation, is noteworthy. These organisations are based on the Ahi organisations. Historically, Kula weddings last three days, and the Yaren organisation is involved throughout the event. The organisation provides kitchen equipment and

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firewood, prepares food, cooks keşkek, washes the dishes, and distributes tea and coffee. Another task of the organisation is to arrange entertainment and ensure that the event is enjoyable for everyone. The entertainment begins on Sunday when the Yaren visit the bride's house. They gather around a barbecue in the large room called "hayat" in the bride's house and start the Fasıl. This is accompanied by a percussion instrument called darbuka and a traditional Turkish entertainment genre called Fasıl. Before 1965, additional activities such as steamboat rides and İlikmen games were also part of the repertoire (Arslan, 2010, 70-79).

Yarenlik plays an important role in the region, particularly in the context of wedding traditions. Wedding hosts usually make a contract with Yaren in advance for their participation. According to sources, in the past, the responsibility of providing food, coffee, water, and related services to wedding guests usually fell to the Yaren girl. The Yaren's pounding of the traditional Central Asian dish keşkek, accompanied by joyful games and songs played on instruments such as drums and zurnas, was a source of entertainment and excitement. The wedding hosts give gifts such as clothing and money to the Yaren as a token of appreciation (Arslan, 2010, 77). Today, the role of the Yaren is largely limited to music, entertainment, and games.

It is important to recognise that every social structure forms a complex system in which the relationships and functions of the social institutions that constitute that structure interact with people and the social values that emerge from these interactions. When evaluating the origins of this social institution, collectively referred to as Yaren, it is necessary to consider the social needs of society and the conditions in which it existed during different periods. The fundamental characteristics and functions of Yaren organisations demonstrate this. From this perspective, the Yaren institution, which emerged under various names, can be seen as a civil social system shaped by the tasks and functions undertaken by Central Asian traditions in different contexts, within the framework of new knowledge and institutionalisations that emerged with Islam. The Yaren system has undergone a process of transformation, resulting in the loss of some functions and the acquisition of new ones. This evolution is concurrent with changes in the social structure. Consequently, Yarenlik has also undergone changes in its social orientation and formation over time.

The activities of the Yaren organisation are concentrated around the living areas and courtyards, which constitute the main areas of activity within the residence. In the context of weddings, circumcision ceremonies and similar events, the Yaren organisation carries out its duties in designated gathering areas within the houses. Consequently, it can be said that there is an intrinsic connection between the tangible cultural heritage value of Kula courtyard houses and the Yarenlik tradition. Courtyards, which are generally associated with the introversion and privacy of houses, are also the points where the dwelling integrates with the city.

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The etymological origin of the word courtyard derives from the Greek word “aule”, meaning enclosed open space, and refers to the area surrounded by walls or fences around a house, or the enclosed space in the middle of a building or group of buildings (Eren, 1999, 25; Parlatır et al., 1988, 165; Hasol, 2008, 57; Coates, Graeme and Stone, 2011, 30). Courtyard-based house architecture has been extensively studied in research on traditional Anatolian dwellings, particularly in terms of climate adaptation, privacy, spatial hierarchy, and typological formation (Kuban, 2017, 105; Bekleyen, 2019, 2; Özkan, 2017, 499). Kula houses in Western Anatolia are characterised by inward-facing spatial arrangements structured around enclosed or semi-enclosed courtyards. These studies define the courtyard as a mediator between the public street and the private domestic space, and as a space that accommodates production, circulation, and daily life (Bozer, 1988, 5-23; Deniz, 1992, 19). However, while studies on the environmental and morphological functions of the courtyard are extensive, its active role in structuring social ritual traditions has not been sufficiently researched.

In cultural heritage research, the concept of Intangible Cultural Heritage (ICH) has shifted the focus from material artefacts to living practices and performative continuity. First adopted on 16 May 2001, the 2003 UNESCO Convention for the Safeguarding of the Intangible Cultural Heritage defines ICH as practices, representations, expressions, knowledge, and skills transmitted from generation to generation (Unesco, 2003). In this context, Türker and Çelik (2014) have highlighted traditions such as the tradition of aşıklık, sema ceremonies, and ceremonial keşkek among Turkey's elements of ICH. As stated by Smith (2006), heritage is not a static object but a cultural process. Similarly, Kirshenblatt-Gimblett (2004) emphasises the performative production of heritage and states that continuity depends on contexts that allow for the staging, concretisation, and social negotiation of practices. Thus, the continuity of intangible heritage requires attention not only to the artefacts themselves but, above all, to the people and their entire habitus and habitats, understood as their living spaces and social worlds (Kirshenblatt-Gimblett, 2004, 54). Furthermore, the 2001 definition of ICH included the spaces associated with these actions, emphasising the importance of space in the continuity of such activities (Kirshenblatt-Gimblett, 2004, 54).

This performance-based understanding requires spatial research. Building on Lefebvre's view that space is a socially produced and socially functioning concept (Lefebvre, 2014), built environments can be interpreted not only as places where activities take place, but also as active frameworks that condition movement, visibility, hierarchy, and collective embodiment. Ritual theory further strengthens this connection. Bell (1992) argues that ritual practices structure movements within space, creating spatial arrangements and relational hierarchies through spatial positioning. Therefore, ritual cannot be considered separately from its spatial arrangement. When we focus on actions, we see that the

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interaction between the body and its environment involves an important cyclicality: while creating the ritual, the body is also influenced and shaped by it. Similar approaches are also seen in local architectural research. Oliver (2006) emphasises that courtyard houses in different cultures are not only shaped by climatic conditions; they also function as social connectors that facilitate people coming together, communal production, and interactions based on ceremonies. Courtyards create a special space that facilitates gathering, with their enclosed yet open-centred structure. Islamic belief also plays an important role here. The place of women in society has determined how they relate to the outdoor space and the boundaries of this relationship.

Yarenlik, a social tradition shaped by hierarchical seating arrangements, communal meals, musical performances, dance, and ritualised interactions, has generally been examined from the perspectives of folklore and ethnography (Arslan, 2010; Bayram & Berrakçay, 2023). Research conducted on Yâren communities in different regions of Anatolia indicates that spatial arrangement is an effective factor in structuring authority and participation (Kartal, 2025). Experience-focused analyses reveal that rhythm, centrality, and social movement are defining elements in Yâren gatherings (Birkon & Köroğlu, 2025). However, these studies do not address the spatial relationships in which these practices occur. In particular, the relationship between the courtyards of houses in Kula and ritual continuity has not yet been sufficiently explored.

Wedding ceremonies associated with camaraderie are increasingly being held in contemporary wedding halls, and in this process, the spatial conditions in which the ceremonies take place are also shifting from enclosed indoor courtyards to standardised event venues. This spatial transformation raises certain issues regarding the compatibility between traditional typologies and ritual performance. Positioned around the axes of courtyard morphology, ritual theory, and the continuity of intangible heritage, this study approaches architecture not as a static cultural object but as a performative infrastructure. By examining how courtyard configurations have historically shaped collective ritual activities, the research aims to contribute to bridging the interdisciplinary gap between architectural typology and intangible cultural practices.

METHODOLOGY

Research Design

This study adopts a qualitative comparative spatial analysis approach to examine the relationship between courtyard morphology and ritual performance capacity. The aim is not to make a quantitative typological classification, but to interpret the structural harmony between historical house typology and the spatial requirements of the Yarenlik tradition.

Case Selection and Sources

The research is based on documented ground floor measurement drawings of three 18th-century courtyard houses in Kula (Beyler House, Zeynep Onbaşı House, and Bozerler House). These examples were selected according to the following criteria:

- The presence of a clearly defined courtyard layout
- Availability of documented ground floor measurement plans
- Representativeness within the Kula courtyard house typology

The architectural plans were obtained from previously published academic sources and archival documents. No new field measurements were taken. Therefore, the study presents a qualitative, comparative spatial reading based on secondary plan documents. The selected houses are treated not as isolated architectural works but as typological representatives of courtyard-based house organisation in Kula.

Data on Yarenlik

Information on the tradition of yarenlik has been obtained from two sources:

1. Existing scientific and folkloric literature
2. Contextual cultural information related to regional practices

This study does not claim to be comprehensive ethnographic field research. Rather, the ritual components defined in the literature — communal sitting, musical performance, hierarchical positioning, food preparation, circulation patterns, and ceremonial transitions — provide a spatial framework for analysis. The aim is to examine the structural compatibility between ritual requirements and historical spatial conditions, rather than to produce a complete ethnographic narrative.

Spatial Analysis Framework

The analysis focuses on ground floor plans, where courtyard layout and access relationships can be most clearly read. The study does not prioritise stylistic or decorative features. Instead, it examines the following spatial parameters:

- The location and morphology of the central void
- The thickness and continuity of the surrounding spatial bands
- Entrance-courtyard relationships and threshold layers
- The placement of service areas
- Circulation continuity and visual orientation
- Transitions between public, semi-public and private areas

The methodological process takes place in three stages:

Morphological Reading; It aims to reveal how the geometry of the courtyard, its enclosure form, access points and spatial hierarchy are shaped.

Proportional Assessment; The spatial interaction and hierarchy of the courtyard within the ground floor layout is being evaluated. This evaluation has been carried out using a proportional approach based on

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a comparative reading of the plan drawings rather than precise metric measurements.

Ritual-Space Mapping; The spatial configuration of documented ritual and traditional practices is interpreted through the identification of potential central performance areas, peripheral seating areas, logistical service corridors, and hierarchical thresholds within the plan configuration.

This study does not suggest that the identified houses were deliberately designed for specific traditional ritual practices; rather, it considers the courtyard typology as a structural spatial framework that enables collective traditional performance.

Limitations

This research has been prepared based on existing planning documents; detailed on-site measurements or comprehensive observations have not been included in the scope of this study. Therefore, the analysis proceeds with a qualitative and interpretative approach rather than a numerical data-based assessment. Although it does not provide quantitative spatial measurements, it aims to reveal the structural relationship between courtyard morphology and the continuity of rituals.

COMPARATIVE SPATIAL ANALYSIS

Morphological Structure of Courtyard Houses

The three selected Kula houses — Beyler House, Zeynep Onbaşı House and Bozerler House — exhibit common spatial principles despite parcel-based geometric irregularities. In each example, the courtyard appears as an open space surrounded by buildings on at least three sides and located at the centre. Although the plan configurations are not entirely regular or angular, the courtyard functions as a spatial core around which circulation and room placement are organised.

The ground floor configurations consistently reveal the following:

- A dominant open courtyard occupying a significant portion of the building's usable area
- A layered transition between enclosed rooms and the courtyard, typically separated by a sofa or semi-open threshold
- Peripheral service units (kitchen, storage, bathroom, toilet, stable) forming a continuous spatial band
- Controlled street access opening onto a semi-private area before reaching the courtyard

The courtyard now functions as a spatial regulator rather than merely an open space. Circulation patterns converge towards the courtyard; visual axes also focus on this central open space. This spatial dominance supports the interpretation of the courtyard typology as an inward-looking residential system (Kuban, 2017; Bozer, 1988). However, the present analysis does not limit this interpretation solely to the residential

context; it broadens the framework by also considering the courtyard's potential to facilitate ritual practices.

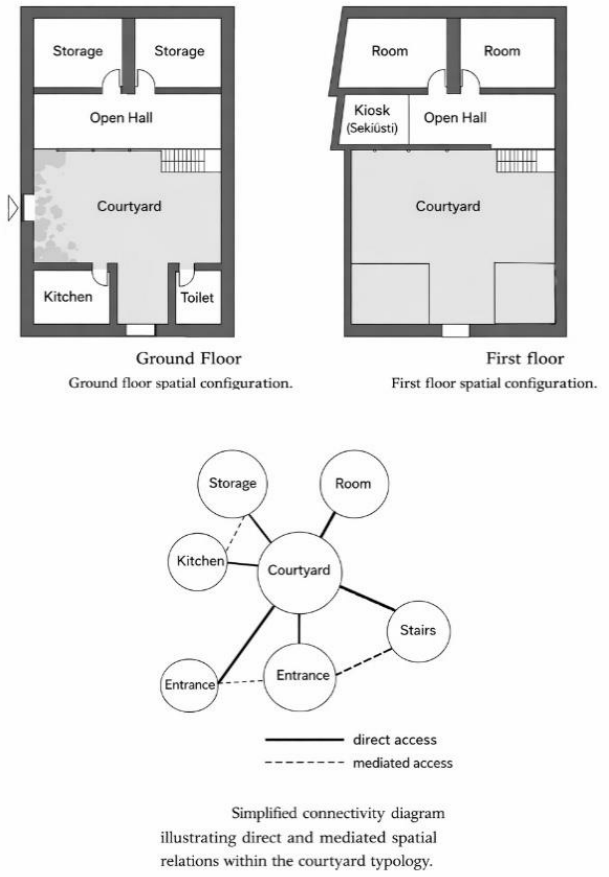


Figure 1. Courtyard space configurations (Author archive).

Proportional Dominance and Spatial Capacity

A proportionate reading of the plan drawings obtained through literature research reveals that the courtyard area is one of the largest uninterrupted spaces in all ground floor layouts. Even when additional structures such as shops or stables are considered, the courtyard maintains its dominant position spatially.

This proportional dominance enables the following:

- Collective gathering without fragmentation
- Clear central performance areas
- Peripheral seating arrangements
- Multi-directional visibility
- Simultaneous logistical operations along service bands

In this sense, the courtyard functions not only as a climatic infrastructure but also as a high-capacity spatial area. The empty space at its centre allows performance and observation to coexist, while the thickness of the surrounding structural elements provides a structural constraint. This situation aligns with the idea of spatial framing and the organisation of bodily practices emphasised in ritual theory (Bell, 1992). Architectural arrangement alone does not determine how a ritual will

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unfold; however, it can prepare suitable spatial conditions in which people can move together and collective experiences can emerge.

Case-Based Micro-Spatial Readings

Beyler Mansion

Beyler Mansion has a relatively balanced and geometrically regular courtyard layout. The central void occupies a significant portion of the ground floor and is clearly defined by the rooms surrounding it. This results in the building developing a strong inward spatial orientation.

One of the striking features of this plan is the thickness of the perimeter band. Service units are placed around the edges of the courtyard, forming a kind of buffer layer between the central gathering area and the outer boundary. Such a spatial organisation allows different activities to be carried out simultaneously: while the courtyard forms the main area for gatherings or performances, the surrounding sections can support food preparation and other functions without interrupting the central focus.

The entrance arrangement completes this concept. Upon entering from the street, one approaches the centre by passing through several transitional layers rather than reaching the courtyard directly. This gradual transition both enhances ritual privacy and creates a certain social filtering. Thus, the courtyard functions as a performance space, enclosed by architectural layers and separated from the outside in a controlled manner.

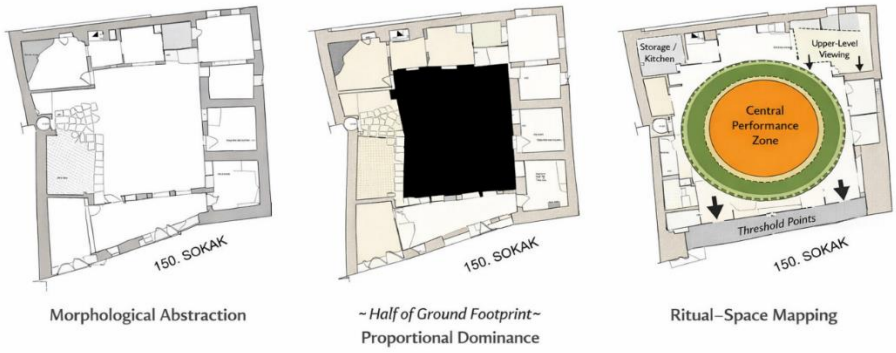


Figure 2. Beyler Mansion Courtyard-Ritual Relationships (Author archive).

Zeynep Onbaşı House

Zeynep Onbaşı House has an irregular courtyard layout. The void in the central area is asymmetrical and offset from the plan. Rather than weakening spatial consistency, this irregularity creates different edges and viewing angles.

The living area acts as a mediating threshold between the enclosed rooms and the courtyard, intensifying spatial stratification and highlighting hierarchical transitions. The courtyard emerges gradually rather than abruptly.

The asymmetrical design creates environmental areas suitable for different ritual functions such as sitting, circulation or service support. The ritual organisation also adapts to this geometry. The courtyard

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functions as a flexible space that maintains the central performance while also preserving the peripheral support systems, as in other examples.



Figure 3. Zeynep Onbaşı Courtyard-ritual relationships (Author archive).

Bozerler House

Bozerler House creates a more comprehensive and functionally diverse environmental band on the ground floor (including the stable and wet areas). Despite this variety of functional movement, the courtyard maintains its structural dominance.

The operation of functional areas does not fragment the central void; instead, it reinforces the distinction between service and gathering areas. Circulation revolves around the courtyard, and controlled transitions maintain spatial boundaries.

This configuration demonstrates that the functioning and ritual life within the house coexist within the same spatial framework. Even if service areas are expanded, the courtyard can continue to serve as an uninterrupted performance space capable of supporting communal gatherings.



Figure 4. Bozerler Courtyard-Ritual Relationships (Author archive).

Ritual-Space Compatibility

The documented components of Yarenlik are as follows:

- Circular or semi-circular arrangements for communal seating
- Central music and dance performance
- Hierarchical positioning of leaders
- Food preparation and distribution

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• Ceremonial entrance and processional movement

When these elements are reflected in the courtyard morphology, structural compatibility becomes clearly apparent. The central void is used for performance and dance. The surrounding edges support seated viewing. Service belts enable logistical operations. Semi-open thresholds denote hierarchical transitions. Elevated viewing positions enhance collective visibility.

This analysis does not claim that Yaren practices constitute a spatial and architectural design. Instead, it explains the reciprocal relationship between spatial construction and ritual organisation. The courtyard typology creates a spatial area where ritual consistency can emerge.

Spatial Displacement and the Transformation of Ritual Regimes

The shift of Yaren gatherings from the courtyards of houses to today's wedding halls is not merely a change of venue; it also signifies a transformation in the spatial arrangement where rituals take place.

The traditional courtyard has a structure shaped by layered thresholds, semi-enclosed spaces and the interior layout of the house. In this environment, movement follows a specific order, visibility is controlled, and participation takes place within a more limited, socially and spatially defined area.

Wedding halls, on the other hand, are more standardised spaces, often designed for commercial purposes. In such venues, scale and flexibility take precedence over a layered and hierarchical order. The distinctiveness of thresholds diminishes, and the restrictive structure of the domestic environment gives way to a more neutral spatial arrangement.

This transformation affects the following:

• Spatial intimacy
• Hierarchical expression
• Acoustic limitation
• Symbolic embedding
• Transition between public and private spaces

Ritual continuity may persist, but its experiential intensity may change. When evaluated from a heritage perspective, this change reveals the delicate relationship between physical space and intangible cultural continuity. The architectural environment does not determine the existence of ritual on its own; however, it significantly influences how it is experienced and its quality.

DISCUSSION

The findings indicate that the courtyard layout in traditional Kula houses functions as a socio-spatial infrastructure that enables collective rituals to take place and shapes them to a certain extent. However, the view put forward here is not an architectural determinism claim that architecture alone determines rituals.

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To suggest that traditional courtyard houses were consciously designed for Yaren rituals would be a reductionist approach. Instead, as noted in the analysis, attention is drawn to the structural harmony between these spaces and ritual practices. The defining role of the central void, the spatial thickness around it, the layered thresholds, and controlled access create particularly suitable conditions for collective performances. This distinction is crucial. The study does not claim that space determines ritual; rather, it emphasises that spatial organisation shapes the scope and consistency of possible performances. In the example of the courtyard typology, the ritual can be performed without spatial conflict thanks to the architectural arrangement being compatible with the requirements of collective gathering.

In this context, courtyard houses demonstrate the power of spatial influence. The built environment is active; it shapes circulation patterns, frames fields of vision, structures hierarchy, and limits acoustics. These elements influence how people come together, how authority is expressed, and how performance is perceived. Lefebvre's approach to space as a concept both produced by and producing social relations provides a theoretical basis for this interpretation (Lefebvre, 2014). Thus, the courtyard emerges not merely as a climatic or typological device, but as a spatial field where social reproduction takes place.

Furthermore, the transfer of Yaren practices to wedding halls demonstrates that the continuity of the ritual is not affected by spatial transformation, but that the qualitative structure of the ritual experience has changed. The weakening of transitions separating different layers of houses and established enclosed spaces indicates a transformation in spatial mediation. While the symbolic elements of tradition are preserved, the relational intensity and concrete form of the practice may change.

This study contributes to broader discussions on heritage. Conservation debates often address the physical preservation of buildings or the sustainability of intangible traditions separately. However, this study reveals that tangible and intangible heritage function as interconnected systems. Architectural typologies can serve as performative infrastructures that stabilise ritual practices across generations. Therefore, the preservation of courtyard morphology should be understood not only as an architectural necessity but also as a phenomenon related to cultural continuity. When domestic spatial infrastructures erode, ritual practices may continue, but their experiential structures are reshaped within altered spatial arrangements. In some cases, rituals may disappear entirely when they lose the spaces in which they emerged.

Positioning courtyard typology at the intersection of spatial form, social organisation, and the continuity of intangible heritage, this research advocates a relational understanding of heritage, analysing built environments and cultural practices not as isolated areas but as mutually conditioning systems.

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CONCLUSION

This study has examined the relationship between the courtyard morphology of traditional Kula houses and the spatial requirements of the Yarenlik ritual tradition. Going beyond climatic and typological interpretations, the research has approached house architecture as a socio-spatial infrastructure that enables and conditions collective cultural practices.

A comparative spatial analysis of the 18th-century three-courtyard house demonstrates that the central open void consistently functions as the dominant regulatory element on the ground floor. Circulation patterns converge towards this void, with peripheral service bands providing logistical support without disrupting communal gathering, while layered transitions mediate between domestic privacy and social performance.

When all documented rituals (group seating arrangements, central music and dance, hierarchical positioning, food preparation, and ceremonial transitions) are placed within these spatial arrangements, structural coherence becomes clearly apparent. The courtyard not only hosts ritual activities; it also spatially frames and stabilises them.

It is important to note that this research does not advocate architecture designed specifically for Yaren practices. The aim is simply to demonstrate the relationship in which spatial typology and social practices mutually shape each other. While the courtyard morphology offers spatial possibilities for the consistent performance of rituals, ritual practices also activate and reproduce the meaning of these spatial structures.

The relocation of Yaren gatherings to standard wedding halls today reveals the fragility of this reciprocal relationship. The ritual may continue symbolically; however, the transition from a layered domestic environment to a commercial and neutral hall space alters the qualitative structure of the experience. The architectural context does not determine the existence of the ritual, but it shapes the intensity of the performance and its relational fabric.

By revealing the structural harmony between the concrete courtyard typology and the abstract continuity of the ritual, this research contributes to heritage discourse in three fundamental ways:

1. It broadens architectural conservation debates beyond material preservation towards performative capacity.
2. It situates courtyard morphology within a relational framework that connects spatial form, social organisation, and cultural reproduction.
3. It proposes that heritage should be understood not as a collection of isolated artefacts or practices, but as an interconnected socio-spatial system.

Accepting this reciprocity allows traditional domestic environments to be interpreted not only as historical dwellings but also as cultural infrastructures that historically sustain collective identity and ritual continuity.

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Typology and Distribution of Squinches in the Transition Zones of Seljuk Square Chambers in Iran

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Abstract

The construction of domes on square-plan chambers in Iranian architecture can be traced back to the pre-Islamic era. In order to address the challenge of building a dome with a circular cross-section on a square space, a transition zone was created using four squinches, with the objective of altering the geometry of the cross-section and making it closer to a circular shape. During the Great Seljuk era, the construction of domes on square-plan spaces became a common practice, with various squinch techniques employed in the transition zones. This paper examines forty-one existing Seljuk chambers in Iran and classifies the squinches in their transition zones into four types: predominantly shouldered arches, Patkaneh, Patkin, and Sekonj. Shouldered arches are principally observed in the transition zones of structures situated in the north-western and north-eastern regions, with a few instances noted in the northern and central parts of the country. The majority of Patkaneh squinches are located in the central region of Iran. Four cases with distinct geometric solutions in the transition zones are situated in north-west Iran, and one example is located in north-east Iran. Additionally, three instances of the Patkin squinch can be observed in a caravanserai located in the north-eastern region. In the northern region, two chambers were identified in two caravanserais with Sekonj squinches in transitional zones. The use of these different squinch techniques reflects the regional preferences in architectural styles and the adaptability of Seljuk builders to local materials and construction methods. This study contributes to the scientific understanding of Iranian architectural history by classifying the squinch techniques used in Seljuk domed chambers. The analysis of forty-one structures provides insights into regional construction practices, geometric innovations, and the evolution of transition methods. The proposed typology enriches architectural historiography and provides a foundation for further comparative studies on structural solutions in Islamic and pre-Islamic architecture.

Keywords: *Iran, Seljuks, Squinches, Transition zones*

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INTRODUCTION

Chahartaqi[1] (Čahārṭāqi), an integral part of Iran's architectural heritage, is believed to have originated during the Parthian[2] architectural era (247 BC - 224 AD) and later became a prominent feature in Sasanian architecture (224 AD - 651 AD) (Vandaee, 2015; Akbari, 2011; Garshasbi and Malekpour Shahraki, 2019). This distinctive design was applied in various contexts during the Sasanian era, including both religious and secular structures. This traditional architectural element was adopted and developed during the Iranian-Islamic era (Golzari and Rabb, 2022b) and was also introduced to the architecture of other nations. A "Chahartaqi" is defined by four arches or short barrel vaults encircling a central square space, with a dome resting above squinches (Huff and O'Kane, 1990). It is characterized by a dome on top of a cube surrounded by four arches and displays a cosmic representation. Its combination of the celestial circle and the terrestrial square is what makes it unique (Ardalan and Bakhtiar, 2000). Chahartaqi stands as an enduring archetype in Iranian architecture, retaining significance across pre-Islamic and post-Islamic eras (Wahdattalab and Ghadimzadeh, 2018).

The earliest instances of domes supported by squinches within Chahartaqi units are discernible in extant Partho-Sasanian structures, prominently represented by architectural marvels such as, Bazeh Hoor Fire Temple, Kooh-e-khaje, Ardeshir Palace, and Dokhtar Castle. These structures exhibit themselves as either an enclosed cube, an autonomous domed chamber distinguished by open arches that permit exposure to the external environment, or as a constituent of a larger architectural edifice demarcated by interconnected chambers and corridors. The transition zones beneath the domes of these pre-Islamic buildings feature four distinct types of squinches, including, Filposh, Patkin, Sekonj, and Shouldered arches (Golzari and Rabb, 2022a).

Following the Muslim conquest of Iran and the demise of the Sassanian dynasty, Iranian-Islamic architecture widely adopted the Chahartaqi form. According to Akbar Tajvidi, during the early expansion of Islam in Iran, many fire temples from the Sasanian era, which are in the chartaqi module, were converted into mosques. The main alteration involved blocking one of the four openings, which were aligned with the Qibla direction, by constructing a wall and incorporating a mihrab. Therefore, mosques with chahartaqi spaces were developed. An example of this can be seen in the Yazdkhast mosque (Tajvidi, 1971), which was a fire temple during the Sasanian empire.

For the first four centuries of the Hijri era, there are a few surviving examples of Chahartaqi structures, such as the Ismail Samani Mausoleum[3] and the tomb of Arsalan Jazeb. The construction of Chahartaqi increased significantly throughout the Seljuk era, particularly in mosques in response to the growing demand for more expansive areas, tombs, palaces (Neyestani et al., 2012), caravanserais, Madrasah, and Khanqah[4]. This period demonstrates an increase in

[1] Chartaqi (Persian: چارطاقی) or chahartaqi (Persian: چهارطاقی). Chartaq (Persian:چارطاق) and chahartaq (Persian: چهارطاق) literally means four arches.

[2] The cruciform ground plan is discernible in a rudimentary manifestation within Parthian structures, exemplified by edifices such as Qalʿeh Zohak (Qalʿa-ye Žaḥḥāk) located in Azerbaijan (Dietrich Huff, Bernard O'Kane, 1990).

[3] The building, which dates back to the Samanid Empire, an Iranian dynasty, according to the current political and geographical map, is situated in Bukhara, Uzbekistan.

[4] A khanqah serves as a dedicated structure for congregations of a Sufi brotherhood or tariqa, functioning as a space for spiritual activities and religious instruction.

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architectural creativity in a wider range of transition zones and squinches beneath domes in square-shaped chambers.

Despite the extensive research conducted on Chahartaqi in relation to its historical and symbolic significance, the transition zones and squinches within these structures have received minimal attention. A paucity of research has hitherto been conducted on the subject of architectural variation in the broader context. Previous studies have focused on individual monuments or regional examples, and as a consequence there are significant gaps in our understanding of broader patterns of architectural variation. The present study aims to classify the types of squinches of transition zones in Seljuk-era square-plan domed structures in Iran, examining both their architectural features and regional distribution. By systematically categorising these elements and their occurrences, this research contributes to the scientific understanding of Islamic architectural evolution and informs preservation strategies.

RESEARCH METHODOLOGY

This study employs a descriptive-analytical approach to examine the typology and regional distribution of squinches in Seljuk square-plan chambers in Iran. A total of forty-one extant chambers were selected based on the availability of architectural documents, the presence of identifiable squinches in their transition zones, and their geographic distribution, in order to capture regional variations. The data were collected through a combination of field surveys, architectural documentation, and archival research, including scholarly publications, historical records, and online repositories. The analysis focused on classifying the squinches in the transition zones into four main types: Patkaneh, Patkin, Sekonj, and Shouldered arches. An examination was conducted of the cases with regard to usage of the chamber, geometric solutions in their transition zones and construction techniques to create the geometry. Photographical evidence and architectural drawings were utilised to ensure precise identification and to facilitate comparisons across structures. Finally, spatial and temporal patterns were analyzed to understand the distribution of squinch types across different regions and periods within the Seljuk era. A cross-referencing of construction dates, geometric solutions and regional architectural influences was undertaken, revealing correlations between squinch type, complexity of the transition zone and local building traditions. This methodology provides a comprehensive framework for understanding both the formal characteristics and regional variations of Seljuk squinches.

TRANSITION ZONES FEATURING SQUINCHES IN SELJUK SQUARE CHAMBERS

The Seljuk dynasty, also known as the Great Seljuk Empire (1037-1194 CE), was founded by Tughril Beg (Abazov, 2008; Ettinghausen et al., 2001). It was a major Muslim power during the medieval period (Peacock, 2015; Akbari, 2009; Zaki, 1941) and emerged from the

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nomadic Seljuk tribe (Alkadi, 2016; Peacock, 2015; Lapidus, 2014). Figure 1 shows the Great Seljuk Empire's wide domain, which included Central Asia, Iran, and parts of the Middle East. The Seljuk period is a distinct phase in Iranian architecture, with some roots in Partho-Sasanian art and architecture. One notable development of this period is the use of chahartaq, which features a transition zone under the dome.



Figure 1. The territory of the Great Seljuk Empire (League, 2010)

In this research, forty-one Seljuk square-plan chambers featuring squinches in their transition zones have been identified within the present-day territory of Iran.[5] The details of these structures are set out in Table 1. Among the spaces, six are designated as tombs, with an additional designation of one functioning as a mosque-tomb. In addition, seventeen chambers were allocated to mosques, another to a mosque-madrassa, and another to a mosque in a caravanserai. Additionally, fifteen chambers are service spaces and are identified within two caravanserais. This suggests that religious purposes accounted for most of the uses of these square-planned chambers. In addition, the exterior cross-section of the thirty-eight chambers is square, circular in one, and octagonal in one.

Four main types of squinches were employed in these structures, namely Patkin, Patkaneh, Sekonj, and Shouldered arches, while Filposh was not observed in any instances. The predominant squinch type is the shouldered arch, utilized in twenty-four chambers, predominantly situated in the north-western and north-eastern regions, with four instances in the northern and central parts of the country. Subsequently, Patkaneh is implemented in twelve rooms, predominantly in the central region, specifically within the present-day Isfahan province, in four cases in the northwest, and one case in the northeast of Iran. In addition, three examples of the Patkin are discerned in a caravanserai located in

[5] While the square chambers of Imamzadeh Nur in Gorgan and Pir-Hamzeh Sabzpoosh Tomb in Abarkuh remain, the transition zone has been entirely destroyed. Furthermore, the study did not include the Jame Mosque of Ardabil since its dome and squinches were destroyed with the end of the Seljuk era.

[6] In this building, thirteen chambers have transition zones featuring squinches.

[7] Despite being included in the National Monuments as a mosque-madrasah, certain scholars, such as André Godard, contend that the building was not built as a madrasah.

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the north-eastern part and two cases of Sekonj was found in the northern part of the country.

Table 1. Square-plan Seljuk chambers with transition zones in Iran

Number	Case Studies	Location	Date	Function	Plan		squinches in transition zones
					Exterior	Interior	
1	Jame Mosque of Isfahan (Nizam al-Mulk Dome)	Isfahan	1080 CE (Jabalamel, 2013)	mosque	square		Patkaneh
2	Jame Mosque of Isfahan (Taj al-Mulk Dome)	Isfahan	1103 CE (Jabalamel, 2013)	mosque			
3	Jame Mosque of Ardestan	Ardestan	1158 CE (Arki et al. 2014)	mosque			
4	Jame Mosque of Barsian	Barsian	1133 CE (Khosravi Javid, 2020)	mosque			
5	Jame Mosque Zavare	Zavare	1168-69 CE (Salehi Kakhaki and Azizpour, 2012)	mosque			
6	Jame Mosque of Golpayegan	Golpayegan	1114-15 CE (Korn, 2012b)	mosque			
7	Gonbad Sorkh	Maragheh	1148 CE (Morvarid, 1993)	tomb			
8	Se Gonbad	Urmia	1184 CE (Behzadpour and Aminpour, 2021)	tomb	circle	square	
9	Jame Mosque of Marand	Marand	1092 CE (Anisi, 2023a)	mosque	square		
10	Jame Mosque of Urmia	Urmia	Middle of the 12th century (Anisi, 2023b)	mosque			
11	Jame Mosque of Sin	Sin	1134-35 CE (Hajloo and Neyestani, 2014)	mosque			
12- 24	Ribat-i Sharaf[6]	45 km to Sarakhs	1114 CE (Zamani and Akbari, 2023)	caravanserai	square		Patkaneh(one) Patkin(three) Shouldered arches(nine)
25	Jame Mosque of Qerveh	Qerveh	1179 CE (Korn, 2018)	mosque			Shouldered arches
26	Jame Mosque of Qazvin	Qazvin	1120-1121 CE (Mashkoti, 1941)	mosque			
27	Heydariyeh Mosque	Qazvin	1119-20 CE (Asgari and Chareie, 2020)	Mosque-Madrasah[7]			
28	Jame Mosque of Semnan	Semnan	Between 1117 and 1158 CE (Hatami, 2017)	mosque			
29	Jame Mosque of Sojas	Sojas	3rd quarter of the 12th century (Anisi, 2023a.)	mosque			
30	Jame Mosque of Borujerd	Borujerd	1139-45 CE (Korn, 2019)	mosque			
31	Gonbad Sangan Mosque	Sangan	1140-41 CE (Mollazadeh, 1999)	mosque			

32	Gonbad Alaviyan	Hamedan	Late 12th Century (Shani, 1996)	mosque-tomb		
33	Tomb of Pir-i Takestan	Takestan	12th century (Hillenbrand, 1972b)	tomb		
34	Imamzade Aqil	Bijar	The second half of 12th century (Mohammadi et al. 2012)	tomb		
35	Tomb of Baba Loghman	Sarakhs	Seljuk dynasty (1037-1194)[8]	tomb		
36	Tomb of Khaje Atabak	Kerman	Between 1164 and 1169 CE (Mosavi Haji et al. 2008. 2424)	tomb	octagon	square
37	Ribat of Mahi[9]	Along rout between Sarakhs and Mashhad	Between 1106-1118 CE (Korn, 2020)	caravanserai	square	
38	Jame Mosque of Mehrabad[10]	Abarkuh	Seljuk dynasty (1037-1194)	mosque		
39	Jame Mosque Haftshoyeh	Haftshoyeh	Seljuk dynasty (1037-1194)	mosque		
40	Mohammad Abad Stony Caravanserai	Qom	Between 1114-1119 CE (Arab, 2006)	caravanserai		Sekonj
41	Ali Abad Stony Caravanserai	Qom	Seljuk dynasty (1037-1194)	caravanserai		

The location of these chambers is indicated on the current map of Iran in Figure 2. With two exceptions, this figure depicts the distribution of structures, which are primarily concentrated in the upper half of the map.

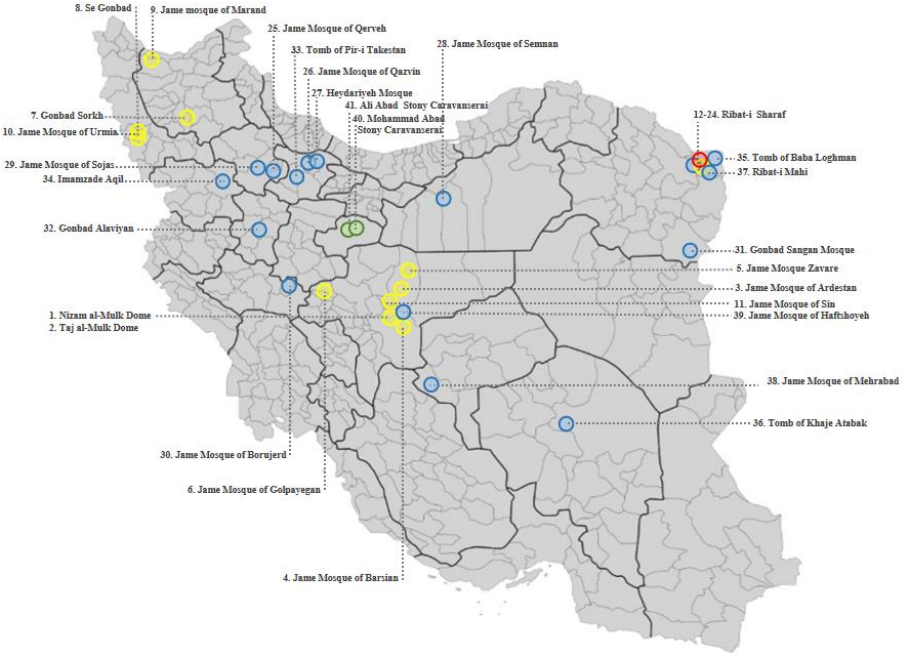


Figure 2. Location of case studies in the present-day territory of Iran

The construction timeline of case studies is displayed in Figure 3. Before the 12th century, Patkaneh was used in two cases, and from then on it was used in successive structures until the end of the era. Shouldered arches became more common in the 12th century, and Patkin and Sekonj were used in a few cases in the first quarter of the

[8] Although Gonbad Khanh's building is listed as having a Seljuk architectural style on the sign adjacent, its exact date is unknown.

[9] According to the plan of caravanserai, several additional rooms had dome roofs, but these had been demolished, and one chamber could be examined using the available photos.

[10] In this mosque, only the Gonbad Khaneh chamber is still in existence and is in critical condition.

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twelfth century. The transition zones with four distinct squinch types in the cases studied were examined in the sections that followed.

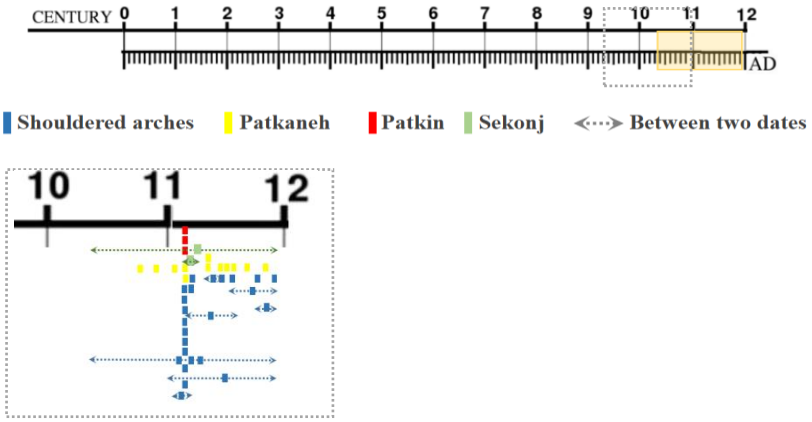


Figure 3. Timeline of instances during the Seljuk era in Iran (1037–1194)

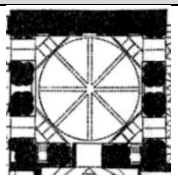
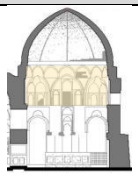
Transition Zones Featuring Patkaneh

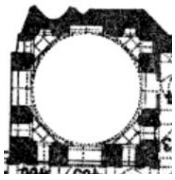
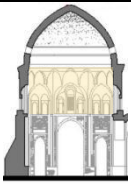
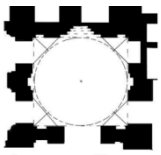
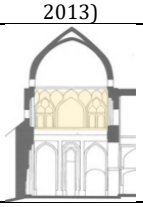
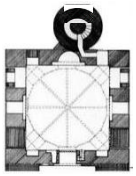
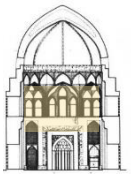
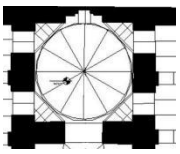
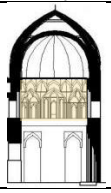
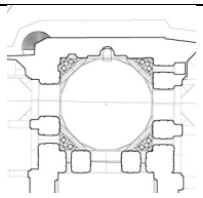
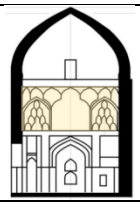
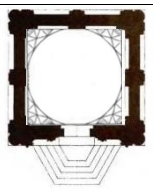
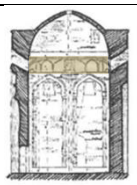
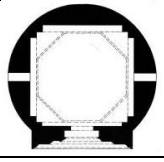
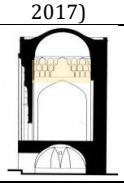
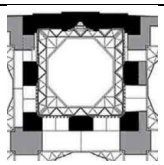
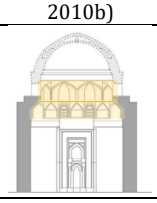
Patkaneh consists of several rows of niches layered on top of each other (Pirnia, 1991; Safaeipour et al., 2013). It can be found as a space covering or as squinches beneath a dome, with a regular and distinct geometry (Memarian and Safaeipour, 2012). The first example of this architectural element is found in Iranian-Islamic architecture, and it was through this method that squinches reached their peak (Golzari and Rabb, 2022a). In three regions of the country, transition zones have been identified, with Patkaneh. These transition zones in the chambers are detailed in Table 2.[11] In the central part, in all six instances, the squinches change the square plan to an octagonal cross section, and then sixteen small arches above them make a hexadecagon base for a dome. The geometry of the squinches in the Jame Mosque of Golpayegan differs from the other cases and there are four layers of niches. The example in the north-east is analogous to these transitional zones in the central region, although it is simpler in design and is likely to have comprised a row of bricks rather than small arches, thus forming a sixteen-sided polygon. In all of the aforementioned cases, the arches were observed to be the final frame in the facade of squinches. Each of the four chambers in the northwest and one example in the central part employ distinct methods for their transition zones, featuring the use of Patkaneh. Two of the cases involved a direct transition of the square cross-section into a sixteen-sided base, one into a 10-sided cross-section, and one case had a direct transition into a 24-sided base for the dome.

[11] This type of squinch was also built under the dome in the Jame Mosque of Gar in Isfahan province, but most of the transition zone has been destroyed and cannot be studied.

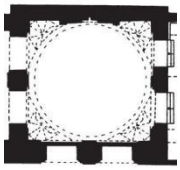
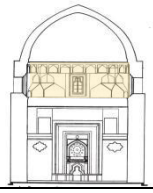
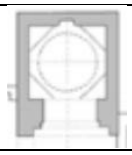
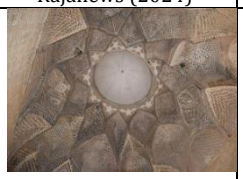
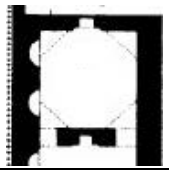
[12] The geometry of the transition zone is expressed in numerical form. For example, the designation "4-8-16" signifies that the transition zone comprises two levels. Initially, the square plan was transformed into an octagon, and subsequently, a sixteen-sided polygon. The designation "4-8" signifies that the final level of the transition zone is an octagonal cross-section.

Table 2. Patkaneh in Iranian Seljuk square chambers

Number	Plan	Section	Transition zone	Geometry of transition zone[12]
1				4-8-16

	(Schroeder, 1931)	(Salehi Khaki et al., 2013)	adapted from Archnet (2023)	
2				4-8-16
	(Schroeder, 1931)	(Salehi Khaki et al., 2013)	adapted from Tovman (2023)	
3				4-8-16
	(Godard, 1965)	(Haji Qasemi, 1996)	adapted from Visitiran (2023)	
4				4-8-16
	adapted from Askdin (2023)	adapted from Askdin (2023)	adapted from Aftabnews (2023)	
5				4-8-16
	(Nasrollahi, 2016)	(Nasrollahi, 2016)	adapted from Jahannews (2023)	
6				4-8-16
	(Korn, 2012a)	(Hagras, 2023)	adapted from Wikimapia (2023)	
7				4-16
	Combination of two plans	(Golchin et al., 2017)	adapted from Lastsecond (2023)	
8				4-16
	(Haji-Qassemi, 2010b)	(Haji Qassemi, 2010b)	adapted from Wikipedia (2023)	
9				4-8
	(Anisi, 2023a)	(Anisi, 2023a)	adapted from	

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			Aazaranjoman (2023)	
10	 (Haji-Qassemi, 2004a)	 (Haji Qassemi, 2010a)	 adapted from Rajanews (2024)	4-24
11	 (Hajloo and Neyestani, 2014)	–	 adapted from Sh-seen (2024)	4-10
12	 adapted from Iran-europe (2024)	–	 adapted from Mybrothertraveler (2023)	4-8-16[13]

[13] Two bricks are observed on the top of a squinch and on the small wall next to it. Based on the angle of the bricks with the top of the squinch, it can be concluded that the octagonal row of bricks was used as the last layer of the transition zones.

Two distinct categories can be identified based on the arrangement of the niches. One category is primarily situated in the central region and the second category is primarily situated in the north-west. The geometry of the central type is obtained based on dividing the right-angled triangle created in the four corners of the square plan. In this way, each triangle is divided into two equal triangles. Then, by dividing the sides into two equal parts and connecting the middle points to each other, four triangles are created (Memarian and Safaeipour, 2012). In an article, Edwards termed it a "tri-lobed squinch." (Edwards, 1999). This type is demonstrated in Figure 4. The north-west type does not adhere to a specific geometrical solution. However, the niches are positioned in such a way that it exhibits superior extension in the transition zone in comparison to the other type. This allows for a greater range of geometrical bases to be employed in the construction of a dome.

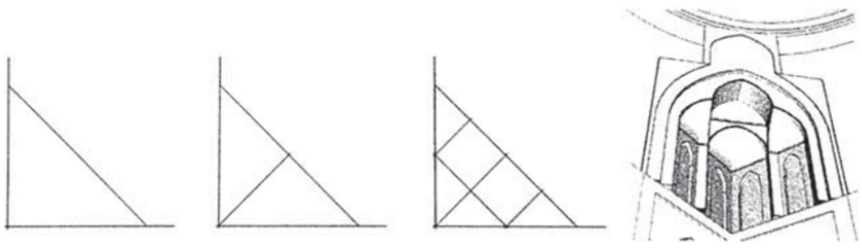


Figure 4. Geometry of Patkaneh in the central type (Memarian and Safaeipour, 2012)

Transition Zones Featuring Patkin

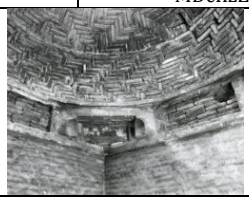
Patkin is a type of squinch in which construction materials are positioned to overlap at corners (Golzari and Rabb, 2022a) between two intersecting walls. The horizontal rows of bricks are advanced in such a way, creating a step-by-step appearance when viewed from below (Ghouchani and Mokaberian, 2022). As per Pirnia, this technique is referred to as "Encrobellement" in French, which can be translated as

gradually advancing the wall forward (Pirnia, 1991; Pirnia, 2019). The Bazeh Hoor fire temple, an ancient pre-Islamic structure in Iran, presents the earliest surviving example of this technique, crafted from wood (Benghida, 2015; Safaeipour et al., 2013: 6; Ghouchani and Mokaberian, 2022). In Iranian-Islamic architecture, Patkin was eventually built using adobes and bricks.

Patkin as a squinch in the transition zone is seen in three chambers of the Ribat of Sharaf[14]. In two rooms, bricks are progressively advanced in four corners, forming an octagon portion in the transition area. Though no arch was constructed for the transition zone, the facade of the squinches and the brick placing in walls between them resemble pointed arches. The next phase of the transition zone consists of placing a row of bricks to cross the octagon corners, creating a sixteen-sided geometric form, and then building a dome on top of it. In the third instance, an unusual module including two layers of overlapped layers of bricks was created to make the squinch. Then, on the facade of the squinch, a squat corbelled arch was formed with two niches. Edwards assert that the unusual structural role these niches play as corner corbels in this sturcutre is distinct from the constituent elements of superimposed tiers of small squinches. He is also adamant that it is as an articulating device that these niches demonstrate their additional role, rather than structural purposes (Edwards, 1999). Table 3 presents images of these transition zones.

[14] This technique was also used under another dome in this building, between the squinches, on the second level of the transition zone.

Table 3. Patkin in Seljuk square chambers

Number	Picture		Geometry of transition zone
13-14			4-8-16
	adapted from wikimedia (2024)	https://www.youtube.com/watch?v=MDcIizZFMLg&t=7s	
15			4-8
	adapted from Archnet (2024)		

Transition Zones Featuring Shouldered Arches

An arch with two bases positioned on the walls that cross at a corner is called a "shouldered arch". Figure 5 illustrates this type of squinch on the walls of a chamber with a square floor plan. These ribs support the downward thrust of the dome (Duarte et al., 2021). The earliest surviving example of this style can be found in Kooh-e-Khaje (Memarian et al., 2017), which dates back to pre-Islamic Iranian architecture. This squinch was later widely employed to construct a transition zone beneath a dome in Islamic-Iranian architecture. By including various

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features and levels, the geometry of the transition zone evolved, enabling the cross-section to approach the circle and support the construction of a dome.

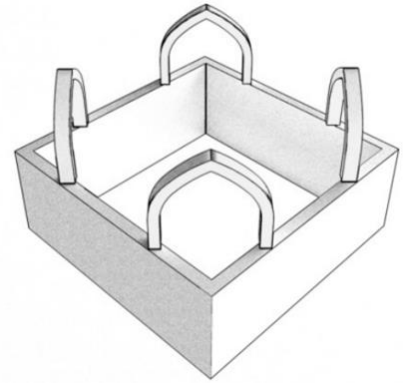
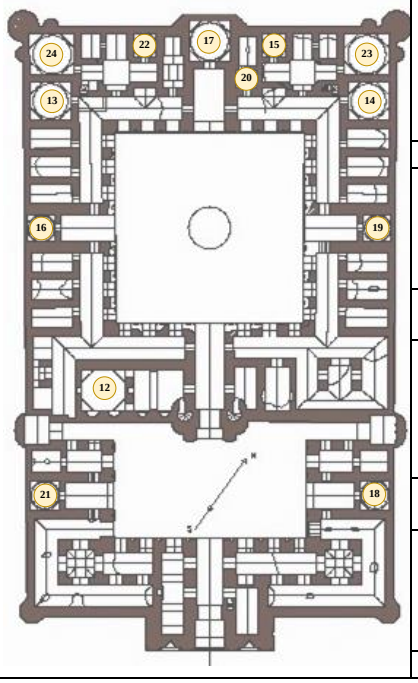
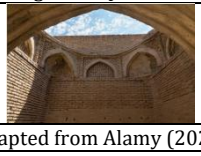
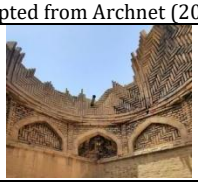
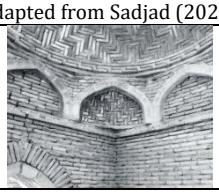
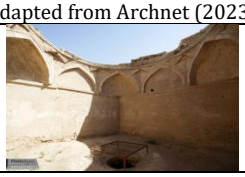


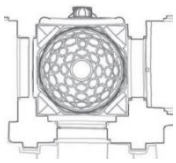
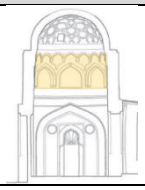
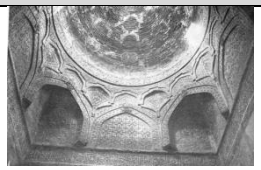
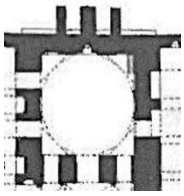
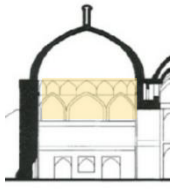
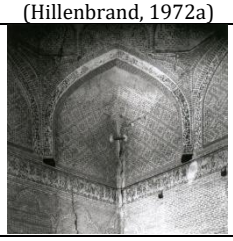
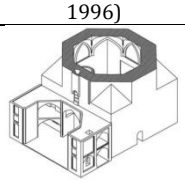
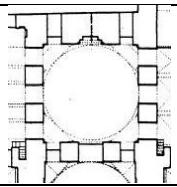
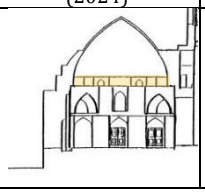
Figure 5. Four shouldered arches in corners (Golzari and Rabb, 2023)

Twenty-four square chambers with shouldered arches in the transition zone have been identified. Table 4 provides data on these transition zones in these structures. Nine instances were built in the Ribat of Sharaf caravanserai. Some scholars regard this caravanserai as a museum of brickworks. It might also be of interest to note that the different transition zones and squinches in this building could be seen as symbols for the range of methods and geometrical solutions. In four chambers, octagonal bases were constructed in the transition zone in order to build a dome on top. It is noticeable that in one chamber, pendentives were built between the arches, and two niches were made between the ribs of each arch as part of the filling of the void. In four chambers hexadecagonal cross sections were created, in three cases with a row of bricks as the second layer of the transition zone and in one case the Patkin method was used between arches.

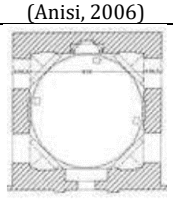
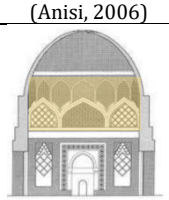
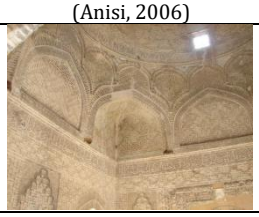
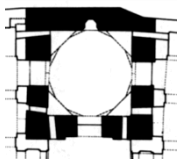
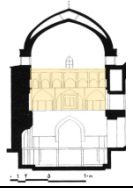
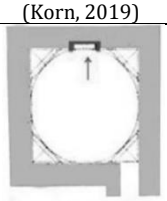
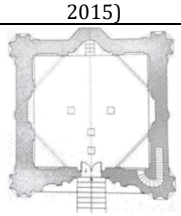
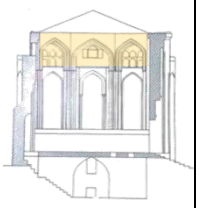
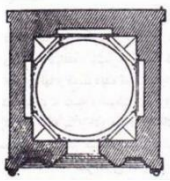
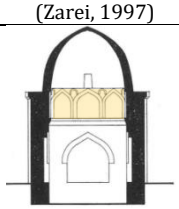
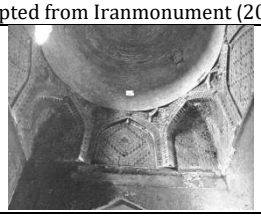
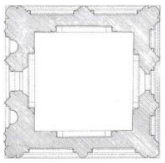
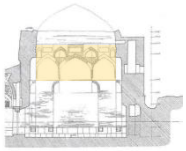
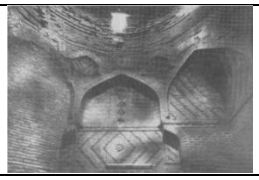
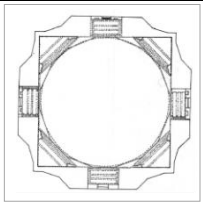
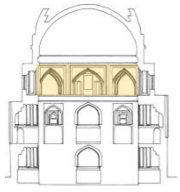
Table 4. Shouldered arches in Seljuk square chambers

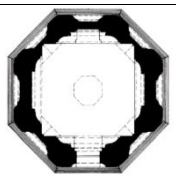
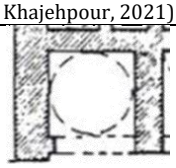
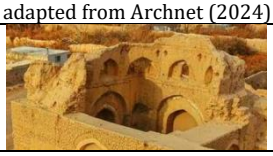
Number	Plan	Transition zone	Geometry of transition zone
16		 adapted from Archnet (2023)	4-8
17		 https://www.youtube.com/watch?v=MDcIizZFMLg	
18		 https://www.youtube.com/watch?v=T1IUg0sb6uQ&t=7s	
19		 Adapted from Alamy (2024)	

20			 adapted from Archnet (2023)	4-4
21			 adapted from Sadjad (2023)	4-8-16
22			 adapted from Archnet (2023)	
23			 adapted fro Karnaval (2024)	
24			 https://lh3.googleusercontent.com/p/AF1QipMgW7j3rLOnsjfwEVdcTyzvOjMg1MSLm0FfrHc8=s1360-w1360-h1020	
	ICHDC (1999)			

Number	Plan	Section	Transition zone	Geometry of transition zone
25	 (Korn, 2017)	 (Korn, 2017)	 (Hillenbrand, 1972a)	4-8-16
26	 (Shahnawaz et al, 2013)	 (Haji Qassemi, 1996)	 adapted from Archnet (2023)	4-8-16
27	_	 adapted from Cgie (2024)	 adapted from Wikiwand (2023)	4-8
28				4-8-16

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	(Anisi, 2006)	(Anisi, 2006)	(Anisi, 2006)	
29				4-8-16
	(Bakhtiari, 2012)	(Bakhtiari, 2012)	adapted from General Office of Cultural Heritage, Tourism and Handicrafts of Zanjan Province (2023)	
30				4-8-16
	(Korn, 2019)	(Korn, 2019)	adapted from Zerk.ir (2023)	
31		-		4-8
	(Ashori and Sheikhi, 2015)		adapted from ISNA (2024)	
32				4-8
	(Zarei, 1997)	(Zarei, 1997)	adapted from Iranmonument (2023)	
33				4-8-16
	(Molazade and Mohammadi, 1999)	(Hillenbrand, 1972b)	(Hillenbrand, 1972b)	
34				4-8-16
	(Nikzad and Esfanjari Kenari, 2006)	(Nikzad and Esfanjari Kenari, 2006)	(Mohammadi et al., 2012)	
35				4-8-16
	adapted from Memari98 (2024)	adapted from Memari98 (2024)	adapted from Nasimesarakhs (2023)	

36	 (Raoufi and Khajehpour, 2021)	 (Raoufi and Khajehpour, 2021)	 adapted from Tripyar (2023)	4-8
37	 (Aslanapa, 1993)	–	 adapted from Archnet (2024)	4-8-16
38	–	–	 adapted from Reiseniran (2024)	4-8
39	–	–	 adapted from ISNA (2024)	4-8-16

In the remaining fifteen cases, an octagonal cross section was used in five cases and a sixteen-sided base in ten cases. No correlation has been found between the geographical location of the structures and the different geometric methods used. Small arches were made in seven cases, a row of bricks was erected in two, and small walls were built in one case to form the second level of the transition zone, which has a sixteen-sided cross-section. It is evident that the north-east buildings employed a row of bricks, while the north-west structures used little arches as the second level. Furthermore, the diversity of architectural options and decorative styles found in the transition zones in examples along the Khorasan route demonstrate the significance of these structures during the Seljuk period.

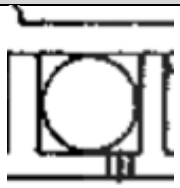
Transition Zones Featuring Sekonj

Sekonj is composed of two curved triangles with a shared central side in space (Hosseini, 1999). Each of these two triangular components is called "Taseh" and later this technique was evolved into Patkaneh and repeated in space with various geometries (Safaeipour et al., 2013). The squinch was first seen in the pre-Islamic architecture of Iran, for instance in the two square rooms of the Sarvestan Sasanian Palace. Subsequently, it was used in the Iranian Islamic architectural tradition. This type of squinch has been identified in the caravanserai of Mohammad Abad and Ali Abad. In these transitional zones, the predominant building material is rubble. In the chamber of Mohammad Abad caravanserai, an octagonal base for the dome was constructed by building one Sekonj in each of the four corners and four vertical small walls between squinches to complete the transition zone. In the room of the Ali Abad caravanserai, pendentives with a very rustic technique

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were constructed between squinches and small walls to form the octagonal base of the dome. The case studies are illustrated in Table 5.

Table 5. Sekonj in Seljuk square chambers

Number	Plan	Picture	Geometry of transition zone
40			4-8
	(Arab, 2006)	adapted from Mehr News Agency (2023)	
41			
	(Maxim Siro, 1970)	Adapted from Wikimapia (2024)	

COMPARISON

Table 6 summarizes the number of transition zones with four distinct squinch types found in the case studies as well as the number of geometric cross-section types identified in the transition zones. Shouldered arches are the most prevalent type of squinch, followed by Patkaneh, Patkin, and Sekonj. It is possible to draw the conclusion that, in comparison to other squinches, shouldered arches were primarily utilised for transition zones because of their simpler geometrical solution and quicker construction time. The transformation of a square into an octagon and then into a hexadecagon in twenty-three chambers is the most common geometrical solution. An octagonal cross section under domes in thirteen chambers is the next most frequently observed. In two of the cases, the square ground plan was directly transformed into a sixteen-sided base for the dome. In addition, transition zones with a decagon, an icositetragon, and a square section have been found in each case.

Table 6. Typology of transition zones in case studies

Squinch	Geometry of the transition zone						Total number
	4-4	4-8	4-8-16	4-16	4-10	4-24	
Patkaneh	0	1	7	2	1	1	12
Patkin	0	1	2	-	-	-	3
Shouldered Arches	1	9	14	-	-	-	24
Sekonj	0	2	-	-	-	-	2
Total number	1	13	23	2	1	1	41

Analogous squinch techniques have been observed in other Seljuk-era buildings across the broader territory of the Seljuk Empire. In the Central Asian region, while a limited number of edifices remain extant,

three distinct forms of squinches have been identified: Patkaneh, Patkin, and shouldered arches. The following edifices are located in present-day Turkmenistan: Patkin in Dayahatyn Caravanserai, Shouldered Arches in Mausoleum of Muhammad ibn Zayd and Talkhatan Baba Mosque, and Patkaneh in Abu Said Meikhene Mausoleum. It is important to note that the Iranian squinches, employed beneath domes, were introduced to Central Asian architecture either prior to the Seljuk dynasty or during the rule of other dynasties in this area, such as the Samanids, Kakuyids, Qarakhanids, and Ghaznavids.

Most Anatolian Seljuk buildings, located in present-day Turkey, employ pendentive or triangular squinch[15], architectural solution that were later adopted and further developed in Ottoman architecture. However, a limited number of examples demonstrate the use of alternative techniques. Notably, Patkaneh squinches are present in the Sultanhani Caravanserai, the Ağzıkara Han Caravanserai, and the Great Mosque of Malatya. In addition, shouldered arches can be observed beneath the domes of the Hoca Hasan Mosque and the Abdulaziz Mosque in Konya. It could be argued that the eastern region of the Seljuk Empire, which encompassed Central Asia, was of greater significance to the subject of the Iranian squinches than the western region, which is the territory of the Anatolian Seljuks.

[15] This type of squinch is referred to as Türk Üçgeni.

CONCLUSION

The distribution of case studies' construction times, squinch types, and transition zones' geometry on the map is depicted in Figure 6. This architectural diversity reflects the intricate craftsmanship and design preferences of Seljuk constructions, contributing to Iran's rich cultural and historical heritage. The following points could be drawn from this:
The locations of the structures are indicative of the importance of the regions during the Great Seljuk Empire, as they functioned as the capital of the Great Seljuk Empire, such as Rayy, Isfahan, Nishapur and later Hamadan, or were under the rule of regional Seljuk Sultans (Atabek), for instance the Kerman Seljuk Sultanate, or were on the main trade routes, for example the Khorasan Route. The structures in the north-west, with the exception of the Jame Mosque of Marand, were built when the region became important as the capital of the Great Seljuks moved to the city of Hamedan. It is important to note the unusual transition zone of the Jame Mosque of Marand, which had its influences on the rest of the later structures in the area.

The majority of the central structures date back to the days when Isfahan served as the region's capital. It is evident that structures in this region, such as the Jame Mosque of Zavare and the Jame Mosque of Marand, were constantly constructed using the same squinch and transition zone technique, and even the capital was relocated. It shows that the technique became a regional architectural type used by local architects.

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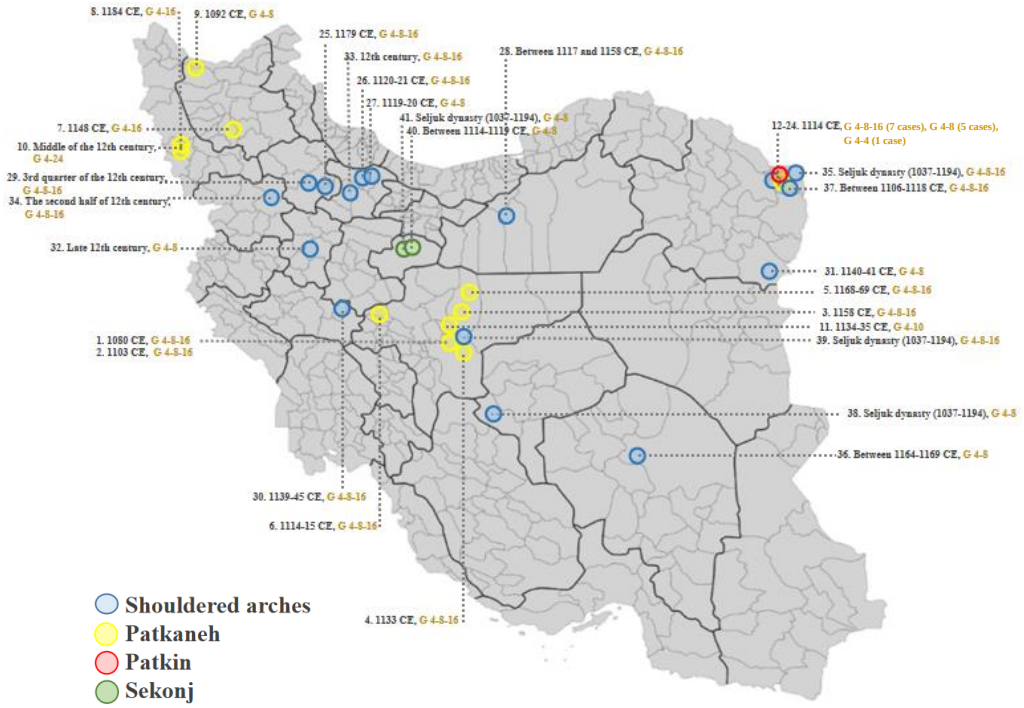


Figure 6. Four Case studies' construction time and geometry on the map

The northeast was important to the Seljuk Empire because of its advantageous position as a commercial route and the fact that Nishapur functioned as one of the empire's capital during its rule. The transition sections of the north-eastern structures are clearly linked to the central structures for the Patkaneh squinch and the north-western buildings for the schouldered arches. It is interesting to note that, despite the obvious influence, the approaches of the north-eastern buildings were simpler.

Additionally influenced by the transition zones featuring shouldered arches in northeast and north-west structures and simpler than them was the tomb of Khajeh Atabak, which is located in the southernmost point on the map. Remarkably, the building was constructed during the rule of the Kerman Seljuk sultanate in this area. The majority of structures with octagonal cross-sections in the transition zone, which serve as the basis for the dome, are located in the eastern part of the country. The sixteen-sided sections, representing the final layer of the transition zones, are observed to exhibit no particular regional preference.

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Traditional Bazaar Spaces in Southern Punjab, Pakistan: Social Life, Urban Identity, and Residential–Commercial Coexistence

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Abstract

This paper focuses on discussing the traditional bazaar space of Uch Sharif, a historic urban centre in Southern Punjab, Pakistan, and how these bazaars have facilitated the social interaction, identity creation in the city and how they have shaped or united the residential and commercial lifestyle. The study, using a qualitative, case-based approach that combines spatial mapping, architectural analysis, visual documentation, and interviewing the stakeholders, reveals that the bazaars of Uch - Chunri, Mehboob Subhani and Bukhari are not just commercial centres, but are also dynamic socio-spatial systems. The buildings are climatically responsive, the plans are multi-use and the activities are culturally embedded, which are all aspects of vernacular urbanism. The bazaars of Uch are hybridities in space, with trade, dwelling, religion and social life in a dense urban structure, a structure that is quite the opposite of the rigid zoning patterns of the modern city. Based on theories of social space (Lefebvre), place attachment (Relph and Tuan), and vernacular resilience, the study demonstrates the importance of these bazaars in maintaining intergenerational knowledge, a community network, and flexibility of its environment. The courtyards, shaded alleys and the thick earthen walls that they employed as passive cooling systems are also good examples of sustainability in the conception of cities in semi-arid landscapes. Yet, these are threats that are becoming more present in these heritage spaces that are threatened by modernization, neglect and uncontrolled development. The study is in favor of comprehensive regeneration plan which comprises heritage zoning, participatory planning and encouragement of the traditional micro enterprises. This study evokes the lived heritage and the architectural intelligence of Uch bazaars which are still relevant as sensitive low energy cities with rich cultural heritage. Concludes that it is not only important to conserve them physically with the renewal of such spaces, but also to maintain the sense of social and symbolic meaning of everyday urban life.

Keywords: *Residential-commercial coexistence, Social interaction, Southern Punjab, Traditional bazar spaces, Urban identity*

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INTRODUCTION

Cities are not mere screens on which human action is projected, but vivid stages on which identity, culture and community are lived. South Asians have been using bazaars as economic markets, social gathering centers and cultural focal points. Pakistan, its old cities and architecture give it a good background to explore these processes. The vernacular architecture and cultural traditions of Uch Sharif in Southern Punjab are a good example. The present paper addresses the role of its bazaar quarters in providing social interaction, urban identity, and the co-existence of residential and commercial life, especially as this space becomes marginalized by the forces of rapid urbanization and the globalizing tendencies.

Trade and gathering places form part of the cultural memory in Pakistan and forgetting of bazaars is a threat to the intangible heritage (Cheema and Bell, 2013). The bazaars such as Chunri, Mehboob Subhani and Bukhari in the Uch Sharif are sources of vernacular knowledge and urban social capital. They are clumped together, have small corridors, and courtyards, as well as shaded alleys, which not only moderate climate but also provide societal interaction (Mahmood, Ali, and Ahmad, 2022). All these characteristics represent the concept of urban interiority, in which form is created by cultural and climatic pressures instead of being dictated by design paradigms (Shah and Muro, 2023).

However, olden-day bazaars are decadent, commercialized, and ignored by the government. These dangers are portrayed in the erosion of place identity in the Anarkali Bazaar of Lahore (Batool and Bahauddin, 2025). In the same way, Uch, where modern infrastructure is emphasized more than cultural preservation, suffers both architectural and social networks due to the redevelopment pressures (Ahmad, 2022). Bazaars overlap with both shrines and communal grounds too, creating a stratified urbanism of sacred and commercial life coexisting (Snehi, 2019). This is inclusive as compared to contemporary forms of the city that spatially isolate functions and classes (Shakir, 2018).

Environmental sustainability is also expressed in traditional bazaars. Climate-responsive solutions, such as jallis, courtyards, tall walls, and thermal massing included passive design features long before the introduction of mechanical systems. Studies have verified that they are cost-effective and thermally comfortable to low-income population (Kazmi, Anjum, Iftikhar, & Qureshi, 2011). Socially, bazaars create a condensing effect, promote interaction, informal economies, and bottom-up urbanism (Bhatti, Hayat, and Mukhtar, 2013). According to Mokhtar (2012), sacred and commercial worlds tend to become one and the same in pluralistic space that cannot be attained in traditional zoning.

The Central Asian, Mughal, and indigenous mix; colorful culture; and bazaars preserving craftsmanship, textiles, and agricultural trade make Uch Sharif an appropriate center of interest (Mahmood et al., 2022). But these cities are ignored by urban research, which focuses on mega-cities such as Lahore or Karachi. This analysis shifts focus to marginal yet

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historically important locations, and proposes cultural sustainability instead of commercial expediency.

Preservation itself, like in Lahore, is often treated outside the community and may diminish heritage to veneer (Snehi, 2023). Regeneration of the city should not only conserve bricks and mortar but also virtual properties, including rituals, relationships and rights to the city. The economic revival of bazaars will boost economies, encourage sustainable tourism and help to improve civic pride. Cultural heritage in South Punjab will be useful in attracting visitors and providing livelihoods with proper planning (Vandal, 2011).

The study is interdisciplinary, cutting across architecture, sociology, anthropology and environmental studies. It emphasizes the construction and maintenance of urban identities through spatial, social, and symbolic aspects of traditional bazaars and explains why they should be preserved in the era of modernity.

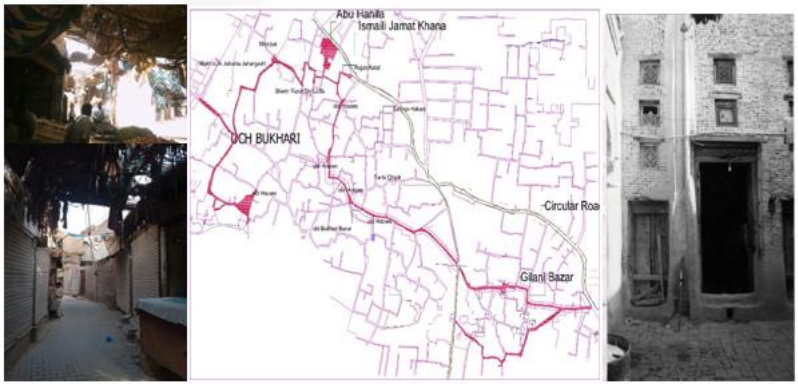


Figure 1. Figure 1. Example of coexistence of residential and commercial life in Uch Bukhari Bazar.

Figure 1 presents a spatial and photographic representation of the unique coexistence of commercial and residential life within the selected sample bazaars of Uch Sharif—Chunri Bazaar, Mehboob Subhani Bazaar, and Bukhari Bazaar. The bazaars were deliberately selected as having architectural continuity, spatial richness and preserving traditional mixed-use urbanism. The master plan of Uch was introduced as the central map to show the embeddedness of these bazaars in the organic urban fabric of the town. They are located near to important religious, communal and circulation nodes, which highlights their functional centrality and historic relevance. The pictures on the left show the inside atmosphere of these bazaars, which are made up of narrow pedestrian alleys with shops in front and temporary roofing. They are for both climatic and social purposes, not only for relief from the heat, but also for social informalities. The right photograph features a vernacular residential frontage, which is a typical feature of Bukhari Bazaar, and which shares a space frame with living quarters and shops. The built form represents an adaptive layering of private and public life, an integral part of Uch's architectural heritage. Altogether, these bazaars have been a dynamic aspect of urban areas in which commerce, culture and community come together in a coherent and sustainable spatial system.

In this regard, this study poses the following questions:

What is the role of the old markets of Uch Sharif in the daily life and in the construction of urban identity?

How do these bazaar locations allow for the coexistence of residential, commercial, religious and communal life in a small historic urban fabric?

How do the spatial and architectural aspects of the Uch's bazaars express vernacular resilience, climate responsiveness and cultural continuity in the context of the pressures of 'modernization' processes?

A novelty of this research is that it defocused major heritage towns of Pakistan and converged the research focus on Uch Sharif, the historic town of southern Punjab that is yet under-explored in urban and heritage studies. Although Uch Sharif has received few academic analyses, its traditional bazaars are still very dynamic that can be considered a living socio-spatial system. The study explores three of these market plazas—Chunri Bazaar, Mehboob Subhani Bazaar and Bukhari Bazaar—as more than just markets, as places of cultural continuity, intergenerational social networks, mingled residential-commercial spaces, climate-responsive environmental adaptations and strong local identity, using systematic spatial mapping, architectural documentation, visual analysis, and local stakeholder engagement. By this the research contributes to the current discourse on vernacular city making, the sustainable conservation of intangible elements of living heritage and inclusive approaches for regeneration of historic towns in South Asian context.

THEORETICAL BACKGROUND AND LITERATURE REVIEW

It is important to consider the manner in which the traditional bazaar space creates the identity of the city and its social interactions, and which is related to the theoretical body of urban sociology, human geography and the theory of the architecture in general. One particularly interesting theoretical orientation is what is known as The Production of Space by Henri Lefebvre (1991) where it is claimed that social spaces are actually actively produced by material, representational and experiential practices. This is because, in the context where it happens, the bazaar isn't just a passive medium for trade, but a social space that is being generated and that belies shared histories, values and identities. These markets can be considered the spatial practice of the urban dweller and the lived experiences, cultural continuity and socio-political negotiation of those people.

This opinion is consistent with the place theory, such as Relph (1976) and Tuan (1977) who highlight the phenomenological nature of space and the significance of human experiences and attachments to make places meaningful. In this sense the traditional bazaar spaces are not abstract spaces, but spaces where the sensory, cultural symbolism and intersubjective relations are served that create social cohesion and identity. Such emotions about place in such spaces can cause a high emotional and political value that cannot be easily translated to an economic transaction, as Cresswell (2015) has observed.

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Such spaces are also vital as a result of the contribution of urban theorist Jane Jacobs (1961). She stated that "eyes on the street" and the short block typologies of traditional bazaar, along with mixed use and tight knit communities, are the elements of successful streets and neighbourhoods. It is a human scale space that grows organically, encourages informal use and informal surveillance, and can be multi-generational, thus supporting the urban form by being both safety enhancing and enhancing the urban form for resilience and adaptability.

The empirical studies also reveal that bazaars help to form urban identity and interaction. The Middle East and North Africa (MENA) area finds that traditional souq is a cultural space that integrates trade, religion and everyday life. In such cases as the ones presented in Aleppo and Fez the presence of bazaars, that typically constitute the nervous center of the city and the city's life revolves around them (Bianca, 2000). Their hierarchical structure, the main and secondary alleys which lead to the resident spaces that are open towards both the public and the domestic life, attaining the balance between commerce and domesticity (Hakim, 1986).

Chattopadhyay (2006) studied the traditional bazaars of Kolkata in India and found that their adaptive nature of architecture and fluidity enable them to be economically viable and culturally resilient. Even under urban pressures, these markets remain socio-cultural nodes due to their integration into the networks of communities. In Southeast Asia, Lim (2015) highlighted the inclusive and fluid nature of vernacular commercial spaces in cities such as Hanoi and Yogyakarta as a way of promoting pluralism and micro-entrepreneurship.

Watson (2009) has reported the informal markets in the African cities such as Lagos and Nairobi, whereby the informal markets contribute to the development of urbanism in the cities and how the informal markets exist outside the formal regulatory framework but play a significant role in the economic sustainability and social life of the cities. Such markets, though informal, generate dense spatial practices and local urban identities.

Bazaar spaces can be considered as a demonstration of how architecture can be sensitive to climate and context, viewed in design and environmental terms. Studies of Iranian bazaars, including those in Isfahan, demonstrate that vaulted arcades, wind towers and courtyards are used not only to provide environmental benefits (shade, ventilation) but also social uses (meeting places) (Memarian & Brown, 2003). These attributes are in line with the concepts of sustainable urbanism and low-energy buildings.

In the Pakistani context, empirical research on the traditional bazaar spaces is sparse and slowly becoming an object of scholarly interest. Batool and Bahauddin (2025) examined the role of the Anarkali Bazaar lived experience in place-making and urban memory in Lahore. In their research, they discovered that in spite of the infrastructural degradation and commercialization, the users continued to have a good emotional

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attachment to the space by conducting daily rituals, seasonal festivals and common histories. One of the points that are emphasized by the researchers is the need to acknowledge the intangible heritage in the urban policy- what can be related to the case of Uch Sharif.

In his study of Sufi shrines and markets surrounding them in Sindh, Shakir (2018) illustrates that these spaces are places of both spiritual and commercial practice. They are centers of urban resilience, where pilgrimage, ritual practice and informal trade are accommodated, therefore, not subject to homogenized urban development. Mokhtar (2012) also confirms this by discussing the sacred economy of Sehwan Sharif, in which bazaars cannot be dissociated with religious activities and communal identity.

Kazmi, Anjum, Iftikhar and Qureshi (2011) in Multan used quantitative method to evaluate the performance of traditional public buildings such as markets and concluded that the traditional buildings scored higher in terms of thermal comfort and energy efficiency compared to modern buildings. According to their study, the passive cooling methods like jallis, thick walls and courtyards have still a relevance in the modern context of sustainable design.

Cheema and Bell (2013) provided a conservationist approach with their recording of the Bibi Jawandi Tomb Complex in Uch Sharif. Although the preservation of monumental architecture was the center of attention, they focus on the importance of the bazaar structures around to preserve the cultural integrity of the heritage zone. These spaces are not only commercial but also enhance the sacred geography of the city.

Mahmood, Ali, and Ahmad (2022) analyzed the morphologies of residential buildings in Uch Sharif and their vicinity to commercial hubs critically. Their results indicate that the spatial overlap of homes and bazaars facilitates dynamic social interactions, informal economies, and gender-sensitive spatial negotiations. This interdependence of spaces questions the contemporary zoning practice and provides alternative models of integrated urbanism.

Moreover, the lack of urban planning that is sensitive to the heritage is also very important. There is a dearth of institutional support in the cities of Southern Punjab to document, preserve, or adaptively reuse their rich collection of vernacular and heritage sites (Ahmad, 2022). Today, cultural capital and its historical context of Uch Sharif is still subject to infrastructural neglect, informal encroachment, and poorly conceived development projects that threaten its urban fabric.

There are some initiatives that offer inspiring examples. The Walled City of Lahore Authority (WCLA) has also demonstrated an approach towards heritage preservation and community engagement in order to redevelop traditional markets like Delhi Gate and Shah Almi. However, the efforts have not spread to other remote regions like Uch Sharif. Many local theories have been expressed by scholars such as Vandal (2011) and Hassan (2004) which emphasizes the need for localization in the urban

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development process by taking local culture into consideration rather than using globally-homogenized approaches to the planning process.

The literature can therefore be summarised around a few themes – the traditional bazaar spaces are multifunctional, socially integrative and climatically responsive. They defy zoning in cities, offer lessons in resilience and sustainability and are important cultural identity statements. But they are under threat due to the problem of policy neglect, commercialization and imperative of modernization. Recent studies like Ding et al. (2024) on cultural sustainability of bazaar spaces across Asia and Iqbal et al. (2022) on bazaar versus shopping center user preferences in Karachi, Pakistan, further emphasize the socio-cultural and economic significance of these vernacular urban forms in the current context of South Asia. In addition, Mahmood et al. (2023) give information about the conservation problems which exist today with the heritage monuments of Uch Sharif.

In conclusion, traditional bazaars and particularly those in the cities that have a stratified history like Uch Sharif can be interpreted as a kind of an archive of space and an archive of place. They are not only transactional spaces, but also spaces of memory, meaning and identity. Such spaces are important in the discourse of urbanism and it is argued in the theoretical and empirical literature that such spaces need to be re-valued in a context like Pakistan where a debate of conservation versus modernization is still ongoing. The future studies should be focused on the elaboration of the integrated frameworks, which would integrate spatial analysis, community participation, and sustainable planning to make sure that traditional bazaars remain the important elements of the urban experience.

RESEARCH METHODOLOGY

The research methodology employed is a case study whereby the researcher concentrated on the historic urban development of Uch Sharif that is characterized by vernacular architecture, dense urban form and rich cultural traditions. The case study methodology is especially applicable to the deep contextual analysis, where the context around the phenomenon is not clearly distinguished and marked (Yin, 2018). Since, the dynamics of bazaar space in Uch Sharif cannot be studied without taking into consideration the larger socio-cultural and environmental context of the city, the case study method allowed comprehensive examination.

A mix of architectural documentation, on-site observation, visual mapping and informal interviews were used to collect primary data. Layout, spatial arrangements and architectural features of bazaars and surrounding houses were documented through visual surveys and spatial mapping. This method has been extensively used in vernacular urbanism studies in attempts to interpret the spatial patterns and typologies of the city in respect to climate, culture, and everyday activities (Rapoport, 2005; Memarian & Brown, 2003). Important bazaar clusters, which were

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examined, were Chunri Bazaar, Mehboob Subhani Bazaar, and the Bukhari market zone.

To capture the architectural features including jallis (lattice screen), wooden balconies, courtyards and facade typologies, photographs were used. The analysis of visual data was used to translate the contribution of these features to passive climate control, community interaction and continuity of cultural identity. According to Dey (2015), visual ethnography enables researchers to take a more active stance regarding the symbolic and experiential aspects of space, which are paramount to the issues of this study.

Purposive sampling was also used to allow informal interviews with residents, shopkeepers, local planners and elders to understand how the spaces are used, perceived and valued. Urban ethnographic research commonly uses informal and semi-structured interviews because they produce detailed and situational answers (Creswell & Poth, 2018). The interviews were not recorded to accommodate comfort and privacy of the participants, particularly in such culturally sensitive areas. Rather, more elaborate field notes were kept and coded on a thematic basis.

Secondary information was acquired through pre-existing academic literature, master plans (where available), heritage reports and policy documents. The historical development of the settlement pattern and the importance of the commercial-residential integration were traced by means of relevant archival materials and maps. The visual, spatial, textual, and narrative data were triangulated, which made the results more reliable and in-depth (Patton, 2015).

A thematic coding process was used to analyze data. The visual and narrative information were categorized into key themes like; social interaction nodes, climatic adaptability, residential-commercial coexistence, aesthetic values, and spatial integration. These codes were not pre-thought, but appeared naturally in the course of fieldwork and data immersion, according to the principles of a grounded theory (Charmaz, 2014).

The spatial analysis was also assisted with field survey sketching of base maps and cross referencing with the master plan information (where it exists). Various aspects including circulation networks, spatial clustering, and boundary conditions were used to explain the similarities or differences between bazaar typologies and modern urban planning models. The approach of spatial layering has been effectively applied to the study of South Asian urbanism to put the relationship between form, function, and meaning in context (Saif, 2025).

Ethics was part of the research. All interviews and observations were accompanied by verbal consent. Participant identities are anonymized, and unnecessary photographs of people were avoided. Additionally, cultural and religious meaning of some places was taken into account during documentation, which means their representation was sensitive as regards to sacred and residential places.

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To sum up, the qualitative and multi-method research design used in the present research allowed to provide the comprehensive, grounded, and contextualized interpretation of the traditional bazaar spaces in Uch Sharif. The combination of spatial analysis, visual ethnography and narrative inquiry provides a strong methodological approach to reveal the socio-cultural, functional, and architectural dynamics that characterize these key urban spaces. Figure 2 summarizes the research methodology used in this study.

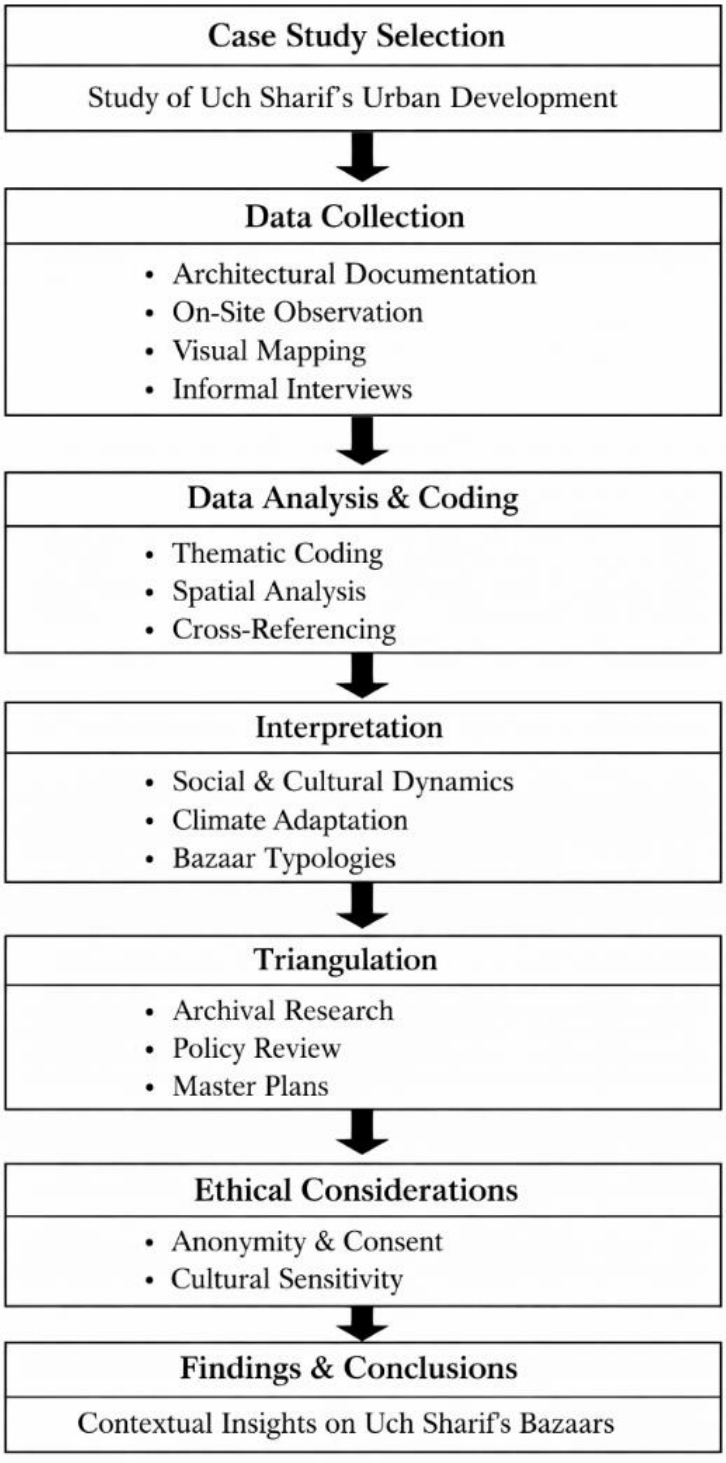


Figure 2. Research methodology framework summarizing the qualitative, multi-method research design. (Source: The Authors).

CASE OF UCH BAZAARS

The city of Uch Sharif in Southern Punjab, Pakistan, has extreme historical, architectural and spiritual dimension. The town of Uch was established in the 8th century or before that as an important staging-post on ancient trade and pilgrimage routes. The urban fabric of Uch Sharif has evolved as a result of cultural accretion over a number of centuries, as a result of the dynastic movement, religious traditions, and more localised vernacular traditions. One of the most outstanding elements of this urban space is its traditional bazaars which act as both spatial and social veins between home life, religious hubs and business. The case study includes an extensive study of the architecture, space dynamics and morphologic characteristics of the bazaar of Uch Sharif, utilizing both the findings of the primary studies and sound secondary sources.

The decision of selecting Uch Sharif as the center of this investigation has been taken due to its rich historical background, architectural value and urban-cultural continuity so that it may be presented in a clear depiction of the traditional bazaar based urbanism of the south of Punjab in Pakistan. Uch is not only a town with rich heritage that has architectural significance but it is also a living example of organically developed mixed-use urban form with religion, commerce and community coexisting. Strategically situated and a religious and trade center, Uch Sharif has been flourishing since the 12 th century, when it was under the Delhi Sultanate and Mughals. It was a strategic trading and pilgrim centre between the areas of Multan (Sindh) and Central Asia (Cheema & Bell, 2013). It is also religiously important as a seat of Sufism with the shrines of the descendants of Bahauddin Zakariya including the saintly Jalaluddin Surkh Posh Bukhari which have been visited by pilgrims since centuries ago (Snehi, 2019). Because the spiritual topography of Uch is a deeply embedded one, its physical topography is also a reflection of the embeddedness. In spite of the fast pace of urbanization, many of Uch's vernacular buildings and spatial rationales have survived. The blended character of residential and bazaar areas and the climate responsive courtyard typologies along with the use of local materials and techniques make Uch an exemplar of indigenous urban resilience (Mahmood, Ali, & Ahmad, 2022). This renders the town particularly relevant in the discussions in the present times on sustainable and inclusive urbanism, especially in the semi-arid space of South Asia. Additionally, Uch is underrepresented in academic scholarship and in heritage policy—even after having been placed on the UNESCO World Heritage Tentative List by the Government of Pakistan. It reflects the hybrid culture of Southern Punjab that is formed by Sufi Islam, artisan traditions and agrarian economy. Thus, studying Uch is not only useful from a localised perspective but can also be used to guide the wider debate on 'heritage sensitive urban development' in Pakistan. Significantly, the urban morphology of Uch Sharif is quite intact and it's possible to explore continuity of traditional urban practices. The presence of heritage zones in Uch is a living urban laboratory, which is

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not found in other large cities like Lahore or Karachi where historic neighbourhoods are in danger of being encroached upon or gentrified. The condition offers a rare chance to analyze an urban system in place that is high functioning but low energy and socially cohesive, a characteristic that is becoming more and more uncommon in the global South. In this context, Uch Sharif is not just a testament to the country's past and contemporary culture but also a pivotal point for considering urban sustainability, cultural resilience, and vernacular planning practices. Moreover, this dedicated case study becomes even more important because of the "relative obscurity" of this town in the mainstream of urban research.

In Figure 3 an in-depth visual survey of Mehboob Subhani Bazaar in Uch Sharif is presented to capture its architectural awareness, ecological awareness and socio-economic dynamism. This is one of the few cases where a vernacular usage has been adapted in a semi-formalised manner, as traditional commerce is still carried out in an adapted spatial framework. The overhead wooden trussed system and the sloping roof, which can be seen throughout the images, are built to accommodate passive ventilation and natural lightings that are enhanced by the perforated concrete blocks (jali walls) that are placed in a strategic location. These properties control the inside temperature and daylight entry – crucial in the hot and semi-arid Uch climate. The linear spatial rhythm is preserved along the central walkway, supported by symmetrical shopfronts which allow visibility and a continuous pedestrian movement. There are images of both street stalls and formalised retail outlet, indicating the stratification of the bazaar's economic system to meet the needs of various income levels. The images of lower level are active images of the market, where the local people trade, such as textile, jewelry and daily goods, which further supports the idea of the bazaar as social and community center. Mehboob Subhani Bazaar is a significant example of transitional urban morphology architecturally as it is a combination of the use of contemporary materials with the traditional planning. Although more modern materials have been used, such as concrete to replace the older ones, the spatial nature and cultural uses have not changed, which highlights the history and modernity in the urban habitat of Uch.

The architectural and atmospheric characteristic of Bukhari Bazaar which is one of the most historically ingrained commercial streets in Uch Sharif is expressed in figure 4. This bazaar is highly vernacular and the semi-covered passageways and the informal interventions within the space have resulted out of the passage of time as it has been developed to suit the environmental conditions and the needs of its users. Of note is the use of local organic materials for roofing the roof, such as thatch, bamboo matting and palm fronds. These materials provide shade and minimize direct solar gain but diffused light penetrates, producing a special atmosphere of diffused light and a pleasant temperature. The simple wooden beams and makeshift trusses point to a simple,

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community-built tradition in which expediency and incremental construction are virtues. While it is clear that some parts of the roof have suffered as a result of poor maintenance, the area is still alive and strong, and has demonstrated remarkable resilience and adaptability. Closed stores and street-side kiosks continue to line the crooked alleys, keeping the small-scale traders very dense and the bazaar a source of financial livelihood for most of the citizens. It may be noted that the spatial proximity and sociality found in the traditional bazaar of Uch is evident with Bukhari Bazaar; the narrowness, the overhead coverings and human scale of the bazaar provide a trading and social space, that traversed several generations of people.

Chunri Bazaar, Uch Sharif is a unique architectural essence as it possesses high heritage content and is more or less intact in terms of historical morphology compared to other market venues of the town as shown in Figure 5. The images depict a two-story market structure featuring arched arcades and timber framing with carved capitals, which suggest influences from colonial or pre-colonial vernacular architecture. The sturdy yet elegantly detailed structure suggests that Chunni Bazaar may have once been used for a semi-formal business center, possibly serving not only the cloth merchants but also the artisan traders, too – which seems to make sense as its name is Chunri Bazaar, which means a traditional patterned cloth draped on women and Chunni. It is clear that there is a spatial stratification as the first floor features recessed shopfronts which would have protected from the strong sun, while the second floor is a series of rhythmic arches which were likely storage space or a continuation of the trade space. These multi-purpose floors are examples of adaptive typology of market buildings in the South Asian context, where the maximum verticality is exploited in the small urban plots. The old faces and the roofed shops of the lower paintings indicate old age and ongoing transformation: some of the areas are no longer in use, others are still functioning as local stores. In modern Kathmandu, Chunri Bazaar is a silent witness to the survival of ancient marketplaces – a perfect blend of elegant decay and unflagging use – and offers a fascinating insight into the layered history of architectural developments in Uch.

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Figure 3. Figure 3. Mehboob Subhani Bazar, Uch Sharif (Source: The Authors).



Figure 4. Figure 4. Bukhari Bazaar, Uch Sharif (Source: The Authors).

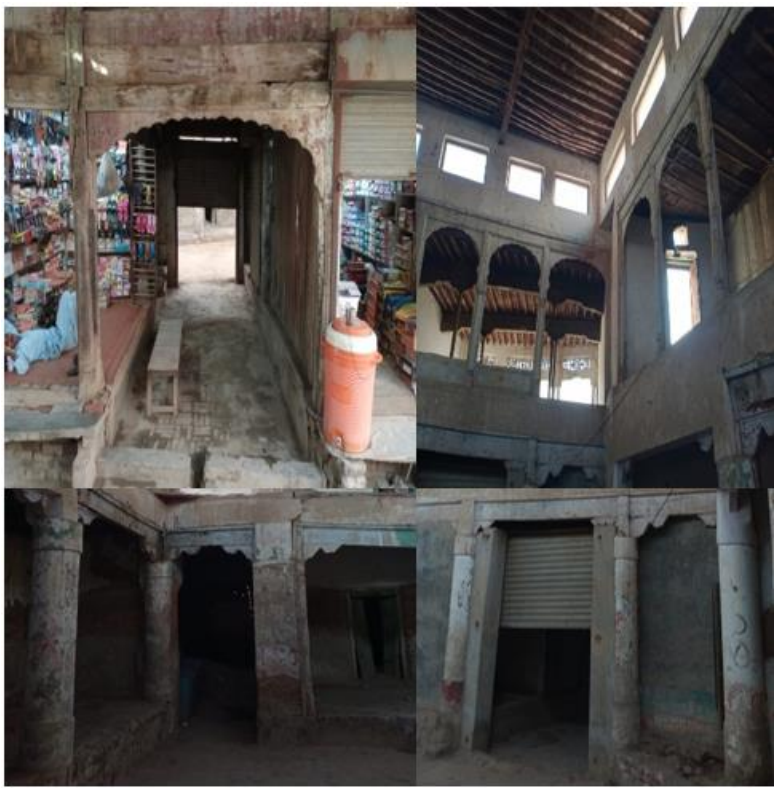


Figure 5. Chunri Bazaar, Uch Sharif (Source: The Authors).

ANALYSIS AND FINDINGS

Morphological Analysis

The organic urban morphology of Uch Sharif is characterized by a combination of meandering streets and compactly mixed clusters of uses, typical of historic south Asian towns (Bianca, 2000). As socio-spatial spines connecting the homes, shrines and communal nodes, the three bazaars studied (Chunri, Mehboob Subhani and Bukhari) are embedded within this dense fabric. These places stand in contrast to modern single-use zoning, as they feature a mixed uses model: shops on the ground floor and upper floor and/or rear residences that are continuously occupied, informally policed and provide a sense of community (Jacobs, 1961; Kazmi et al., 2011).

The use of vernacular elements is predominant such as thick mud-brick and stone walls for thermal mass, internal courtyards (sehān) for cross-ventilation and social gathering, jharokhas, jalis and narrow alleys with shade. These elements are a suitable passive cooling system for hot semi-arid climate and they are in use since before mechanical systems (Memarian & Brown, 2003). As a multi-functional and lived space, Courtyards perform tasks like domestic activities, vendors' gatherings and festivals, a performance of Lefebvre's (1991) socially produced space.

The bazaars are connected with Uch's sacred landscape around important shrines (e.g. Jalaluddin Surkh-Posh Bukhari and Bibi Jawandi), which allows for seamless interactions between trade, pilgrimage and

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ritual (Snehi, 2019). Yet, the heritage is under threat from vehicular encroachment, ad hoc concrete interventions, competition from modern retail, and infrastructure neglect, which threaten both the physical fabric of the heritage and the intangible practices.

Traditional solutions such as diurnal thermal storage in thick walls, night ventilation by courtyards and alleys and localized evaporative cooling are verified by psychrometric analysis (Figure 8) which shows the shift of the conditions towards the thermal comfort zone, which confirms the low-energy performance of this indigenous urbanism.

Heritage Value Analysis of Traditional Bazar & Houses in Uch

Heritage significance is evaluated within six interconnected dimensions, which collectively represent a dynamic and evolving system and not monuments.

Urban Character and Values

A century by century accretion, producing a consistent but diverse morphology. Mehboob Subhani Bazaar is a linear, structured form, Bukhari Bazaar displays organic, semi-covered winding alleys and Chunri Bazaar presents vertically stratified arcades with timber framing. That diversity is a sign of vernacular flexibility, human-scaled, walkable and socially intimate, in contrast to the inflexibility of modern planning (Bianca, 2000).

Uses and Activities

The bazaars are multi-temporal cultural spaces. The day is dedicated to commerce – textiles, handicrafts, spices and produce – while the evening is spent in socializing. The proximity to shrines weaves together an economic life and the pilgrimage and Sufi rituals, and the courtyard serves as a space for festivals and communal gatherings (Snehi, 2019). Temporal layering contributes towards vibrant street life and place attachment.

Functional and Economic Value

The local availability of materials along with passive design (thick walls, high ceiling, clerestory openings, cross-ventilation) provide thermal comfort and low maintenance (Kazmi et al., 2011). The live-work model provides for low capital micro-enterprises and inclusive informal economies, which help marginalised groups and counter gentrification trends in larger cities.

Community Needs and Cultural Value

Spatial organisation is sensitive to the local cultures' protocol. The inward facing courtyards provide a balance of privacy (purdah) and family interaction and hospitality. Extended-family compounds and spaces for common use promote intergenerational solidarity and support. Market and courtyard spaces are directly related to intangible heritage, with rituals practiced within these spaces that are integrated into the built fabric through kinship, religious observance and communal practices.

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Aesthetic and Architectural Value

The aesthetic expression is a result of pragmatic craftsmanship which comprises of carved timber columns, arched verandas, jali screens and context-sensitive roofing (bamboo matting and thatch in Bukhari Bazaar versus pitched timber trusses in Mehboob Subhani). All these elements are sensitive to climate, skills and cultural idiom and contribute to Uch's unique visual identity (Cheema & Bell, 2013).

Cultural Memory and Continuity

The bazaars and houses are places which witness events of generations of human life and at the same time give meaning to the emotional-historical events (Tuan, 1977). The intergenerational transmission of property, artisanal skills (textile work, embroidery, wood carving) and ritual practices are the source of cultural continuity and are essential for the maintenance of Southern Punjabi identity in the face of homogenisation.

Integration of Domestic Architecture with Bazaar Morphology

Figures 6 and 7 show a typical house with two floors, which is next to Chunri Bazaar, where the domestic–commercial interface is seamless. The plan is inward looking, with a central courtyard (sehān) as the thermal and social spine which offers natural ventilation, daylight and privacy buffering. Climate control and controlled interaction are provided for ground floor spaces (baithak, kitchen, utilities) through thick perimeter walls and minimising street openings to reduce heat gain. Patios on the first floor add to the ventilation.

This set up allows estimated 15-20% reduction of cooling demand in passive mode. Live-work patterns and reciprocal oversight is facilitated by direct proximity to the bazaar. Due to cultural aspirations for hospitality and gender appropriate behavior, and to deal with monsoon flooding, the facade (Figure 7) is narrow, includes controlled thresholds and a step-by-step public-to-private zoning. The typology reveals this way vernacular domestic architecture actively helps and is helped by the surrounding bazaar system.

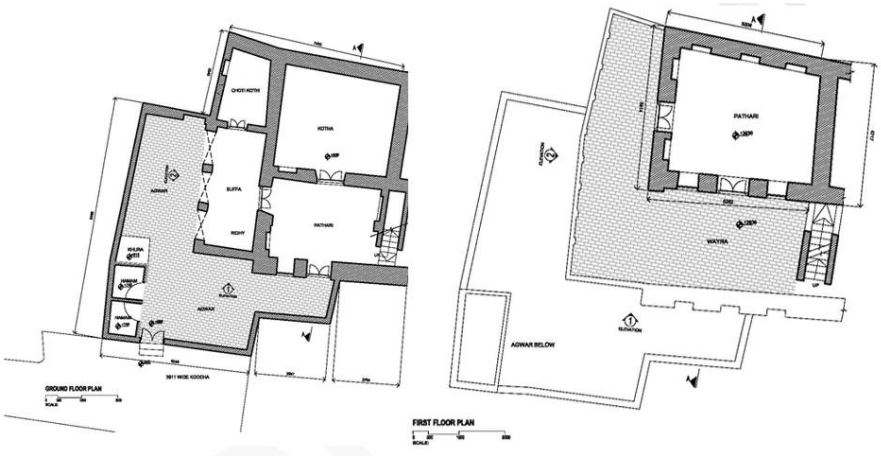


Figure 6. Typical Two-Story Traditional House for analysis w.r.t neighboring Bazar (Source: The Authors).

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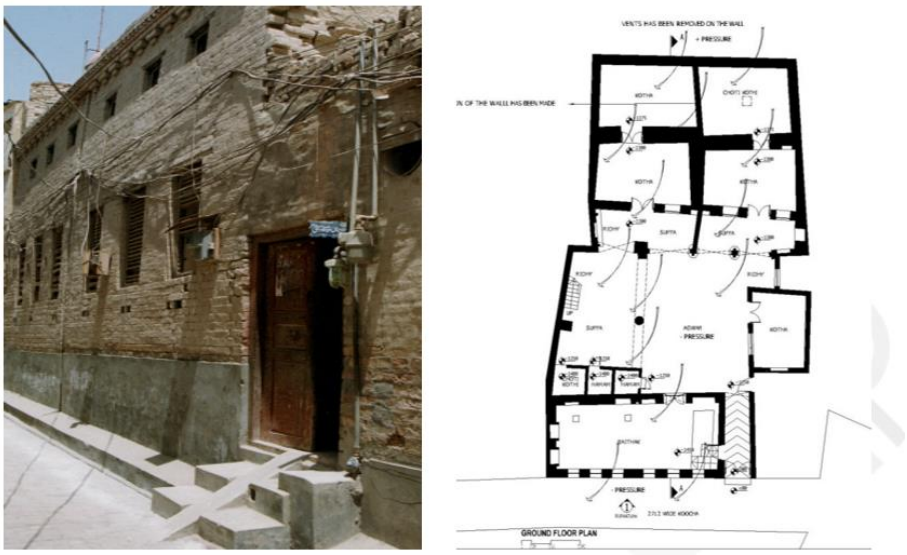


Figure 7. Front View of house with Ground Floor plan (Source: Authors).

Synchronic and Diachronic Microclimatic influences on Uch Sharif's Heritage Cluster

Figure 8 is the psychrometric chart, which is drawn from the local meteorological data, to show the position of the climate of Uch Sharif with respect to the thermal comfort envelope. Much of the year is outside comfortable conditions as there are extended periods of hot, low-humidity weather with high solar radiation. The vernacular response is synergistic: high thermal mass store and release heat diurnally; high clustering of form and narrow alleys provide shade and channel breezes; high internal courtyards provide stack-effect ventilation and localized evaporative cooling; and selective fenestration using jalis modulate light and airflow.

These strategies move the indoor and semi-outdoor conditions towards the comfort zone (illustrated as adaptive pathways on the chart). The traditional system is climatically intelligent, low-carbon urban form, which is energy saving compared with mechanical systems. The analysis has confirmed the cultural value and environmental performance of Uch's heritage architecture and thus has provided empirically-based knowledge for sustainable design in similar historic sites in semi-arid regions.

In conclusion, the psychrometric chart underscores the scientific validity of vernacular architecture, showing that indigenous methods are not only culturally rooted but also performatively robust. In the context of climate-responsive design, the chart affirms that traditional architectural practices in Uch are inherently sustainable, capable of delivering thermal comfort with minimal reliance on external energy inputs—an increasingly critical criterion in global climate adaptation strategies.

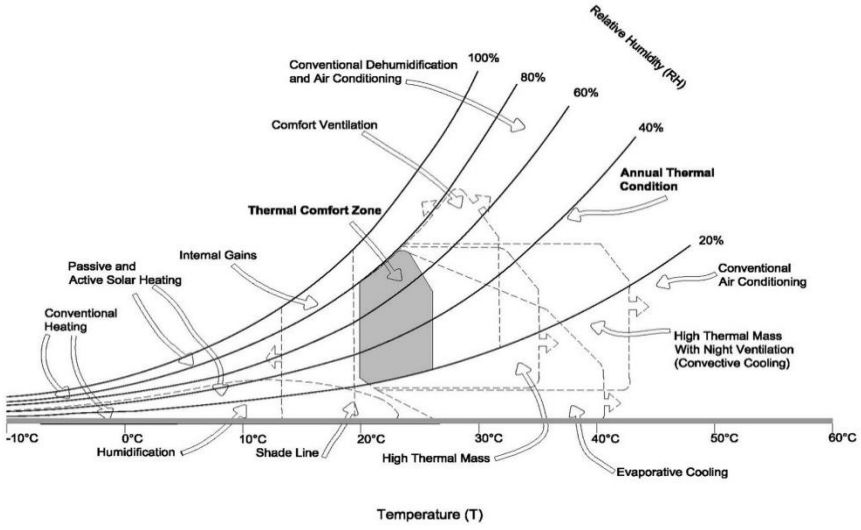


Figure 8. Psychometric Chart on the basis of Metrological data (Source: Authors).

CONCLUSION AND RECOMMENDATIONS

Conclusion

The traditional bazaars in Uch Sharif are not mere markets, but rather, living, intertwining socio-cultural systems where trade, residence, religion and communal life overlap. The current research forms their significance as the urban settings that are simulated by human experience, social relations, and adaptation to the environment. Unlike modern zoning, which separates land uses, the bazaars have a mixed spatial rationality; houses, shops and holy places exist side-by-side, making possible organic participatory urbanism. This arrangement is consistent with the idea of the French philosopher Henri Lefebvre of the concept of a social space, the space created in the course of lived practices, and not a projection of a blueprint. Bazaars are centers of community integration in Uch, where daily trade, festivals and family customs are conducted. Their continued application strengthens cultural identity and knowledge transfer between generations, especially with regard to artisanal skills and religious practices. Architecturally, strong affinity to passive environmental design principles are evidenced by the use of courtyards, narrow shaded alleys and thick walls made out of local materials. Psychrometric modeling - an analysis of temperature–humidity conditions against human comfort thresholds - proves that the outlined measures improve comfort of the semi-arid climate in Uch, which minimizes the use of mechanical cooling and makes the city a vivid case of sustainable urbanism. The heritage is, however, threatened. The character and usability of these spaces are being eroded due to encroachment, unplanned development, loss of craftsmanship and neglect of infrastructures. Modernization and digital transition are disrupting local economies, and informal traders and artisan communities are becoming more and more marginalized. To deal with this challenge, one should go beyond architectural conservation. The local involvement, adaptive reuse, and socio-economic regeneration should be enabled through regeneration strategies. There should be heritage zones,

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better facilities and cultural tourism coupled with respect of local traditions. The existence of counterpart models, like the Walled City of Lahore, can be used as an instructive precedent but is lacking in smaller heritage municipalities, like Uch. Finally, Uch Sharif bazaars teach a lot about inclusive, low-energy, culturally rooted urbanism. Their survival does not depend on how they are kept in the past but how they are modified to be relevant to the current needs, how they are made alive, operational and rooted in their past rich heritage. Table-1 provides brief summary of the entire study based on different components.

Recommendations

The findings of this study have direct relevance for broader heritage management and urban planning frameworks. The observed residential–commercial hybridity, climate-responsive vernacular design, and strong place attachment in Uch's bazaars align closely with the principles of the UNESCO Historic Urban Landscape (HUL) approach, which advocates integrating heritage conservation with sustainable urban development and community participation. The study's evidence of passive cooling performance and low-energy urban form also supports Pakistan's commitments under SDG 11 (Sustainable Cities and Communities), particularly targets related to inclusive, safe, resilient, and sustainable urbanisation. Furthermore, the identified threats of encroachment and loss of intangible heritage underscore the need for stronger implementation of provincial heritage legislation and the development of Integrated Conservation and Development Plans (ICDPs) that move beyond monument-centric protection toward living heritage management. The eight recommendations proposed below are designed to operationalise these frameworks at the local level while remaining sensitive to the specific socio-spatial and climatic realities of Southern Punjab's historic towns.

In order to protect and restore the historic bazaars of Uch Sharif, the implementation of a multi-dimensional community-based approach is essential. The empirical evidence implies the following specific interventions:

1. Heritage Zone Declaration: The historic bazaar localities of Uch Sharif ought to be declared a Heritage Zone in the national and provincial cultural heritage laws. Official designation would restrict uncontrolled building, automobile encroachment, and land-use transformation, and it would allow the receipt of restoration funding and technical support.

2. Participatory Regeneration Framework: No regeneration program can be run without involving the local stakeholders such as traders, artisans, residents, and religious leaders. Community-based participatory planning workshops would help to make sure that interventions meet the needs of the community, foster local trust, and maintain the socio-cultural practices inscribed in it.

3. Cultural and Microenterprise Revival: Develop support programs of the traditional crafts like textile dyeing, calligraphy, wood carving, and

embroidery. Creation of a cultural cluster or a place where bazaars meet near Mela Ground can be used as a platform to display local talent, attract tourists and earn an income to marginalized communities.

4. Better Infrastructure and Facilities: Enhance basic facilities like garbage disposal, water drainage, street lights and toilets without making any changes to the spatial or visual nature of the bazaar. To further enhance the sustainable nature of these spaces, it is possible to incorporate eco-friendly technologies, e.g. solar lighting or rainwater harvesting.

5. Connectivity and Walkability: Create foot-friendly paths between Chunri, Bukhari and Mehboob Subhani bazaars and shrine precincts to create a logical urban heritage walk. Accessibility and cultural tourism may be promoted through wayfinding signage, resting places, and interpretive boards.

6. Architectural Guidelines: Provide architectural conservation guidelines in facade repairs, roofing materials and signage regulation so as to ensure that interventions are done in a manner that is sympathetic to local vernacular styles. Sustainability will be enhanced by conducting training workshops to the local masons and builders in heritage sensitive methods.

7. Institutional Support: Form a Uch Heritage Cell in the local government that will have conservation architects, planners, and community liaisons. This unit has the capacity to serve as a facilitator between provincial governments, donors, and community organizations.

8. Education and Awareness: Put in place heritage education in schools and in the form of public workshops to cultivate a bond of pride and stewardship among the youth and future generations.

With these recommendations implemented, Uch Sharif will become a living heritage town, which will find a balance between tradition and development and would serve as an excellent example of sustainable and inclusive urbanism in Pakistan.

Limitations and Future Directions

This study has a number of limitations which need to be recognised. First, it is a single case study and results are context specific and would not be fully generalizable to other historic towns in Pakistan or in the region. Second, the qualitative nature of the research is suitable for the investigation of lived experiences and socio-spatial dynamics, but the research itself is inherently interpretive and therefore, triangulation was used throughout the spatial, visual and narrative data to strengthen the credibility of the research. Third, to avoid offense to participants, field notes were taken in lieu of audio recordings, which might have restricted the recording of subtle participant expressions. Finally, the study was concentrated on the three selected bazaars and it was impractical to study the three in detail, to cover the whole of the historic core of Uch Sharif. Future studies may be able to remedy these shortcomings using multi-case comparison studies, mixed-methods studies that combine

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quantitative thermal or spatial analysis, and longitudinal studies which can examine the effectiveness of regeneration interventions over time.

Table 1. Brief Summary of the Study

Component	Brief Description in This Study
Problem Statement	Traditional bazaars in historic secondary cities like Uch Sharif are marginalised by modernisation, neglect, and uncontrolled development, threatening social interaction, urban identity, residential–commercial coexistence, and sustainable heritage.
Research Gap	Limited integrated research on vernacular bazaars in Southern Punjab. Most studies focus on large cities or monumental heritage; few combine spatial morphology, multi-dimensional heritage value, microclimate, and policy recommendations for living heritage.
Significance	Provides a replicable model for inclusive, low-energy, culturally rooted urbanism in historic towns of the Global South. Supports heritage policy, local economies, climate adaptation, and shifts conservation from monumental to living heritage approaches.
Context	Uch Sharif: 8th-century historic trade and Sufi pilgrimage centre in Southern Punjab with organic urban fabric, vernacular architecture, and strong residential–commercial–religious integration. Currently facing modernisation pressures while retaining traditional mixed-use character.
Chosen Sample	Three key bazaars in Uch Sharif were purposively selected: Chunri Bazaar (high heritage value with arcaded structures), Mehboob Subhani Bazaar (linear structured form), and Bukhari Bazaar (organic, semi-covered vernacular typology). Selection criteria included architectural continuity, spatial richness, functional centrality, and representation of traditional mixed-use urbanism.
Theoretical Framework	Integrates Lefebvre's production of space, Relph & Tuan's place attachment, Jane Jacobs' urban vitality principles, and vernacular resilience/bioclimatic architecture theories.
Research Philosophy	Qualitative, interpretive/constructivist paradigm. Emphasises lived experience, meaning-making, cultural context, and inductive understanding of socio-spatial phenomena.
Research Methodology	Qualitative single-case study (Yin). In-depth exploration of Uch Sharif bazaars using multi-method design with triangulation for rigour and contextual depth.
Techniques	Spatial mapping, architectural documentation, visual ethnography, purposive sampling, informal interviews (field notes), thematic coding (grounded approach), and psychrometric analysis. Data triangulated across visual, spatial, and narrative sources.
Findings	Bazaars function as dynamic socio-spatial systems with strong residential–commercial hybridity, high multi-dimensional heritage value, effective passive climate control, and significant threats from encroachment and modernisation.
Research Contributions	Advances interdisciplinary understanding of vernacular urbanism in South Asia by integrating Lefebvre's social space, place attachment theory, and sustainability frameworks. Demonstrates the academic value of lived heritage, mixed-use morphology, and indigenous knowledge in secondary historic cities.
Policy Implications	Delivers eight practical recommendations: heritage zone declaration, participatory regeneration, cultural microenterprise revival, infrastructure improvement, enhanced walkability, context-sensitive architectural guidelines, dedicated institutional support

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	(Uch Heritage Cell), and heritage education programmes. Offers a transferable model for other historic towns in Pakistan.
Limitations	Qualitative single-case study focused on three bazaars in one historic town, limiting generalisability. Reliance on field notes (due to cultural sensitivity) and interpretive analysis introduces potential subjectivity, despite triangulation. Absence of longitudinal or quantitative data restricts assessment of long-term impacts and precise environmental performance.

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Resume

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Visual Data Browsing in the Design Process: Interior Architecture Students' Approaches to the Use of Social Networking Platforms

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Abstract

This study examines the visual data browsing approaches of interior architecture students through social networking platforms (SNP) in the design process. Based on the characteristics of the research group, the study aims to reveal the contributions of SNP to interior architecture education and the emerging trends in this context. Within this aim, a total of 298 students from the Interior Architecture and Environmental Design Departments of Bilecik Şeyh Edebali University and Hacettepe University participated in the study. A questionnaire including 28 questions was used to assess the use of SNP during the design process, usage habits, preferred platforms, and data collection methods. The findings indicate that interior architecture students actively use SNP in the design process for purposes such as design innovations, seeing different design approaches, getting inspiration or learning new techniques. It has been determined that as the level of education differs, differences may occur in the students' approaches to bringing together visuals and analysing existing designs better to create original designs. It was determined that students generally use SNP for professional projects and design content, and that weekly and daily use is common. It has been observed that 3rd grade students benefit from SNP more than students in other educational levels. No significant differences were found between universities; Pinterest was found to be the most preferred platform. Despite the limited negative effects of SNP, such as distractions and reliability issues, it was concluded that their conscious and balanced use, contributes academically and professionally to the design education process.

Keywords: *Design process, Interior architecture, Interior architecture education, Social networking platforms, Visual data*

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INTRODUCTION

The rapid proliferation of online platforms, driven by advancements in digital technologies, empowers design students to integrate these platforms into their educational processes, thereby transforming information access and production methods (Güler, 2015; Cho and Cho, 2020; İlter, 2020; Scolere, 2023). While this change reveals new approaches in design education, SNP become a part of visual data browsing and inspiration-seeking processes for students. Specifically, SNP are defined as digital environments where users generate, disseminate, and engage with visual, textual, and auditory content (Weaver and Morrison, 2008; Castells, 2023). Students frequently use these platforms to search, collect, and interpret visual data. Visual data are spatial representations that influence design decisions, such as images, drawings, and photographs that students access through information search methods.

Interior architecture education encompasses the instruction of knowledge and skills pertinent to space design, developing individuals with creative and analytical abilities, and strives to furnish students with the essential knowledge, skills, and values required for career success (Kurt Cavuş and Kaptan, 2022). A key requirement of interior architecture education is that students understand diverse social, cultural, and spatial contexts and stay up to date with contemporary lifestyles. In this context, design students are increasingly utilizing SNP to better understand users' lifestyles and spatial requirements in the modern era. SNP are defined as online spaces where users can share their emotions, thoughts, experiences, knowledge, and areas of interest either vocally or visually with known or unknown individuals (Ince and Koçak, 2017). The rapid development of these platforms and their ease of access to visual and informational data have encouraged students to integrate SNP into their educational processes, thereby enhancing the efficiency (Akçay et al., 2021; Atar, 2022).

Studies on the interaction between SNP and educational systems suggest that out-of-school education will increasingly occur through these platforms (Akgün, 2016; Eryılmaz, 2017; Izadpanah, 2021; Atar, 2022). This interaction not only extends learning beyond the classroom, making the process more flexible and accessible for students but also broadens the learning experience, thereby creating a more inclusive structure. Furthermore, it enables students to personalize their learning processes and engage with a wider array of resources. SNP foster students' creativity while also encouraging the growth of digital literacy, self-directed learning, teamwork and communication abilities, and critical thinking skills (Allen et al., 2012; Eryılmaz, 2017; Pérez Nanclares and Del Blanco García, 2024). The use of SNP not only engages individuals cognitively, but also supports their cognitive development, enhances their level of awareness, enriches their knowledge base, and contributes to behavioral transformation (Gillet et al., 2008).

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Through the content they share on SNP, students not only enhance their learning but also contribute the skills they acquire back to society (Ham and Schnabel, 2011). In design education, knowledge and experience gained from previous projects assist students with similar design challenges. This accumulation of knowledge and experience guides new designs while continuously evolving through professional practice (Özgür, 2019). Pourahmad Ghalejough et al. (2022) stated that the more designers enrich their visual resources and archives, the more creatively they can manage design challenges and processes. Moreover, students use images at the beginning of the design process to seek inspiration, guide their work and establish a general atmosphere for their designs (Gilman and Vincent, 2013; Erçevik Sönmez, 2020). SNP make learning processes more innovative and engaging, facilitate the comprehension of information and enable students to save both time and money (Agusintadewi et al., 2021). However, these platforms can also lead to the loss of critical resources, create pressure and result in disruptions, fatigue, exhaustion, and information overload that inhibit self-dependence and personal control (Zhang and Mao, 2023). Additionally, when students struggle with time management, they may opt for a superficial approach over in-depth learning, face difficulties critically evaluating the possibilities offered by representational media, and experience indecision about which information to pursue due to excessive information access—leading to the neglect of other relevant stimuli while focusing on specific cues (Ham, 2013; Gonçalves et al., 2016; Özsavaş Uluçay, 2017). This situation can result in negative outcomes in design culture, such as distortion, repetition and even replication or imitation (Özsavaş Uluçay, 2017). The study is structured around the following research questions:

RQ1: How does the practice of visual data exploration on social networking platforms (SNP) during the design process affect the creativity and technical development of interior architecture students?

RQ2: What are the potential positive and negative impacts of visual data exploration on social networking platforms (SNP) during the design process for interior architecture students?

RQ3: What are the social networking platforms (SNP) usage habits, preferred content types, and data collection methods of interior architecture students during the design process?

While existing studies in the literature offer helpful information regarding students' visual data exploration through SNP (e.g., in medical education: Cheston et al, 2013; in secondary education: Greenhow and Lewin, 2016; in engineering education: Junco et al, 2011; in language learning: Zhou, 2021), there is still a lack of sufficient research on how interior architecture students engage with these platforms and how they are affected by them. The contribution of this study to the literature aims to fill gaps in the existing literature, specifically the limited number of studies on interior architecture education, which are generally confined to one or a few SNP (Ham, 2013; Gilman and Vincent, 2013; Ilter and

Karacar, 2017; Gürdağ et al., 2018; Taşdelen, 2018; Chai and Fan., 2018; Al Hashimi et al., 2019; Scolere, 2019; Dwijendra and Yogantari, 2019; Ilter, 2020; Izadpanah, 2021; Pourahmad Ghalejough et al., 2022; Gök Tokgöz and Altın, 2022; Atar, 2022; Özteke Aysal et al, 2024). In this sense, it aims to examine the role of SNP in design processes from a broader perspective and to provide a resource to fill the gaps in this field. This study examines the relationship between interior architecture students' visual data exploration on SNP at different stages of the design process and their creativity and overall design development. It seeks to identify the similarities and differences in the approaches of interior architecture students, as well as to explore the reasons behind these approaches, providing a detailed evaluation of interior architecture education and students' engagement with SNP. Moreover, the study aims to identify the preferred SNP among interior architecture students

RESEARCH METHOD

In this research, a questionnaire was developed to assess the opinions of students in the Departments of Interior Architecture and Environmental Design at Bilecik Şeyh Edebali University (BŞEU) and Hacettepe University (HU) about the relationship between their creativity and overall design development through visual data discovery on SNP at various stages of the design process.

Participants

Participants consisted of a total of 298 students from the Departments of Interior Architecture and Environmental Design BŞEU (194 individuals) and HU (194 individuals) during the fall semester of 2024-2025, all of whom willingly consented to participate in the study (Table 1).

Table 1. General Information About the Participants

Characteristics of Participants		**F**	**%**
Gender	Female	248	83,2
	Male	50	16,8
Age	17-22	218	73,2
	23-30	79	26,5
	31 and above	1	0,3
University	Bilecik Şeyh Edebali University	149	50
	Hacettepe University	149	50
Level of Education	1st Grade	47	15,8
	2nd Grade	91	30,5
	3rd Grade	59	19,8
	4th Grade	101	33,9

Notes: F: Number of participants %: Percentage value

According to Table 1, 16,8% of the respondents male, and 83.2% were female; 73,2% were between the ages of 17-22, 26,5% were between the ages of 23-30, and 0,3% were between the ages of 31 and above; 15,8% were in 1st grade, 30,5% were in 2nd grade, 19,8% were in 3rd grade, and 33,9% were in 4th grade. Consequently, gender and age variables

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were excluded from the analysis because most of the participants were female, and between the ages of 17-22.

Questionnaire Design and Procedure

A single questionnaire was prepared consisting of four parts: the first part consists of questions about demographic information, the second part consists of nine questions to evaluate the use of SNP in the design process using a Five-point Likert-type scale (1: Never, 5: Always), the third part consists of ten questions to evaluate the approach of using SNP using a Five-point Likert-type scale (1: Strongly Disagree, 5: Strongly Agree) and the fourth section consists of five multiple choice questions to evaluate the habits of using SNP. The questionnaire form was prepared by using the literature in the interior architecture discipline and different design disciplines. (Toğay et al, 2013; Chai and Fan, 2018; Ilter and Karacar, 2017; Alacacı Torun, 2019; Gürdağ et al, 2018; Abdul Kadir, 2020; Izadpanah, 2021; Tümer, 2022; Pourahmad Ghalejough et al., 2022; Gök and Altın, 2022; Scolere, 2023; Özteke Aysal et al., 2024).

The questionnaire, which received the necessary ethical permissions from the relevant institutions, was shared with the participants online via Google Forms in the fall semester of 2024-2025 and was structured in a way that their voluntary consent for participation could be obtained.

Statistical Methods

Statistical analyses were carried out with IBM SPSS Statistics (v. 22.0). Data collected from the questionnaire, designed in accordance with the research questions, were analysed using appropriate statistical methods. First, Cronbach's alpha reliability coefficients, mean, and standard deviation values were computed for each dependent variable. Then, relationships between universities and education levels were analysed using one-way analysis of variance (ANOVA). Data were also presented graphically to better illustrate the differences between the obtained percentages and means.

FINDINGS

The data obtained were evaluated and interpreted within the framework of the main questions of the research (RQ1, RQ2 and RQ3) and detailed under the relevant headings. The findings are divided into three different sections as 'Analysis of Evaluations on the Use of SNP in the Design Process', 'Analysis of the Potential Positive and Negative Impacts on the Use of SNP' and 'Analysis of SNP Usage Habits, Preferred Platforms, and Data Collection Methods' following the sections of the questionnaire form and the research questions.

Analysis of Evaluations on the Use of SNP in the Design Process

To examine how visual data exploration on SNP influences creativity and technical development in the design process of interior architecture education. (RQ-1), nine statements were directed to the participants and

the attitudes and behaviours of interior architecture students regarding the use of SNP in the design process were examined.

Initially, the Cronbach's alpha reliability coefficients for the dependent variables were computed, and the reliability levels of the scales are displayed in Table 2. Subsequently, the mean and standard deviation scores reflecting participants' responses to the statements were determined.

Table 2. Means, Standard Deviations and Results of Reliability Analysis Regarding the Use of SNP

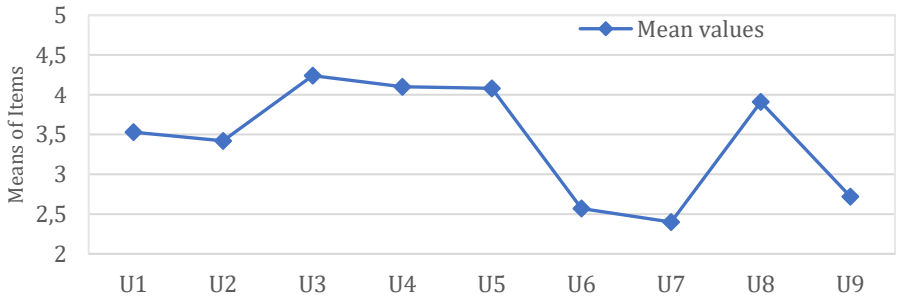
Dependent Variables		M[a]	SD	N	Item Reliability	Scale Reliability
U1	During the design process, I find an image by browsing visual data on SNP, then I try to improve it.	3,53	0,92	298	0,72	0,759
U2	During the design process, I find visuals by searching visual data on SNP, then I create my design by bringing them all together.	3,42	0,97	298	0,72	
U3	Browsing visual data through SNP enables me to observe various design approaches.	4,24	0,85	298	0,72	
U4	Browsing visual data on SNP allows me to better analyse existing designs.	4,10	0,85	298	0,71	
U5	Browsing visual data through SNP allows me to learn new techniques.	4,08	0,88	298	0,72	
U6	Browsing visual data through SNP puts me into repetitive design patterns during the design process.	2,57	1,10	298	0,75	
U7	Browsing visual data through SNP sometimes makes it difficult for me to find inspiration.	2,40	1,15	298	0,77	
U8	Browsing visual data through SNP inspires me and helps me develop my ideas.	3,91	0,87	298	0,74	
U9	Searching visual data through SNP causes me to create similar designs with my friends with whom I share the same project.	2,72	1,03	298	0,74	

Notes: M: Mean, SD: Standard Deviation, N: Number of Participants, [a]: Scale. Variable means ranged from 1 (never) to 5 (always)

According to the results in Table 2, the scale reliability of the nine statements is 0.759. Cronbach's alpha reliability coefficient above 0.70 is considered reliable (George et al., 2010; Büyüköztürk, 2011; Akyüz, 2018; Yıldız and Uzunsakal, 2018). On this basis, Cronbach's alpha coefficient, which is above 0.70 for all statements that constitute the dependent variables of the study, indicates that the research data are reliable.

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According to Table 2, when the participants' use of SNP in the design process is evaluated; indicating that the statements with the highest mean values are U3 (M: 4,24), U4 (M: 4,10) and U5 (M: 4,08), respectively. The statements with the lowest mean scores are U7 (M: 2,40), U6 (M: 2,57) and U9 (M: 2,72), respectively. The graphical expression of the scale averages of the nine statements was presented in Figure 1.



Note: Variable means ranged from 1 (never) to 5 (always)

Figure 1. Participants' Use of SNP in the Design Process

In this direction, it is understood that interior architecture students' visual data browsing on SNP to improve their creativity and technical development in the design process is basically to see different design approaches; then to better analyse existing designs and learn new techniques. It can be said that the students partially benefit from browsing data in order to inspire and contribute to the development of ideas; they are undecided about whether they find one or more images and then try to improve them or whether they try to create their design by combining them all together. It is understood that design students do not have difficulty in finding inspiration in the process of visual data browsing through SNP, and that they think that visual data browsing does not lead them to repetitive design patterns or cause them to create similar designs.

Table 3. The Effect of Universities of Study on Dependent Variables

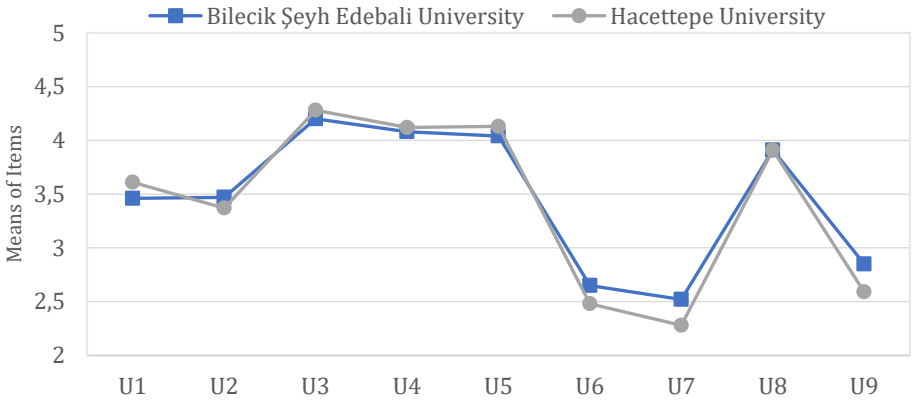
Dependent Variables	BŞEU		HU		ANOVA		
	M[a]	SD	M[a]	SD	F	df	Sig.
U1	3,46	0,86	3,61	0,97	1,91	1	0,16
U2	3,47	0,99	3,37	0,96	0,78	1	0,37
U3	4,20	0,84	4,28	0,86	0,66	1	0,41
U4	4,08	0,87	4,12	0,83	0,22	1	0,63
U5	4,04	0,93	4,13	0,83	0,83	1	0,36
U6	2,65	1,20	2,48	0,99	1,58	1	0,20
U7	2,52	1,28	2,28	1	3,09	1	0,08
U8	3,91	0,88	3,91	0,86	0,00	1	1,00
U9	2,85	1,05	2,59	0,99	5,12	1	0,24

Notes: BŞEU: Bilecik Şeyh Edebali University, HU: Hacettepe University, M: Mean, SD: Standard. Deviation, F: F-statistic, df: Degrees of freedom, Sig: Significance Value, significant at p<0.05 level, [a]: Scale, variable means ranged from 1 (never) to 5 (always)

Whether the attitudes and evaluations of interior architecture students towards the effect of visual data searches on design processes through SNP in line with the statements directed to them differ according

to the universities where they are educated is examined with ANOVA in Table 3.

According to the analysed results, since the significance value of all nine statements is greater than p<0.05, there is no significant difference between the groups. This shows that the university variable does not reveal a difference between the students, and that students studying at different universities have similar views. The findings obtained in line with Table 4 are shown graphically in Figure 2.



Note: Variable means ranged from 1 (never) to 5 (always)

Figure 2. The Effect of Universities of Study on Dependent Variables

Whether the students' attitudes and evaluations towards the impact of visual data browsing on design processes through SNP in line with the statements directed to them differ according to their bachelor's degree education levels is analysed by ANOVA in Table 4. Based on the analysis, significant group differences were found only for the statements U1, U2 and U4 at the level of p<0.05 among the nine statements (Table 4).

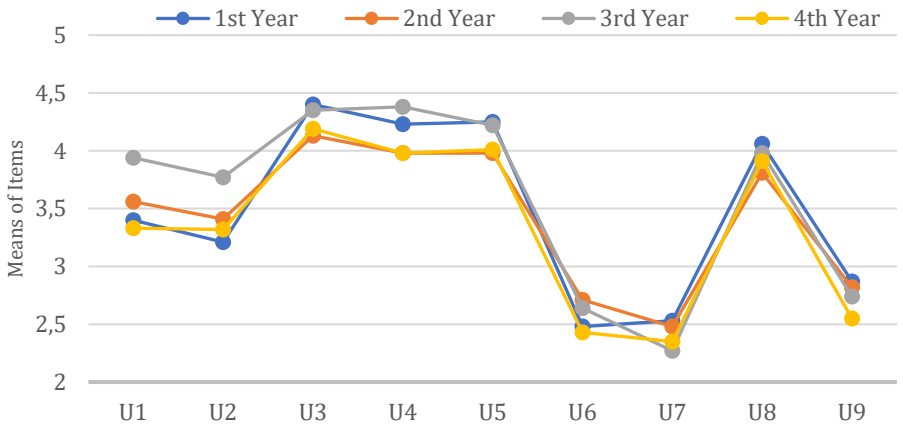
Table 4. The Effect of Education Levels on Dependent Variables

Dep. Vari.	1st Grade		2nd Grade		3rd Grade		4th Grade		ANOVA		
	M[a]	SD	M[a]	SD	M[a]	SD	M[a]	SD	F	df	Sig.
U1	3,40	0,92	3,56	0,87	3,94	0,83	3,33	0,94	6,18	3	<,001*
U2	3,21	1,14	3,41	0,89	3,77	0,98	3,32	0,92	3,75	3	0,01*
U3	4,40	0,85	4,13	0,88	4,35	0,76	4,19	0,87	1,51	3	0,21
U4	4,23	0,83	3,98	0,90	4,38	0,78	3,98	0,81	3,95	3	0,009*
U5	4,25	0,89	3,98	0,86	4,22	0,87	4,01	0,90	1,58	3	0,19
U6	2,48	1,24	2,71	1,05	2,64	1,20	2,43	1,01	1,18	3	0,31
U7	2,53	1,29	2,48	1,11	2,27	1,11	2,35	1,15	0,64	3	0,58
U8	4,06	0,86	3,81	0,86	3,98	0,81	3,91	0,87	0,98	3	0,39
U9	2,87	1,11	2,82	0,97	2,74	0,99	2,55	1,05	1,53	3	0,20

*Notes: M: Mean, SD: Std. Deviation, F: F-statistic, df: Degrees of freedom, Sig: Significance Value, *:Significant at p<0.05, [a]: Scale, Variable means ranged from 1 (never) to 5 (always)*

The findings revealed that interior architecture students' approaches to visual data search and its development may differ according to their education levels and are shown graphically in Figure 3.

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Note: Variable means ranged from 1 (never) to 5 (always)

Figure 3. The Effect of Bachelor's Degree Education Levels on Dependent Variables

1st grade students frequently use SNP, especially to see different design approaches (U3: 4,40) and to analyse existing designs (U4: 4,23). The low U6 and U7 scores indicate that these platforms do not lead to repetition or inspiration problems. Grade 2 students similarly have high averages in statements U3, U4 and U5. This shows that they see SNP as a complementary tool for exploring new ideas and techniques. 3rd grade students use SNP more intensively to develop different approaches (U3: 4,35) and to create their own designs (U1, U2 high). 4th grade students also prefer SNP mostly to see different designs (U3: 4,21) and to obtain technical information. However, U1 and U2 values decreased slightly, indicating that advanced students rely on their own knowledge rather than SNP. Considering of these data, it is understood that 3rd graders are the students who make the most use of SNP to create and develop their designs and analyse existing examples in the design process.

The findings reveal that as the level of bachelor's degree education among students differs, differences may occur in their approaches to creating original designs by combining visuals. In addition, it also reveals that as the level of bachelor's degree education among students differs, differences may occur in their approaches to better analyse existing designs.

Analysis of the Potential Positive and Negative Impacts on the Use of SNP

To examine the potential positive and negative impacts of visual data exploration on SNP during the design process (RQ2), ten statements were presented to the students using a Five-point Likert-type scale, and their evaluations of these statements regarding the use of SNP were analysed.

Initially, Cronbach's alpha reliability coefficients were computed, together with the mean and standard deviation statistics for the dependent variables, and the corresponding results are displayed in Table 5. Then, analyses were made according to the characteristics of the universities and education levels. ANOVA was applied to determine the differences between students' evaluations.

Table 5. Means, Standard Deviations and Results of Reliability Analysis Regarding the Impacts of SNP

Dependent Variables		Mᵃ	SD	N	Item Reliability	Scale Reliability
I1	SNP should be used in the design process.	3,96	0,94	298	0,82	0,807
I2	Using SNP in the design process causes difficulties in finding reliable sources due to information pollution.	3,00	1,03	298	0,78	
I3	Using SNP in the design process causes time management problems.	2,54	1,06	298	0,77	
I4	Using SNP in the design process causes distraction and concentration problems.	2,51	1,09	298	0,77	
I5	Using SNP in the design process causes excessive competition and pressure.	2,56	1,10	298	0,77	
I6	Using SNP in the design process limits creativity and originality.	2,67	1,09	298	0,78	
I7	Using SNP in the design process supports their development through sharing projects and educational materials.	3,78	0,98	298	0,80	
I8	Using SNP in the design process provides an understanding of international and local design influences.	3,92	0,97	298	0,79	
I9	Using SNP in the design process can weaken critical thinking skills because it can lead to superficial evaluations.	2,73	1,07	298	0,78	
I10	Using SNP in the design process can make it difficult to find one's design language.	2,85	1,12	298	0,79	

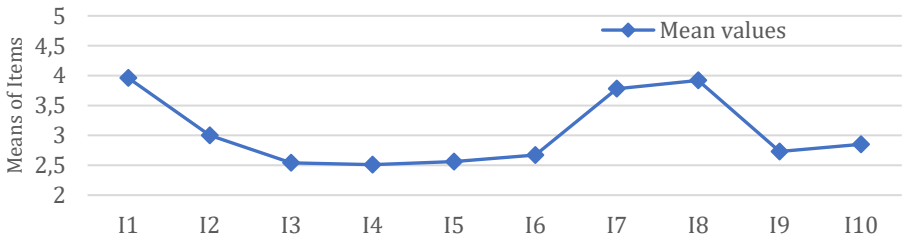
Notes: M: Mean, SD: Standard Deviation, N: Number of Participants, ᵃ: Variable means ranged from 1 (Strongly Disagree) to 5 (Strongly Agree)

According to the Table 5, the reliability coefficient value of the ten statements is 0.807. Therefore, Cronbach's alpha coefficient is above 0.70 for all statements that constitute the dependent variables of the study, indicating that the research data are reliable.

According to the results of the participants' opinions to using SNP (Table 5), it is seen that the statements with the highest mean score with the participation of the students are I1 (M: 3,96), I8 (M: 3,92), and I7 (M: 3,78), respectively. According to interior architecture students' evaluations, SNP should be used in the design process; local and international designs are better understood for evaluation, and students' development is supported by sharing projects and materials through SNP. Based on the students' ratings (I2, Mᵃ: 3.00), it is understood that the students participating in the study are uncertain as to whether the use of SNP in the design process will cause difficulties in finding reliable sources due to information overload. The statements with the lowest mean

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scores were I4 (M: 2.51), I3 (M: 2.54) and I5 (M: 2.56), respectively. The graphical expression of the results is given in Figure 4.



Note: Variable means ranged from 1 (Strongly Disagree) to 5 (Strongly Agree)

Figure 4. Distribution of Participants' Approaches to the Use of SNP

Whether the attitudes and evaluations towards the impact of visual data searches on design processes through SNP differ according to the universities of education is examined with ANOVA in Table 6.

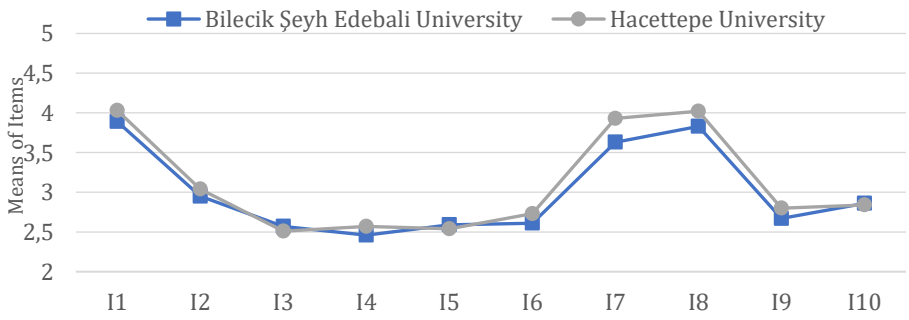
Table 6. The Effect of Universities of Study on Dependent Variables

Dep. Vari.	BŞEU		HU		ANOVA		
	Ma	SD	Ma	SD	F	df	Sig.
I1	3,89	1,03	4,03	0,83	1,51	1	0,21
I2	2,95	1,05	3,04	1,02	0,52	1	0,47
I3	2,57	1,03	2,51	1,08	0,29	1	0,58
I4	2,46	1,07	2,57	1,11	0,71	1	0,39
I5	2,59	1,13	2,54	1,07	0,13	1	0,71
I6	2,61	1,14	2,73	1,03	1,01	1	0,31
I7	3,63	1,06	3,93	0,89	6,77	1	0,01*
I8	3,83	1,00	4,02	0,92	2,80	1	0,09**
I9	2,67	1,12	2,80	1,01	1,16	1	0,28
I10	2,86	1,17	2,84	1,07	0,02	1	0,87

Notes: BŞEU: Bilecik Şeyh Edebali University, HU: Hacettepe University. M: Mean, SD: Std. Deviation, F: F-statistic df: Degrees of freedom, a: Scale, Sig: Significance Value, significant at p<0.05 level. Variable means ranged from 1 (Strongly Disagree) to 5 (Strongly Agree)

The analysis revealed significant differences between the groups only in the I7 statement at the p<0.05 level of significance among the ten statements. In this direction, mostly HU students evaluated more positively than BŞEU students that sharing projects and educational materials by using SNP in the design process supports development.

As seen in Figure 5 both BŞEU and HU students evaluated in the same direction.



Note: Variable means ranged from 1 (Strongly Disagree) to 5 (Strongly Agree)

Figure 5. The Effect of Education Level on Dependent Variables

This finding shows that SNP have similar impacts on interior architecture students even their university differs. In other words, it can be said that the university has no effect on SNP usage.

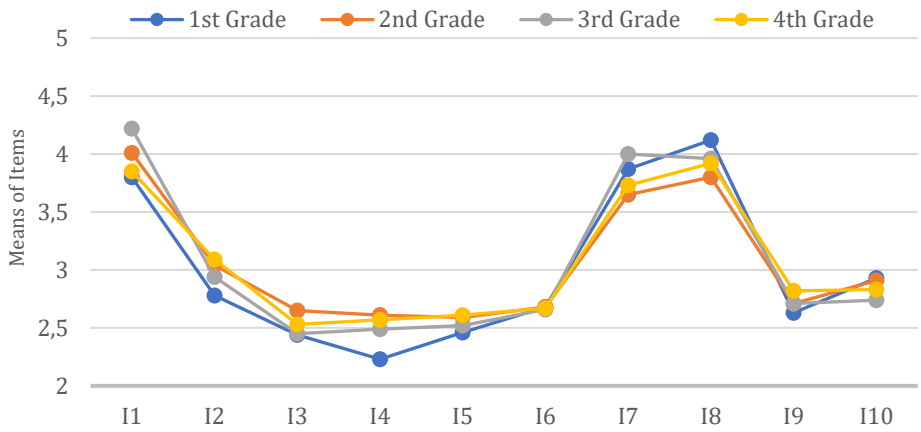
Table 7 shows whether attitudes and evaluations of the effect of visual data browsing on design processes through SNP differ based on bachelor's degree education levels, as analysed using ANOVA.

Table 7. The Effect of Education Levels on Dependent Variables

Dep.	1st Grade		2nd Grade		3rd Grade		4th Grade		ANOVA		
Vari.	Ma	SD	Ma	SD	Ma	SD	Ma	SD	F	df	Sig.
I1	3,80	1,15	4,01	1,00	4,22	0,67	3,85	0,88	2,47	3	0,06
I2	2,78	1,17	3,04	0,96	2,94	1,04	3,09	1,03	1,06	3	0,36
I3	2,44	0,99	2,65	1,11	2,45	1,03	2,53	1,05	0,62	3	0,60
I4	2,23	1,04	2,61	1,13	2,49	0,97	2,57	1,13	1,40	3	0,24
I5	2,46	1,08	2,59	1,13	2,52	1,08	2,61	1,10	0,23	3	0,87
I6	2,68	1,10	2,68	1,14	2,66	0,99	2,67	1,10	0,00	3	1
I7	3,87	1,13	3,65	1,02	4	0,80	3,73	0,96	1,64	3	0,17
I8	4,12	1,09	3,80	1,06	3,96	0,76	3,92	0,92	1,20	3	0,30
I9	2,63	1,11	2,71	1,00	2,71	1,09	2,82	1,10	0,36	3	0,77
I10	2,93	1,14	2,91	1,07	2,74	1,10	2,83	1,18	0,35	3	0,78

*Notes: M: Mean, SD: Std. Deviation, F: F-statistic df: Degrees of freedom, a: Scale, Sig: Significance Value, *significant at p<0.05. Variable means ranged from 1 (Strongly Disagree) to 5 (Strongly Agree)*

According to the analysed results, among the ten statements, no statement with a significance value of p<0.05 was found and no significant between-group differences were identified. The findings were presented in Figure 6.



Note: Variable means ranged from 1 (Strongly Disagree) to 5 (Strongly Agree)

Figure 6. The Effect of Education Levels on Dependent Variables

Analysis of SNP Usage Habits, Preferred Platforms and Data Collection Methods

Within the scope of RQ-3, the attitudes and behaviours of the statements regarding the habits of interior architecture students' use of SNP, preferred contents and data collection methods were examined. In this direction, descriptive statistics on students' approaches are shown in Table 8 and explained in detail in other tables.

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Table 8. Distribution of Approaches to the Use of SNP

Which SNP do you use in the design process?	f	%	T %
Instagram	167	19,3	56
Pinterest	278	32,1	93,3
Behance	67	7,7	22,5
Facebook	2	0,2	0,7
LinkedIn	14	1,6	4,7
YouTube	44	5,1	14,8
TikTok	13	1,5	4,4
Dribble	0	0	0
Houzz	2	0,2	0,7
Google Image Search	40	4,6	13,4
Tumblr	5	0,6	1,7
Int. Arc./Arc. Comp. Web	153	17,6	51,3
AI (Artificial Intelligence) Plat.	82	9,5	27,5
Other	0	0	0
None of them	0	0	0
Total	867	100	290,9

Notes: f: Frequency number, %: Percentage value, T %: Total Percentage Value

When the participants' approaches to using SNP are evaluated in line with the data shown in Table 8, it is seen that the most preferred platforms of the students are 'Pinterest' > 'Instagram' > 'Interior Architecture/Architectural Firm Websites' > 'AI (Artificial Intelligence) Platforms' > 'Behance' > 'YouTube', while the least preferred platforms below 5% are 'Facebook', 'Houzz', 'Tumblr', 'TikTok' and 'LinkedIn', respectively. None of the participants selected 'Dribbble', 'Other' and 'None'. In this sense, it is also shown that students do not use a platform different from the SNP presented to them. The findings were presented in Figure 7.

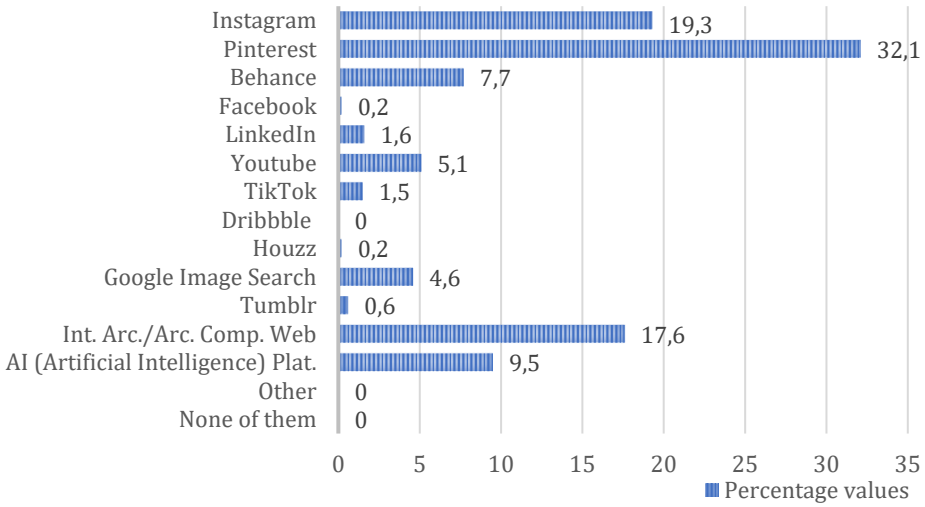


Figure 7. Distribution of Approaches to the Use of SNP

The fact that 278 of the 298 students who participated in the survey preferred 'Pinterest' shows that it is the most effective and widely preferred platform in terms of students' visual data browsing approaches. 167 students preferred 'Instagram' and this shows that they can use SNP to access design examples and follow approaches related to the discipline of interior architecture as well as features such as photo and video sharing and communication. In addition, 153 students

preferred 'Interior Architecture/Architectural Firm Websites', which shows that students also turn to professional resources in the design process. The fact that 'Behance' (67 students), which was established to create a portfolio for designers (67 students), and 'AI (Artificial Intelligence) Platforms' (82 students), which focus on production and aim to increase productivity (82 students), are preferred by less than half of the students suggests that students are still less inclined to turn to creative and project-oriented content production.

In line with the data shown in Table 9 and Figure 8, when the use of SNP is evaluated according to the universities where the participants receive education; the preference rates of SNP in both universities show a small difference.

Table 9. Distribution of SNP by University of Education

SNP	BŞEU		HU		Total	
	f	%	f	%	f	%
Instagram	94	31,5	73	24,5	167	56
Pinterest	134	45	144	48,3	278	93,3
Behance	21	7	46	15,4	67	22,5
Facebook	2	0,7	0	0	2	0,7
LinkedIn	10	3,4	4	1,3	14	4,7
YouTube	28	9,4	16	5,4	44	14,8
TikTok	9	3	4	1,3	13	4,4
Dribble	0	0	0	0	0	0
Houzz	1	0,3	1	0,3	2	0,7
Google Image Search	21	7	19	6,4	40	13,4
Tumblr	3	1	2	0,7	5	1,7
Int. Arc./Arc. Comp. Web	69	23,2	84	28,2	153	51,3
AI (Artificial Intelligence) Plat.	42	14,1	40	13,4	82	27,5
Other	0	0	0	0	0	0
None of them	0	0	0	0	0	0
Total	434	145,6	433	145,2	867	291

Notes: BŞEU: Bilecik Şeyh Edebali University, HU: Hacettepe University. f: Frequency number, %: Percentage value

Among the most preferred platforms, 'Pinterest' is preferred by 134 students at BŞEU and 144 students at HU. 'Instagram' was preferred by 94 students at BŞEU and 73 students at HU. 'Behance', which was established to create a portfolio for designers, was preferred by 46 students at HU and 21 students at BŞEU.

It is seen that the most preferred platforms by the students of BŞEU are 'Pinterest' > 'Instagram' > 'Interior Design/Architectural Company Websites' > 'AI (Artificial Intelligence) Platforms' > 'YouTube' > 'Behance' = 'Google Image Search', while the least preferred platforms below 5% are 'LinkedIn', 'TikTok', 'Tumblr', 'Facebook' and 'Houzz'. 'Dribbble', 'Other' and 'None' options were not selected by the participants.

The most preferred platforms by HU students are 'Pinterest' > 'Instagram' > 'Interior Design/Architectural Firm Websites' > 'Behance' > 'AI (Artificial Intelligence) Platforms' > 'Google Image Search' > 'YouTube', while the least preferred platforms below 5% are 'LinkedIn', 'TikTok', 'Tumblr' and 'Houzz', respectively. 'Facebook', 'Dribbble', 'Other' and 'None' options were not selected by the participants.

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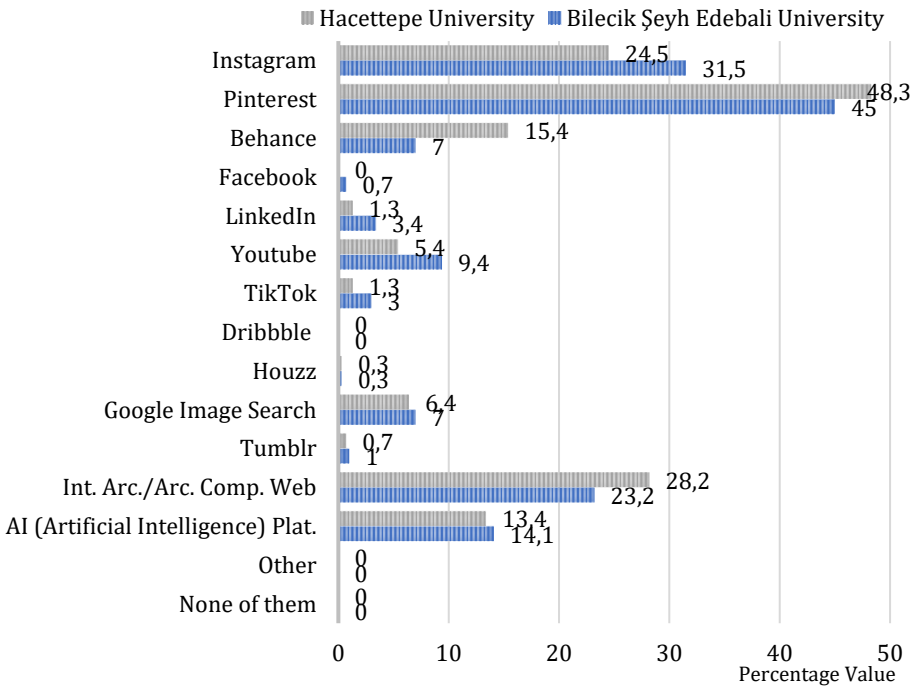


Figure 8. Distribution of SNP by University

In general, the fact that HU students prefer platforms such as 'Pinterest', 'Behance' and 'Interior Architecture/Architectural Websites' relatively more than BŞEU students shows that they prefer more technical, professional and production-oriented platforms in the design process, while the fact that BŞEU students prefer platforms such as 'Youtube', 'Instagram', 'Linkedin' and 'Tiktok' relatively more than HU students can be evaluated as giving priority to more popular and user-oriented SNP applications in the design process.

Table 10. Distribution of SNP by Education

	1st Grade (47 People)		2nd Grade (91 People)		3rd Grade (59 People)		4th Grade (101 People)		Total
	f	%	f	%	f	%	f	%	f
Instagram	22	46,8	55	60,4	30	50,8	60	59,4	167
Pinterest	43	91,5	82	90,1	57	96,6	96	95	278
Behance	3	6,4	15	16,5	18	30,5	31	30,7	67
Facebook	0	0	1	1,1	0	0	1	1	2
LinkedIn	3	3	1	1,1	5	8,5	5	5	14
YouTube	11	23,4	11	12,1	5	8,5	17	16,8	44
TikTok	4	8,5	5	5,5	2	3,4	2	2	13
Dribble	0	0	0	0	0	0	0	0	0
Houzz	0	0	1	1,1	0	0	1	1	2
Google Image Search	14	29,8	10	11	9	15,3	7	6,9	40
Tumblr	1	2,1	1	1,1	1	1,7	2	2	5
Int. Arc./Arc. Comp. Web	25	53,2	51	56	30	50,8	47	46,5	153
AI Platforms	11	23,4	32	35,2	13	22	26	25,7	82
Other	0	0	0	0	0	0	0	0	0
None of them	0	0	0	0	0	0	0	0	0
Total	47	-	91	-	59	-	101	-	298

Notes: f: Frequency number, %: Percentage value (Within All Classes)

When the SNP preferred by the participants are evaluated according to their bachelor's degree education levels in line with the data shown graphically in Table 10 and Figure 9, it is understood that the three most used platforms in all classes are 'Pinterest', 'Instagram' and 'Interior Architecture/Architectural Firm Websites'.

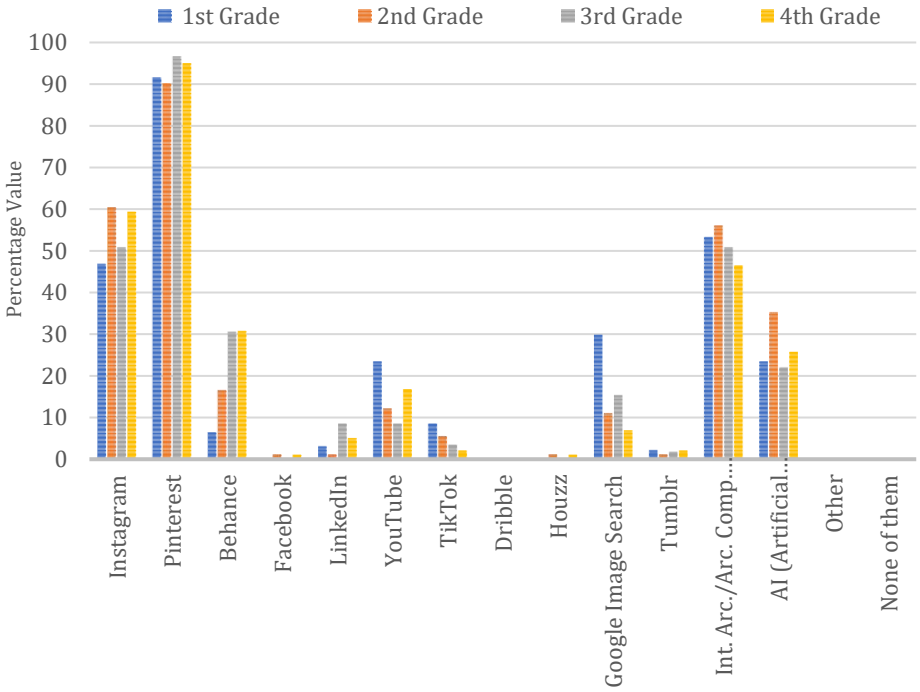


Figure 9. Distribution of SNP by Education

It is understood that the least used platforms among all grades are 'TikTok', 'LinkedIn', 'Tumblr', 'Facebook' and 'Houzz'. While 'Houzz' and 'Facebook' were not preferred by Grade 1 and Grade 3 students, they were preferred by 1 student each in Grades 2 and 4. It was observed that 'Dribbble' platform was not used in any class.

1st grade most used platforms are Pinterest> Interior Design/Architectural Company Websites> Instagram> Google Image Search> AI (Artificial Intelligence) Platforms> Youtube;

2nd grade preferred to use Pinterest> Instagram> Interior Design/Architectural Company Websites> AI (Artificial Intelligence) Platforms;

3rd grade preferred to use Pinterest > Instagram = Interior Design/Architectural Company Websites > Behance > AI (Artificial Intelligence) Platforms;

4th grade, similar to 3rd grade, preferred to use Pinterest > Instagram > Interior Design/Architecture Company Websites > Behance > AI (Artificial Intelligence) Platforms.

It is also understood that 1st grade use 'Youtube' and 'Google Image Search' platforms more frequently than other grades. It is thought that 1st grade students, who have just started their education process, prioritize the use of these platforms because they can search using keywords and the desired result can be reached more concisely.

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It is understood that 3rd and 4th grade students prefer to use the 'Behance' platform. In this case, it can be said that as the level of education increases, the use of more technical, professional and production-oriented platforms begins to increase.

When the frequency of participants' use of SNP is evaluated in line with the data shown in Table 11 and Figure 10, it is seen that students prefer SNP quite frequently.

Table 11. Frequency of Participants' Use of SNP

How often do you use SNP in the design process?		
	f	**%**
Every Day	120	40,3
Several Times a Week	148	49,7
Several Times a Month	30	10,1
Never Use	0	0
Other	0	0
Total	298	100

Notes: f: Frequency number, %: Percentage value

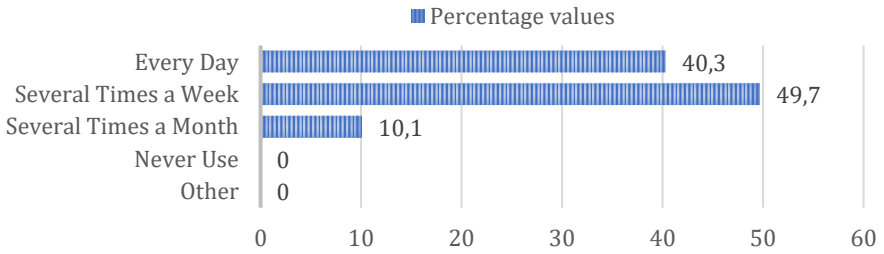


Figure 10. Frequency of Participants' Use of SNP

In addition to the fact that 148 students with a rate of 49.7% stated that they use SNP 'several times a week', 120 students with a rate of 40.3% stated that they use them 'every day'. This shows that students frequently use SNP on a daily or weekly basis during the design process, while the fact that 30 students with a rate of 10.1% indicated the option 'A Few Times a Month' shows that the number of students who use SNP infrequently is quite low. None of the participants selected the 'Never Use' and 'Other' options.

In this context, the data in this study makes it possible to say that students use SNP as a tool in the design process.

When the frequency of use of SNP is evaluated according to the university of study in line with the data shown in Table 12 and Figure 11, it is seen that the most preferred option is 'Several Times a Week' with a rate of 24.8% in both universities.

Table 12. Distribution of Frequency of Use of SNP According to the University of Education

Dependent Variables	**BŞEU**		**HU**		**Total**	
	f	**%**	**f**	**%**	**f**	**%**
Every Day	55	18,5	65	21,8	120	40,3
Several Times a Week	74	24,8	74	24,8	148	49,7
Several Times a Month	20	6,7	10	3,4	30	10,1
Never Use	0	0	0	0	0	0
Other	0	0	0	0	0	0
Total	149	50	149	50	298	100

Notes: BŞEU: Bilecik Şeyh Edebali University, HU: Hacettepe University. f: Frequency number, %: Percentage value

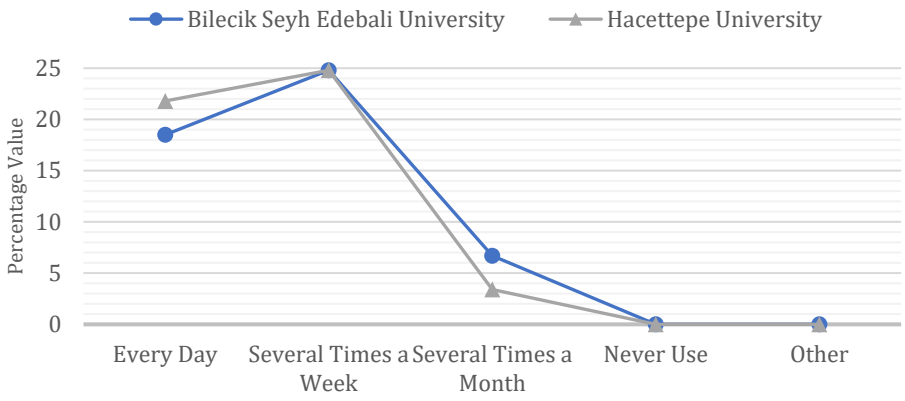


Figure 11. Distribution of Frequency of Use of SNP According to the University of Education

While HU students chose the 'Every Day' option more frequently, BŞEU students chose the 'Several Times a Month' option more frequently. This shows that HU students use SNP relatively more frequently in the design process.

Table 13. Distribution of Frequency of Use of SNP According to Education Level

	1st Grade		2nd Grade		3rd Grade		4th Grade		Total
	f	%	f	%	f	%	f	%	f
Every Day	10	21,3	42	46,2	29	49,2	39	38,6	120
Several Times a Week	27	57,4	43	47,3	26	44,1	52	51,5	148
Several Times a Month	10	21,3	6	6,6	4	6,8	10	9,9	30
Never Use	0	0	0	0	0	0	0	0	0
Other	0	0	0	0	0	0	0	0	0
Total	47	15,8	91	30,5	59	19,8	101	33,9	298

Notes: f: Frequency number, %: Percentage value (Within All Classes)

When the frequency of use of SNP is evaluated according to undergraduate education levels in line with the data shown in Table 13 and Figure 12, it is seen that the most preferred option of 1st, 2nd and 4th grade students is 'Several Times a Week', while 3rd grade students mostly choose 'Every Day'.

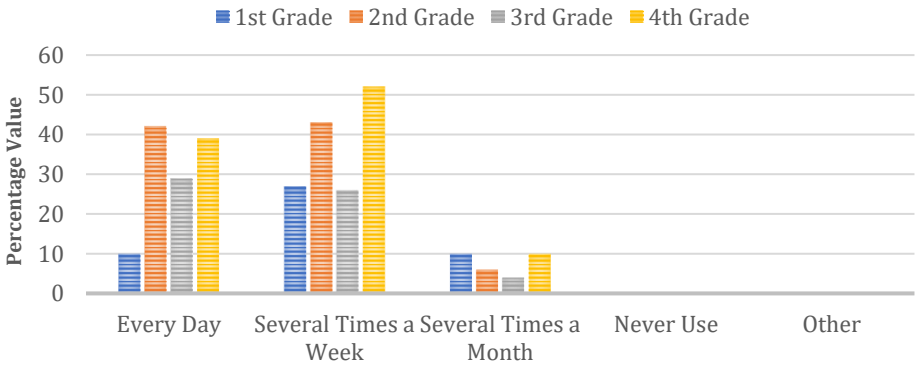


Figure 12. Distribution of Frequency of Use of SNP According to Education Level

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When the participants' approaches to the use of SNP are evaluated in line with the data shown in Table 14 and Figure 13, a total of 847 markings were made as each student marked more than one option. The most preferred ones were 'Design and Architectural Projects' > 'Art and Aesthetics' > 'Culture and Entertainment' > 'Fashion and Trends' > 'Education and Information'.

Table 14. Distribution of Content of SNP Usage

What kind of content do you analyse SNP for the most?	f	%	T %
Design and Architectural Projects	259	30,6	86,9
Art and Aesthetics	194	22,9	65,1
Fashion and Trends	92	10,9	30,9
Education and Information	73	8,6	24,5
Sports and Health	20	2,4	6,7
Food and Recipes	27	3,2	9,1
Travel and Attractions	39	4,6	13,1
Technology and Innovations	26	3,1	8,7
Culture and Entertainment	94	11,1	31,5
Nature and Environment	23	2,7	7,7
Other	0	0	0
Total	847	100	284

Notes: f: Frequency number, %: Percentage value, T %: Total Percentage Value

These findings show that students use SNP not only for daily use but also for finding inspiration and examining design examples. The least preferred platforms under 5% were 'Travel and Travel', 'Food and Recipes', 'Technology and Innovations', 'Nature and Environment' and 'Sports and Health'. No respondent selected the 'Other' option.

This shows that students prefer less daily content that is not related to the design process on SNP. In addition, although the rate of content related to 'Technology and Innovations' is low, it can be predicted that the use of current artificial intelligence technologies, digital software and tools may increase among students in the following periods.

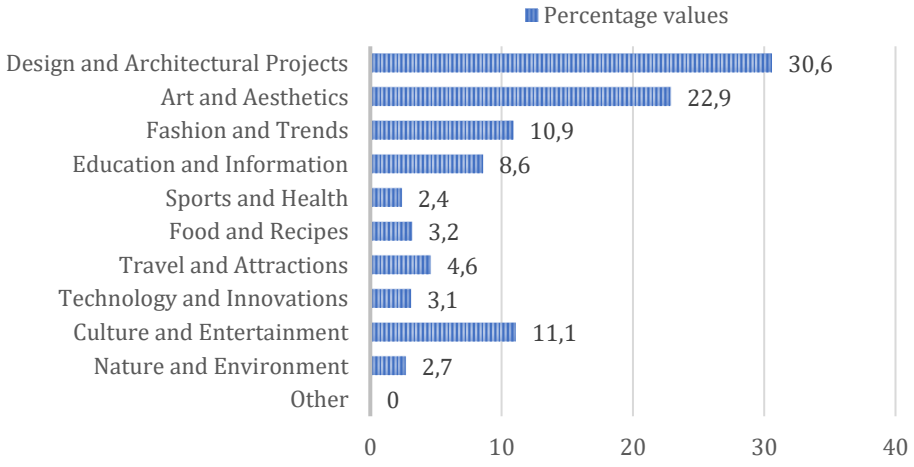


Figure 13. Distribution of Content of Social Network Platforms Usage

When the keywords used by the participants while searching on SNP are evaluated in line with the data shown graphically in Table 15 and Figure 14, it is seen that the total number of options marked reached 917 since each student marked more than one option.

Table 15. Distributions of Keywords Used in Search

What keywords do you use when searching for your designs on SNP?	f	%	T %
Interior Design	229	25	76,8
Architectural Design I Projects	167	18,2	56
Colour Palettes I Materials I Texture	157	17,1	52,7
Furniture and Accessories	134	14,6	45
Styles and Themes	157	17,1	52,7
Trends and Innovations	73	8	24,5
Other	0	0	0
Total	917	100	307,7

Notes: f: Frequency number, %: Percentage value, T %: Total Percentage Value

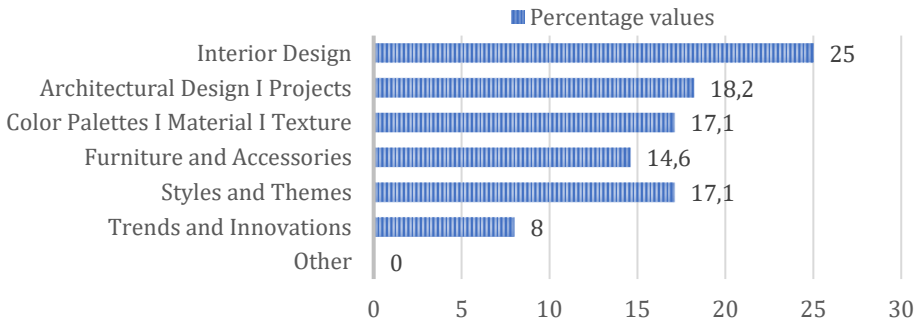


Figure 14. Distributions of Keywords Used in Search

The most preferred keywords used by students while searching on SNP are 'Interior Design' > 'Architectural Design I Projects' > 'Colour Palettes I Material I Texture', while the least preferred options are 'Style and Themes' > 'Furniture and Accessories' > 'Trends and Innovations'. 'Other' option was not preferred by any student.

These findings show that students' keyword choices during searches are generally directed towards professional and practical examples of existing design, material and style information. Trends and innovations, on the other hand, are of relatively less interest to students.

When the visual data collection and organization approaches of the participants are evaluated in line with the data shown in Table 16 and Figure 15, it is seen that the total number of options reached 899 students since each student checked more than one option.

Table 16. Distributions of Visual Data Collection and Organization

How do you collect and organize visual data?	f	%	T %
Categorizing	154	17,1	51,7
Creating My Own Design Library	159	17,7	53,4
Following Some Hashtags	42	4,7	14,1
Following Interior Design I Architectural Pages	199	22,1	66,8
Online Courses and Webinars	22	2,4	7,4
Design Blogs and Forums	55	6,1	18,5
Design Events and Fairs	29	3,2	9,7
Taking My Own Photos	51	5,7	17,1
Keeping My Own Sketches and Notes	110	12,2	36,9
Using Design Apps	78	8,7	26,2
Other	0	0	0
Total	899	100	301,7

Notes: f: Frequency number, %: Percentage value, T %: Total Percentage Value

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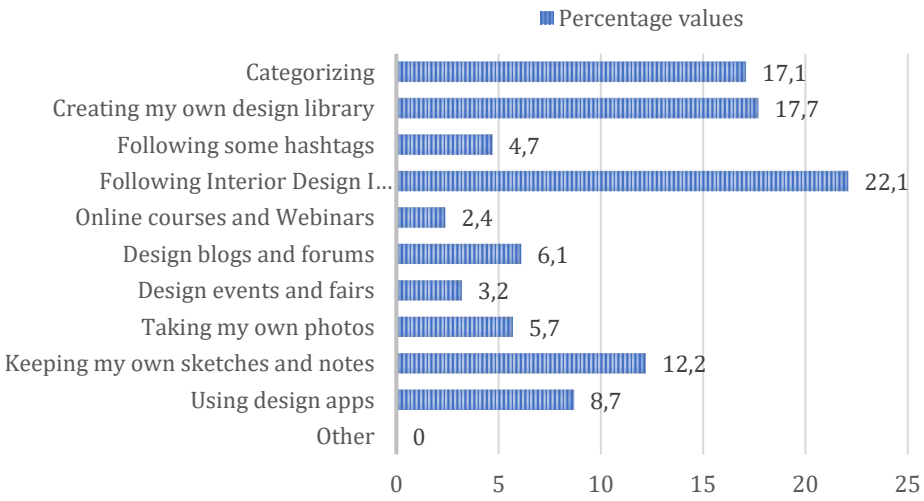


Figure 15. Visual Data Collection and Organization Breakdowns

The most preferred options for how students collect and organize visual data are 'Following Interior Architecture I Architectural Pages' (199)> 'Creating My Own Design Library' (159)> 'Categorizing' (154)> 'Keeping My Own Sketch Notes' (110). The least preferred options under 10% are 'Using Design Apps', 'Design Blogs and Forums', 'Taking My Own Photos', 'Following Some Hashtags', 'Design Events and Fairs', 'Online Courses and Websites'. None of the participants selected the 'Other' option.

CONCLUSION

This study investigated the relationship between creativity and the design processes of interior architecture students as they browsed visual data through SNP at various stages of the design process. Similarities and differences in students' approaches to using these platforms are evaluated, the reasons for these approaches are investigated and their effects on interior architecture education are analysed. In addition, it was tried to determine which platforms students prefer at which stages of the design process.

The findings obtained within the scope of RQ-1 showed that SNP provide positive contributions in terms of inspiration, seeing alternative approaches, developing analysis skills, technical learning and generating ideas. In this context, it was concluded that SNP support students' creativity and technical development through visual data browsing. Furthermore, it is understood that these tools are a complementary element in the design process.

ANOVA results showed that although there was no significant difference between universities ($p>0.05$), there were significant differences ($p<0.05$) in some variables according to bachelors. It was observed that especially 3rd grade students were more active in SNP usage. This shows that their access to digital tools and their tendency to use these tools for academic purposes are higher. This finding is in line with the results of studies such as Akçay et al. (2021) and Korzynski et al.

(2020). However, the negative effects of social networks such as causing repetition in designs, difficulty in finding inspiration and loss of originality were supported at a limited level. No significant difference was found in the opinions on these negativities according to university and education level variables.

Within the scope of RQ-2, students stated that SNP contributed to their development by allowing them to see national and international design effects and sharing project materials. According to the ANOVA results, these contributions show a significant difference according to the university variable ($p<0.05$), but there is no significant difference according to the education level ($p>0.05$). On the other hand, the negative statements that SNP can cause distraction, time management problems and superficial evaluations found limited support. These findings differ from studies such as Zhang and Mao (2023), Ham (2013) and Özsavaş Uluçay (2017). The difficulty of finding reliable sources due to information pollution was met with ambivalence by the students; this shows that the benefits and limitations of SNP are perceived equally by the students.

In line with RQ-3, it was determined that students generally use SNP for professional projects and design content, and weekly and daily use is common. It was seen that the most preferred platform was Pinterest, and this coincided with the results of studies such as Cho and Cho (2020), Scolere (2023), and Izadpanah (2021). It was determined that Pinterest functions as visual data browsing, digital archiving and inspiration source. In their searches with vocational keywords, students mostly preferred traditional content and less preferred keywords related to new technologies. This situation shows that current technologies have not yet been sufficiently integrated into design, but the use of artificial intelligence and digital tools may increase in the future. In addition, students tended to collect and organise visual data through interior architecture themed pages and interacted less with online courses, professional events and professional contacts. This finding reveals that students' methods of accessing information should be diversified and their professional interactions should be increased.

In conclusion, the contribution of social networking platforms (SNP) to the design process is valuable in terms of both creative development and professional knowledge. However, the risks such as distraction, time management and information reliability should also be taken into consideration, and these tools should be used in a conscious and balanced manner.

The study's limited generalizability stems from its specific sample (two universities) and imbalances in demographic variables (age, gender). Future research should aim for a more balanced participant distribution and employ a mixed-method approach (questionnaire and face-to-face interviews) to enhance the depth and completeness of findings. It is anticipated that this will lead to more robust conclusions.

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NOTES

This study was prepared within the scope of Şule Koç's master's thesis titled "*Tasarım Sürecinde İçmimarlık Öğrencilerinin Sosyal Ağ Platformları Üzerinden Görsel Veri Tarama Yaklaşımları*", under the supervision of Assoc. Prof. Ayşen Özkan at the Department of Interior Architecture and Environmental Design, Hacettepe University, Institute of Fine Arts. Ethics Committee permission was obtained with the decision of the Hacettepe University Social and Human Sciences Research Ethics Committee dated 24/12/2024 and numbered 00003963881.

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Resume

Şule Kara is a Research Assistant in the Institute of Fine Arts at Hacettepe University. Having earned her Master's degree, she is currently pursuing her PhD at the same institution. Her academic research focuses on interior architectural design, interior space perception, and design education. Her research interests are situated at the intersection of history, theory, and criticism in interior design, encompassing interdisciplinary studies on design methodology, environmental psychology, and cinematic space analysis.

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The Fountains of Korgun, Çankırı: Representations of Rural Heritage in Daily Life

Melike Demirtaş*
Murat Karademir **

Abstract

This study examines the fountains of Korgun (Çankırı) as architectural and socio-spatial components of rural heritage. While Ottoman water architecture has been extensively studied in urban contexts, rural fountains have received limited scholarly attention. Adopting a qualitative case study approach, the research is based on field documentation, typological analysis, and comparative evaluation within existing scholarship on Ottoman fountain architecture. Seven surviving fountains were analyzed in terms of construction technique, formal characteristics, inscriptional evidence, decorative characteristics, conservation status, and spatial distribution within the settlement. Beyond architectural description, the study interprets these structures as infrastructural and symbolic nodes embedded in daily rural life, emphasizing their role in shaping patterns of social interaction, communal memory, and the organization of public space. The research also evaluates the relationship between architectural form and environmental context, demonstrating how local materials, construction practices, and settlement morphology influenced the development of rural fountain architecture. The findings reveal that the fountains of Korgun reflect both continuity within Ottoman typological traditions and localized adaptations shaped by rural settlement patterns and regional building practices. Furthermore, the presence of inscriptions, decorative programs, and restoration traces provides valuable evidence for understanding the historical development and cultural significance of these structures. By integrating architectural documentation with socio-spatial interpretation, the study contributes to a more comprehensive understanding of rural water architecture as a lived component of local heritage rather than merely a functional infrastructure. It also highlights the importance of documenting and preserving modest rural monuments, which remain vulnerable to neglect despite their historical and cultural value. In conclusion, the fountains of Korgun represent distinctive examples of Ottoman rural architecture, reflecting local construction traditions while illustrating the close relationship between water, settlement organization, and everyday social life.

Keywords: *Çankırı, Fountain, Korgun, Rural architecture, Turkish water architecture*

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INTRODUCTION

Ottoman water architecture not only produced structures to meet the needs of daily life but also shaped these structures through aesthetics, functionality and social representation, thereby contributing to the identity of the urban fabric. In this context, fountains became integral architectural elements of both Ottoman cities and rural settlements. Functioning as the terminal elements of the water distribution system, these structures played an active role in shaping public spaces and the understanding of charity by integrating with the waqf system (Eyice, 1993).

In rural settlements, fountains should not be understood solely as utilitarian structures providing access to water. Their placement within everyday circulation routes, near village squares, mosque courtyards, marketplaces, or residential clusters enabled them to operate as socio-spatial nodes. Around these structures, practices such as water collection, ablution, animal watering, resting, and daily encounters created informal public spaces. Therefore, rural fountains contributed not only to the physical organization of settlements but also to the formation of social memory and collective use of space.

The fountains located in and around Korgun were generally positioned near the centers of settlements, in village squares, or along roads. This placement ensured easy access to water for the public while also creating a social gathering point. By being situated especially in mosque courtyards, marketplaces, or village centers, fountains became an integral part of daily life.

The district of Korgun, located in the province of Çankırı, lies 20 kilometers north of the provincial center. It is bordered by Ilgaz to the north, Kurşunlu to the west and Eldivan and Şabanözü to the south. Due to the predominantly mountainous and rocky terrain outside the plain areas, the region is colloquially referred to as “Taş Yakası” (Rocky Side) (Zeyrek, 2013). The name Korgun derives from the “Kargın” tribe (Ayhan, 2007). Etymologically, the word means “a stream or waterway formed by melting snow” (Ayhan, 1988).

Throughout history, the indispensable role of water in urban life has been reflected in fountain architecture across many parts of Çankırı, as in Anatolia. Particularly during the Ottoman and Republican periods, fountains were not only sources of water but also significant architectural structures where aesthetics and functionality converged, thereby contributing to the urban identity. This study focuses on a total of seven fountains from the Ottoman period located in the Korgun district of Çankırı province, which have either survived to the present day or have been partially preserved.

The identification of the fountains included in the research area was carried out through preliminary field surveys, as well as archival records of local administrations and the Regional Directorate of Foundations. The primary material of the research consists of data related to the plans, facade characteristics, inscriptions, decorative details, building materials

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and restoration conditions of these fountains. The selection of the seven fountains included in this study was based on specific criteria. These criteria comprise the degree to which the structures have survived and preserved their architectural integrity, the presence of inscriptional or datable evidence where available, their representativeness within the spatial distribution of the rural settlement, and their capacity to reflect typological diversity in the local context. Data were collected through direct observation, measurement, documentation and photography of the fountains. During observation, aspects such as the location of the structure, construction materials, building technique, dimensions, content of inscriptions, decorative elements and traces of restoration were individually recorded. Fieldwork was conducted between 2019 and 2022, and original architectural documentation forms were prepared for each fountain.

The findings obtained were evaluated in comparison with similar fountain examples found in the literature. Through this methodology, both the original and transformed aspects of the documented fountains were systematically revealed and the general characteristics of rural Ottoman water architecture in Korgun were assessed within the context of local construction traditions.

Studies on Ottoman water architecture have predominantly focused on monumental fountains and sebils located in urban centers, while more modest water structures in rural settlements have received comparatively limited scholarly attention. In the existing literature, fountains have generally been classified according to their location and physical characteristics. Yılmaz Önge (1997) categorized fountains based on their spatial position and structural condition; Semavi Eyice (1968) proposed typological distinctions between urban and extra-urban fountains. Ayla Ödekan (1992), on the other hand, grouped fountains according to both their spatial context and physical form, systematically defining their structural components and examining their transformation across periods. While these typological approaches provide an important framework for understanding the formal characteristics of water structures, their relationship to rural settlement patterns and everyday life has been addressed only to a limited extent. Building upon this typological scholarship, the present study re-evaluates the fountains of Korgun within a rural context, approaching them not merely as formal architectural entities but also as socio-spatial components embedded in daily life and local identity.

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KORGUN FOUNTAINS

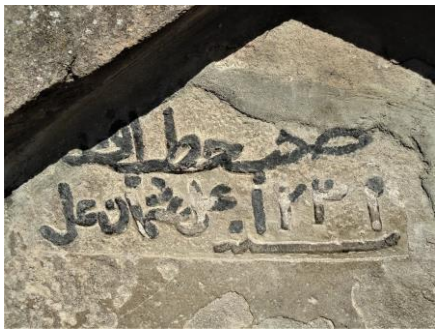
Kayıçivi Village Fountain

The fountain is located in Kayıçivi Village, which is 7 km away from the center of Korgun District (Figure 1).



Figure 1. General view of Kayıçivi Village Fountain

Above the keystone of the fountain's arch, there is a date inscription with a diameter of 0.11 meters. The inscription is enclosed within a thin circular molding and contains the phrase "سن ١٢١١" (Hijri 1211). This inscription, which was engraved into the stone using the recessed carving technique, confirms that the fountain was built in the years 1796-97. Additionally, just below the arch of the fountain, there is a prose inscription in Ottoman Turkish written in Jali Thuluth (Celî Sülüs) script. This inscription is placed on a horizontally rectangular panel measuring 0.48 × 0.13 meters and was later painted black, likely to enhance its visibility (Figure 2, Drawing 1).



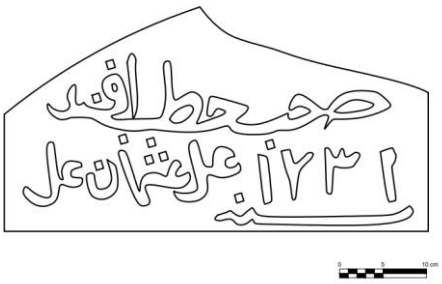


Figure 2. Inscription of Kayıçivi Village Fountain

Drawing 1. Inscription of Kayıçivi Village Fountain

The inscription text is as follows:

ساهيب حطب افندي

على عثمان اغ ا

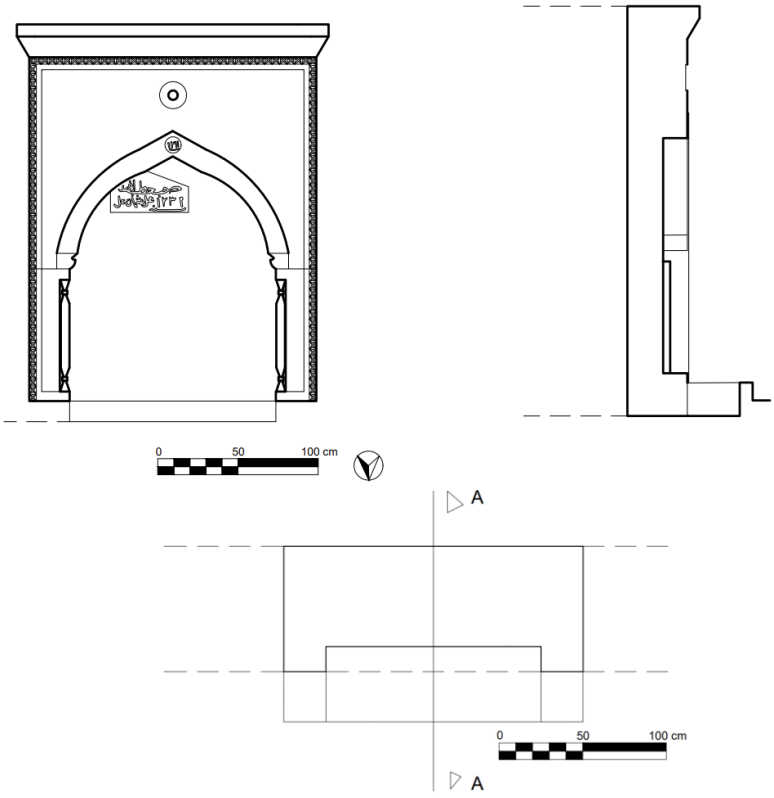
سنه ١٢٣١

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This inscription indicates that the fountain was repaired or renovated by Hatip Ali Osman Efendi in the year H. 1231 / CE 1815-16.

The fountain, named after the village in which it is located, rises on a horizontally rectangular mass. Extending in an east-west direction, the fountain has a height of 2.35 meters and a width of 1.80 meters (Drawing 2).

The fountain's superficial tangent arch has a depth of 0.15 meters. The 1.55 × 1.30 meter superficial arch rests on cylindrical corner pilasters measuring 0.84 meters in length, positioned beneath S-curved bases on both sides. The pilasters have a plain surface, with no transitional elements at the points where they connect with the base and capital. The bases and capitals, measuring 0.17 meters, are designed in an hourglass form, with their central sections constricted by a cubic molding.



Drawing 2. Elevation, section and plan drawing of Kayıçivi Village Fountain

The fountain is externally framed in an inverted U-shape by two rows of moldings. The inner molding is convex, while the outer molding is concave. The outer molding is decorated with a repetitive "X" motif, created by intersecting diagonal lines. Directly above the arch form, there is a rosette (gülbezek) with a diameter of 0.17 meters. At its center, a protruding boss (kabara) is designed within a circular area. The surface of the boss is adorned with a twelve-petaled floral motif, radiating outward from the center. The spaces between the petals are concavely carved, creating a grooved appearance. Surrounding the boss, "V" shaped extensions diverge from the center, ending in sharp points that form star-like edges. Above the keystone of the arch, a date inscription with a diameter of 0.11 meters is engraved using the recessed carving

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technique. Below the superficial arch, there is a rectangular restoration inscription (0.48 × 0.13 meters), placed horizontally on the fountain's surface.

The fountain does not feature a mirror stone or a basin niche on its surface. However, it has a single-spouted faucet hole, which retains its original iron spout. At the upper part of the fountain, there is an overhanging stone cornice with a projecting profile, measuring 1.87 × 0.23 meters. The five-section trough in front of the fountain is a later addition, constructed from reinforced concrete. Only the north facade of the structure is decorated, while the other facades remain plain and unembellished, emphasizing the functional nature of the fountain. Its location in Kayıçivi Village suggests that the fountain functioned not only as a water supply structure but also as a point of everyday encounter within the rural settlement. The presence of a multi-section trough in front of the fountain indicates that the structure may also have served animal watering practices, thereby connecting domestic use, agricultural life, and daily circulation around a shared water point.

Dikenli Village Fountain I

The fountain is located in Dikenli Village, which is 8 km away from the center of Korgun District. It is situated on parcel no 5 of block no 139 (Figure 3).



Figure 3. General view of Dikenli Village Fountain I

On the plain surface of the fountain, there is a vertically rectangular inscription measuring 0.41 × 0.28 meters. The short edges of the inscription are curved in the form of a scalloped ogee arch and contain three decorative cartouches. The prose inscription, written in Ottoman

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Turkish using Celî Sülüs script, is engraved onto the stone using the recessed carving technique (Figure 4, Drawing 3).

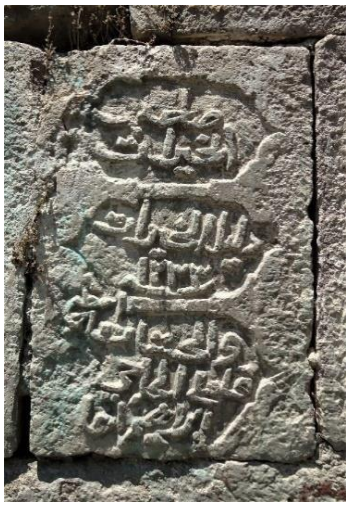
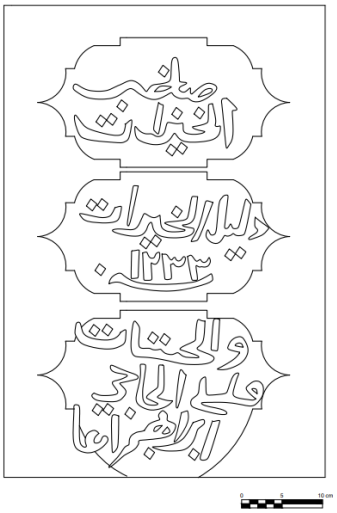


Figure 4. Inscription of Dikenli Village Fountain I



Drawing 3. Inscription of Dikenli Village Fountain I

The inscription text is as follows:

صاحب الخيرات

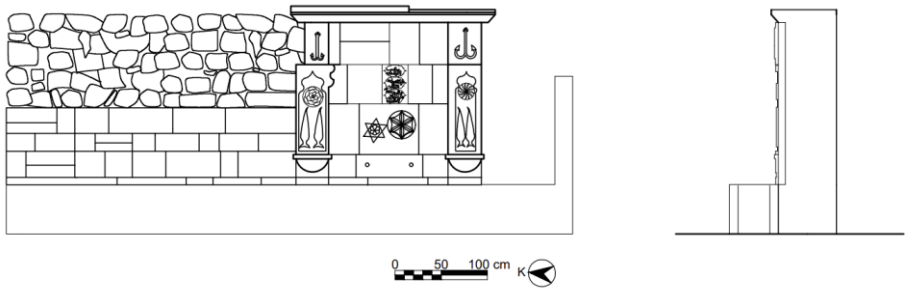
دليل الخيرا ت

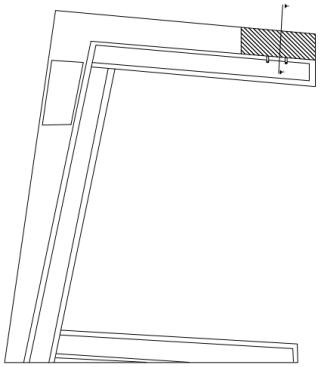
سنه ١٢٣٣

و الحسنات قلعه لى الحاجى ابراهيم آغ ا

This inscription indicates that the fountain was constructed by Hacı İbrahim Ağa in the year H 1233 / CE 1817-18.

The fountain, named after the village in which it is located, rises on a horizontally rectangular mass. Extending in a north-south direction, the fountain has a height of 1.95 meters and a width of 2.00 meters (Drawing 4). The front facade is constructed using finely cut stone, while the other facades are built with rubble stone material.





Drawing 4. Elevation, section and plan drawing of Dikenli Village Fountain I

The fountain, which has a plain surface, is flanked on both sides by a pair of pilasters. At the end of the pilasters, there are plain and convex-molded profiled bases. Near the cornice level of the pilasters, anchor motifs are symmetrically placed on both sides. On the lower section of the pilasters, decorative elements are incorporated within scalloped ogee-arched panels. On the north pilaster's surface, there is a 0.20-meter diameter rosette (gülbezek) motif placed above two symmetrical cypress tree motifs with right-curving tips. The central rosette consists of a four-petaled flower expanding outward in five layers, forming a six-tiered rosette. The central bud-shaped element is surrounded by larger concavely carved leaves. On the south pilaster's surface, a 0.15-meter diameter rosette with a passionflower (çarkıfelek) form is positioned above two symmetrical cypress tree motifs with left-curving tips. The passionflower design is composed of thirteen interwoven, oval-shaped arms radiating from a central circular core, creating a rotational floral pattern (Figure 5, Drawing 5).



Figure 5. Decorative elements on the pilasters of Dikenli Village Fountain I

Drawing 5. Decorative elements on the pilasters of Dikenli Village Fountain I

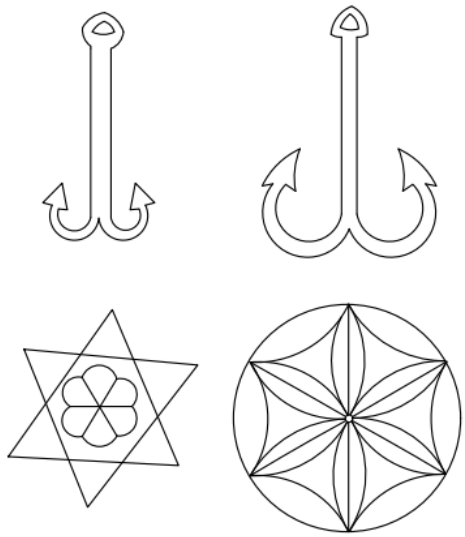
On the western facade, there is a vertically rectangular inscription measuring 0.41 × 0.28 meters. Below the inscription, on a horizontally rectangular block stone measuring 0.55 × 0.45 meters, Seal of Solomon

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(Mühr-ü Süleyman) and rosette motifs are present (Figure 6). The left decoration features a six-petaled floral motif at its center, surrounded by a six-pointed star. The right decoration, a rosette motif with a diameter of 0.30 meters, has at its core a six-pointed star motif that radiates outward in a sunburst pattern. The star's sharp tips are concavely carved, creating a thin central dividing line. These star points are interconnected through concave semicircles, forming a hexagonal frame around the motif. The outermost layer consists of a thin circular molding encircling the entire composition (Drawing 6).



Figure 6. Decorative details on Dikenli Village Fountain I



Drawing 6. Decorative details on Dikenli Village Fountain I

The fountain does not feature a mirror stone or a basin niche on its surface. However, it has two spouted faucet holes, both retaining their original iron spouts. At the upper part of the fountain, there is an overhanging stone cornice with a projecting profile, measuring 2.19 × 0.15 meters. The trough in front of the fountain is a later addition, constructed from reinforced concrete. Only the western facade of the structure is decorated, while the other facades remain plain and unembellished, emphasizing the functional nature of the fountain. The relatively rich decorative program of the western facade indicates that the fountain was not conceived solely as a utilitarian water structure. Its decorated surface, inscription, and symbolic motifs suggest that it also functioned as a visible communal marker within the village, contributing to the formation of a shared social and spatial focus in everyday rural life.

Yolkaya Village Fountain

The fountain is located in Yolkaya Village, which is 8 km away from the center of Korgun District. It is situated on parcel no 2 of block no 144 (Figure 7).

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Figure 7. General view of the south facade of Yolkaya Village Fountain

On the eastern facade of the fountain, there is a construction inscription engraved on marble using the recessed carving technique. The horizontally rectangular inscription, measuring 0.40 × 0.27 meters, is framed by a thin molding and consists of three lines of text (Figure 8, Drawing 7).

The inscription text is as follows:

ماشاء الله كان

الحمد لله سنه ١٣٠٢

محرم



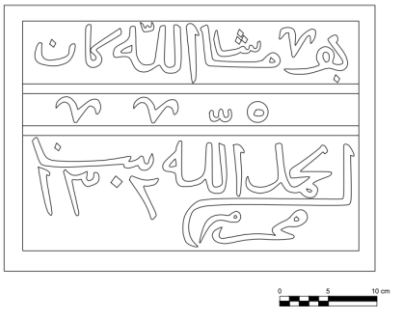


Figure 8. Inscription of Yolkaya Village Fountain

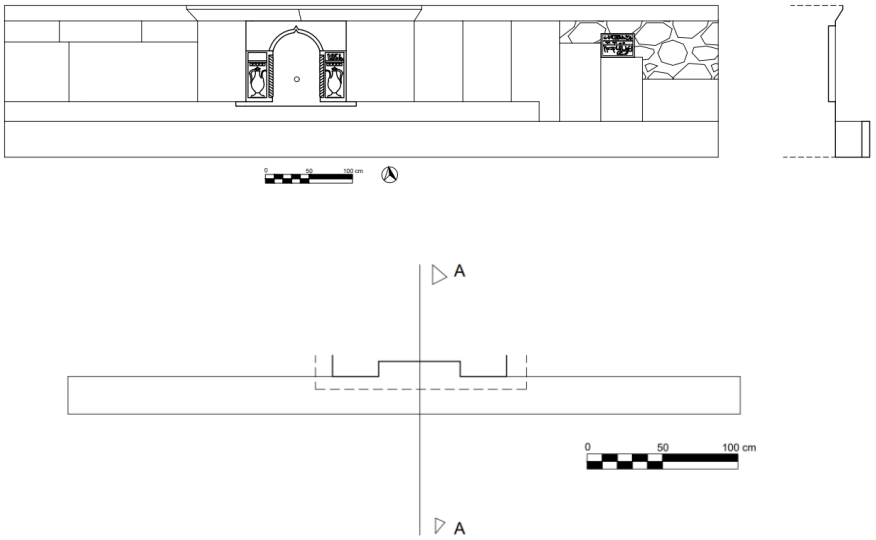
Drawing 7. Inscription of Yolkaya Village Fountain

This inscription indicates that the fountain was constructed in the year H 1302 / CE 1884-85.

Additionally, the ewer motifs on the pilasters contain the inscription “1964”, engraved using the recessed carving technique. This indicates that the fountain underwent restoration in 1964.

The fountain, named after the village in which it is located, rises on a horizontally rectangular mass. Extending in an east-west direction, the main structure of the fountain has a height of 0.93 meters and a width of 1.15 meters (Drawing 8). The structure is built using andesite cut stone.

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Drawing 8. Elevation, section and plan drawing of Yolkaya Village Fountain

The superficial ogee arch rests on two twisted pilasters measuring 0.60 meters in height. On the pilasters flanking the columns, there are symmetrical ewer motifs. These ewer motifs, engraved using the recessed carving technique, feature a wide body, a slender elongated neck and a spout. The handle extends from the upper part of the body, curving over the neck and attaching above it. Just above these motifs, a rectangular cartouche contains the 1964 inscription in the Latin alphabet (Figure 9, Drawing 9). While the inscription on the left pilaster is worn and illegible, the one on the right remains partially visible. This suggests that the majority of the fountain was demolished and completely reconstructed in 1964.

The fountain does not feature a mirror stone or a basin niche. However, it has a single-spouted faucet hole, which retains its original iron spout. The upper covering of the fountain is not original; it was later constructed using a combination of rubble and cut stone materials, extending over the entire wall. Similarly, the trough (yalak) in front of the fountain is a later addition made of reinforced concrete. The other facades of the structure remain plain and unembellished, maintaining a simple and functional design. Although the fountain was largely reconstructed in 1964, its continued use and restoration indicate the persistence of water-related memory within the village. The survival of the inscription and ewer motifs shows that the fountain remained a meaningful element of the rural landscape, linking functional water use with local memory and communal continuity.

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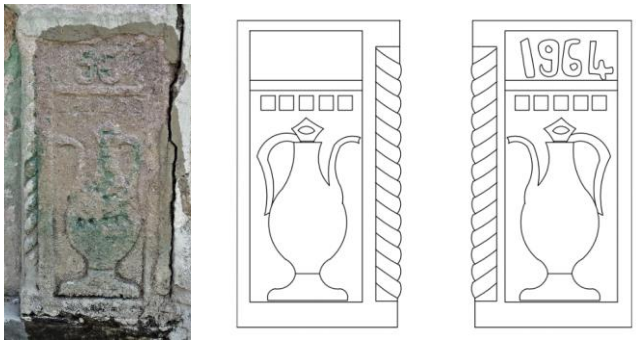


Figure 9. Decorative details on Yolkaya Village Fountain

Drawing 9. Decorative details on Yolkaya Village Fountain

Dikenli Village Fountain II

The fountain is located in Dikenli Village, which is 8 km away from the center of Korgun District. It is situated on parcel no 5 of block no 139.

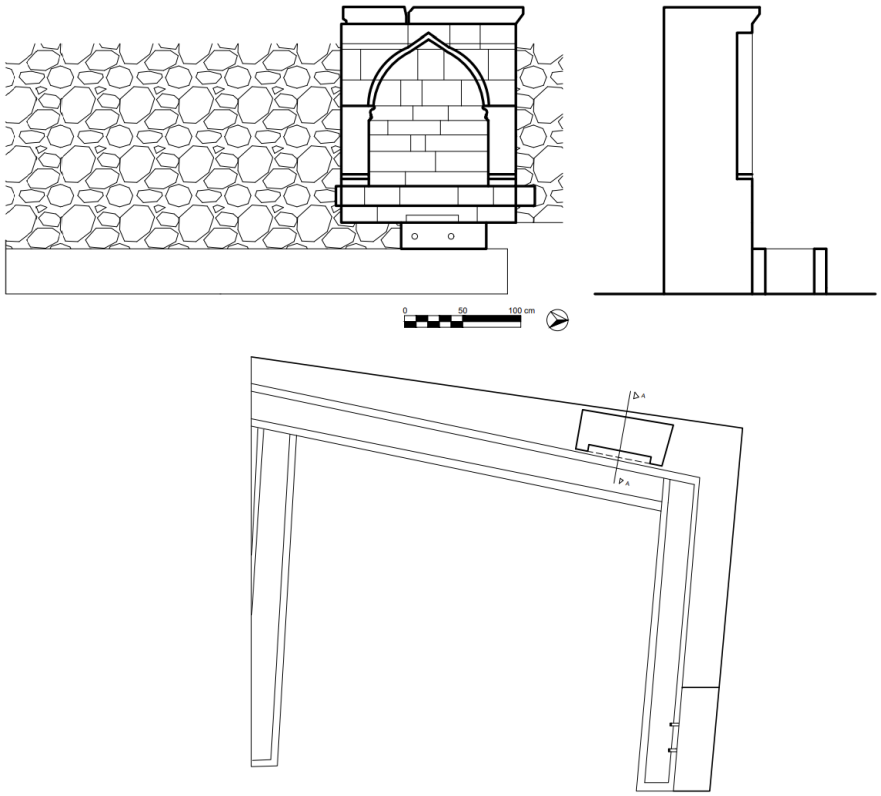


Figure 10. General view of Dikenli Village Fountain II

The fountain, named after the village in which it is located, rises on a horizontally rectangular mass (Figure 10). Extending in a north-south direction, the fountain has a height of 2.25 meters and a width of 1.62 meters (Drawing 10). The front facade is constructed using finely cut stone, while the other facades are built with rubble stone material.

The superficial tangent arch of the fountain, with a depth of 0.13 meters, rests on two legs with S-shaped curved capitals. The bases of these legs have plain surfaces, ending with convex moldings. The fountain does not feature a mirror stone or a basin niche. However, it has two spouted faucet holes, both retaining their original iron spouts. At the upper part of the fountain, there is a projecting stone cornice measuring 2.18 × 0.15 meters. The trough in front of the fountain is a later addition, constructed from reinforced concrete. All facades of the structure are designed to be simple and unembellished, emphasizing its functional character.

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Drawing 10. Elevation, section and plan drawing of Dikenli Village Fountain II

Since the fountain lacks an inscription, its exact construction date remains unknown. However, based on its plan, architectural style and facade composition, it closely resembles several 19th-century fountains in various regions of Turkey. Notable comparisons include: Hatıbın Pınarı (mid-19th century, Çankırı), Karataş Fountain (19th century, Çankırı), Ilgın Kese Village Fountain (19th century, Çankırı) (Demirtaş&Karademir, 2025), Halil Efendi Fountain (1730, Üsküdar) (Koçyiğit, 2013), Hacı Mahmut Ağa Fountain (1758, Balıkesir) (Işıkakdoğan, 2013), Ali Ağa Fountain (1810-11, Eğirdir, Isparta) (Akbaş, 2012). Considering these architectural parallels, it is likely that the fountain was constructed in the mid-19th century. Despite its plain and undecorated character, the fountain's two-spouted arrangement and location in Dikenli Village suggest that it served repeated collective use rather than an exclusively individual function. In this sense, the structure can be interpreted as part of the everyday water network of the settlement, supporting daily circulation and informal encounters around a shared functional space.

Mitik Fountain

The fountain is located in the center of Korgun District, on Büyük Mahalle, Mitik Street, situated on block no 204, parcel no 38 (Figure 11).



Figure 11. General view of Mitik Fountain

On the western facade of the fountain, there is a restoration inscription engraved on the stone using the recessed carving technique. The inscription measures 0.46 × 0.40 meters and is framed by a wreath-shaped border (Figure 12, Drawing 11).

The inscription text is as follows:

صاحب ...
الخیرات دلیل الخیرا ت
بموق اوغلو احمد
تعمیر فی سنه ۱۲۹۲

This inscription indicates that the fountain was repaired by Ahmed Efendi in the year H 1292 / CE 1875-76.





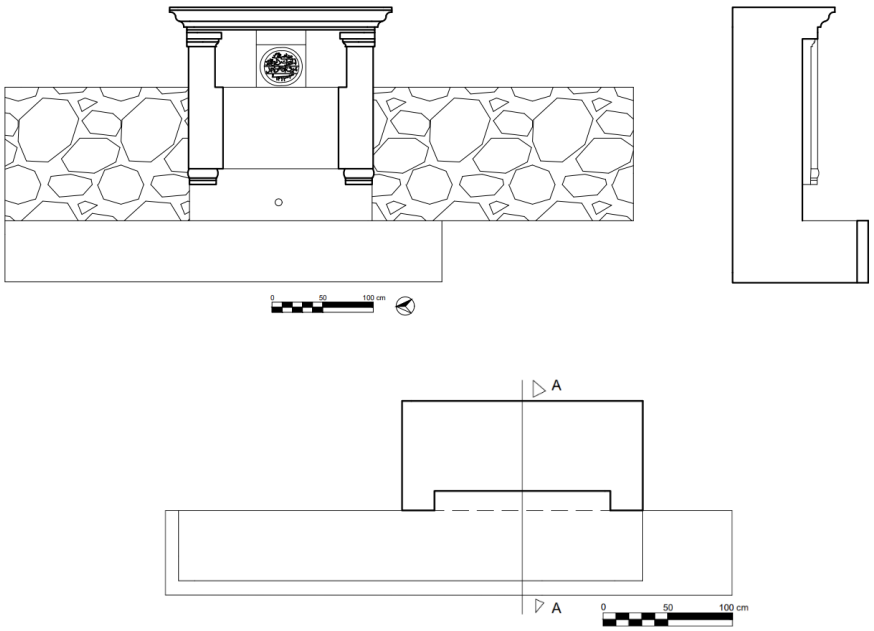
Figure 12. Inscription of Mitik Fountain

Drawing 11. Inscription of Mitik Fountain

The fountain, named after the street in which it is located, rises on a horizontally rectangular mass. Extending in a north-south direction, the structure has a height of 2.10 meters and a width of 1.80 meters (Drawing 12). It is constructed using andesite cut stone and block stone materials. The fountain has a plain surface, flanked on both sides by a pair of pilasters. At the end of the pilasters, there are plain and convex-molded profiled bases. With its simple and unadorned appearance, the western facade of the fountain features a 0.46 × 0.40-meter inscription, framed by a wreath-shaped border.

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The fountain does not feature a mirror stone or a basin niche on its surface. However, it has a single-spouted faucet hole, retaining its original iron spout. At the upper part of the fountain, there is an overhanging stone cornice with a concave profile, measuring 2.06 × 0.20 meters. The trough in front of the fountain is a later addition, constructed from reinforced concrete. All facades of the structure are designed in a simple and unembellished manner, emphasizing its functional nature.



Drawing 12. Elevation, section and plan drawing of Mitik Fountain

Since the structure lacks an inscription, its exact construction date remains unknown. However, based on its plan, facade composition and architectural unity, it closely resembles several 19th-century fountains in Çankırı, Ankara and Bolu. Notable comparisons include: Kayabaşı Street Fountain (19th century, Çankırı), Güdük Minaret Fountain (19th century, Çankırı) (Demirtaş, 2022), Naciye Hanım Fountain (1907, Ankara) (İşçen, 2019), Kabirler District (19th century, Bolu) (Durman, 2014). Considering these architectural parallels, it is likely that the fountain was constructed between the late 18th century and the early 19th century. Since the fountain is located in the district center on Mitik Street, it can be considered within a more active everyday circulation network than the village fountains. Its position on a street suggests that it functioned as a small-scale public node where access to water, movement through the settlement, and short-term social encounters intersected.

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FOUNTAINS THAT HAVE PARTIALLY SURVIVED TO THE PRESENT DAY

Çukurören Village Fountain

The fountain is located in Çukurören Village, which is 15 km away from the center of Korgun District. It is situated on block no 124, parcel no 3 (Figure 13).

The fountain has undergone multiple repairs over time and was eventually demolished. In its place, a new L-shaped fountain was constructed, incorporating stones from the original structure. The inscriptions from the old fountain were also integrated into the new structure to preserve them. The construction inscription on the south facade is severely worn and difficult to read today. On the east facade, another inscription from the old fountain is embedded within a superficial semi-circular arch. This arch is framed by two rows of concavely carved moldings. Above the arch, a projecting stone cornice (1.30 × 0.15 meters) with a profiled design extends outward.



Figure 13. General view of Çukurören Village Fountain

The fountain contains two inscriptions from the original (old) fountain. The construction inscription on the south facade is engraved using the recessed carving technique and is framed by a thin molding. It is set within a horizontally rectangular panel measuring 0.86 × 0.64 meters (Figure 14). Due to significant wear and erosion, the inscription is difficult to read today.

The inscription text is as follows:

صاحب الخيرات و الحسنات
الحج على ابن الحج
حسين سنه ١٢٣

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Figure 14. Inscription of Çukurören Village Fountain

The restoration inscription on the eastern facade measures 1.17 × 0.65 meters and consists of three lines of text (Figure 15, Drawing 13). It is positioned within the superficial semi-circular arch of the structure and is engraved on andesite stone using the recessed carving technique.

The inscription text is as follows:

ماشاء الله بو چشمه نك بناسنه

نوكه ميسر اولنلره رحمت اولسون انشاء الله

سنه ١٣٠

According to these inscriptions, the fountain was constructed in the year H 1233 / CE 1817-18 and underwent restoration in the year H 1302 / CE 1884-85.



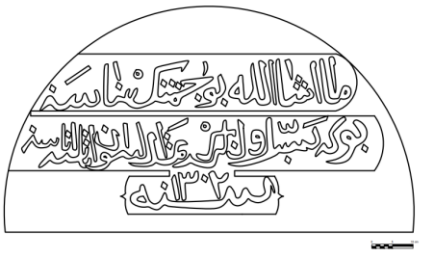


Figure 15. Restoration inscription of Çukurören Village Fountain

Drawing 13. Restoration inscription of Çukurören Village Fountain

Karatekin Village Fountain

The fountain is located in Karatekin Village, which is 12 km away from the center of Korgun District (Figure 16). It is situated in front of the village mosque. The fountain has been completely demolished and replaced with a newly constructed fountain[1].

[1] During an oral interview conducted on June 10, 2020, with Ekrem Baş, the retired imam of the village, he stated that the historic fountain was demolished approximately fifteen years ago. During the interview, Ekrem Baş also mentioned that following the demolition of the fountain, he personally placed the inscription inside the roof cavity of the new fountain for preservation purposes.



Figure 16. General view of the newly constructed fountain replacing Karatekin Village Fountain

Archival records and photographs from the Regional Directorate of Foundations indicate that the original fountain was constructed using block stone material, attached to the building behind it (Figure 17). The structure featured two arches, with a horizontally rectangular inscription positioned at the central axis. Both arches were designed in a superficial pointed arch form and rested on pillars with profiled capitals and bases. The photograph reveals that the left pillar of the right arch had been broken. Above the arches, a concave-profiled plain molding was present.



Figure 17. Karatekin Village Fountain (VGMA, 180702002-RP002, fol. 12b)

The inscription of the historic fountain is currently stored within the roof of the newly constructed fountain for preservation. Measuring 0.65 × 0.42 meters, the inscription is in the form of a horizontally rectangular panel, surrounded by a thick border. However, its upper right corner is broken (Figure 18, Drawing 14).

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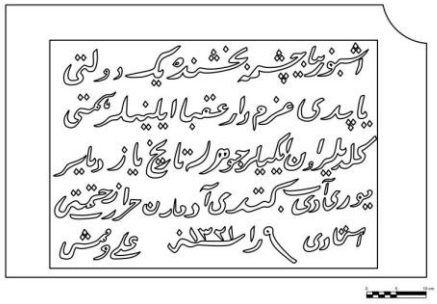


Figure 18. Inscription of Karatekin Village Fountain

Drawing 14. Inscription of Karatekin Village Fountain

The inscription text is as follows:

اشبو زیبا چشمه بخشنده یك دولتی
یاپدی عزم دار عقبا ایلینلر همتی
کلدیلر اون ایکیلر جوهرله تاریخ یازدیلر
یوریدی آب کتدی آدملرن حرارت زحمتی
استادی ۹ را سنه ۱۳۲۱ علی و ممش

According to the inscription that has survived to the present day, the historic fountain was constructed in the year H 1321 / CE 1903-04.

On the southern facade of the fountain, there was also a tombstone inscription and a spolia inscription dated H 1291 / CE 1874-75[2]. These inscriptions have also been placed inside the roof cavity of the newly constructed fountain for preservation purposes (Figure 19).

The spolia inscription text is as follows:

ماشاء الله
ممش آغا که ایدوب... .کانقری قلعه سنك دزداری
... حاجی مصطفی آغا
...ابدی .همان .. . .در مادری ایچون انجق
... یدیلر چقدی دیدی تاریخنی
۱۲۸۲

[2] This information has been obtained from the Ankara General Directorate of Foundations Archive, report number 180702002-RP001.



Figure 19. Spolia inscription located on the southern wall of the fountain

EVALUATION

The historic untains in Korgun are significant cultural heritage elements that reflect Ottoman-era architecture and social structure. These fountains, with their functional and decorative features, provide valuable insights into the stone craftsmanship, calligraphy and architectural aesthetics of the period. Research indicates that while some fountains have preserved their original structural characteristics, others have either been demolished over time or altered for continued use.

Within the scope of the research, five fountains in Korgun that have survived to the present day and two fountains that have partially survived have been examined. The fountains in Korgun have been classified based on Ayla Ödekan's typology, which categorizes fountains according to their location and physical characteristics (Ödekan, 1992). This classification allows for a more systematic examination of the architectural features and local contexts of the fountains.

Typology

Fountains According to Their Location

All of the examples identified in Korgun were constructed independently, without any structural connection to other buildings. Although some of the examined examples give the impression of being attached to a structure, the absence of any static connection between the fountain and the building places them in the category of freestanding fountains.

Four of the fountains examined in the catalog were constructed as square (public square) fountains. These include the Kayıçivi Village Fountain (1796–97), Dikenli Village Fountain I (1817–18), Yolkaya Village Fountain (1884–85) and the Mitik Fountain (19th century). Examples of the square fountain type from Anatolia include the Merzifonlu Kara Mustafa Pasha Fountain in Edirne (1667) (Karademir, 2020), the Hacı Veli Mosque Fountain, Kastamonu (19th century) (Gür, 2009), the Nazım Bey Fountain in Ankara (İşçen, 2019).

Dikenli Village Fountain II (19th century), on the other hand, is classified as a wall fountain. This type of fountain is quite common in Anatolia. Especially due to unplanned urbanization in city centers and villages, many fountains have been surrounded by residential buildings and walls. Examples of this type include the Taş Minare Street Fountain in Safranbolu (1691) (Bölükbaşı Ertürk, 2014), the Bereketzâde Fountain in Istanbul (1732–33) (Barışta, 1989), the Ulu Yolu Fountain in Gediz, Uşak (1893–94) (Durman, 2014), the Keçeciler Cihannüma Sarı Mosque Fountain in Konya (1924) (Kunt and Soy, 2020).

Fountains According to Their Physical Form

Fountains According to Facade Composition

In the overall context of Korgun, the arch stands out as a significant architectural element in the facade compositions of the examined structures. Based on their facade composition, the fountains have been

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classified under two categories: those with a single arch and those with a flat facade. All of the fountains analyzed were constructed with a single facade.

Single-Arched Fountains

In this category, the facades of the fountains, most of which face public squares, feature niches framed by arched forms. The tangent arch, commonly used in many fountains across Istanbul and Anatolia, begins in a circular form at the impost level but transforms into a linear trajectory above, terminating in a triangular shape (Mutlu, 2014). Among the examples examined in Korgun, the Kayıçivi Village Fountain (1796–97) and Dikenli Village Fountain II (19th century) fall into this group.

Although numerous examples of tangent arches can be found throughout Anatolia, studies often group tangent and pointed arches together. Examples of fountains with tangent arches include the Hacı Ali Fountain in Çorum (1843) (Okumuş, 2017), the Hacı Beşir Ağa Complex Fountain in Eminönü (1744) (Tay, 2015), the Kapı Ağası Hüseyin Ağa Fountain in Amasya (1489) (Urak, 1994), the Sultan Selim Fountain in Karapınar (1569–70) (Mutlu, 2014) and the Halil Efendi Fountain in Karaman (19th century) (Denktaş, 2000).

The fountain in Yolkaya Village (1884–85), on the other hand, features a shallow horseshoe-shaped arch over its fountain niche. Examples of horseshoe-arched fountains in Anatolia include the Hacı Abdullah Fountain in Kastamonu (1904–05) (Gür, 2019), the Çatal Fountain in Tire (16th century) (Geyik, 2007) and the Kümbetli Mosque Fountain in Karatay (Mutlu, 2014).

Flat-Facade Fountains

Flat-facade fountains are those constructed without arched niches, featuring plain, flat surfaces on their facades. Among the fountains examined in Korgun, the Dikenli Village Fountain I (1817–18) and the Mitik Fountain (19th century) fall under this category. This type is widely observed in both Anatolia and Istanbul. Examples include the Abdülcebbar Fountain in Kastamonu (1891–92) (Gür, 2019), the Sultan Mustafa III Fountain in Istanbul (1760) (Kara Pilehvarian et al., 2000), the Kavaklı Mosque Fountain in Bursa (1778) (Çetinkaya, 2012), the Ciğercioğlu Abdullah fountain in Afyonkarahisar Bolvadin (Bahargülü, 2024), the Dümen Village Fountain in Aydın (19th century) (Özbalkan, 2019), the Eski Çeşme Street Fountain (1890–91) and the Mustafa Fountain (1910) in Bodrum (Kakız, 2019), the Çarıkçıoğlu Fountain in Erzurum (19th century) (Yurttaş and Özkan, 2002), the Çaypınar Fountain in Tokat (1818) (Demirbağ, 2022).

Fountains According to Body Form

The fountains of Korgun, distinguished by their niches and arched forms on the facades, are built upon a horizontally (transversely) oriented rectangular prism mass. These fountains, characterized by their

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simple and functional structures, feature straight lines and are generally positioned in public squares.

Material and Construction Technique

In the construction of the historical fountains in Korgun, locally sourced materials such as andesite ashlar and rubble stone were commonly used. Ashlar stones were generally preferred for facades, arches and inscription panels, while rubble stones were used in the side and rear sections of the structures, where visibility was limited. In terms of construction technique, the stones were laid using a stacking method with regular joint spacing; some structures were later repaired with mortar and thick mortar fillings were particularly applied on the surfaces. The inscriptions were usually carved into the stone using a recessed ground technique. Architectural elements such as cornices, pilasters, capitals and bases were shaped using stone carving techniques, serving both structural and decorative functions. In later interventions, reinforced concrete troughs were added to the fountains and the upper coverings were rebuilt using a mixture of local stone and concrete.

The Kayıçivi Village Fountain (1796–97), Yolkaya Village Fountain (1884–85) and Mitik Fountain (19th century) were constructed using andesite ashlar and block stone materials. Dikenli Village Fountains I (1817–18) and II (19th century) were built with neatly cut ashlar stone on the front facades, while the other facades were constructed with rubble stone.

The use of locally sourced materials in construction and the continuation of traditional stone craftsmanship in building techniques indicate that these structures were shaped in accordance with both the geographical identity and the production methods of their respective periods.

Structural Elements

The historical fountains in Korgun were generally designed as freestanding structures with a single facade and a horizontal rectangular plan. Architectural elements such as water troughs, arches, back panels and upper coverings are present in their composition.

In all the fountains examined in the catalog, the water troughs were later additions and constructed using reinforced concrete. In terms of functionality, water troughs are among the most essential components of a fountain; however, due to their constant contact with water and exposure to seasonal temperature variations and freezing conditions, they are also the most deteriorated parts of the structures.

Niche recesses for water cups, commonly referred to by various names such as taslık, bardaklık, or maşrapalık, are small arched niches built into the back panels of fountains, designed for placing a cup or ladle. These features began to appear in the 15th century (Önge, 1997). They can be formed either by building them into the wall masonry or carving them

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from a single block of stone. None of the fountains identified in Korgun include taslık applications.

Arches are among the most prominent architectural elements that add dynamism to the fountain's facade. The Kayıçivi Village Fountain (1796–97) and Dikenli Village Fountain II (19th century) have tangent arches, while the Yolkaya Village Fountain (1884–85) features a horseshoe arch. The piers supporting the arches are shaped like pilasters and in some examples, they include decorative details such as twisted shafts, S-shaped capitals and hourglass-shaped bases.

In the Kayıçivi Village Fountain (1796–97), the arch rests on cylindrical pilasters on both sides. The capitals and bases of these pilasters are shaped in an hourglass form. In the Yolkaya Village Fountain (1884–85), the horseshoe arch sits on twisted pilasters that lack both capitals and bases. On the front facade of the Dikenli Village Fountain I (1817–18), there are projecting pilasters with distinct capitals and bases.

The back panel is an architectural element in fountains where the spout or tap is mounted. It is typically positioned at the center of the facade and often designed with ornamental features (Mutlu, 2014). None of the fountains examined include an ayna taşı. The original taps of all the fountains have not survived to the present day. In some cases, new taps or spouts have been added later to restore water flow.

The fountains studied in Korgun are freestanding structures with visible upper coverings. Their roofs have flat covering systems and overhanging eaves with profiled projections.

Among the surviving fountains, four have inscriptions that remain intact, while the two partially preserved examples also feature inscriptions. These inscriptions were written in Ottoman Turkish in celî sülüs script, carved using the recessed-ground technique on stone or marble surfaces. The Kayıçivi Village Fountain includes both a construction inscription (1796–97) and a repair inscription (1815–16). The inscription of the Dikenli Village Fountain I (1817–18) features concave-curved, scalloped horseshoe-arch-shaped short edges and contains three cartouches. On the eastern facade of the Yolkaya Village Fountain (1884–85), there is a construction inscription carved into marble using the recessed-ground technique. Additionally, on the pilasters, within ewer (ibrik) motifs, the number "1964" is inscribed using carving techniques, indicating that the fountain underwent repairs in 1964. Although the Mitik Fountain does not have a construction inscription, it does feature a repair inscription framed with a wreath-shaped border.

Ornamentation

Although the historical fountains in Korgun generally exhibit a simple architectural style, they occasionally feature symbolically meaningful decorative elements. Ornamentation is most commonly observed on the front facades, which are the functional areas of the fountains. Decorations are concentrated primarily on inscription panels, arch pediments,

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pilaster surfaces and stone plaques. Among the most frequently encountered motifs are rosettes, passionflowers, cypress trees, ewers, the Seal of Solomon and X-shaped symbols. These elements reflect the belief systems, aesthetic sensibilities and symbolic language of the period. The motifs were typically carved into the stone surface using the recessed-ground technique; in some cases, they are framed with concave or convex border designs.

Geometric Ornamentation

On the facade of the Kayıçivi Fountain, two rows of moldings frame the surface in an inverted U-shape. The inner molding is carved in a convex form, while the outer one is concave. The surface of the outer molding is decorated with repeated "X"-shaped motifs that intersect diagonally. The "X" shape, also used as a "Tengri" symbol in ancient Turkic beliefs, came to represent faith in God, devotion to Him and unity with Him following the Turks' conversion to Islam (Kuru, 2020). These types of emblems, frequently seen in inscriptions from the Göktürk and Uighur periods on the Central Asian steppes, were used by tribes to mark both living beings and inanimate objects as symbols of belonging. After the adoption of Islam, such motifs continued to appear in architectural works, especially from the Karakhanid period onward, and persisted within geometric arrangements during the Seljuk and Ottoman periods (Duran, 2019).

Another decorative element observed in the Korgun fountains is the rosette (gülbezek) with geometric compositions. Among these compositions, star-shaped ornaments are the most common. In the Kayıçivi Village Fountain (1796–97), a rosette is located just above the arch, featuring a central twelve-petaled floral relief, around which star points are formed by V-shaped lines radiating outward from the center and ending in sharp tips. In the Dikenli Village Fountain (1817–18), beneath the inscription, there is a rosette containing a six-pointed star motif that radiates from the center. Examples of star-composition rosettes on arch keystones or other surfaces in Anatolia include the Temenne Deveci Fountain in Çorum (Okumuş, 2017) and the Ulusu Street Fountain in Demirciler Neighborhood, Bolu (1790–91) (Can, 2015).

On the surface of the southern pilaster of the Dikenli Village Fountain I (1817–18), there is a rosette in the form of a çarkıfelek (passionflower). The çarkıfelek motif consists of a decorative pattern formed by curved arms radiating from a central point in a spiral or rotating arrangement (Demiriz, 1979). Examples of this motif in Anatolia include the Karagöz Cemetery Fountain in Kayseri (1878–79) (Tali, 2014), the Tahta Mosque Fountain in Nevşehir (18th century) (Sevim, 2015).

Among the fountains examined, a six-pointed star (Seal of Solomon) motif can also be observed on the Dikenli Village Fountain (1817–18). Symbolizing power, authority and spiritual strength, this motif also conveys meanings of continuity and permanence (Türeli, 2006). Examples of fountains in Anatolia that feature the Seal of Solomon motif

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include the Tarakçılar Fountain in Kastamonu (Gür, 2019) and the Üçler Fountain in Nevşehir (1902) (Sevim, 2015).

Floral Ornamentation

Floral ornamentation, widely used in Turkish architecture, offers significant insight into the period and cultural context of the structure in which it appears.

On the surface of the northern pilaster of the Dikenli Village Fountain (1817–18), there is a rosette (gülbezek) motif with a diameter of 0.20 meters. Examples of fountains in Anatolia and Istanbul that feature similar motifs include the Başkadın Square Fountain in Istanbul (1729) (Koçyiğit, 2013), the Darıcı Fountain in Konya (Taşdelen, 2023), the Square Fountain in Kütahya (18th century) (Verim, 2009) and the Safalan Fountain in Kastamonu (Gür, 2019).

The cypress tree motif, commonly used in Turkish decorative arts, symbolizes immortality and is thought to be associated with the concept of Ab-ı Hayat (Water of Life) when placed beside or above the spout of a fountain (Gür, 2019). In the late Ottoman period, cypress trees became frequent elements in decorative programs, appearing singly or in pairs, symmetrically or asymmetrically, on the front facades of fountains (Gökler, 2018).

At the Dikenli Village Fountain (1817–18), the cypress trees are arranged in symmetrical pairs with curved tips. Examples of fountains featuring the cypress tree motif in Anatolia and Istanbul include the Fındıklılı Mehmet Ağa Fountain in Istanbul (1726) (Koçyiğit, 2013), and the Büyük Olucak Fountain in Afyon (1789–90) (Karasu, 2006).

On the Mitik Fountain (19th century), the surface of the floral wreath is decorated with acanthus leaves. This motif, which began to appear in Turkish architecture in the 18th century, can be seen in examples such as the Ahmed III Square Fountain in Istanbul (1729) (Koçyiğit, 2013), the Hacı Kadir Fountain in Edincik, Balıkesir (1834–35) (Işıkakdoğan, 2013) and the Karaağaç Village Fountain in Bolu (Can, 2015).

Figurative Ornamentation

On the Dikenli Village Fountain (1817–18), an anchor motif is located near the eaves on the surfaces of the pilasters, placed symmetrically. Based on this motif, it is presumed that the person who commissioned the fountain may have been a sailor. In Turkish art, the anchor motif is more commonly seen on gravestones, symbolizing the profession of the deceased. One example is the gravestone of Ömer bin Elhac Muhammed (1800) in the Üçler Cemetery of Konya (Önder, 1970). Other examples of the anchor motif can be found on the Fountain of Cezayirli Gazi Hasan Pasha, the Ottoman Grand Admiral, in Istanbul (18th century) and the Mirkelamoğlu Han Fountain in Izmir (18th century) (Geyik, 2007).

Another frequently observed figurative motif in Ottoman decorative art is the ewer (ibrik). Typically depicted with a low base, a bulbous or pear-shaped body, a long neck and a straight or S-shaped spout, the

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earliest examples of the ewer motif date back to the Sasanian and Mamluk periods (Altıer, 2019).

On the pilasters of the Yolkaya Village Fountain (1884–85), a pair of symmetrical ewer (ibrik) motifs can be observed. Executed using the recessed-ground carving technique, these ewers have wide bodies, long slender necks and spouts. The handle emerges from the upper part of the body and connects above the neck. Examples of fountains in Anatolia featuring the ewer motif include the Büyük Olucak Fountain in Afyon (1789–90) (Karasu, 2006), the Taşçılar Mosque Fountain in Manisa (1799–1800) (Uçar, 2012) and the Hacı Ömer Ağa Ilıca Fountain in Ilgın (1791–92) (Mutlu, 2014). The depiction of the ewer motif on structures directly associated with water—such as bridges, baths, fountains and ablution fountains (şadırvan)—is particularly meaningful. This motif, which evokes the act of ablution before prayer, may be interpreted as symbolizing bodily purification and the sacred nature of water (Altıer, 2019).

Fountains as Socio-Spatial Nodes in Rural Daily Life

The spatial distribution of the Korgun fountains indicates that these structures functioned beyond their basic role as water supply points. Their placement in village centers, mosque courtyards, along roads, and within residential clusters shows that they were embedded in the everyday spatial organization of rural life. In this context, fountains operated as small-scale socio-spatial nodes where daily practices such as water collection, ablution, animal watering, resting, and short-term encounters took place.

These fountains also contributed to the formation of informal public spaces in rural settlements. Unlike formally designed urban squares or monumental public spaces, the social spaces created around rural fountains emerged through repeated everyday use. The act of accessing water brought different members of the community together and transformed the immediate surroundings of the fountain into a shared place of interaction. Therefore, the fountains of Korgun should be evaluated not only as architectural and functional water structures but also as elements that organized daily movement, social relations, and local memory.

The surviving examples in Korgun demonstrate that rural water architecture played an active role in shaping the spatial identity of settlements. Even when modest in scale and architectural decoration, these fountains created recognizable points within the rural landscape. Their continued presence, partial survival, or transformation also reflects the changing relationship between water infrastructure, collective memory, and everyday life in rural Çankırı.

CONCLUSION

The fountains of Korgun constitute more than modest rural water structures; they represent enduring components of the socio-spatial

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organization of the settlement. While their formal characteristics demonstrate continuity with established Ottoman fountain typologies, their scale, material choices, functional arrangements, and spatial positioning reveal adaptations shaped by rural production patterns and local community needs.

In this study, seven Ottoman-period fountains located in Korgun and its surrounding villages were examined. Five of these examples have survived substantially, while two have been partially preserved. Within this scope, the fountains were analyzed in terms of their plan schemes, facade compositions, construction materials, inscriptions, decorative details, functional elements, restoration traces, and spatial locations. The findings show that a simple architectural approach dominates the fountains of Korgun. However, this simplicity should not be interpreted as a lack of architectural value. On the contrary, refined stone craftsmanship, carefully designed inscriptions, symbolic motifs, and functional details demonstrate that these structures combined practicality with aesthetic and cultural meaning.

Beyond their architectural attributes, the fountains functioned as infrastructural and symbolic nodes within everyday rural life. As water supply points, they structured daily routines; as fixed elements within the settlement fabric, they contributed to the formation of informal public spaces. Their locations near village centers, roads, mosque courtyards, residential clusters, or street networks indicate that they were embedded in daily movement patterns and collective practices. They supplied water, supported animal watering and ritual use, created places of encounter, and contributed to the continuity of local memory.

The examined fountains also reveal the role of patronage, charity, and repair practices in rural Ottoman water architecture. Their inscriptions indicate that some were constructed or repaired as acts of piety and public benefit. Later additions, restorations, reinforced concrete troughs, and partial reconstructions show that these structures continued to be used, adapted, and reinterpreted over time. This variation reveals how preservation awareness, local interventions, and changing patterns of use have influenced the aesthetic and authentic values of the fountains.

All these findings demonstrate that the fountains of Korgun should be regarded not only as architectural elements but also as historical, social, and cultural documents. They provide evidence for the continuation of traditional construction practices in rural areas while also showing how small-scale water structures could shape settlement identity, social memory, and communal use of space. In this respect, the study contributes to the literature by shifting attention from monumental urban water architecture to the socio-spatial role of rural fountains within local heritage contexts. Future restoration and conservation efforts will be critical for ensuring the transmission of this heritage to future generations.

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NOTES

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Mapping as a Tool for Revealing Collective Memory: The Case of Yeniköy, Istanbul

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Abstract

The significance of intangible values in the holistic preservation of architectural heritage has been widely recognized in the recent literature. Since both individual and collective memory are intrinsically linked to place, memory studies have become indispensable tools in interpreting and understanding intangible values in architectural conservation. While historical sites and structures are valued as repositories of memory, they become subject to preservation over time. In this context, documenting memory elements and enhancing their visibility through mapping contributes to a more holistic preservation approach. This study conceptualizes "memory" as an "intangible" phenomenon, elucidates the scientific methods employed to investigate it, and offers recommendations for selecting appropriate methods in alignment with the future research objectives. To emphasize the importance of methodological selection and to observe the applicability of the tools, historical urban landscape of Yeniköy was selected as a case study, exploring whether historical places concurrently function as sites of memory. Consequently, the neighborhood's memory sites were identified, and thematic memory maps were generated. Briefly, the study analyzes methods for revealing collective memory visible within the framework of documenting the relationship between historical spaces and user memory while evaluating the role of its representation in architectural discourse within the overarching conservation process.

Keywords: *Collective urban memory, Intangible heritage, Places of memory, Yeniköy*

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INTRODUCTION

Symbiosis of "memory" and "architecture" is based on the words of Ruskin (1889) in the 19th century; "*There are two powerful conquerors of human forgetfulness; poetry and architecture.*" While architecture was a tool that keeps memory and transmits it to the future, the necessity of conserving the architectural heritage with natural and social environment, will be discussed at the beginning of the next century (UNESCO, 2003).

The "mutual" relationship between the architecture and remembrance is defined as the "commemorative value" (Alois Riegl, 2015)." The commemorative value is also regarded as "intangible cultural heritage" within the conservation discipline (UNESCO, 2003). Like tangible assets, intangible heritage elements that are disappearing day by day are doomed to be forgotten if they cannot find a place to emerge. In this context, identifying which cultural heritage elements are sustained within Yeniköy's historical urban landscape, alongside the specific sources and underlying socio-cultural catalysts of this remembrance, emerge as crucial lines of inquiry in the conservation of architectural heritage.

While traditional conservation approaches focus on the physical structure, there is a lack of a methodology for mapping the relationship between intangible heritage, collective memory and place. Grounded in the theoretical foundations of Halbwachs (2018) and the concept of collective memory, this study utilizes Pierre Nora's "Lieux de Mémoire" framework. Concurrently, it cross-examines which methodological tools can effectively externalize architectural heritage to materialize intangible values, while critically evaluating to what extent sites of memory can successfully transform into tangible spatial representations through cognitive cartographic mapping. Accordingly, the historical urban landscape of Yeniköy is analyzed as a holistic entity, integrating its architectural heritage, natural environment, and socio-cultural evolution.

This study formulates a framework for identifying, documenting, and visualizing collective memory elements within architectural heritage, establishing a methodological bridge between data collection and mapping. First, the research delineates methodologies to uncover and classify memory components of historic urban landscapes. Subsequently, it examines the tangible and intangible layers of Yeniköy to detect memory elements and spatially correlate them with their respective locales, ultimately providing a basis for constructing dynamic memory maps.

Data related to intangible values and analysis methods should be identified for each historic area, such as Yeniköy. Specific data and methodological tools have been identified for the Yeniköy historical urban landscape on the conducted investigation. The lack of local data underscores the importance of site-specific memory studies for holistic conservation. This study is critical for documenting the tangible and intangible heritage elements that are on the verge of disappearing in

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Yeniköy, an important historical district of Istanbul that has become a cosmopolitan settlement over last century, and for shedding light on the similar studies. Unlike purely descriptive studies, this research proposes a methodological model that integrates alternative memory references with traditional documentation. It explores how intangible data can be systematically related to tangible elements within historic urban landscapes.

METHODOLOGY: TOOLS FOR EXPLORING MEMORY OF PLACE

While the exploration of collective memory of places requires interdisciplinary collaboration, the clear definition of methodologies brings together researchers from diverse fields and ensures accurate process planning. Within this theoretical framework, the values attributed to urban spatial memory, the information sources used for systematizing and evaluating scientific data, and the tools employed to uncover this information have been defined. Furthermore, the commonalities between these methods have been established for purpose of classification.

Table 1. Classification of methods according to the tools and resources.

Tool	Resource	Method
Literary writings, biographies, memory texts, newspaper articles, engravings, photographs, films, songs, old and new maps, official land registries	Archives and formal records	Written, visual, and cartographic archival analysis
Aboveground and underground remains	Physical findings	Archaeological data analysis
Individual and focus group interviews	Individual memory	Oral history
Workshops, memory walks, storytelling and dramatization, web-based platforms, mobile applications, individual/communal cognitive mapping	Individual contribution, and co-creation	Participatory methods

Determining to the purpose, scope, and goals of memory studies -the type of data accepted as the source of memory elements- is important in determining the methodology. Sources like social media archives or open access applications available are used to collect data such as: scientific or non-scientific written sources such as historical writings and poems; documents from different professional groups such as engravings or maps; media elements such as songs or films; various photographic archives -belonging to families or compiled systematically-; underground or aboveground physical remains and place names; narratives or mappings of the users of the place; group activities that facilitate remembering in a similar manner. Each of the tools, which contain the spirit of historical environments and structures, were examined in four

groups according to their common qualities: "written, visual, and cartographic archival analysis", "archaeological data analysis", "oral history" and "participatory methods" (Table 1).

Written and visual documents are the most used sources in exploring the memory of the past. Compared to other resources, archives and formal records are preferred because they are fast, direct, objective, cumulative and accessible. On the other hand, sometimes they are biased due to the perspective of the creator and the effect of context; for example, different communities may have read and recorded the same events or places differently (Bastian, 2014). Moreover, it is known that artificial sources have been produced throughout history for political reasons such as identity construction (Bastian, 2014). In this method, information should be verified as possible as from many sources and different parties.

Within the framework of cartographic documentary analysis, the investigation of place names (toponymy) serves as a significant analytical layer to unveil hidden dimensions of urban memory. While naming often possesses a symbolic function, Alderman (2016) conceptualizes toponymic practices as powerful catalysts directly linked to collective and political memory, emphasizing their influence on broader socio-political constructs. Consequently, the nomenclature of regions, streets, or avenues within historical urban landscapes functions as a vital repository; these names preserve the tangible and intangible traces of architectural structures, historical figures, or cultural traditions that existed in the past but have been fragmented or lost over time.

Revealing the memory related to historical urban landscapes, other methods may be insufficient due to reasons such as the large amount of time passed since the memory, the loss of documents, or the inability to find anyone who witnessed the events. From this perspective, archaeological data gain the role of memory element. Findings are not only physical elements but also provide a source for valuable readings about from a small part. Van Dyke (2019) defined archaeology as a collective memory construction in a sense, as it questions the relationship between the material element and the place.

The oral history method, which emerged in America in the first half of the 20th century; used in social research in Europe in the second half of the same century and enabled the research of disadvantaged groups such as minorities, immigrants, and women who could not find a place in scientific history (Köksoy Karpat, 2009). The tool used to record people's lives, memories, and experiences, aims to compile the information remembered by living witnesses of the past as an alternative to historiography. This information can provide important clues about important events, places, architectural details, activities, and social changes. The oral history method is not only using in academic studies today but can also utilizing for architectural production such as urban designs or museums.

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Participatory methods are based on the principle of residents, short-term and long-term users, business owners and professionals coming together to exchange ideas. This approach runs parallel to oral history practices; however, the exchange is inherently multi-sided rather than one-directional, emphasizing the essence of "being a part of it" (Bavilolyaei, 2018). Although its roots trace back to Plato, user-oriented approaches formally emerged in Northern European countries in the mid-20th century, often utilized during periods of crisis or within complex urban territories (Bavilolyaei, 2018). Given that citizens are frequently resistant to transformations within their environment, participatory frameworks serve as highly effective mechanisms to mitigate this resistance, ensuring that the final spatial output is genuinely adopted by the community. Nevertheless, obstacles such as securing representation from all demographics, financial limitations, and strict time constraints often complicate the implementation of this method.

As a primary tool deployed within this participatory scope, cognitive mapping functions as a qualitative mode of documentation that captures how the city is constructed within the perception of its citizens, moving well beyond its physical reality. The process that contextualized through spatial orientation, movement and remembrance; culminates in individuals synthesizing and concretizing various cognitive images of their environment, thereby generating a collaborative map as a final product (Bekar et al., 2021). Within this framework where lived experience is a paramount catalyst, everyone's cognitive map emerges as a unique narrative, framed by the socio-spatial codes brought from their past lives. Consequently, the participants' memories of the place feed all kinds of information networks that will help remember the environment, such as place, location, distances, and the relationships between the objects, as valuable as the objects themselves (Bekar et al., 2021).

In this section the methods utilized in revealing memory elements related to historical urban landscapes were explained. Due to the inherent nature of memory, it is crucial to acknowledge from the outset that these recollected elements may contain discrepancies, thereby necessitating the confirmation and cross-checking of the gathered data.

As an observation; diversifying and increasing the number of data collection tools, increases the accuracy of the data. While it is important to include information that cannot be verified in the studies in terms of data protection, clearly stating this situation is important in terms of reliability and future research. It should not be forgotten that presentation products can be created in many ways in physical and digital environments and that their visibility at the level of the non-professional public can be increased compared to scientific studies. It is observing that memory studies strengthened the sense of belonging due to the establishment of an emotional bond at the level of the participant and target audience.

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Table 2. Analysis of the methods used in the study in terms of tools and resources[1].

Tool	Resource	Method	Rationale for using or not using the method
Literary writings, biographies, memory texts, newspaper articles, engravings, photographs, films, songs, old and new maps, official land registries	Archives and formal records	Written, Visual, and Cartographic Archival Analysis	This approach analyzes written archives and visual-cartographic records to establish a historical baseline, determining heritage's impact on naming conventions while verifying spatial evolution through intangible traces.
Aboveground and underground remains	Physical findings	Archaeological data analysis	No data found.
Individual and focus group interviews	Individual memory	Oral history	To examine the impact of tangible and intangible heritage on its users and determine the relationship between remembrance and acceptance with a place.
Workshops, memory walks, storytelling and dramatization, web-based platforms, mobile applications, individual/communal cognitive mapping	Individual contribution, and co-creation	Participatory methods	Removed due to the research design.

[1] The selected tools, resources, and methods are highlighted in green in the table.

In this study; written, visual, and cartographic archival analysis, and oral history methods were used, considering the preliminary research on Yeniköy (Table 2). Participant group studies were excluded from the scope of this research because of the methodological framework was designed to prioritize individual narratives and the analysis of primary

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archival records. It was aimed to use all methods to compile all the data in the region, but data could not be found with every tool, as archaeological data. A trial was conducted for the cognitive mapping tool, but no results were obtained due to the large size of the area and the high age of the participants.

LAYERS OF YENIKOY HISTORICAL URBAN LANDSCAPE

Yeniköy is one of the Bosphorous villages inhabited mostly at the reign of Suleiman the Magnificent (1520-1566). In the second half of the 16th century, the population brought from the Eastern Black Sea region was settled in the area and it is understanding that the migrated community carried the local culture and character with them: they were known as good sailors and merchants.

In the 17th century, some of the residents were Turkish, the majority were Greek, and a small part were Armenian (Kömürciyan, 1988). Also, the region gradually developed and became richer, and therefore construction activities increased (Evliya Çelebi, 2008). Yeniköy experienced several major fires: 107 buildings were damaged in the fire in 1908 and 80 buildings in the fire in 1918 (Sözbir, 2011) and unknown number of buildings were destroyed in the 1927 fire.

Yeniköy was negatively affected by the World War I. The locals experienced financial difficulties and concerns about looting (Türker, 2004). The establishment of nation states caused mixed-ethnic communities to fail to maintain their structure. In the last half century, Greek, Armenian and Jewish communities migrated, and Yeniköy lost its cosmopolitan structure (Kaya, 2020).

In 1936, Henri Prost's zoning plan directly affect the Yeniköy as one of the important steps in the history of urbanization in Istanbul. Prost suggested that the original architecture should be preserved (Akpınar, 2010). Main road routes were largely established and the Yeniköy-Sarıyer coastal road was constructed. Suggestions such as covering the roofs with Turkish style tiles instead of Marseille tiles emerged as steps towards urban conservation (Salman, 2004).

In Yeniköy, Sait Halim Pasha Grove was opened to construction in 1953 with the subdivision, and between 1966-75, building density began to increase on the slopes of the district with the "local zoning plan" (Salman, 2004). Slum constructions that began in 1966 on the Yeniköy, Istinye and Tarabya ridges were legalized with the amnesty granted in 1981, and a ban was imposed thereafter (Salman, 2004). The luxury villa construction trend that continues today began in 1985 on the ridges the Bosphorus, and the surrounding neighborhoods of Yeniköy (Salman, 2004).

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Natural Environment

Yeniköy is a neighborhood in Sarıyer district; It is located on the shore of the Bosphorus and approaches the Beykoz Coast as a cape (Hovannesyan, 1996). When viewed from the Bosphorus, Yeniköy appears as a settlement located between the hill and the coast (Figure 1).

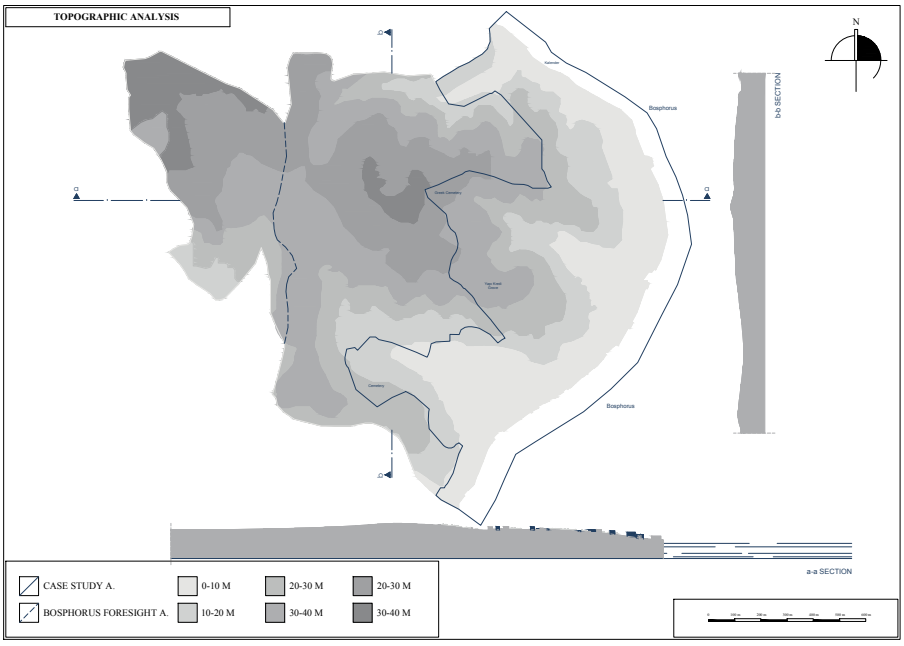


Figure 1. Topographic analysis of Yeniköy.

Yeniköy is a "historical urban landscape" that needs to be conserved in a holistic manner with its places of worship such as churches, mosques and synagogues and the traditional houses around them, the mansions on the coast and the groves on the hills. Urbanization of the region is a linear character focused on coastal use, because of geography. Today, the main axis of the Yeniköy, which is accessible by sea and land, is "Köybaşı Street".

The air and greenery of the region have been frequently praised in historical sources; in the mid-19th century, Byzantios noted that there was a stream formed by snow and rainwater 700 steps from Istinye Bay and that Yeniköy cape was a very windy and flowing area (1862, cited in Türker, 2004).

The vegetation of Yeniköy, one of the old villages along the Bosphorus Strait, comprises a mixture of forest formations and groves (Türker, 2004). Yeniköy is characterized by Kumariotissa (strawberry tree) and pine, oak, laurel species are predominant throughout the landscape (Byzantios, 1862 in Türker, 2004). Additionaly, newly urbanized areas commonly feature afforestation with pine and cypress trees. Owing to its location, Yeniköy represents a transition zone between Mediterranean and Black Sea vegetation (Evliya Çelebi, 2008).

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Built Environment

The built environment of Yeniköy historical urban landscape is analyzed under two main headings: "urban morphology, roads, open and green spaces"; and "historic buildings". The northern half of the neighborhood is called "Upper Yeniköy" and the southern is called "Lower Yeniköy". The first settlements emerged in the Upper Yeniköy region. The Plaj Park, Çamlık Park, Yapı Kredi Grove, Greek Cemetery and Yeniköy Martyrs' Cemetery are prominent examples of "open and green spaces".

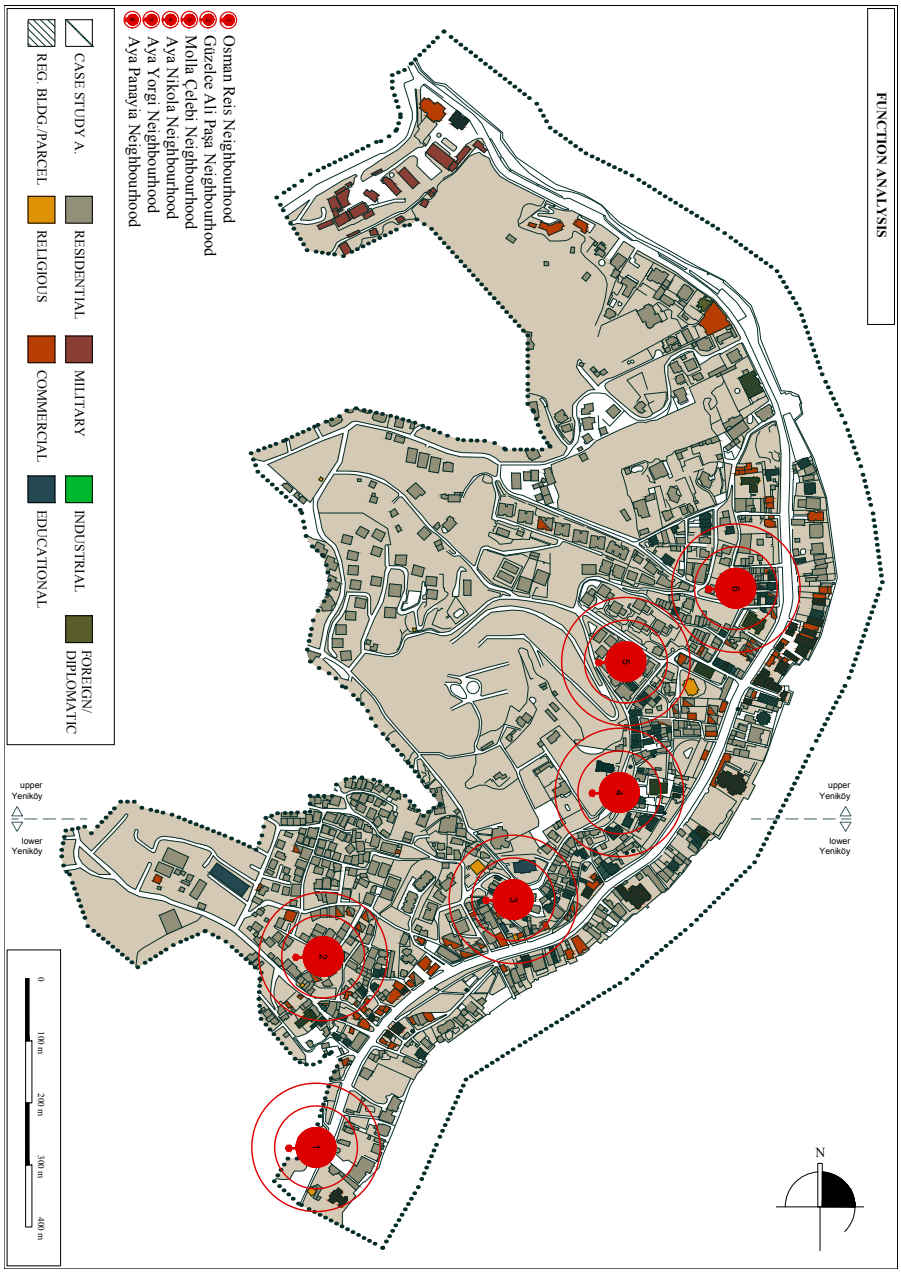


Figure 2. Function analysis of Yeniköy.

Located on the remains of the historical Molla Çelebi Mosque the Plaj Park is a recreation area that offers a defined interior landscape without direct visual contact with the sea. Çamlık Park, adjacent to the Austrian

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Consulate, is a historical focal point that has hosted collective activities such as archery in the past. Yapı Kredi Grove, situated on the ridges of the neighborhood, represents the privately owned green space, while the Greek Cemetery and the Martyrs' Cemetery constitute the neighborhood's passive green space stock. These areas hold high symbolic value for the local population due to the personal and communal connections they embody.

"Historic buildings" classified through their function as; "residential", "religious", "military", "commercial", "industrial", "educational", and "foreign / diplomatic" buildings (Figure 2).

Historical neighborhood centers are marked to illustrate the relationship between early residential cores and historic zones were public, civic, or religious functions originally intensified. Due to the lack of definitive territorial boundaries in historical archives, only these approximate centers could be identified (Figure 2).

Waterside residences, mansions, and traditional houses, which have an important place in the fabric of Yeniköy, under the category of residential buildings. The mansions are which mostly belonged to Greek citizens in the past, hosted Ottoman pashas in the late 19th century (Türker, 2004). The owners of the mansions have changed frequently throughout the history. The only mansion that belongs to Greek citizens today is the Aleko Nikolaidis Mansion, where the restaurant called "Aleko's Place".

City residents have moved over time, and the names of the mansions have changed frequently, this situation damages the bond and memory between the community and heritage elements. The walls of the mansion gardens that have risen over time have weakened the bond between the inner parts of the neighborhood and the coast (Figure 3).

The religious buildings in Yeniköy are churches, holy springs, synagogues, and mosques. The Panayia, Aya Nikola, and Aya Yorgi Greek Orthodox churches; Panayia Tis Fatnis, Aya Paraskevi, Aya Haralambos holy springs; Surp Asdvadzadzin (Virgin Mary) Armenian and Surp Hovhannes Mıgırdiç Armenian Catholic churches; Tiferet İsrael Synagogue and Osman Reis, Yeniköy Çarşı mosques, which are places of worship for people of different religions.

The Mihrişah Valide Sultan Fountain is one of the religious structures and it is an element of the Molla Çelebi Mosque and Hamam that was both demolished. Although all these structures still exist today, they placed randomly within the region and there is no clustering in terms of religion or ethnicity.

Military structures in Yeniköy are the Military Branch (Old Police Station), Kalender Pavilion and the Army House. While the former Military Branch has undergone a functional transformation and currently serves as a private assembly hall, the Kalender Pavilion and the Military House maintain its original institutional function.

The commercial fabric in Yeniköy has evolved from units focused on local needs around Iskele Street throughout history to the widespread

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commercialization of ground floor residential buildings along Köybaşı Street today. There is no independent commercial building typology in the area; commercial functions are maintained by being integrated into the existing residential fabric.

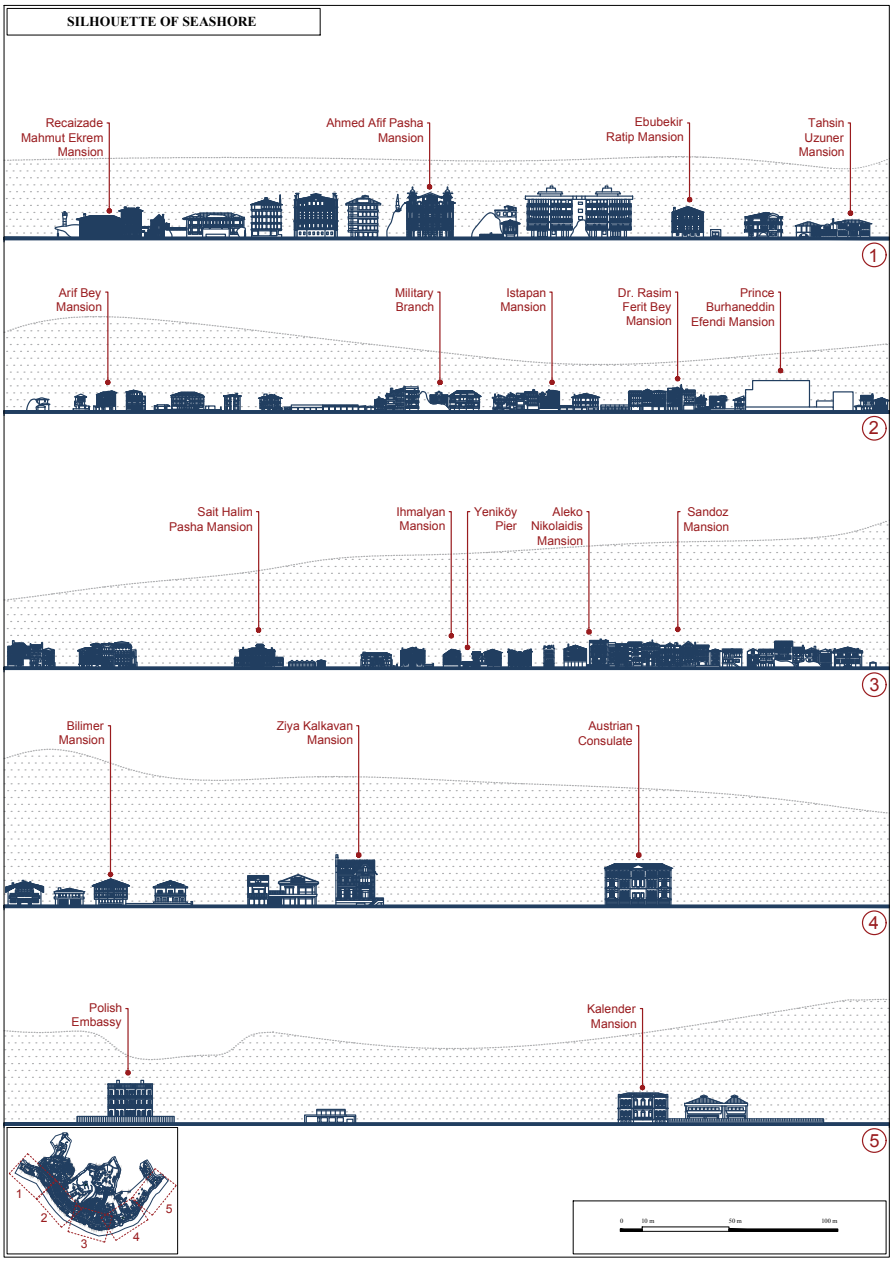


Figure 3. Silhouette of seashore from Bosphorus.

Known that there were industrial structures in the region that lost in the past but only the physical trace of "Yeniköy Yağhanesi" as a street name has been documented. According to interviews with local people, there was a factory called "Yeniköy Gazoz" located opposite the current "Military Branch" and it was demolished during road widening works in 1958. Similarly, a "Yemeni (kind of scarf) Factory" was once located on the site of the present "Plaj Park", though the exact years in which its operations ceased have not been determined.

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Educational buildings that are considered as one of the elements that constitute the Yeniköy built environment are Zoğrafyon Greek School, Karatodori Girls and Boys School and Yeniköy Primary School.

The coastal settlements on the European side of the Bosphorus have acquired a unique character through the presence of diplomatic buildings and summer residences. Yeniköy bear the traces of this morphological structure, with the Austrian Consulate, located on the Kalender axis, constituting the only monumental example of this type in the district. This structures, with their physical and social layers, stand out as fundamental components of the region's multicultural fabric for generations.

Economic Activities, Socio-Cultural Life, and Intangible Heritage

Privileged situation of Yeniköy, where the socio-economic welfare level has been high since its establishment, has ensured that the district has remained relatively well-maintained and conserved (Hovhannesyan, 1996). According to Grosvenor (1895), villagers were wealthy Ottoman, Armenian and Greek families in the 19th century and the streets, houses, churches, and schools were attractive structures. First inhabitants of the village were famous for their bakeries and there were shops on the coast selling "peksimet", a food that did not stale for a long-time during sea voyages (Taşçıoğlu, 1995). There were piers called "Ekmekçi" and "Simitçi" in Yeniköy, which was known as a stopover point for sailors heading to the Black Sea in the 19th century, supports this narrative (Türker, 2004). The historical bakeries on the coast have been closed and lost over time. The last bakery to have survived to the present day, the Historical Yeniköy Bakery, continues to operate.

The people migrating from the Black Sea were engaged in jobs such as fishing, boating and tavern keeping (Hovhannesyan, 1996). Türker (2004) noted that the Greeks were engaged in viticulture and gardening, albeit to a small extent. Another traditional business of the district is the "çiroz fish" trade (Hovhannesyan, 1996, cited in Taşçıoğlu, 1995).

Women in the district, especially, contributed to the family economy by making "yemeni" and that this occupation continued until nowadays. A famous Armenian master named "Vahan Vartanyan" from Yeniköy and his apprentices produced "yemeni" that were famous beyond Istanbul and reached Europe at the end of the 19th century, the products with dimensions of 80x80 or 70x70 had crocheted borders on the edges (Türker, 2004). In addition to traditional works, small commercial activities such as grocery, barber and haberdashery increased in the district over time (Türker, 2004).

The settlement history of the Yeniköy, which has multiple groupings with intersecting and diverging points, is explained in parallel with its history: while it was a village where the Greek community lived, it was composed of Muslim Turks coming from the Eastern Black Sea, and Armenian residents who settled in the later period. In addition to this situation, under the influence of various identities, a distinction was formed between the coastal line where mansions were bought and sold

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by wealthy people and the inner part where middle-class citizens settled, while in the inner regions, settlement clusters called "neighborhoods" emerged in line with religious beliefs (Evliya Çelebi, 2008).

In the 17th century, Yeniköy experienced its most multi-cultural period, during these years, the district was divided into neighborhoods called by the same names in their main places of worship and their surroundings (Artan, 1989). While three of the neighborhoods were Turkish and three were Greek (Evliya Çelebi, 2008), Armenian people did not form a separate settlement area and lived randomly in the existing neighborhoods although they have places of worship (Artan, 1989). The main places of worship of the period with the same name of neighborhoods were Osman Reis, Güzelce Ali Pasha and Molla Çelebi Mosques; Aya Nikola, Aya Yorgi and Aya Panayia Churches.

Yeniköy largely preserved its multicultural and cosmopolitan character until the 20th century. In the 20th century, many events that affected the social structure took place and there were migrations from Anatolia to large cities. The relationship of the Bosphorus villages with Istanbul changed dramatically with the development of transportation (Salman, 2004). The neighborhood has received immigration from within and outside the city, and its social structure has changed. Until the 21st century, especially the waterside residences in Yeniköy, changed hands many times and became the independent residences of businessmen and foreigners who were not "locals". Over the past 30 years, the district gained touristic value, and accordingly, businesses that opened for profit began to overshadow the old shops, and the district profile entered a dynamic cycle of change.

REVEALING THE COLLECTIVE MEMORY IN YENIKOY

The strong sense of belonging that the locals who have lived in the Yeniköy for generations, created a community that conserves its traditions and values. Information and documents regarding the structures, spaces, and fabric of the region with high architectural quality and memory value have eroded over time and the visibility of the elements of memory has decreased.

In order to reveal the values of the Yeniköy historical urban landscape; "written, visual, and cartographic archival analysis" was conducted to compile literary writings, biographies, memories, engravings, photographs, films and songs, old and new maps, official land registries; and "oral history studies" were conducted to compile information that had not been recorded in any formal archive until today.

In the studies, expressions were recorded about the meaning of historical urban landscape elements in addition to the identification. The interviews were aimed to be conducted one-on-one; group interviews were less and just as trial (Koçhan, 2023).

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Written, Visual, And Cartographic Archival Analysis

To identify elements of Yeniköy's collective memory, the writings of Evliya Çelebi, Sarraf Hovhannesyan, Eremya Çelebi Kömürciyan, G. V. İnciciyan, Robert Walsh, Pardoe, Skarlatos D. Byzantios, Konstantinos Kavafis, Edwin Grosvenor, and Maria Tsangari were examined.

In the 17th century, Evliya Çelebi depicts Yeniköy's well-kept houses with gardens and their affluent residents. Subsequently, Sarraf Hovhannesyan noted that the Greek community constituted the majority in the 18th century while documenting the names of various places of worship. In the second half of the same century, Walsh (1839, cited in Türker, 2004) stated that the exterior colors of the houses varied according to different ethnic groups, noting that Turkish houses exhibited a more introverted character. Furthermore, the detailed information provided by Pardoe (1838) about the 19th century Fire Festival is highly valuable due to the limited resources on the subject.



Figure 4. Old photos about daily life from Yeniköy (a, b: citizens' albums; c: Kihara archive).

Engravings, family and official archival photographs, local or foreign films, songs concerning Yeniköy were compiled. Engravings emphasize the magnificent mansion architecture and picturesque coastal views by depicting these structures flamboyantly amidst an exaggerated landscape, while the prominent presence of boats and caiques further confirms written historical accounts of active 19th-century maritime activities in the region. In collective memory studies, historical visuals are analyzed not only for architectural and structural data but also for the critical insights they provide regarding daily life (Figure 4).

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Figure 5. Movies from Yeniköy (Uçurumdaki Kadın, 1964; You Can't Win 'Em All, 1970; Bizim Aile, 1975; Tosun Paşa, 1976).

Archives of the Yeniköy's citizens, social media accounts and community groups, records in the mukhtar's office, archives such as SALT Research, Atatürk Library, German Archaeological Institute (DAI), and Abdülhamit II Yıldız Collection were searched, and the identified memory elements were presented in relation to the structures and landscape. During the intensification of Turkish cinema between the 1960s and 1980s, Yeniköy's open spaces and historical buildings served as extensive filming locations, leaving a significant source for heritage conservation. A prominent cinematic venue in the 1960s was the Orhan Günşiray Mansion; its interiors, gardens, and immediate surroundings hosted the production of seminal films such as "Ölmüş Bir Kadının Mektupları", "Uçurumdaki Kadın", and "Kanun Namına".

The Sait Halim Pasha Mansion has hosted local and foreign productions with its variety of places, open and close areas, view and location. Some of the movies in question are "Bizim Aile", "Tosun Paşa", "Süt Kardeşler", "Deli Yusuf" and "You Can't Win 'Em All" (Figure 5). "Haremde Dört Kadın (1965)" is the film in which the interior of the structure is shown in the most detail. Also, the Afif Ahmed Pasha (Muhayyeş) Mansion is prominently remembered as the filming location for the 1975 television series Aşk-ı Memnu. Beyond such monumental structures, the neighborhood's open public spaces, including its streets and parks, have extensively hosted various television and cinematic productions.

Beyond visual documents, auditory elements also preserve regional traces. Two pieces were reached in the study, one of which is Yesari Asım Arsoy's work titled "Aşkım Yeniköy Sahili Deryasını Sardı" and "Sarı Zambak", while the other is Feridun Düzağaç's song "Yeniköy".

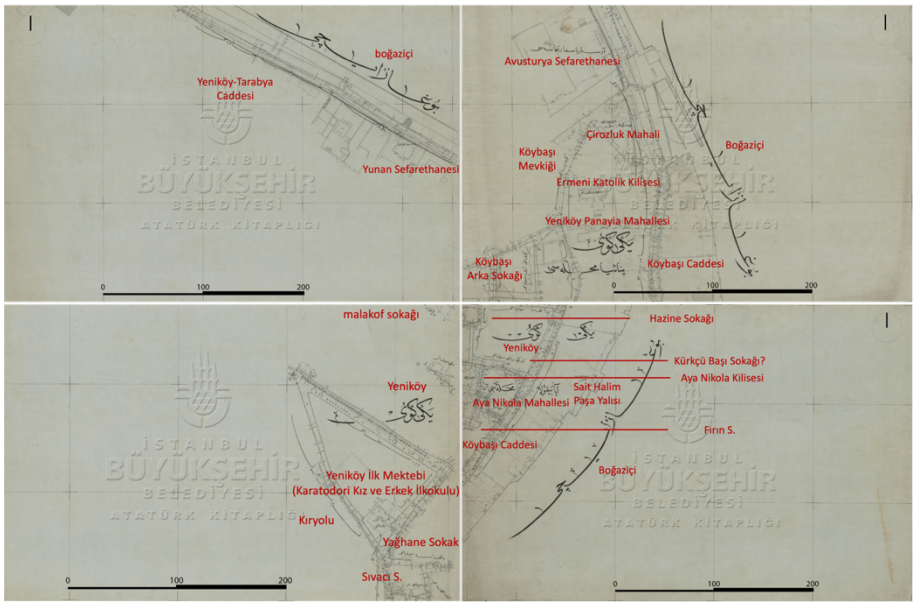


Figure 6. 1926 Rumeli Ciheti Map with street, avenue and place names.

Through the framework of this cartographic and archival analysis, the toponymic evolution of Yeniköy was identified by conducting a comparative analysis between historical maps and contemporary street signage. While certain street names have been preserved, others were modified during subsequent municipal naming processes in Türkiye. Furthermore, this archival investigation revealed the historical existence of localized micro-toponyms. Due to the administrative practice of adopting the district's general name for official neighborhood designations, these localized micro-toponyms have largely faded from collective memory.

These historical maps contain critical data regarding the transformations in the neighborhood fabric and the construction processes; consequently, archival toponymic data and old street nomenclature serve as vital clues for urban memory, particularly in cases where no other archival source can be reached. Within this scope, The City Governorate Maps dated 1883 and 1890, the Necip Bey Maps dated 1918, the Rumeli Ciheti Maps dated 1918-1922, and the 1/500 and 1/2000 scale Rumeli Ciheti Maps dated 1926 were examined (Figure 6).

Oral History

Within the methods used to reveal Yeniköy's collective memory, oral history studies stand out. Semi-structured interviews conducted in accordance with the permission of Science and Engineering Scientific Research and Publication Ethics Board, obtained from the "Mimar Sinan Fine Arts University" with the decision numbered 111146 dated May 17, 2023. Fifteen long-term residents with over 30 years of local residency were selected (Table 3).

Of the interviews conducted face-to-face for 30-60 minutes, 12 were individual and 3 were group interviews. In the interviews based on mutual dialogue with open-ended questions, the commonality of the

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shared topics yielded a more efficient result in terms of collective memory by evoking or reminding each other (Koçhan, 2023).

The qualitative data obtained from these narratives were subjected to spatial coding to analyze their precise coordinates within the contemporary landscape. While participants inherently tended to describe memories through physical spatial references, any ambiguous landmarks were cross-checked and verified with the interviewees in a follow-up phase. For memory sites whose exact locations remained unidentified by the participants, a triangulation method was employed, utilizing secondary archival sources, historical maps, and engravings to accurately georeference the data. Finally, holistic or macro-scale memory elements associated with the landscape were systematically integrated into specific spatial focal points or distinct thematic layers in accordance with the final map design.

Table 3. Classification of methods according to the tools and resources.

Interviewee	Gender	Residence	Role	Location of the Interview
E**** C********** (I1)	Male	56 yrs	Mukhtar	Molla Çelebi Nbhd. (Mukhtar's Office)
N******* A**** (I2)	Male	71 yrs	Textile Designer	Güzelce Ali Paşa Nbhd. (Participant's Residence)
O***** Ö***** (I3)	Male	66 yrs	Businessman	Coastal Area (Emek Cafe)
E*** Ç** (I4)	Male	72 yrs	Retired	Güzelce Ali Paşa Nbhd. (Participant's Residence)
T**** Ç** (I5)	Male	47 yrs	Tradesman	Güzelce Ali Paşa Nbhd. (Participant's Residence)
Ö*** G***** (I6)	Male	60 yrs	Engineer	Coastal Area (Domani Restaurant)
H**** K****** (I7)	Male	51 yrs	Constructor	Aya Nikola Nbhd. (Participant's Residence)
M***** G******* (I8)	Male	32 yrs	Teacher	Hillside Area (Participant's Residence)
M****** E******* (I9)	Female	74 yrs	Retired	Hillside Area (Participant's Residence)
A**** K****** (I10)	Male	58 yrs	Tradesman	Aya Nikola Nbhd. (Historical Yeniköy Börek Shop)
F*** Y******** (I11)	Male	48 yrs	Construction Technician	Aya Yorgi Nbhd. (Participant's Residence)
E*** F******** (I12)	Male	32 yrs	Banker	Aya Panaiya Nbhd. (Participant's Residence)
L*** V***** (I13)	Male	62 yrs	Greek Community Leader	Aya Nikola Nbhd. (Participant's Residence)
H**** D**** (I14)	Male	80 yrs	Taxi Driver	Güzelce Ali Paşa Nbhd. (Participant's Residence)
M***** T** (I15)	Male	86 yrs	Casino Owner	Aya Nikola Nbhd. (Participant's Residence)

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Oral history narratives conducted with interviewees randomly selected from the neighborhood, reveal that Yeniköy's historical social fabric was once organized around diverse religious landmarks, giving rise to distinct districts such as the Osman Reis, Güzelce Ali Paşa, Molla Çelebi, Aya Nikola, Aya Yorgi, and Aya Panayia neighborhoods (Figure 7).

These areas emerged as organic clusters where different faith-based communities coexisted in proximity. However, these localized neighborhood identities have dissolved over time and do not exist in the contemporary administrative structure. Furthermore, the lack of recorded data or collective memory regarding their precise historical boundaries suggests that these districts functioned as fluid social spaces rather than rigidly defined jurisdictional territories.

Among the open spaces, groves, parks, and gardens that have shaped the district's morphology, and form part of its historical urban landscape are several shared and functional areas, including Çirozluk, İskele Sokak, Çilek Bağları, Sokrat's Dalyanı, Havuz and Ermeni Tepe (UNESCO, 2011). Infrastructure elements also have meaning in the historical area and Kumsuyu is the only memory element at this category.

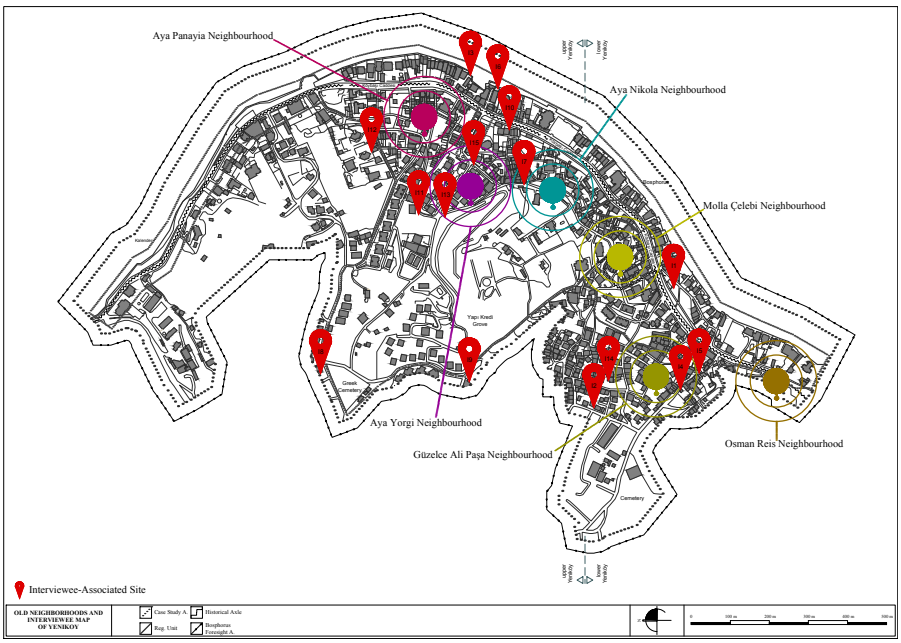


Figure 7. Old neighborhoods and location of interviewees.

The "Molla Çelebi Mosque and Bath, Halveti Tekke and Churches" came to the fore among the religious buildings from the historical urban landscape layers in the built environment. It is noteworthy that the names of the churches are not remembered in detail. Then, the "Military Branch - Old Police Station" was mentioned as military structures, but other ones such as the German Naval Officers' House were not remembered.

Among the commercial buildings in the memory of the local people, the "Summer and Winter Cinemas, Aleko's Place, Historical Yeniköy Börek Shop, Emek Cafe, Domani Restaurant" stand out. The only

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educational structure that remained in the minds of Yeniköy locals was the "Greek Primary School". The picturesque appearance of the structure and the fact that it is still in use are effective in this situation. Also, the examples of residential buildings in the memory of the locals are the "Carlton Hotel, Şekerciyan and Sait Halim Pasha Mansions". Austrian Consulate was another prominent building highlighted during the interviews.

As a result of the interviews, five social events stated in the memory of Yeniköy residents. These are Kazakh raids that took place in the 17th century, the events of September 6-7 (1955), the expropriations of 1957-1958, 1974 Cyprus Peace Operation and the 1995 Sait Halim Pasha Mansion fire. Considering the time that has passed since the events; Kazakh raids were evaluated as memory elements learned from historical sources, the events of September 6-7 (1955) were transferred from family elders, the expropriations of 1957-1958 were transferred from family elders or witnessed in childhood, and the 1995 Sait Halim Pasha Mansion fire was evaluated as memory elements acquired by witnessing. According to the statements of the Yeniköy residents interviewed; 26 July Commemorations, Easter Celebrations, Barrel-organ Playing, 23 April Cortege and the Yeniköy Jazz Days event in recent years have been identified as the traditional activities of the district.

Stories about the daily life of Yeniköy Neighborhood, highlight close neighborly relations and living different ethnic communities together. The funeral ceremonies of the Greek community with the "koliva" as well as "yemeni factory" with production process have been compiled as memory elements that should be conserved.

RELATING THE YENIKOY'S COLLECTIVE MEMORY WITH PLACE

Nora's (2018) suggests that a place of memory (*lieux de mémoire*) may take various forms: a space such as Gettysburg Battlefield or Robben Island; a structure such as Eiffel Tower or Colosseum; a public event such as Thanksgiving or Victory Day; or even a historical figure such as Nelson Mandela or Abraham Lincoln. Accordingly, whole the data were classified as "urban morphology, roads, open and green spaces", "historical buildings" and "public events and living heritage". Although Nora's definition includes "significant personae" this category was excluded from the analysis as no prominent historical or symbolic figures with legacies intertwined with the neighborhood's collective memory emerged during the data collection process.

Within the analytical framework of the study, the geographical structure, urban fabric, natural areas, open spaces, and infrastructure of the neighborhood are evaluated under the category of the "urban morphology, roads, open and green spaces", which reflects the spatial and environmental characteristics shaping the settlement (Figure 8).

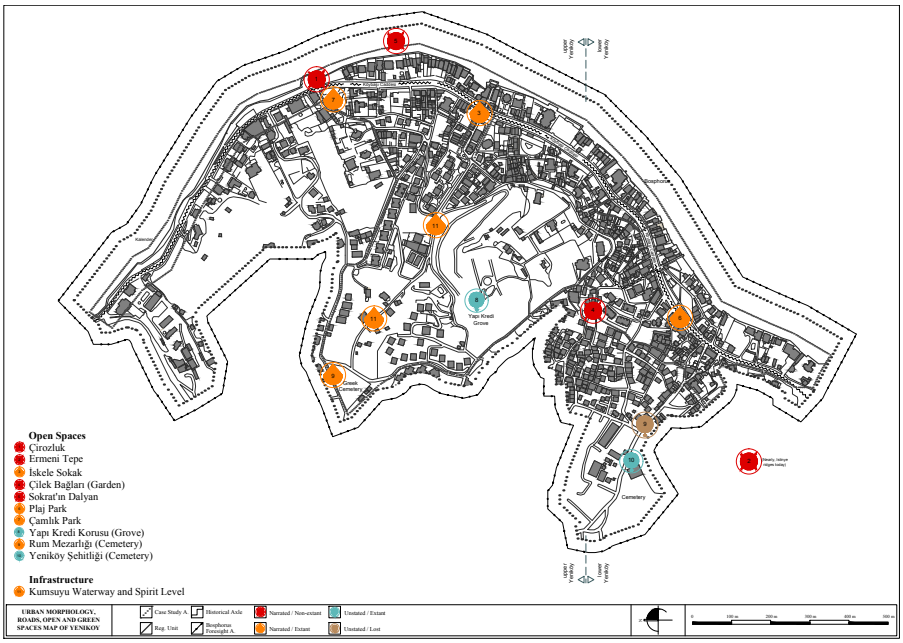


Figure 8. Findings on collective memory of Yeniköy: Category- "Urban morphology, roads, open and green spaces".

"Historical buildings" grouped into residential, religious, military, commercial, industrial, educational, and foreign / diplomatic categories, represent the tangible architectural elements through which the historical development of the area can be traced (Figure 9). Furthermore, social events, everyday practices, traditions, and rituals are defined as "public events and living heritage", highlighting the intangible cultural expressions that contribute to the formation and continuity of collective memory.

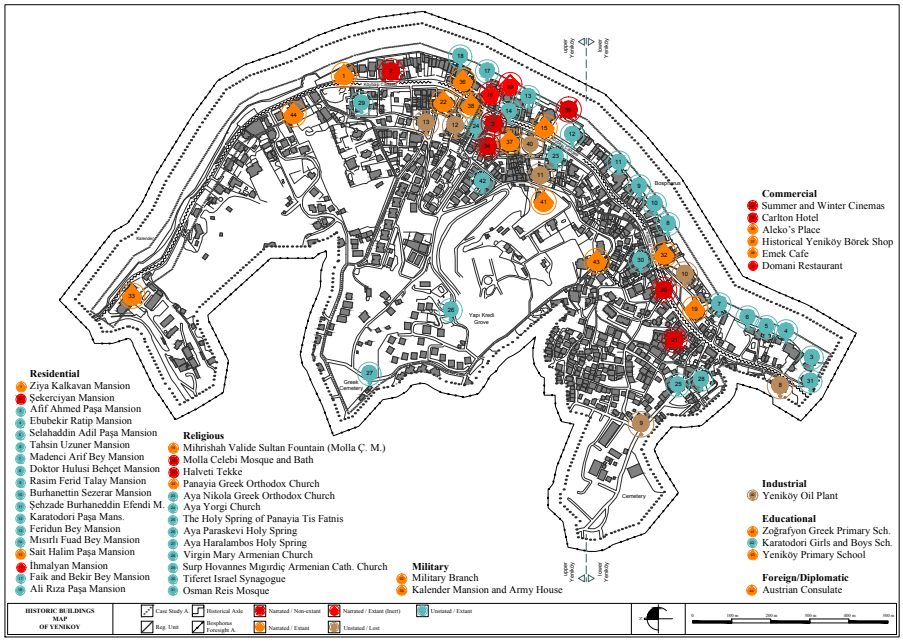


Figure 9. Findings on collective memory of Yeniköy: Category- "Historic buildings".

The elements were compiled and aimed to creating thematic memory maps of Yeniköy. The themes have been shaped according to the headings described above. Given that some elements are intangible, putting

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forward their relation to the site was designed as a preliminary methodological step.

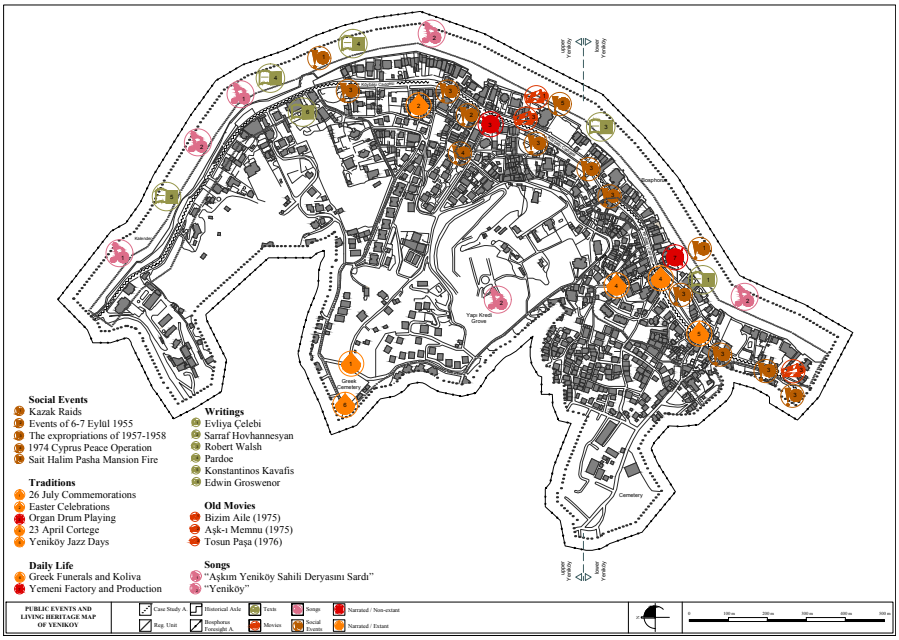


Figure 10. Findings on collective memory of Yeniköy: Category-"Public events and living heritage".

Written and visual archives data were examined and their spatial references at the neighborhood and locations were determined. The names of places in literary writings or the references regarding the atmosphere of the site were recorded and related to place. In biographies, traces of the environment or structure where persons spent their life were sought, also the location and architectural features of the destroyed structures were followed up.

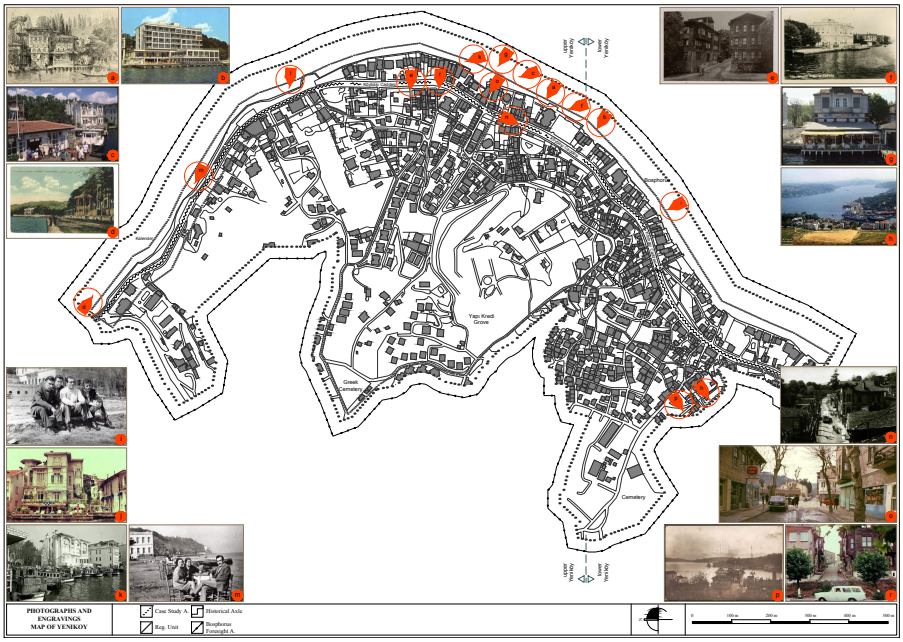


Figure 11. Map indicating the locations of historical photographs and engravings (a: Allom, SALT R.; b: SALT R.; c: Çalıkoğlu arch., SALT R.; d: IBB Atatürk Lib.; e: IBB Atatürk Lib.; f: IBB Atatürk Lib.; g: Çalıkoğlu arch., SALT R.; h: locals social media grp.; i: arch. of locals; j: Kihara arch.; k: locals social media grp.; m: arch. of locals; n: locals social media grp.; o: Kihara arch.; p: IBB Atatürk Lib.; r: Kihara arch.).

Memory texts became sources containing information about the entire historical urban landscape and engravings contributed to the formation of ideas about the landscape features of the 19th century. In the study, old maps dating to the late 19th century were examined. These maps contributed to distinguishing between the historical urban area and the unqualified settlement areas that expanded over time by documenting the original characteristics of the urban fabric in subsequent periods.

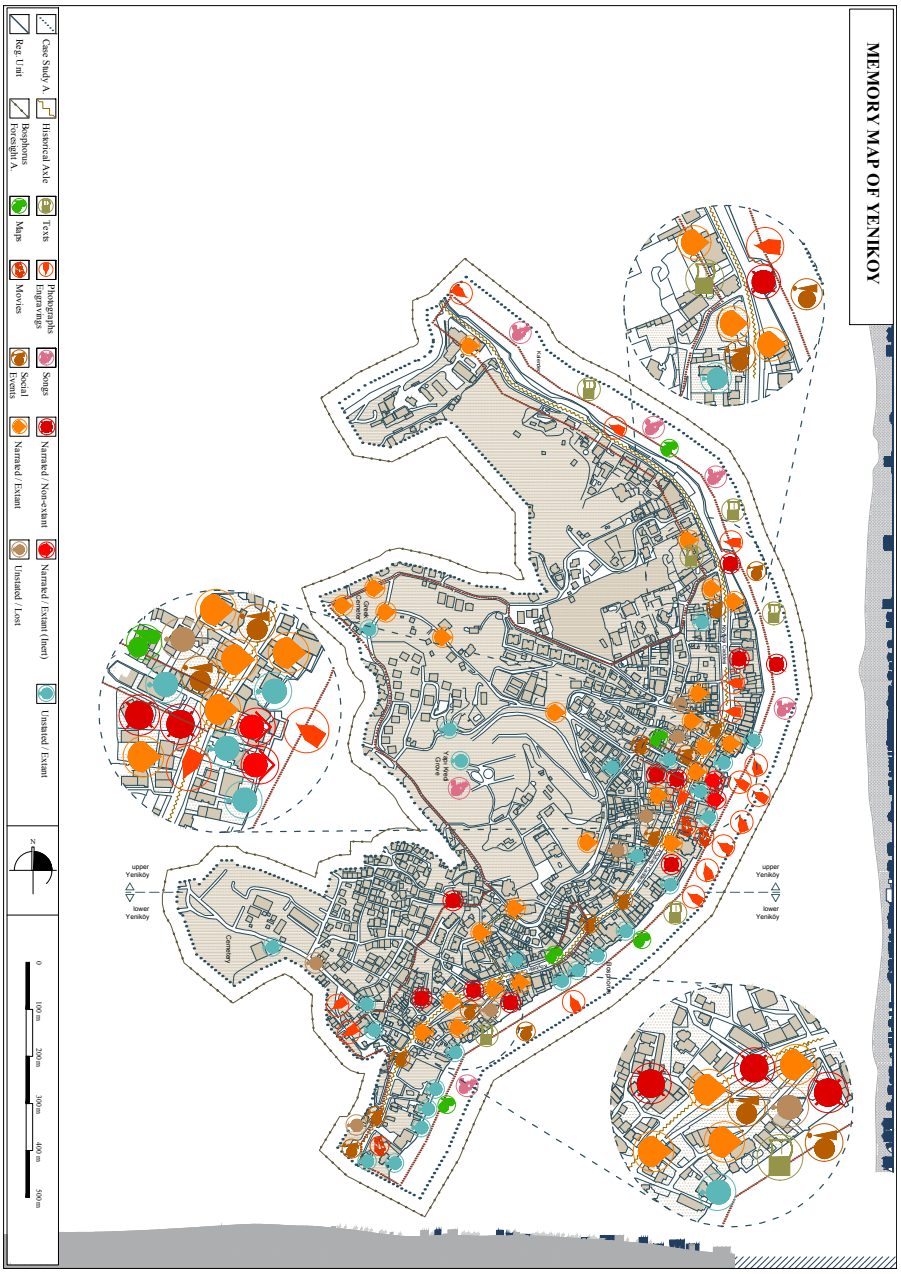


Figure 12. Synthesis: The memory map of Yeniköy.

In the old photographs, the existing landmarks were searched; impressions about the physical condition of the environment were placed on the map. Similarly, films and songs were related with places of Yeniköy based on their visual perspectives and lyrics (Figure 10-11). In the processing of the maps, in addition to the distinction between the places

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mentioned and not mentioned in the interviews, a distinction was made between elements that preserve their existence today and those that do not. Additionally, archival photographs were georeferenced and oriented on the map based on their original viewpoints (Figure 11).

Figure 12 integration of data from thematic maps, highlighting cultural assets and illustrating their intersections with sites of memory. Despite certain divergences, a distinct density of icons was observed in frequently mentioned areas, leading to the magnification of these three specific zones. Ultimately, mapping by materializing memory minimized the margin of error throughout this process.

CONCLUSION

This study examines methodological approaches to uncovering tangible and intangible cultural heritage components in historical urban landscapes and relating these values to their spatial context within a holistic framework. The research is based on the issue of the loss of spatial memory and erosion of original values that arise from the neglect of intangible heritage in traditional documentation processes. Accordingly, tools available in the international literature and provided by the case area were classified according to their reliability and relationality levels. This step supports the originality of the research.

In the pilot studies conducted in Yeniköy: written, visual, and cartographic archival analysis, place names, and oral history methods were adopted as the main approaches. Layers of Yeniköy historical urban landscape was analyzed and during the memory processing phase, cross-validation with this data was performed.

In the process of systematizing the memory findings, Pierre Nora's Lieux de Mémoire (Sites of Memory) conceptual framework was utilized. While it is acknowledged in the literature that this framework has been applied in previous studies regarding the mapping of collective memory, the specific contribution of this study lies in its reinterpretation of Nora's theoretical approach. Rather than using it solely as a classification tool, the study employs Nora's framework to develop a categorization model that bridges the gap between intangible memory elements and spatial documentation through an intermediary methodology. Ultimately, the findings suggest that rendering spatial memory visible—even in the absence of official documentary status—significantly enhances the comprehensive perception of the historical urban landscape by bridging physical structures and their socio-cultural narratives.

Yeniköy Neighborhood; is a historical urban landscape that should be preserved with its natural formation, location on the Bosphorus, historical architectural heritage, neighborhood fabric, traditions, and other elements of collective memory. The study includes: the relationship between memory and the conservation of architectural heritage, the definition of Yeniköy Neighborhood as a historical urban landscape, the presentation and mapping of the memory elements determined to reach an inference regarding the definition.

Due to the slowness of change, the historical city is one of the most important elements that feeds collective memory. The resistance of the residents of the historical environment to change increases their commitment to memory on the one hand, while on the other hand, it contributes to the increase in the tendency to protect. Due to the nature of memory, city dwellers -who tend to minimize changes in their environment-, become key factors in the conservation of the historical urban landscape by fostering a sense of belonging. In this respect, memory studies are important for positively managing the relationship between users, visitors, and heritage elements.

In the study, ways of indirectly reaching traces of a region were investigated. While it provides a guiding approach in situations where sufficient resources are unavailable or where documentation was not considered necessary at the time, it is recommended that any information obtained in future studies, be verified through alternative means.

The memories of the groups in Yeniköy are common at many points and a direct "collective memory" is formed. Among the elements remembered about the district; there are structures that do not have the status of cultural assets but have a memorial value, while there are also structures that are not mentioned despite having a high architectural heritage. Thus, it appears that the memorial value and the status of cultural assets are not directly related. There were monuments mentioned in the interviews but did not survive physically to the present, and some are both demolished and not mentioned. While this situation emphasizes the feature of memorial value to keep alive, it has brought up new discussions about the reasons why an element from the past could not acquire a memorial value. It has been noted as an element that needs to be addressed in future research.

As a situation that limits the study outputs; having a more mixed identity in the interviewee group would expand the quality of the data. However, the fact that the existing diversity is not sufficiently suitable as a negative effect. Another limitation, the problems experienced in determining the location due to the structures or places being called by different names from time to time; is recommended to be solved by carefully considering and having the residents of the district describe the location on the map. On the other hand, "significant personae", defined as memory place within Nora's framework, could not be included in the study due to the lack of data in the study area.

The survival or disappearance of values within the living historical urban landscape depends not only on their inherent qualities, but also on the attitudes and perceptions associated with them. Remembering or forgetting of "urban things" is related to complex cognitive processes. These reasons are beyond the scope of this study. For example, the seashore residences were not mentioned much, and this situation was associated with the fact that a building's being a house overshadowed its other meanings. However, the underlying causes are not always self-evident, and subjective conjectures may lead to misleading conclusions.

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The extensive studies of Halbwachs (2018) should be examined in this regard.

Within the scope of the findings, the role of memory in the processes of documentation, narration, and transmission to future generations, as well as the multitude dimensions it can influence, has been revealed. In conservation studies, it is necessary and recommended that individual and collective memory be used more effectively. Finally, as illustrated in the memory maps, preserving the relationship between memory and place, plays a vital role in sustaining urban identity and guiding architectural conservation.

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Resume

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Towards a Comprehensive Typo-Morphological Exploration of Silifke (Mersin, Turkey)'s Multi-Layered Urban Form: Methodological Insights within the Context of Urban Morphology

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Şebnem Hoşkara**

Abstract

Many Anatolian towns with historically layered urban fabrics have undergone rapid spatial transformations in recent decades, often resulting in the loss of traditional morphology and the weakening of collective urban memory. This study focuses on Silifke (ancient Seleuceia ad Calycadnum), a mid-sized Anatolian town with a rich historical background, and examines the planning and morphological changes in its historic core within the broader context of cultural heritage conservation and urban policy. The analysis covers an approximately 150-hectare area that encompasses Silifke's multi-layered historical center and archaeological protection zones, as defined in the 1995 conservation plan. The research employs a typo-morphological approach grounded in multi-layered mapping techniques and historical data. Its originality lies in developing a context-specific morphological framework for medium-sized Anatolian towns, a category that remains underrepresented in urban morphology literature. A key methodological contribution is the introduction of an "x-ray" analysis—superimposing chronological urban layers produced from archival maps, cadastral records, aerial photographs, historical engravings, and municipal plans. This method reveals the evolution of spatial elements such as street networks, building patterns, and plot configurations across different historical periods. Findings indicate that Silifke's historic core retained strong spatial continuity until the mid-20th century. However, post-1950 rural-to-urban migration led to increased building activity; during the 1960s, parceling practices began to alter the traditional plot structure; and from the 1980s onward, the rise of high-rise construction further disrupted the historical urban fabric. Notably, the absence of a conservation-oriented development plan until 1995 allowed these transformations to unfold without a regulatory heritage framework. These cumulative changes constitute key turning points in the town's morphological evolution. Overall, the study underscores the importance of integrating morphological analysis into heritage-sensitive urban planning and proposes a transferable analytical model for other Anatolian towns facing similar developmental pressures.

Keywords: *Urban form, Urban history, Urban morphology, Urban transformation, Silifke-Mersin-Turkey*

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INTRODUCTION

Urban morphology offers a crucial framework for understanding the spatial, social, and cultural evolution of cities by analyzing their physical structure and its interaction with human activity over time (Kropf, 2018; Oliveira, 2019; Arefi & Aelbrecht, 2024). The morphology of a city encompasses not only the arrangement of buildings and streets but also the historical layers, socio-economic dynamics, and political shifts embedded in the urban fabric (Karaarslan & Çelikyay, 2019; Ayten & Aygen, 2022; Moudon, 1997). This multifaceted perspective supports the recognition of urban identity and cultural memory as essential components in the persistence and transformation of cities (Rodger & Rau, 2020; Bandarin & van Oers, 2012).

Historically, cities have been conceptualized in diverse ways shaped by their socio-political and cultural contexts. From Aristotle's notion of the city as a community pursuing collective well-being (Topal, 2014), to medieval understandings centered on defensive, walled settlements (Yapıcı et al., 1999), and to Mumford's (1961) description of medieval cities as "walled human settlements" reflecting socio-economic and defensive functions, interpretations of urban space have evolved considerably. Contemporary studies increasingly view cities as dynamic, socially constructed environments shaped by the interplay of economic, political, and cultural forces (Rodger & Rau, 2020), reflecting a broader shift from static models toward more process-oriented approaches to urban transformation (Arefi & Aelbrecht, 2024).

Urban morphology systematically examines the spatial organization of urban environments by focusing on the relationships between streets, plots, and buildings (Conzen, 1968). This approach is particularly valuable for analyzing historical layering and transformations driven by changing social and political dynamics (Bilsel, 2015). Drawing upon geography, architecture, and history, it provides a comprehensive analytical lens for understanding the evolution of urban form (Kubat & Topçu, 2009).

The foundations of modern urban morphology were laid in the 18th and 19th centuries, beginning with Goethe's early ideas on form and later formalized through the evolutionary models of M.R.G. Conzen (Tezer, 2021). Conzen emphasized the interdependence of streets, plots, and buildings as elements that evolve in response to socio-economic shifts (Conzen, 1981; Kaya, 2019). Complementing this perspective, the Italian school—led by Muratori and Caniggia—developed typological analysis methods integrating historical continuity with contemporary design (Caniggia & Maffei, 2001; Levy, 1997; Oliveira, 2016; Panerai et al., 2004). The French school further enriched the field through its focus on spatial systems and urban structure (Panerai, 1970).

Despite their rich historical layering, mid-sized Anatolian towns remain underrepresented in urban morphology research (Ünlü & Baş, 2017; Kubat, 2009). These settlements face pressures arising from modernization, migration, and planning interventions, which gradually

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reshape their spatial logic. Recent studies highlight the need to analyze urban fabrics both vertically (as historical stratification) and horizontally (as spatial configuration), offering a dual lens essential for understanding such environments (Tezer, 2021).

Silifke—a town with Hellenistic origins and successive Roman, Byzantine, and Ottoman layers—provides a compelling case for examining these dynamics. Its historical core, covering approximately 150 hectares (1.5 km^2), illustrates the challenges experienced by Anatolian towns undergoing rapid socio-economic and spatial change. Prior research shows that parcelization, increasing building density, and planning interventions often lead to fragmentation and the loss of traditional urban characteristics (Ünlü & Durmuşoğlu, 2022; Ayten & Aygen, 2022; İnceoğlu, 2013; Akyürek Algın & Hoşkara, 2024), particularly where large-scale renewal projects or gated communities introduce spatial discontinuities.

This study addresses these issues through an integrated typo-morphological methodology that combines spatial analysis, historical mapping, and typological reading to investigate the transformation of Silifke's urban core. It seeks to answer the following questions: How have planning interventions and socio-economic forces reshaped Silifke's urban morphology? What key moments define continuity and rupture within the historical core? How do changes in streets, plots, and building typologies reflect broader socio-spatial processes? By superimposing multiple historical layers and analyzing morphological change across scales and time, the study contributes to filling the research gap on mid-sized Anatolian towns and offers a transferable framework for similar contexts.

Methodologically, the research adopts a multi-scalar and diachronic approach grounded in typo-morphological analysis (Ünlü, 2018; Ünlü, 2019). It integrates historical cartographic materials, cadastral records, aerial photographs, urban plans, and field observations to construct a comprehensive, multi-layered representation of Silifke's spatial evolution. Through this framework, the study identifies patterns of morphological transformation, continuity, and fragmentation shaped by planning decisions and socio-political change, highlighting the interplay between urban form and socio-economic processes beyond the scope of heritage conservation.

Urban morphology continues to expand through the integration of advanced spatial analysis tools such as Geographic Information Systems (GIS), three-dimensional modeling, and big data analytics, which enable more precise mapping of urban transformations (Li, Zhang & Wu, 2023; Martins & Silva, 2024). These technological advancements help capture the complexity of historically layered towns like Silifke. Moreover, contemporary studies emphasize the importance of incorporating socio-environmental factors and participatory approaches, contributing to a more holistic understanding of urban change (Rahman & Chen, 2025; Silva & Gomes, 2023). This integrative perspective enriches academic

discourse and supports sustainable, context-sensitive planning strategies.

While this study focuses on the morphological evolution of Silifke, urban morphology as a discipline benefit from comparative perspectives. Historical examples—such as the transformation of Paris under Haussmann in the 19th century—demonstrate how large-scale political and socio-economic agendas can profoundly reshape urban form (Harvey, 2003; Jordan, 1995). Recognizing such precedents enables a deeper interpretation of morphological change as a process intertwined with governance, ideology, and modernization paradigms (Hall, 2014). Although this research does not undertake a comparative urban analysis due to its scope, these insights inform its conceptual and interpretive framework.

Building on this conceptual and historical framework, the present study now turns to the methodological strategies required to examine Silifke's multi-layered urban form. Given the town's complex spatial history and the interplay of socio-economic, political, and planning dynamics discussed above, a methodological approach capable of capturing both diachronic continuity and contemporary transformation is essential. The following section therefore outlines the integrated typo-morphological and spatial analytical framework employed in this research, explaining how historical cartographic materials, quantitative indicators, and qualitative field observations are combined to reveal the processes shaping Silifke's urban morphology.

METHODOLOGICAL FRAMEWORK AND CASE STUDY APPLICATION: SILIFKE'S URBAN FORM

This study investigates the interplay between physical and social transformations shaping Silifke's urban morphology, focusing on buildings, plots, urban blocks, and street patterns (Marshall, 2005). Taken together, these components reveal the district's structural and socio-cultural evolution, enabling a comprehensive qualitative and quantitative interpretation of the city's form and its transformation processes. The methodological framework employs a layered analytical approach grounded in typo-morphological principles and enhanced through the integration of diverse data sources and digital mapping tools. The metaphor of an "x-ray" analysis is used to describe a diachronic method in which successive urban layers are superimposed to identify spatial continuities, ruptures, and transformations over time (Kropf, 2018; Oliveira, 2016; Arefi & Aelbrecht, 2024). This approach establishes a dynamic visualization of Silifke's development across multiple scales—from citywide structures to individual plots—reflecting the two-directional analytical logic emphasized in contemporary morphological research.

Data sources include municipal maps from 1975, 1988, and 2023; cadastral records; archival aerial photographs; historical engravings; and extensive field documentation. These materials were cross-

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validated using official archives, conservation council records, and on-site inspections. For instance, while the 1902 cadastral map indicates approximately 350 residential buildings, conservation zoning plans and field surveys confirm that only 21 Ottoman-period houses remain, revealing a pronounced degree of morphological loss and fragmentation. Historical maps, aerial photographs, and cadastral plans were digitized, georeferenced, and vectorized using AutoCAD and GIS to enable chronological layering and multi-scalar comparison. These layers were then subjected to morphological mapping to identify spatial continuity and rupture, supported by space syntax analysis to quantify street integration and hierarchy (Cömert & Hoşkara, 2013).

For the quantitative component, three neighborhoods representing distinct phases of Silifke's Republican-era development were selected: Göksu, the most recently developed; Atik, developed earlier yet still expanding; and Say, shaped during the early Republican period. Within each neighborhood, representative urban blocks (adalar) were chosen. Blocks containing registered heritage buildings were excluded to ensure that the analysis reflects typical developmental patterns rather than protected outliers. The objective of this phase is to reveal the morphological characteristics of urban growth—such as density, building form, and plot utilization—while capturing the social and spatial dynamics that differentiate the three neighborhoods.

Quantitative indicators—including building counts, footprint areas, plot shapes and sizes, and connectivity indices (beta and gamma values)—were extracted to compare traditional and contemporary spatial configurations. To assess morphological similarity between blocks, four variables were used: average plot size, average building footprint, average number of storeys, and built-up ratio. Each variable Xwas standardized using z-score normalization:

$$X' = \frac{X - \bar{X}}{s_X}$$

where X^'is the standardized value, X ¯is the mean, and s_Xis the standard deviation. Euclidean Distance between any two blocks was then calculated as:

$$D = \sqrt{(x_1' - x_2')^2 + (y_1' - y_2')^2 + (z_1' - z_2')^2 + (w_1' - w_2')^2}$$

Lower distance values indicate higher morphological similarity between blocks. This systematic comparison provides insight into the diachronic evolution of urban form across the three neighborhoods and clarifies how spatial patterns have shifted since the early Republican period.

Complementary qualitative observations focused on building typologies, façade elements, materials, and conservation status, with specific attention to the relationships between streets, blocks, and plots, as well as the visual integration of architectural elements. This component responds to earlier critiques regarding the insufficient representation of design-related attributes in morphological studies.

The results of the qualitative and quantitative analyses were synthesized with historical and contemporary planning data to delineate urban protected areas, transition zones, and development zones, illustrating how governance, conservation policy, and socio-economic forces have reshaped spatial continuity and urban boundaries.

By combining typo-morphological principles with spatial network analysis and socio-spatial interpretation, this framework captures the layered, diachronic structure of Silifke's urban form. It bridges historical and contemporary dimensions, demonstrating how planning decisions, conservation approaches, and socio-economic processes interact to shape morphological change. This integrated methodology highlights the value of detailed morphological understanding—supported by digital tools and multi-scalar analysis—for informing adaptive and context-sensitive strategies in historically layered mid-sized Anatolian towns (Steadman et al., 2009; Cömert, 2013; Siyavuş & Belge, 2024).

CASE STUDY CONTEXT: THE HISTORICAL TOWN OF SILIFKE (SELEUCEIA AD CALYCADNUM)

Silifke—whose name derives from the Greek "Seleucia"—is located approximately 80 km west of the city of Mersin, within the western part of Mersin Province, at the edge of the Çukurova Plain (Figure 1) (Aktüre, 1997). Founded in the early 3rd century BCE by Seleucus I Nicator, one of Alexander the Great's generals, the town possesses a rich historical heritage shaped by successive Greek, Roman, and Byzantine civilizations (Taşkıran, 2009; Aykaç, 2018). Although its formal establishment dates to the Hellenistic period, the settlement history of the area stretches back nearly 8,000 years, making Silifke one of the oldest continuously inhabited locations in the region (Sevim, 2019). The earliest known inhabitants were the Luwians, who settled in the region around 3000 BCE (Uçar, 2009).

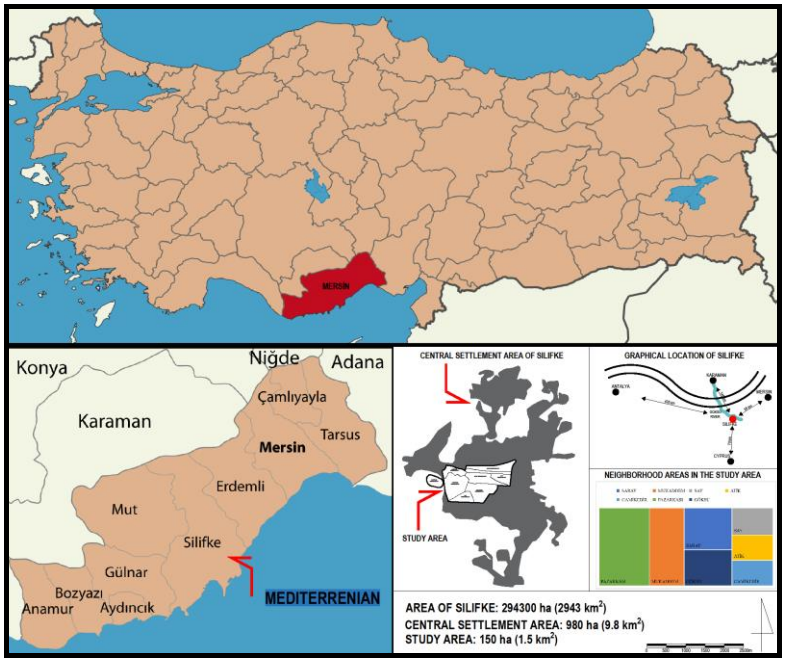


Figure 1. Geographical location of Mersin Province, Silifke District, and the selected case study area within Silifke (Edited by the author based on cografyaharita.com)

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Silifke's socio-spatial development can be understood through six major administrative phases, beginning with its foundation under the Seleucids in 312 BCE. These phases include Roman rule (64 BCE), the Byzantine period (395 CE), the Karamanoğulları Principality (1256 CE), the Ottoman era (1483 CE), and the Republican period (from 1923 CE onward) (Aykın, 2011). Across these eras, the town's development consistently gravitated toward the acropolis—a pattern characteristic of many ancient Anatolian cities. The trade route linking the Anatolian interior to Taşucu Port and the Port Castle (Ak Liman) played a significant role in shaping Silifke's urban axis. The stone bridge constructed over the Göksu River strengthened this connection and facilitated the expansion of urban functions along the flatter southern banks of the river, which were better suited for settlement.

Today, Silifke's economy is primarily based on agriculture, animal husbandry, and tourism, reflecting both its rural character and its extensive archaeological and cultural assets. Administratively, Silifke is a district within Mersin Province, covering approximately 2,943 km^2, while the central settlement spans roughly 9.8 km^2. The historical urban core—the focus of this study—covers about 150 hectares (1.5 km^2).

Silifke's historical urban structure emerged from two interrelated components: the upper town (acropolis), situated on a fortified hill and functioning historically as a strategic and defensive center; and the lower town along the riverbank, which accommodated markets, warehouses, and trade facilities, forming the economic backbone of the settlement.

TYPO-MORPHOLOGICAL CHARACTERISTICS OF SILIFKE

Silifke presents a historically layered and morphologically complex urban fabric shaped by continuous settlement from the Bronze Age through the Roman period (64 BCE–395 CE) and subsequent eras. Archaeological findings from the Bronze Age, together with architectural remains from the Roman period, demonstrate the area's long-standing urban occupation and spatial organization. While systematic architectural documentation and formal urban mapping became widespread during the Ottoman period, earlier phases of Silifke's urban development are reconstructed primarily through archaeological excavations, historical engravings, and archival textual sources.

This study investigates Silifke's typo-morphological characteristics by analyzing the key spatial and architectural components that reveal the continuity, adaptation, and transformation of its urban form over time. The analysis focuses on:

- Buildings: Examined through surviving structural remains and their functional evolution across historical periods, with attention to typological continuity, material use, and construction techniques.
- Plan Typology: Evaluation of building layout patterns—such as courtyard houses, row houses, and detached dwellings—to uncover the

spatial logic, cultural practices, and land-use principles informing urban design.

- Façade Typology: Assessment of the architectural expression of buildings, including façade composition, openings, ornamentation, and materials, to trace stylistic transitions and identify elements that contribute to the town's streetscape identity and historical layering.
- Land Utilization: Analysis of how plots were allocated and adapted for residential, commercial, religious, and civic uses throughout Silifke's historical development.
- Street Network: Examination of the street system's morphology in terms of connectivity, hierarchy, orientation, and integration within the wider urban structure, considering historical trade functions and topographical constraints—particularly the Göksu River and surrounding slopes.

Through this integrated typo-morphological framework, the study reveals both enduring spatial continuities and transformative processes that have shaped Silifke's urban fabric across successive civilizations. The interplay between persistent spatial structures and adaptive modifications illustrates the dynamic evolution of a mid-sized Anatolian town within its layered historical context.

Buildings

Although Silifke was founded during the Seleucid period, no architectural remains from this era have survived, likely due to rebellions and subsequent destructions. Silifke Castle, which remains standing, preserves medieval features and is believed to have Hellenistic origins. Roman-era remnants include ruins around the temple area, the remains of a theater, and a stone bridge over the Göksu River, although much of the bridge's original Roman character has been lost. Byzantine contributions are represented by the Tekir Warehouse water cistern and several masonry buildings, reflecting the typical construction techniques of the period (Mansel, 1943).

During the Ottoman period, the castle continued in use, with additional development constructed atop earlier ruins. According to the Adana Provincial Yearbook (Salname) of 1289 AH, by the 16th century there were approximately 17 houses, mainly on the southern bank of the Göksu River outside the castle walls. At that time, Tevekkül was the only recorded neighborhood, with a population of around 86. Political unrest throughout the 18th century limited population growth, which reached only about 200 residents by the century's end.

The 19th century marked gradual demographic and urban growth:

- By 1876, the population reached 854, distributed across 2 neighborhoods.
- By 1879, the population doubled to 1,708 across 5 neighborhoods.
- By 1902, the district included approximately 350 houses across 8 neighborhoods (Adana Province Yearbooks, 1872; Keil & Wilhelm, 1931).

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Despite evolving neighborhood boundaries, 7 of these 8 historical neighborhoods retain their original names today (Yalçın, 2021). By the late Ottoman period, Silifke exhibited a multi-ethnic composition—including Turks, Greeks, and Armenians—which further enriched the district's morphological and social fabric (İnceoğlu, 2013).

Architectural Plan Typology

The urban core of Silifke has been examined through its typological development during two key historical periods: the Ottoman Period and the Republican Period. This section focuses on the layout patterns and spatial organization of individual buildings rather than broader urban zoning or planning aspects. Although few Ottoman-period houses survive, extant architectural remnants provide valuable insight into the town's historical urban fabric.

Silifke Castle, with its medieval appearance, was originally constructed during the Hellenistic period and served as the town's first urban nucleus. According to Evliya Çelebi, the castle housed approximately 60 residences during the Ottoman Period (Dağlı et al., 2005). The Silifke Conservation Plan identifies 40 of 58 preserved structures in the study area as Ottoman-period buildings, including 21 residences, 12 shops, and various other functional structures (Figure 2).

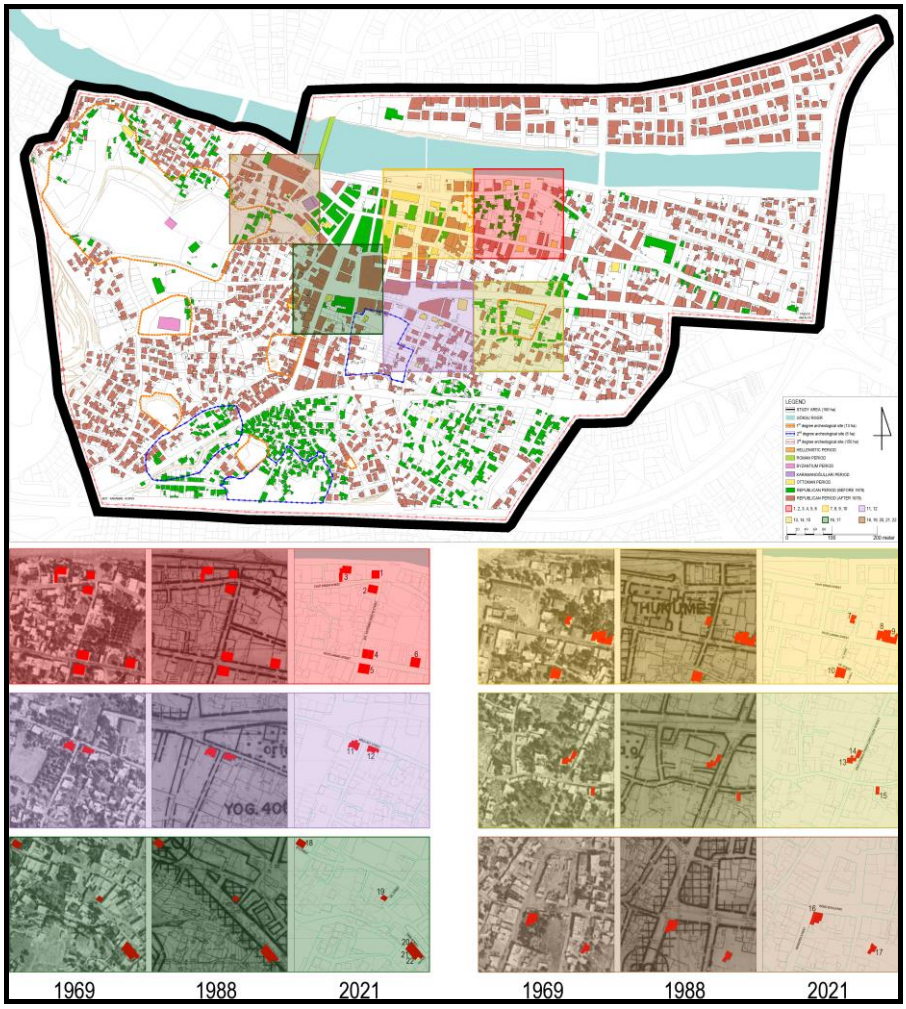


Figure 2. Period-based zoning map showing the distribution of Ottoman-era traditional houses in the study area (Prepared by the author based on the 1969 aerial photograph and Silifke municipal maps from 1988 and 2021)

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Typical features of Ottoman houses in Silifke include:

- One or two stories, often accompanied by gardens or open areas.
- Street-parallel walls acting as buffers between private and public spaces.
- Placement on corner plots or along street edges, with façades oriented for optimal street engagement.
- Interior layouts separating service areas, private rooms, and reception spaces, often including a central hallway (hayat) and sofa (Figure 3).

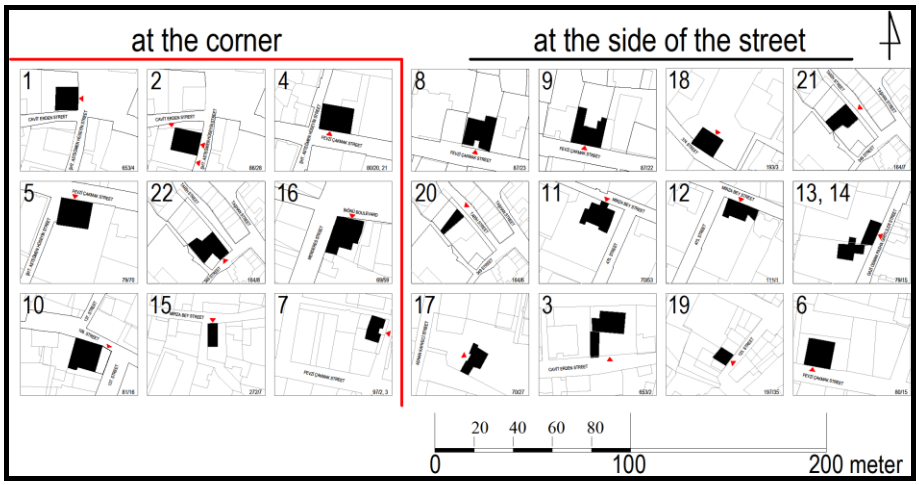


Figure 3. Examples of plot–street relationships in Ottoman period houses (Prepared by the author based on the Silifke municipal maps)

For morphometric analysis, four representative Ottoman houses were selected based on neighborhood proximity and corner-plot positioning, revealing both typological consistency and individual variation in spatial hierarchy:

- House 1 (β = 0.93, γ = 0.125): Moderate compactness, clearly defined functional zones, emphasizing privacy.
- House 2 (β = 1.045, γ = 0.099): Higher compactness, fluid circulation, less rigid functional separation.
- House 3 (β = 1.111, γ = 0.130): Intermediate compactness with moderately articulated spaces.
- House 4 (β = 0.944, γ = 0.111): Balanced functional separation and interconnectivity.

Single-storey houses typically feature a central hallway connecting rooms, while two-storey houses place service areas on the ground floor and living spaces above. Ornamentation in wood and stone, evident in ceilings, doors, and façades, reflects the aesthetic and social values of the period. Variations in compactness and circulation patterns demonstrate subtle adaptations to plot geometry, family structure, and cultural practices.

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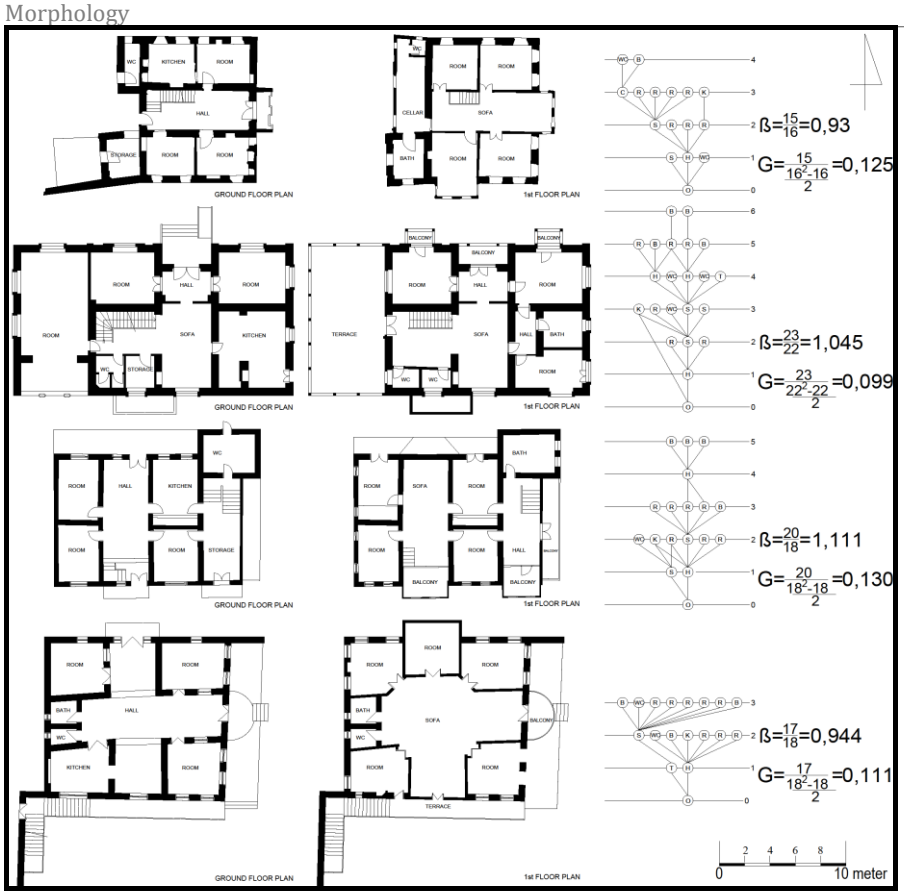


Figure 4. Spatial analysis of four Ottoman houses (H1–H4) with β and γ values (Prepared by the author)

The Republican Period introduced substantial typological change, particularly after Silifke's first zoning plan in 1978, which reshaped plot organization and building patterns. Republican houses are analyzed in two groups:

Houses Built Between 1923 and 1978

These dwellings were typically one or two stories, reflecting residents' economic status. Traditional construction methods—such as mud-brick walls, earthen roofs, and garden integration—persisted. Interior layouts included:

- 1 room + kitchen,
- 2 rooms + kitchen,
- rooms + kitchen + sofa

Single-room houses had garden-accessed kitchens, whereas two-room houses incorporated a central sofa, separating day and night functions. Morphometric analysis of eight representative houses (R1–R8) highlights (Figure 5):

- R1 (β = 0.500, γ = 1.0) and R2–R3 (β = 0.666, γ = 0.666): Minimal spatial complexity, strong functional separation.
- R4–R8 (β = 0.750–0.800, γ = 0.400–0.500): Moderately articulated spaces, compact layouts, simple circulation patterns.

Compared to Ottoman houses, early Republican dwellings are more compact, less connected internally, and dominated by orthogonal layouts. Pragmatic concerns, material economy, and functional efficiency outweighed formal or aesthetic considerations.

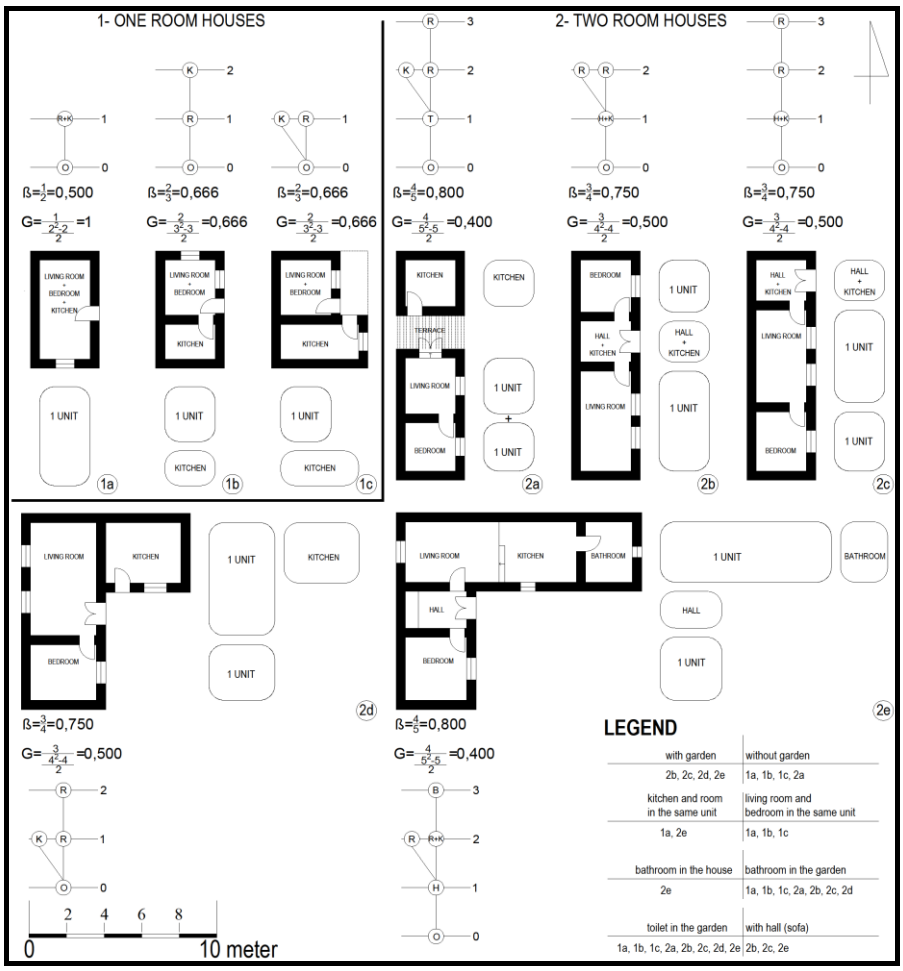


Figure 5. Morphometric analysis of eight Early Republican houses (R1–R8) with β and γ values (Prepared by the author)

Houses Built After 1978

Modern construction, including reinforced concrete, introduced standardized floor plans, symmetrical façades, and stricter alignment with the street grid. While some elements of traditional vernacular architecture persist, modernist influences increasingly replaced local spatial patterns, marking a significant transformation in late 20th-century Silifke.

Morphometric and qualitative analyses reveal the evolution of domestic spatial logic in Silifke:

- Ottoman houses emphasize flexibility, privacy, and integration of indoor and outdoor spaces.
- Early Republican houses prioritize compactness, orthogonal layouts, and functional clarity.
- Late Republican houses reflect modernist standards, favoring repetition, street alignment, and efficiency over traditional spatial articulation.

This dual-period analysis, combining quantitative morphometrics with qualitative typology, provides a comprehensive framework for understanding the continuity and transformation of Silifke's domestic architecture and its contribution to the town's historical urban morphology.

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Facade typology

Silifke's architectural fabric exhibits heterogeneity in terms of façade typology and building heights. While the study area includes structures ranging from one to nine storeys, low-rise buildings—particularly one- and two-storey houses—predominate, reflecting the town's historical development, socio-economic diversity, and zoning practices. A clear spatial contrast exists along the Göksu River:

- Southern bank (historical core): Predominantly one- to two-storey buildings maintaining traditional morphology and a human-scaled urban form.
- Northern bank (modern expansion): Mid- to high-rise apartment blocks enabled by reinforced concrete and fewer conservation constraints.

Vertical densification remains spatially fragmented and localized (Figure 6).

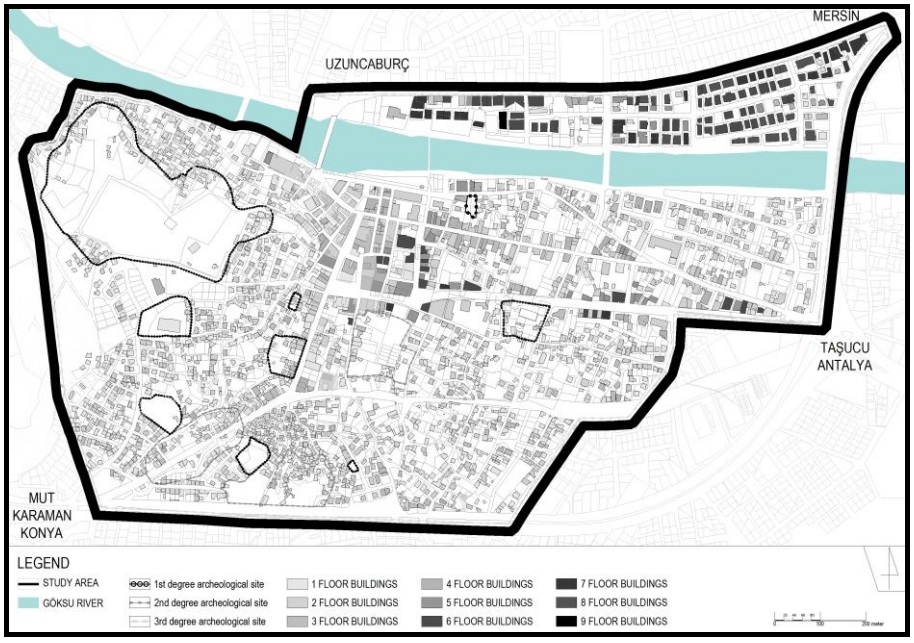


Figure 6. Building heights and floor area ratios derived from the 2023 zoning map of Silifke Municipality (prepared by the author based on municipal data, 2023)

Two diagrams summarize these patterns:

- Diagram 1: One-storey buildings occupy ~103,575 m^2 of total footprint, while nine-storey buildings cover only 620 m^2, confirming low-rise dominance in land coverage.
- Diagram 2: Among 1,406 buildings, 1,380 are one-storey and only 26 exceed seven storeys, showing that vertical growth is rare and localized.

Diagram 1. Total footprint area (m^2) by storey count in the study area.

Diagram 2. Number of buildings by storey count in the study area.

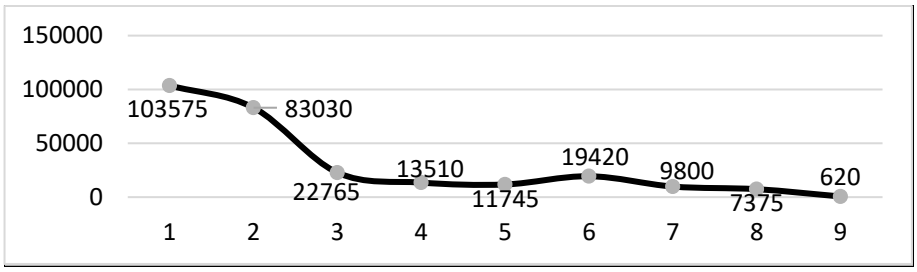


Diagram 1. Total footprint area (m^2) by number of storeys in the study area (Prepared by the author)

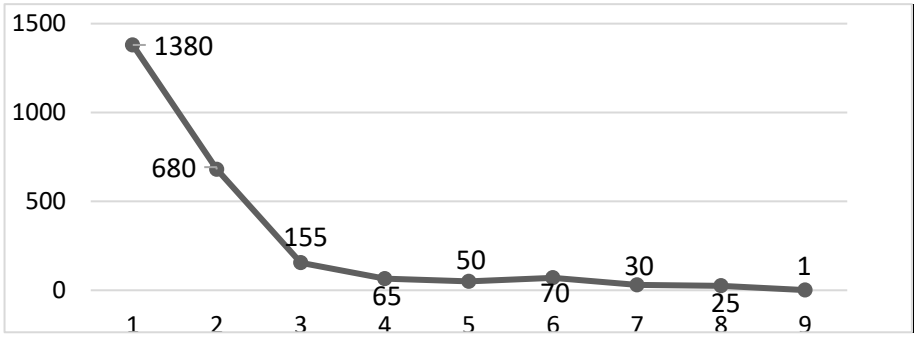


Diagram 2. Number of buildings by storey count in the study area (Prepared by the author)

Buildings from the Ottoman and early Republican periods display consistent morphological characteristics:

- Rectangular windows with wooden or iron frames.
- Flat or pitched roofs with overhanging eaves.
- Arched or winged entrance doors.
- Smaller ground-floor and larger vertically aligned upper-floor windows.
- Use of local stone and timber.
- Bay windows (cumba) in two-storey houses built with the Bağdadi technique, enhancing articulation and seismic resilience (Figures 7–8)





Figure 7. Unrestored traditional residential buildings in the historical core of Silifke (Author, 2023)

Constructed entirely from locally sourced stone, these façades feature modest openings, thick walls, and restrained decoration. Restoration projects preserve original proportions, window arrangements, and material harmony, sustaining visual coherence while improving structural resilience (Figure 8).

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Figure 8. Restored residential façades representing traditional building typologies in the southern bank of Silifke (Author, 2024) bank of Silifke (Author, 2024)

Early Republican Period (1923–1950)

This era represents a transitional phase with partial dissolution of the Ottoman street fabric and fragmented alignments. Neighborhoods such as Say experienced irregular parceling and heterogeneous built environments due to incomplete planning and accelerated construction in the 1940s (Figure 9).



Figure 9. Early Republican-period development in Say neighborhood, showing irregular parceling and fragmented building fabric (Author, 2023) bank of Silifke (Author, 2024)

Post-1980s Façades (Modern/Contemporary)

The introduction of reinforced concrete facilitated rapid apartment-based development, producing standardized façades and dense vertical forms that disrupted the town's traditional human scale. Northern bank construction, previously constrained by flood risk, expanded built-up areas from 2,220 m^2 in 1975 to 14,600 m^2 in 2021 (Figure 10).



Figure 10. Post-1980s apartment development in Göksu neighborhood, northern bank of Silifke (Author, 2023)

Large-scale apartment blocks exemplify a morphological rupture from the organically evolved southern core. Repetitive façades and mixed-use programs reflect modern zoning trends but often lack typological diversity and contextual integration.

On the southern bank, heritage awareness has encouraged new constructions attempting to harmonize with historic surroundings. While these projects reference traditional materials—stone façades, pitched roofs, wooden details—they often rely on superficial imitation rather than genuine morphological understanding, creating visual and spatial inconsistencies within the historic fabric (Figure 11).



Figure 11. New constructions on the southern bank reflecting contextual imitation and adaptive attempts (Author, 2023)

Morphological Duality

Silifke's urban landscape demonstrates a clear duality (Figure 12):

- Southern core: Cohesive, low-rise, historically grounded fabric.
- Northern districts: Fragmented, vertical, modern development with repetitive forms.

Spatial and quantitative data confirm that one- and two-storey buildings dominate, while taller structures remain exceptional and spatially concentrated. This duality reflects the coexistence of two architectural trajectories: one rooted in historical continuity and traditional craftsmanship, and the other shaped by modernization, contemporary planning practices, and reinforced concrete construction.

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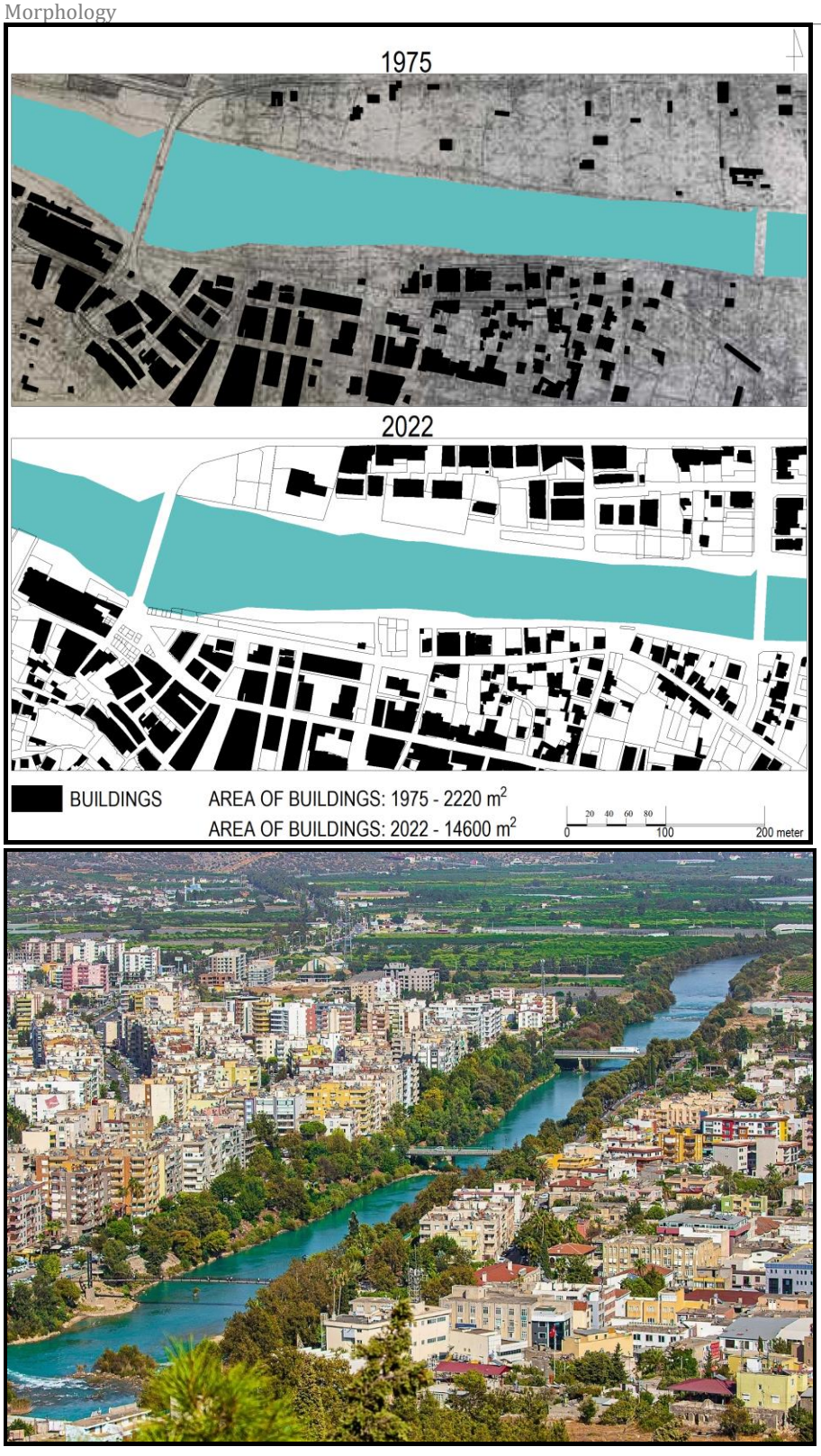


Figure 12. Urban expansion of the Göksu Neighborhood over 45 years (Prepared by the author based on Silifke Municipality maps from 1975 and 2021, https://www.sitso.org.tr/tr/silifke-kulturu)

Urban Block and Plot Typology

Silifke's urban morphology reflects a complex stratification, shaped by successive layers of historical continuity and contemporary planning interventions, particularly observable in the varying patterns of its blocks and plots. A comparative spatial analysis of cadastral and architectural datasets (Silifke Municipality, 2023) reveals a clear distinction between planned and organic growth patterns. While the urban blocks north of the Göksu River display a rectilinear, grid-like structure associated with recent planned development, those immediately to the south present a more heterogeneous pattern, blending early 20th-century planning schemes with remnants of the organic historical fabric. In contrast, the far southern and western neighborhoods—such as Atik and Mukaddem—exhibit irregular, topography-driven forms, suggesting incremental and less formalized patterns of urban expansion. The central commercial core, including Pazarkaşı and Camikebir, reveals a hybrid configuration, combining a loose grid with radial alignments—indicative of layered historical urban phases (Figure 13).

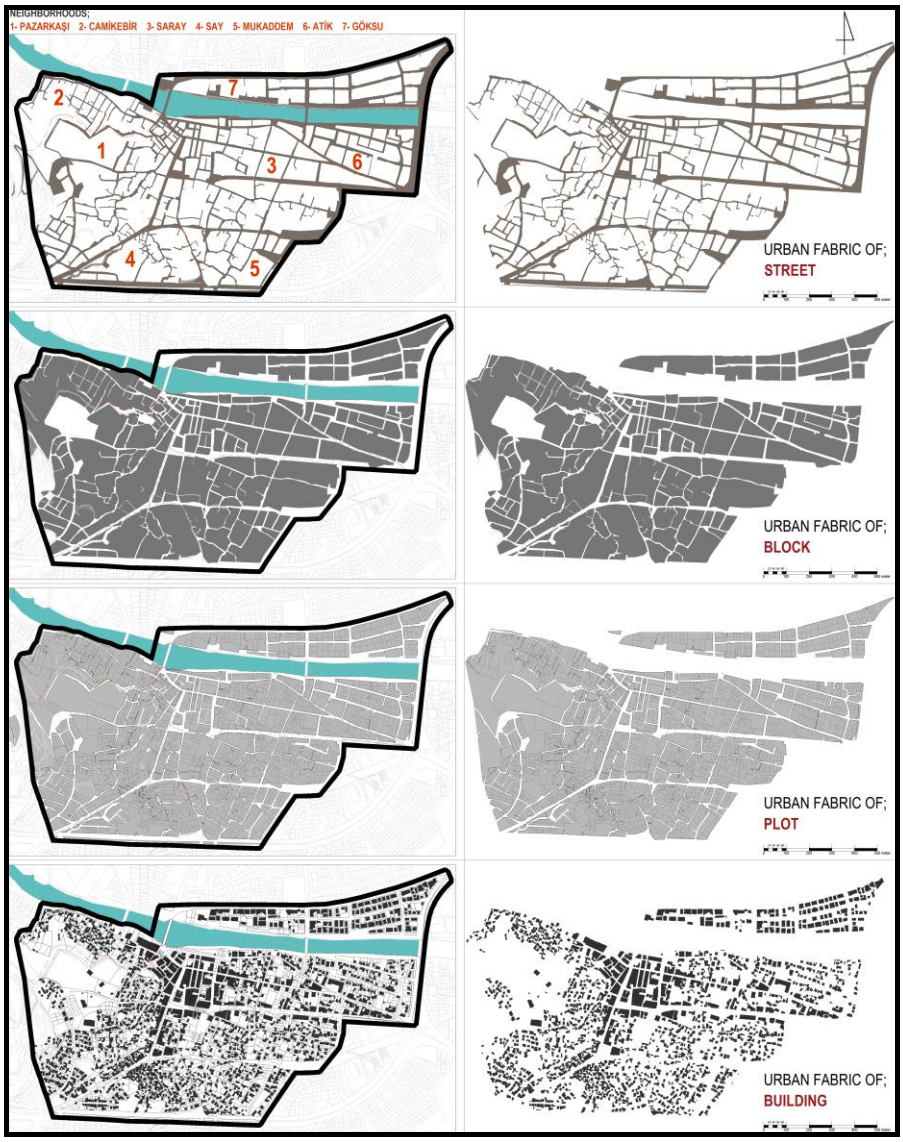


Figure 13. Spatial configuration of streets, blocks, plots, and buildings in seven Silifke neighborhoods, showing morphological differences shaped by historical and planning contexts (Prepared by the author based on Silifke Municipality maps, 2021)

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At the plot level, significant diversity emerges in terms of shape, orientation, and built density. In the historical core, plots tend to be smaller and irregularly shaped, while newly developed northern areas—such as the Göksu Neighborhood—exhibit more regular, spacious, and geometrically coherent plots. In commercial zones, floor area ratios (FAR) generally range between 1:1 and 1:2, highlighting a correlation between the period of urban development and the degree of spatial regulation (Figures 7 and 8).

A typological analysis of plots reveals three predominant categories based on geometric proportions and spatial constraints:

- Rectangular plots with elongated proportions (1:3, 1:4, 1:5),
- Square or near-square plots (1:1 or 1:2), and
- Irregular plots, often shaped by topographic or pre-modern cadastral constraints.

To assess diachronic transformation at the plot level, seven representative drilling/sample areas were selected across the study neighborhoods. These circular samples—each approximately 5× magnified from their original scale—capture the spatial configuration of streets, plots, and buildings in two temporal snapshots: before 1978 and after 1978. The comparative analysis reveals clear morphological contrasts between earlier organic patterns and later planned interventions (Figure 14).

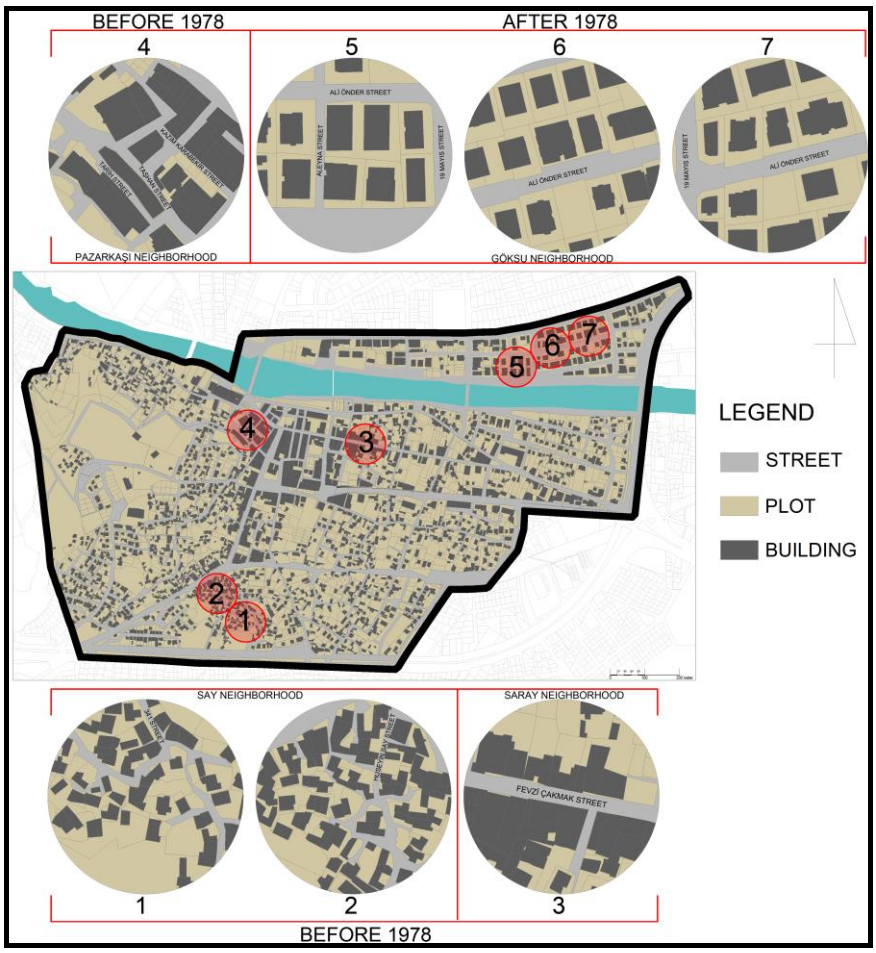


Figure 14. Diachronic morphological analysis of seven sample areas in Silifke, showing pre-1978 and post-1978 changes in streets, plots, and buildings (Prepared by the author based on Silifke Municipality maps, 2021)

In the older cores—such as Pazarkaşı, Camikebir, and Say—the pre-1978 fabric is characterized by irregular plots, narrow streets, and dense building coverage. Post-1978 development in these same areas tends to follow infill patterns, with minimal structural reorganization. In contrast, neighborhoods like Göksu, which underwent major expansion after 1978, exhibit a more regular, rectilinear layout with wider streets, larger plots, and lower initial building densities—indicating a shift toward planned urbanism.

Separately, a quantitative analysis of morphological similarity between three selected urban blocks was conducted using the Euclidean Distance method. As emphasized in the methodology section, three blocks from Göksu, Atik, and Say neighborhoods were selected to assess morphological proximity and potential social implications. The first block, located in Göksu Neighborhood, was labeled Block 1 (B1); the second, in Atik Neighborhood, Block 2 (B2); and the third, in Say Neighborhood, Block 3 (B3). The measured morphological data are summarized in Table 1.

Table 1. Morphological data of selected blocks

Block	Avg. Plot Size (m^2)	Avg. Building Footprint (m^2)	Avg. Height (storeys)
B1	886 m^2	384 m^2	6.5
B2	1215 m^2	472 m^2	2.7
B3	114 m^2	62 m^2	1.5

These values were normalized using z-score standardization:

- Average Plot Size: Mean ≈ 738.33, Std ≈ 461.4
- Average Building Footprint: Mean = 306, Std ≈ 176.3
- Average Height: Mean ≈ 3.567, Std ≈ 2.13

Table 2. Standardized Values (Z-scores)

Block	Plot Size (m^2)	Building Footprint (m^2)	Height
B1	0.32	0.44	1.38
B2	1.03	0.94	-0.41
B3	-1.35	-1.38	-0.97

The Euclidean Distance formula was applied to measure morphological similarity:

$$D = \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2 + (z_1 - z_2)^2}$$

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Table 3. Calculated Distances

Block Pair	Distance
B1–B2	1.99
B1–B3	3.41
B2–B3	3.37

Lower distance values indicate higher morphological similarity. B1 and B2 are the most similar blocks, while B1–B3 and B2–B3 are less similar. These physical differences suggest that blocks with larger plots and taller buildings (B1 and B2) may support higher population densities, more complex social interactions, and shared spaces such as courtyards or pedestrian paths. Conversely, smaller, lower-rise blocks (B3) are associated with lower density, more private living, and fewer daily encounters. If these blocks correspond to different historical periods, B3 may represent a traditional urban pattern with close-knit community networks, whereas B1 and B2 reflect modern planning approaches emphasizing individual living and more fragmented social structures.

Finally, to examine broader diachronic trends across all neighborhoods, drilling samples were analyzed at three time points—1969, 1988, and 2021—focusing on changes in construction density and plot utilization. The analysis revealed distinct growth patterns (Figure 15):

- Pazarkaşı saw a significant increase (1.5–2.5×) between 1969 and 1988, followed by stabilization after 1988.
- Camikebir increased moderately until 1988 but experienced minor declines in some plots thereafter.
- Saray exhibited initial decline, with gradual recovery and expansion after 1988.
- Say remained largely static until the late 1980s, with a slight rise in built-up area in the following decades.
- Mukaddem showed negligible change across both periods.
- Atik experienced an increase (approx. 1.5×) between 1969 and 1988, but remained unchanged post-1988.
- Göksu, representing the most dynamic transformation, grew roughly 2× between 1969–1988 and surged with a 6× increase from 1988 to 2021.

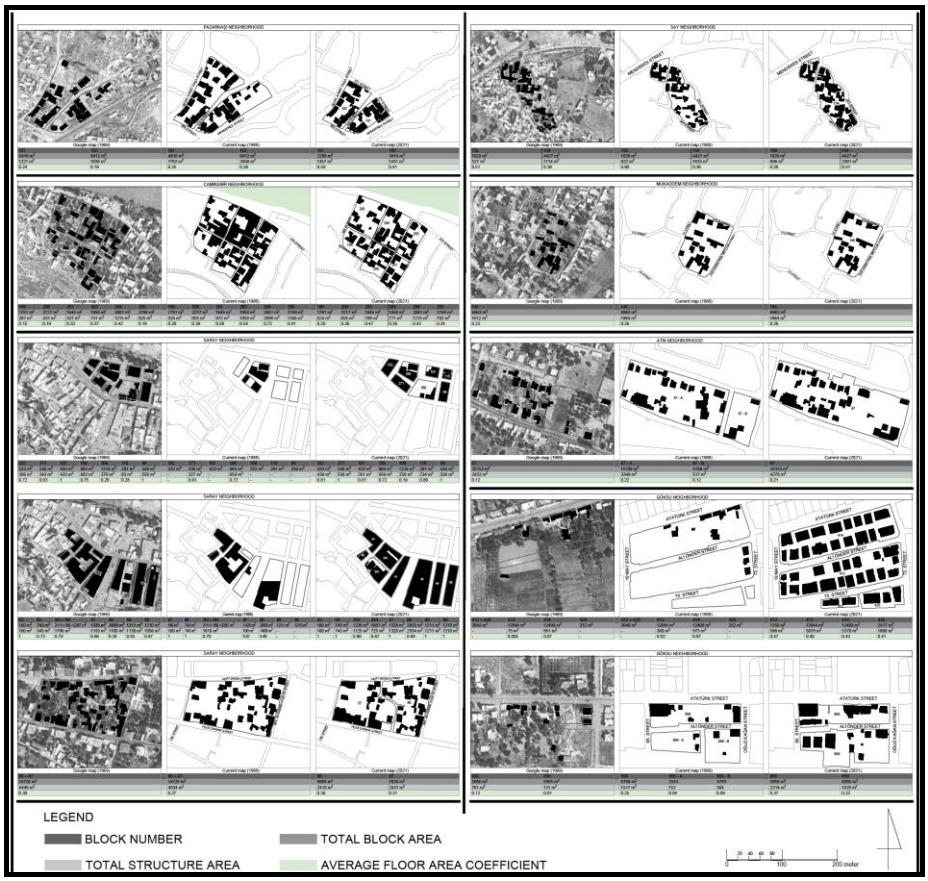


Figure 15. Temporal comparison of block areas, built-up areas, and average FAR in selected Silifke neighborhoods based on 1969, 1988 aerial photos and 2021 cadastral maps (Prepared by the author)

By clearly separating the Euclidean Distance analysis of specific blocks from both the pre-/post-1978 drilling samples (Figure 14) and the long-term historical growth analysis (Figure 15), this section provides a comprehensive understanding of Silifke's urban morphology, combining both micro-level block typology and broader temporal transformations.

Street System

The street network of Silifke exhibits a dual and layered morphology shaped by both natural topography and successive phases of urbanization. Variations in terrain, function, and historical context have produced distinct street typologies across the city. In the historic residential zones surrounding Silifke Castle and the acropolis, narrow and irregular streets follow the contours of the land, while flat areas along the Göksu River display a more rectilinear organization, reflecting the interaction between natural form and human adaptation, a relationship that continues to define the town's present-day circulation structure.

In the southern historic core, streets maintain a pedestrian-oriented scale, forming an intimate relationship with adjacent plots and façades. Conversely, modern neighborhoods—especially Göksu—feature wider, vehicular-oriented streets designed according to zoning regulations. This contrast highlights Silifke's dual urban logic: a historically continuous organic core versus a planned, expansionary periphery (Figure 13, Figure 14).

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Historically, the city's street structure originated under Seleucus I Nicator (295–290 BCE) as a planned settlement, later reorganized during the Roman period around two main spatial anchors—the Roman Temple and Silifke Castle. The Stone Bridge (77–78 CE) introduced a perpendicular axis across the Göksu River, creating the foundational east–west circulation spine that still defines the city's structure (Keil & Wilhelm, 1931). Subsequent Byzantine, Seljuk, and Ottoman interventions retained and reinforced this network, especially around religious and civic nodes such as the Tekir cistern and Alaeddin Mosque. As a result, the historic core demonstrates a remarkable degree of spatial persistence, while peripheral areas evolved through episodic expansion and renewal.

South of the Göksu River, where mixed-use functions such as trade and administration concentrate, a semi-grid pattern dominates, gradually dissolving into irregular streets toward the southern and western edges. On the northern bank, post-1978 zoning and reinforced concrete construction introduced standardized building setbacks—3 m from plot boundaries and 5 m from streets—establishing a more uniform and rhythmic urban pattern.

A global axial analysis using DepthmapX was conducted to quantify the spatial structure and centrality of Silifke's street system (Radius = n). The results (Figure 16) show the highest integration values along the historic spine connecting Silifke Castle, the Roman Temple, and the Stone Bridge, indicating the continued functional and symbolic centrality of this corridor. Peripheral neighborhoods such as Mukaddem and Atik show lower integration, reflecting their fragmented street forms and topographic constraints. This digital analysis strengthens the two-way interpretive approach adopted in this study—moving from the overall spatial system to the individual street level and vice versa—revealing how morphological continuity and transformation coexist across time.



Figure 16. Global axial integration map of Silifke (Radius = n), showing higher integration in the historic core (red-yellow) and lower integration in peripheral areas (green-blue) (Prepared by the author using DepthmapX)

A diachronic morphological comparison based on maps and aerial imagery (1838–2021) further clarifies this evolution (Figure 17). The analysis demonstrates gradual densification after the 1950s, followed by accelerated expansion in the late 20th century. Periodic reductions in built-up areas correspond to socio-economic disruptions, including material reuse from ancient structures and post-exchange housing abandonment. From the 1980s onward, rural-to-urban migration and zoning-driven development spurred steady spatial expansion, particularly on the northern bank.

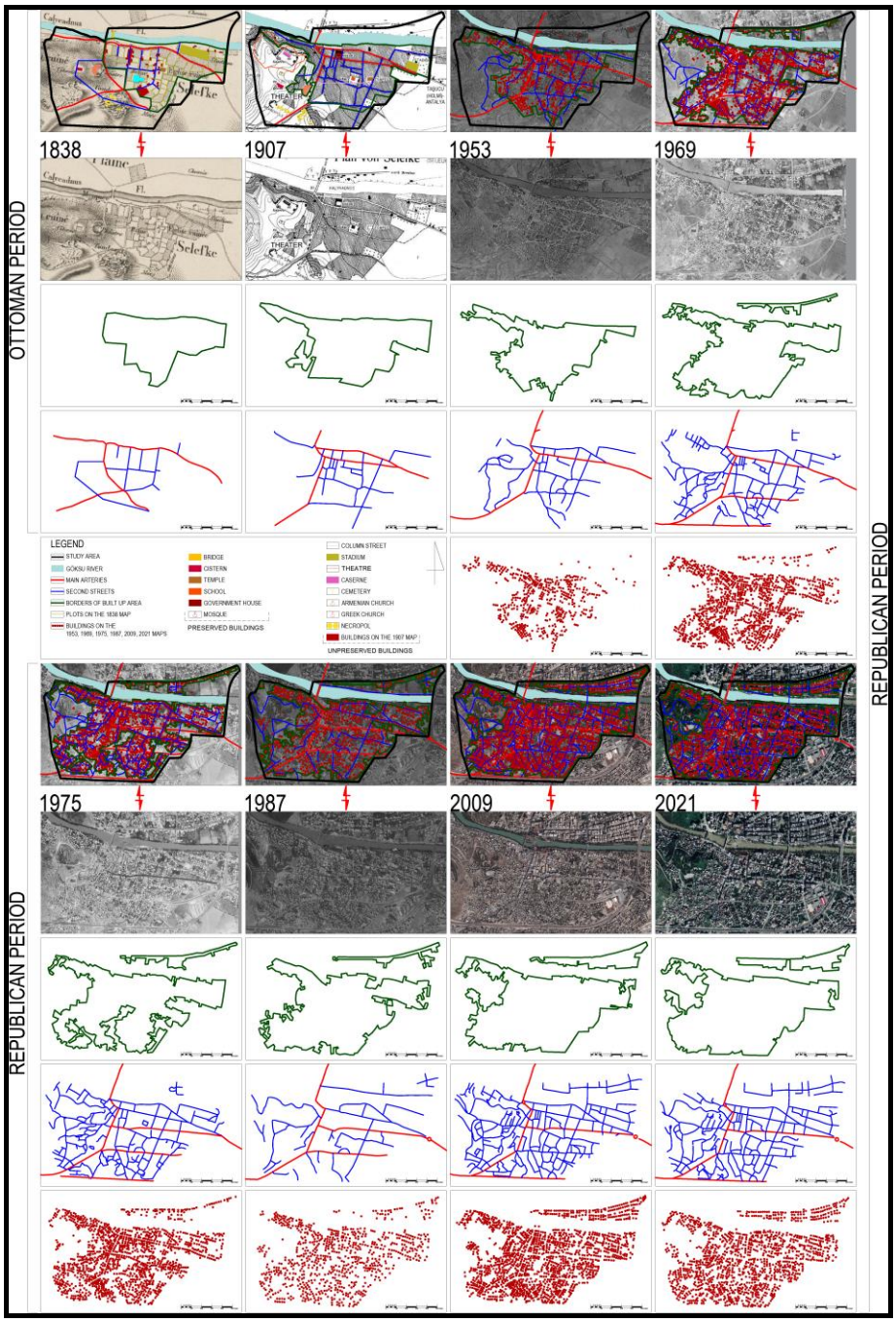


Figure 17. Evolution of Silifke's street system, building density, and plots from 1838 to 2021 (Prepared by the author using historical engravings and aerial photographs)

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The apparent reduction in built-up area observed in 1953 reflects historical and socio-economic factors. The two significant Roman-era buildings, the theatre and the stadium, which still appear prominently in Ottoman-period maps, were partially dismantled in the early Republican period, with their materials reused for housing. In addition, many houses of Greek and Armenian residents were abandoned or destroyed due to the population exchange. Combined with the post-war economic hardships, these factors temporarily deformed the urban fabric, explaining the smaller built-up areas recorded in the 1953 map. From the 1950s onward, with migration from villages to the city, the built-up area began to expand periodically, reflecting the gradual growth of Silifke's urban footprint.

Figure 18 presents a spatial overlay map highlighting morphological overlaps and changes identified across different time periods in Silifke. The percentages in the timeline indicate the proportion of built-up areas that have persisted, expanded, or diminished relative to previous periods, offering a quantitative perspective on urban transformation. Notably, a slight decrease in built-up area is observed between 1975 and 1987, reflecting the physical and socio-economic conditions of the period. Following the early Republican era, the town experienced material reuse from significant Roman buildings such as the theatre and stadium, and the departure of Greek and Armenian populations resulted in partial demolition or abandonment of their residences. This, combined with the post-1950 rural-to-urban migration, contributed to periodic expansions and contractions in the urban fabric. The overlay map thus not only illustrates morphological continuity and changes but also contextualizes these patterns within broader historical, demographic, and socio-economic processes, providing a nuanced understanding of Silifke's layered urban development and linking the visual data directly to the analytical insights of this study.

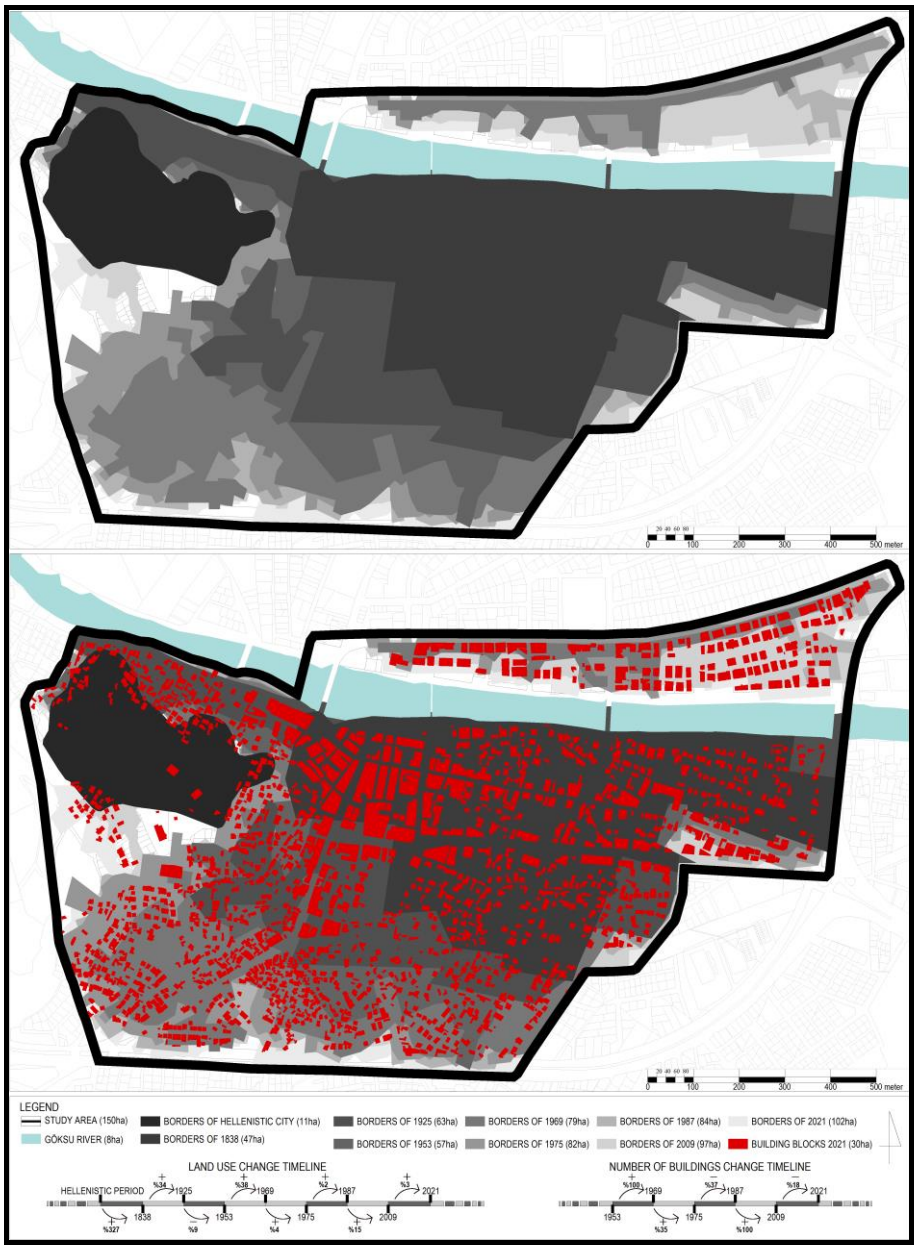


Figure 18. Composite map of Silifke's settlement growth from the Hellenistic period to 2021 with current building footprints and protected areas (Prepared by the author using historical engravings, aerial photographs, and the 1995 Conservation Plan)

The percentage values shown in the timeline of Figure 18 represent the relative change in built-up areas compared to the preceding period within the total study area of 150 hectares. The hectare figures in parentheses (e.g., 57 ha, 73 ha) indicate the absolute extent of the urbanized area at each recorded time point, while the positive and negative percentages denote the proportional increase or decrease relative to the previous stage. For example, the expansion from 11 ha in the Hellenistic core to 47 ha in the Ottoman period reflects a gradual outward growth of settlement, whereas the slight decrease observed between 1975 and 1987 corresponds to the partial demolition and material reuse of abandoned Greek and Armenian houses, as well as the dismantling of ancient buildings during the early Republican period. From 1988 onward, consistent increases in built-up area, particularly toward the northern riverbank, illustrate Silifke's response to demographic and planning pressures. This quantitative clarification

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reinforces the interpretive depth of Figure 18, linking the visualized data to the historical and socio-spatial dynamics that shaped Silifke's urban morphology.

Townscape Reading of Silifke

Silifke's townscape is the result of layered historical, topographical, and social processes. Understanding its urban fabric requires not only the documentation of historical buildings and land use patterns but also the application of modern tools—such as aerial photographs, GIS, and Google Earth mapping—to visualize continuity, changes, and the interaction between historical and contemporary buildings (Siyavuş & Belge, 2024). To complement this townscape reading, spatial analysis tools such as DepthmapX can be applied to examine street network integration and connectivity, providing a digital perspective that reinforces historical and morphological observations. This approach allows us to examine how the town can be understood, sustained, and communicated to its users.

Land Use

The historical continuity in Silifke's spatial organization is evident in the persistence of functional cores established during the Ottoman period (Siyavuş & Belge, 2024). Early representations, such as the 1925 engraving, show land use patterns centered around key religious and commercial anchors, which remain recognizable in the Saray neighborhood and extend into Pazarkaşı and Camikebir. Despite urban expansion, this historical core maintains economic and social centrality. In addition, digital tools such as aerial photographs and Google Earth allow for a precise visualization of these functional cores, facilitating an understanding of how land use patterns have persisted or transformed over time.

Current land use analysis reveals:

- Residential functions occupy approximately 76% of the built environment, serving as the primary morphological determinant.
- Commercial functions account for 6%, concentrated mainly within the historic center.
- Mixed-use buildings, with commercial spaces on the ground floor and residences above, constitute 18%, typically along major streets or transitional zones (Manav & Urak, 2024).

This distribution illustrates how secondary functions are spatially localized while residential buildings dominate the townscape.

Building Typology

Silifke's built environment presents a layered architectural typology shaped by six historical periods. Spatial and material characteristics vary distinctly between the north and south banks of the Göksu River, reflecting contrasting development patterns and construction techniques. Traditional Ottoman-period residential architecture along Fevzi Çakmak and Cavit Erden Streets employs masonry with horizontal wooden beams at 1.5-meter intervals, enhancing load distribution and structural flexibility in seismic conditions (Manav & Urak, 2024).

Cantilevered bay windows (cumba), built using the Bağdadi technique—a wooden skeletal frame filled with plastered lath—articulate facades and add spatial richness, a pattern also observed in Mut district, indicating shared regional traditions (Manav & Urak, 2024). Early Republican houses integrated natural bedrock on sloped plots (Figure 19), providing thermal insulation and reducing construction costs, while supporting functional adaptation to the terrain.



Figure 19. Dwellings constructed on bedrock in Pazarkaşı Neighborhood, Tarih Street. (Photographs taken by the author in 2023)

In addition, digital documentation through Google Earth and 3D modeling can support the visualization of building typology and facade variations, enabling a more interactive analysis of how architectural features respond to terrain, plot geometry, and historical continuity.

Today, reinforced concrete dominates northern expansion areas, largely aligned with plot-based zoning, yet inconsistencies with the historic urban fabric remain due to partially enforced regulations. This has led to a fragmented architectural landscape, where loss of typological continuity affects both visual coherence and functional integration. Historical maps, archival photographs, and recent Google Earth observations help document these transformations, providing insights into how residents interact with and adapt to the evolving urban environment.

FINDINGS

This study investigated the transformation of Silifke's urban fabric through a multi-layered analytical approach, using the metaphor of an "X-ray" to reveal vertical stratifications over time. The diachronic analysis covers nearly two centuries, from 1838 to 2021, interpreting Silifke's full morphological evolution—from the Hellenistic to the Republican periods—as a continuous layering process.

Key urban elements such as plots, street networks, and building typologies were analyzed both independently and overlaid to detect patterns of continuity, shifts, and ruptures. Additionally, a localized "urban coring" method—focused morphological probing of selected zones—was applied, uncovering micro-scale stratifications and typological changes that are not visible in broader district-level analyses.

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A major finding is the morphological and functional differentiation between the southern and northern banks of the Göksu River. The southern bank preserves a traditional commercial core and residential neighborhoods with strong spatial continuity, forming Silifke's historical backbone. In contrast, the northern bank exhibits recent development characterized by apartment blocks with commercial ground floors and residential upper floors, oriented towards consumer-driven mixed-use functions along the riverfront and Atatürk Boulevard.

Among the neighborhoods examined, those on the southern bank include Saray, Pazarkaşı, Camikebir, Mukaddem, Say, and Atik, either entirely or partially included in the study area. On the northern bank, only part of the Göksu neighborhood was analyzed. Six of these neighborhoods display typological similarities that indicate a consistent historical urban language. The northern bank, however, stands out as a distinct morphological and functional zone shaped by post-1980s expansion.

Figures 12 and 13 visually support these observations by illustrating the diachronic development of urban form, building density, street networks, and spatial overlays that highlight significant changes and continuities.

Overall, these findings demonstrate how Silifke's urban form is the product of a complex interaction between historical continuity, topographical constraints, and contemporary urban pressures—resulting in a spatially layered and functionally divided townscape.

Discussion and Comparison

The findings of this study reveal a distinct morphological duality in Silifke's urban form. This duality is most evident in the contrast between the historically layered southern bank and the rapidly developed northern bank of the Göksu River. These zones differ not only in building typology and density, but also in planning logic—organic versus planned growth, pedestrian-oriented versus vehicle-prioritized streets, and traditional versus modern construction techniques.

This morphological duality is further supported by quantitative analysis at the block scale. The Euclidean Distance analysis, as outlined in the methodology section, provides insight into the morphological similarity between selected urban blocks. The results indicate that Block 1 (Göksu) and Block 2 (Atik) are the most similar, reflecting larger plots and taller buildings associated with more recent planned development, whereas Block 3 (Say) exhibits greater distance, consistent with smaller, irregular plots and lower-rise structures characteristic of the historic core. These findings not only reinforce the qualitative observations of neighborhood-scale differences but also demonstrate the strength of quantitative approaches in capturing urban form patterns. Although this analysis was applied to a limited number of blocks in this study, extending it across the entire city could provide even stronger evidence of Silifke's spatial structure and morphological evolution. In this sense, the current implementation serves as a demonstrative example for

urban morphology studies, bridging quantitative assessment with historical and planning insights.

Such spatial dichotomies are not unique to Silifke. Nearby towns offer instructive comparisons. Mut, for example, retains a largely traditional morphology with limited vertical development. Tarsus, sharing Silifke's Roman and Ottoman heritage, exhibits a more fragmented urban landscape where historic cores coexist with sprawling modern peripheries. However, its greater regional centrality and population pressure have led to different patterns of integration and transformation. Safranbolu stands as a successful case of historic core preservation, where regulatory frameworks and conservation practices have maintained strong morphological coherence.

At the international level, mid-sized European towns such as Siena (Italy) and Toledo (Spain) offer further insights. Despite experiencing modern development pressures, Siena has managed to maintain spatial continuity between its historic and newer districts. Toledo, similarly, has integrated tourism and conservation strategies to maintain the identity of its historical core while supporting economic development. Compared to such cases, Silifke's urban transformation appears more fragmented—largely due to the lack of an integrated conservation vision that connects planning with typological continuity.

In the specific study area analyzed in this research—entirely located within a third-degree archaeological site—there are legal conservation constraints. However, these constraints have not always been accompanied by comprehensive planning or design guidelines, leading to partial and sometimes contradictory implementations. As a result, although physical development is allowed under controlled conditions, the absence of a typologically sensitive planning approach has contributed to morphological inconsistency and underutilization of spatial potential within the historic fabric.

In this context, the study argues for a heritage-led urban development model that balances conservation with adaptive reuse and functional integration. Such an approach—anchored in typological continuity and multi-scalar morphological awareness—can provide a roadmap for resilient urban transformation in similar medium-sized towns. These insights contribute to the broader discourse in urban morphology by emphasizing not only the descriptive but also the prescriptive potential of morphological analysis in guiding urban policy and design.

CONCLUSION

This study presents a comprehensive morphological analysis of Silifke, a medium-sized Anatolian town with layered historical development and significant contemporary transformation. Using diachronic cadastral maps, street networks, building typologies, and localized urban coring, the research examined the town's spatial anatomy across multiple scales—from individual plots to entire

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neighborhoods—revealing patterns of continuity, rupture, and hybridization.

Employing the "X-ray" metaphor as an interpretative framework, the urban fabric was analyzed as a multi-layered system through digital tools such as AutoCAD and Depthmap. Morphological strata—plots, streets, and building types—were examined both individually and in superimposed configurations, enabling quantification of spatial relationships and typological continuity across historical phases.

One of the key findings is the identification of distinct morphological zones shaped by the intersection of historical continuity, topographical variation, and regulatory interventions. The southern bank of the Göksu River retains a hybrid historic core, where irregular street patterns coexist with grid-based fragments from early 20th-century planning, accommodating low-rise residential fabric and a continuous commercial spine. In contrast, the northern bank reflects post-1980s planned development, characterized by rectilinear street grids, regular plots, and multi-story reinforced concrete buildings, showing minimal integration with the historic core.

Quantitative analysis using Euclidean Distance on representative urban blocks (Göksu, Atik, Say) further illustrates morphological similarity and divergence. Blocks with larger plots and taller buildings (Göksu and Atik) were more morphologically proximate, while smaller, lower-rise blocks (Say) reflected the traditional urban pattern. These differences correlate with social dynamics, population density, and historical period of development, offering measurable insight into urban form transformations.

Compared to other towns such as Tarsus, Mut, Safranbolu, and Siena, Silifke shows a more visible rupture between traditional and modern areas. While some towns integrate new development incrementally or preserve typological continuity, Silifke reflects fragmented growth influenced by speculative development and ambiguous zoning policies.

The study contributes to planning-oriented urban morphology by identifying zones of typological and functional disjunction, emphasizing adaptive reuse, spatial coherence, and typological continuity as core principles for heritage-sensitive development. Digital visualization tools, including 3D overlays and spatial mapping, enhance communication with planners, authorities, and residents, supporting participatory approaches and informed decision-making.

In sum, the research bridges morphological analysis with practical planning strategies, highlighting how quantitative measures, such as Euclidean Distance, alongside diachronic and spatial analysis, can inform interventions that respect the multilayered identity of medium-sized, historically complex towns.

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Rethinking the Relationship Between Architectural Representation and Spatial Experience Through the 12th International Architecture Exhibition

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Abstract

The experience of space has a multi-sensory structure realized through the movement of the body. This situation effectively discusses the architectural representations used both in the design process of the space and after it is built, through the concept of experience. Architectural representations are conventionally evaluated for their capacity to communicate formal and technical knowledge of space; their ability to convey the experiential qualities of space — what it feels like to move through, inhabit, and perceive a building — remains theoretically underdeveloped. This study investigates the relationship between architectural representation and spatial experience. Drawing on a cross-reading of phenomenological architectural theory, seven experiential qualities that structure spatial perception are identified: light-shadow, acoustics-sound, proportion-scale, color-texture, movement, temporality, and relationship with landscape. These categories form an analytical framework applied to the 12th International Architecture Exhibition of the Venice Biennale (2010), curated by Kazuyo Sejima under the theme "People Meet in Architecture." Using Luis Alfonso's "components of experiential representation" as the analytical instrument, each installation is examined by asking what experiential quality it represents and how that quality is communicated through the medium. The analysis demonstrates how all seven qualities are represented through the exhibition medium. This study contributes to the field by transforming phenomenological spatial theory into a structured analytical framework, empirically applying it to an architectural exhibition as a representational medium, and expanding the concept of experiential representation by situating it within concrete analytical categories.

Keywords: *Architecture exhibition, Architectural representation, Experiential qualities of space, Experiential representation, Perceptual experience*

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INTRODUCTION

According to Dewey (1980), art begins with what is understood and ends in astonishment. However, in architecture, reshaping an experience is more direct and comprehensive than in other art forms. When this act of reshaping is taken as a reproduction of the experience of nature or life, Dewey argues that architecture itself is not representation. Architecture is more than the use of natural forms. They express the values of collective human life and their characteristic effects on the observer. That is, space itself is not a representational art like painting or sculpture, and therefore not something that is understood. One gradually grasps the space by moving in and out of it and through repeated visits, in different light levels of the building and in relation to changing moods (Dewey, 1980).

This spatial quality is effective in discussing architectural representations through the concept of experience. Architecture uses representations both during the design process of the space and after the space is physically present in the world. During the design process, representations are used to express ideas about the design, while afterward they serve many purposes, such as knowledge, criticism, and documenting the building. However, the adequacy of representational tools in conveying the experience of space has been debated. According to the existing literature, representational tools are selective, and qualities of space are subjected to a reduction process determined by the limits of the tool used to represent them (Perez-Gomez, 2006; Böhme, 2017; Croset, 1988; Loos, 2021; Frascari, 2007). Therefore, representations can only be considered reflections of the spatial object or of the technical knowledge of the space. However, in architectural representations, the key is to convey the qualities of the space and how we experience it. Although there is an opposing view in the literature (Nigianni, 2007; El-Bizri, 2007; de la Fuente, 2016) arguing that representational tools reflect the spatial experience, what this experience is and how it is communicated through representational tools has not been clarified, as all these discourses are discussed through the same representational tools (drawing, model, perspective, photograph, text, diagram, etc.).

In his article “Towards experiential representation in architecture”, Luis Alfonso (2016) uses the term “experiential representation”. This term arises from the intention to encompass the representation of architectural phenomena in general, rather than limiting it to the visual experiences that iconic representation focuses on. When representing an architectural object or idea, the designer must consider the experience the representation will create for the final audience (de la Fuente, 2016, p. 47).

Mallgrave argues that architectural theory, as it has been taught and disseminated in recent decades, has failed in contemporary practice. This failure in practice has been compounded in recent years by the profession's forced shift to digital design and the teaching of design

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education to students to think about architecture on the computer, ignoring the experiential dimension of architecture. For this, instead of focusing on the formal properties of design at the level of architectural practice, we need to ask how to make the transition to how a person experiences it (Mallgrave, 2018, p.174). Considering that we rarely encounter high-quality buildings in our daily lives and communicate with architecture mostly through its representations, re-establishing or strengthening the relationship between architectural representation and spatial experience may constitute a starting point for seeking an answer to Mallgrave's question.

The study aims to expand the concept of experiential representation by explicitly relating it to phenomenological theories of spatial experience. Despite a growing body of literature on phenomenological approaches to space and on the representational limits of conventional architectural media, no prior study has systematically operationalized phenomenological spatial qualities into a structured analytical framework and applied it empirically to an architectural exhibition as a representational medium. The discourse on experiential representation (de la Fuente, 2016) remains largely normative and design-oriented; it establishes the desirability of communicating spatial experience through representation but does not specify the constituent qualities of that experience, nor does it test whether any given representational environment successfully conveys them. Furthermore, while architectural exhibitions have received sustained attention as curatorial and historiographical objects (Lopez Serfozo, 2018; Levy & Menking, 2010), they have not been examined as sites of representational inquiry in which specific phenomenological qualities can be identified, traced, and evaluated. Based on this, the analysis conducted through the architecture exhibition can establish a framework that includes experiential spatial qualities as analytical categories for architectural representation.

The central research question guiding this study is: Can an architectural exhibition, regarded as a representational medium, convey the experiential qualities of a space, and, if so, which qualities can be represented and how? Therefore, the study's original contribution is threefold: it translates phenomenological spatial theory into seven distinct analytical categories—light-shadow, acoustics-sound, proportion-scale, color-texture, movement, temporality, and relationship with landscape—derived from a cross-reading of foundational theoretical sources; it empirically examines these categories through the interpretive analysis of a single, theoretically grounded case study; and by expanding Alfonso's concept of experiential representation, it provides this concept with a concrete analytical foundation it has lacked until now.

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EXPERIENTIAL QUALITIES OF SPACE

Fred Dretske (2003, p. 67) argues that the phenomenal character of perceptual experience—what it is like to have an experience—is determined by the properties of the object represented rather than by the object itself. He calls these the "experiential qualities" of the thing perceived. This claim has a direct architectural implication: if what we experience when encountering a space is constituted by the properties that space makes perceptible, then an architectural representation can convey spatial experience only to the extent that it makes those properties—those experiential qualities—available to the perceiver. Merleau-Ponty (2020, p. 31) arrives at a compatible position from the side of embodied perception, noting that what is heard or seen are the properties of the object; Norberg-Schulz (1966, p. 28) frames the same relationship architecturally, writing that we perceive objects through their "manifestations or mediating phenomena," which he calls properties.

Dretske (2003, p. 68) further distinguishes between the medium and the content of representation. This distinction matters here because it clarifies the evaluative criterion for architectural representation: the question is not whether a representational tool accurately reproduces the physical form of a space, but whether it makes available the experiential qualities that constitute the content of spatial experience. If those qualities are absent from the representation, the phenomenal character of the experience it produces will differ fundamentally from the experience of the space itself. The question that follows—what are those qualities?—organizes the remainder of this section.

Moholy-Nagy defines architecture as experienceable spatial relations. Although most people today judge space by its formal character, these qualities do not speak to the qualities of space. The true spatial experience lies in the simultaneous penetration of inside, outside, above, and below, that is, in the flow of volumetric relations and the invisible play of material forces. One's movement in space is necessary for the comprehension of space, which is essentially a set of positional relations between objects (Moholy-Nagy, 2005, p. 163). Only when we experience space does architecture mean something to us; it becomes meaningful. Space only means something to people when it is experienced, when all the senses are engaged with it simultaneously. Space involves an embodied experience determined by the reach and grasp of our hand, the touch of our fingers, the warmth and coldness we feel on our skin, the sound of our footsteps, the posture we take, and the position of our eyes (McCarter & Pallasmaa, 2012, p. 5). In Bachelard's words, "Inhabited space transcends geometrical space" (Bachelard, 1994, p. 47).

Wölfflin is another name who draws attention to the relationship between space and experience, stating that architectonic formations do not act as simple geometry but as mass forms (Wölfflin, 2015, p. 13). According to Wölfflin, spatial form makes sense in the context of the

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movements and forces that bring it into existence. For this, the movement in question must also be experienced by the subject, and the subject must accompany this movement (Wölfflin, 2015, p. 17).

An architectural structure demands certain perspectives to be understood, and to perceive these perspectives, one must interact with the structure at a sufficient depth. Movement is key in this interaction, since a complex architectural organism can only be experienced through movement, where successive perceptions are organized into a total experience. The experience of space is then more than just a visual impression at any given moment (Norberg-Schulz, 1966, p. 198). Expressing a similar statement, Croset states that the complex reality of a building can only be understood through an in-depth visit, and that the temporal experience, which is the fundamental dimension of architecture, only emerges when the building is encountered (Croset, 1988, p. 201).

The visible signs and perceptible aspects of architectural structures are revealed in an experiential continuum of diverse appearances in space-time. It is through the spatio-temporal displacement of the body that the formal totality of what is seen can be clearly perceived. Architectural space is invisible in perceptual reality but reveals itself through the emergence of its various visible aspects in a sequential continuum. While the space is seen from multiple perspectives in spatio-temporal space, its geometric structure brings the visible parts together into a structural totality that is invisible in the whole. The perceptual field is revealed in the flow of various appearances through bodily movement. And the image is woven under the guidance of spatio-temporal experience. The experiential visibility of architecture is directly related to spatial depth, as the open and perceptible space that makes bodily movement possible (El-Bizri, 2007, p. 37-38).

According to Rasmussen, the spatial forms that architecture creates for people are not only to be viewed from the outside or to determine a building's style from its external appearance, but also to be lived in. By walking through the space, one should feel its emptiness, how it is surrounded by walls, its acoustics, and become aware of its textural effects (Rasmussen, 2010, p. 35). Space cannot be grasped by looking at it from a certain distance, like a painting; one must walk around in it. A space is more than the sum of its length, width, and height. This excess, which Zevi calls the fourth dimension, is time, and to comprehend it, one needs to move through the space one after another. One must experience the space, step into the “architectural organism,” and feel that we are part of this structure; this is how it is possible to grasp the space (Zevi, 2015, p. 43).

According to Scott, the value of architecture is first and foremost affected by dimensions. It is also affected by the position of light and shadows, colors, and the character of the lines that dominate the space (Scott, 1914, p. 229). The change of all these qualities changes the space experienced. According to Moholy-Nagy, space is produced by stable

spatial relationships between movement, visual effects, acoustics, light, and balance (Moholy-Nagy, 2005, p. 164). Therefore, it is difficult to give a clear answer to the question of what the experiential qualities of space are. Although it is seen that each architect or theorist produces different definitions of space by drawing attention to different qualities, their common intersection is light-shadow (McCarter & Pallasmaa, 2012; Holl, 2007; Kahn, 2017; Scott, 1914; Zumthor, 2006), acoustic-sound (Neutra, 1954; Schafer, 1994; Rasmussen, 2010; Pallasmaa, 2016; Zumthor, 2006; Holl, 2007; McCarter & Pallasmaa, 2012; Moholy-Nagy, 2005), ratio-scale (Scott, 1914; Rasmussen, 2010; Holl, 2007; Wölfflin, 2015; Zumthor, 2006; Moholy-Nagy, 2005), color-texture (Rasmussen, 2010; Holl, 2007; Zumthor, 2006; Scott, 1914), movement (Moholy-Nagy, 2005; Scott, 1914; ; Pallasmaa, 2016; Zumthor, 2006; Holl, 2007), temporality (Lynch, 1972; Pallasmaa, 2016; McCarter & Pallasmaa, 2012; Holl, 2007), and the relationship with landscape (Siza, 2015; Holl, 2007; Zumthor, 2006; Norberg-Schulz, 1991; McCarter & Pallasmaa, 2012) stand out as qualities that structure the spatial experience.

METHOD

This study employs an interpretive qualitative approach combining conceptual analysis with a single instrumental case study design. The research proceeds in five sequential steps. Step 1 is the derivation of analytical categories. The experiential qualities of space were derived from a cross-reading of architectural theory and phenomenological literature. Sources that provide a clear explanation of how a specific quality (such as light-shadow or movement) contributes to the perception or experience of architectural space were included. A quality was retained as an analytical category when it emerged as a significant topic in at least three independent theoretical sources. This process yielded seven categories: light-shadow, acoustics-sound, proportion-scale, color-texture, movement, temporality, and relationship to landscape. These categories, along with their supporting sources, are presented in Table 1.

In Step 2, the case was selected. The 12th International Architecture Exhibition (Venice Architecture Biennale, 2010), curated by Kazuyo Sejima under the theme “People Meet in Architecture,” was selected as a case study on theoretical grounds. The exhibition was explicitly designed to foreground spatial experience and bodily perception—Sejima’s curatorial directive asked participating architects to “create atmosphere” within the exhibition space's existing conditions rather than display representational objects. This renders the exhibition a paradigmatic and theoretically saturated instance of experiential representation (Flyvbjerg, 2006), making it appropriate for a study concerned precisely with the conditions under which representational environments can convey experiential spatial qualities.

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Table 1. The experiential qualities of the space.

	Scott, 1914	*Holl, 2007*	*Pallasmaa, 2016*	*Moholy-Nagy, 2005*	*Zumthor, 2006*	*Rasmussen, 2010*	*McCarter& Pallasmaa, 2012*
Light-Shadow	light and shadow	light and shadow	shadow	light-shadow	the light on things	daylight	light
Acoustic-Sound		sound	acoustic intimacy	acoustical phenomena	the sound of a space	sound	silence
Ratio-Scale	dimension, character of the predominating lines	proportion-scale		balance	levels of intimacy	solids and cavities, scale and proportion	space
Color-Texture	color	color, haptic realm	the shape of touch	visual factors	material compatibility, surrounding objects	color, textural effects	
Movement	movement	perspectival space	the body in the centre, mimesis of the body	Movement, alteration of position	between composure and seduction		
Temporality		spatiality of night, time duration	time and solitude, images of muscle and bone				time, ritual, memory
Relationship with landscape		the merging of object and field, site circumstance			tension between interior and exterior, architecture as surroundings		landscape, place
Other		water	scent		the temperature of a space coherence		matter, gravity

Step 3 of the study involves data collection. Data was collected from three complementary source types. Primary curatorial sources include the official exhibition catalog (Sejima, 2010), which provides authoritative statements regarding the curatorial intent, and Sejima's extensive interview with Aaron Levy and William Menking (Levy & Menking, 2010). Critical evaluation sources include studies on the Venice Biennale exhibition design that document visitor and professional reactions (Lopez Serfozo, 2018) and contemporary critical texts (Stathaki et al., 2010). Visual documentation of the installations—sourced from the catalog and publications—provided the evidence base for the analytical tables.

In Step 4, spatial boundaries were defined, and the installation site was selected; the analysis is limited to the Arsenale's main exhibition space. The Giardini section was excluded because, as Sejima herself noted, it is organized in a traditional, multifaceted exhibition format lacking the spatial continuity and site-specificity that characterize the Arsenale (Levy & Menking, 2010, p. 171). Within the Arsenale, an installation was included in the analytical table for a specific quality when the curatorial logic was primarily aimed at conveying that quality—that is, when the installation's representational strategy was structured to make that quality perceptible or experiential for visitors. Installations in which a quality emerged only by chance, as a byproduct of the Arsenale's material or spatial context, were noted in the narrative analysis but excluded from the tables.

In the final step, the analytical framework was applied. Luis Alfonso's "components of experiential representation" framework (de la Fuente, 2016, p. 51) was applied by posing two structured questions to each selected installation: (a) what experiential quality is being represented—that is, which spatial quality does this installation address as the subject of the act of representation; and (b) how is this quality conveyed—that is, through which material, spatial, or curatorial means is it made perceptible. The responses were recorded in tables prepared separately for each quality in Chapter 4 and later synthesized in the results section.

PEOPLE MEET IN ARCHITECTURE: 12TH INTERNATIONAL ARCHITECTURE EXHIBITION [1]

In this study, the representation of the experiential qualities of space is examined through the 12th International Architecture Exhibition (People meet in architecture) of the Venice Architecture Biennale held in 2010. This exhibition, curated by Kazuyo Sejima, does not refer to a specific concept but focuses on the space itself and aims for people to experience architecture. At this point, it can be said that the exhibition's referent is the experience of architecture, as Louis Alfonso stated.

[1] The images used in this section are from the exhibition book "Sejima, K. (2010). People Meet in Architecture: 12th Venice Architecture Biennale", while the collages and tables were created by the authors.

According to Sejima, in the age of the internet, people can access information instantly. It is more important to come together with people and experience the projects, to establish some kind of contact with the exhibited materials. Sejima states that he wants to use the existing exhibition space to realize this idea. For this reason, he divided the main exhibition spaces in the Arsenale and Giardini into rooms, defining a separate space for each participant and inviting them to create a distinct atmosphere with the limited materials available. Thus, visitors will be able to have diverse experiences and feel distinct atmospheres (Levy & Menking, 2010, p. 166). In this sense, Sejima characterizes the Biennale as "a chance for less information and more emotion" (Levy & Menking, 2010, p. 176). The fact that each work has its own space allows the fixed space to be taken out of context and incorporated into the exhibition's content in some parts. Considering the intensity of the projects, the representations on display are juxtaposed in a rhythmic order, so that the transitions between the rooms are, in a sense, designed (Levy & Menking, 2010, p. 167). At the core of this approach lies the problem of how to show architectural qualities since it is not possible to exhibit a real building in an architecture exhibition. Sejima, seeking an answer to how to exhibit architecture with its unique qualities, states that even when a one-to-one scale model is exhibited, the context is ignored. For this reason, the curator asked the participants to create something in the context of each room and to consider the possibilities of exhibiting a project within the existing conditions of the exhibition space (Levy & Menking, 2010, p. 173).

The exhibition is constructed to emphasize site-specificity and bodily interaction, referencing the scale of the human body moving through the

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space envisioned in the Arsenale. Sejima pursues the idea that people meeting in the Arsenale can recognize a social architectural experience because their bodies are constantly moving through the space. Each installation in the Arsenale can therefore be said to function as an interface between spatial information and visitors' bodies, abstracting different formal strategies into singular experiential situations (Lopez Serfozo, 2018, pp. 98-99). The exhibition design emphasizes key points such as the relationship between humans and architecture, creating atmosphere, showcasing architecture's qualities, and fostering spatial experience. What makes the 12th International Architecture Exhibition experiential rather than theoretical is the intuitive perception of materials, water, wood, color, sound, and light. All these elements are represented spatially, so the works in the exhibition, like those in previous biennials, do not require explanatory texts and have no commercial concerns (Stathaki et al., 2010).

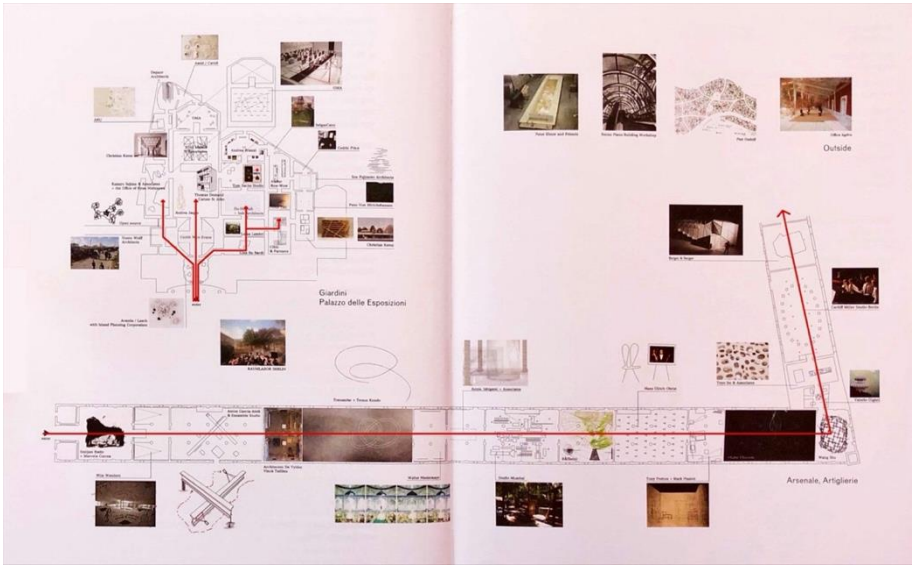


Figure 1. Giardini and Arsenale exhibition plans (Sejima, 2010, pp. 16-17).



Figure 2. Location of the Arsenale and outdoor installations (Created by the author).

When the exhibition plans are analyzed, the difference between the Giardini and Arsenale exhibition spaces is striking (Figure 1). In his interview with Aaron Levy and William Menking, curator Sejima states that Giardini is composed of fragmented volumes and its circulation is multidirectional. Small works, photographs, and solo exhibitions were

shown in this space due to the inability to create a definite route and the space's dimensions (Levy & Menking, 2010, p. 171). At this point, we can say that the Giardini section was organized in the traditional exhibition format.

Due to the fact that both the works with experiential qualities were located in the Arsenale exhibition space and the idea of the installations using the exhibition space as a context, which was mentioned in the theme of the exhibition, was embodied in this part of the exhibition, the main exhibition space of the Arsenale was focused within the scope of the study; the Giardini section of the exhibition was not included in the analysis. The Arsenale section of the exhibition includes the main exhibition space, divided into 17 rooms with one installation each, and the outdoor spaces, which host 4 installations (Figure 2). It has been revealed how experiential qualities are represented, with which tools, and how they are perceived/experienced by visitors in Arsenale.

Light-Shadow

Light and shadow are the most emphasized experiential qualities of space. This result is related to the fact that the experience of space would not be possible without light. Light and shadow give volumes, spaces, and surfaces their character and expressive power, revealing the quality of materials. The reflections of temporal changes, such as day, night, and season, in space link architectural space with the dynamics of nature; “natural light breathes life and connects the material world with cosmic dimensions” (McCarter & Pallasmaa, 2012, p. 151).

Since the sun is not a point source of light, the effect of daylight is infinitely varied. Light is vertical at the equator, horizontal at the poles, cool at the full moon, warm and colorful at sunrise and sunset, and different in character both during the day and in all geographical regions, so each different space has its own unique light. Light often directly affects our mood. Because light controls the processes of biological life, our mood, activity, and energy levels are transformed by its effects (Holl, 2007, p. 63; McCarter & Pallasmaa, 2012, p. 151).

Light and shadow divide space into parts and sub-spaces, giving it rhythm, a sense of scale, and intimacy. According to Scott, another name that emphasizes the quality of space as directly related to the position of light and shadows, the light source attracts the eye and suggests independent movement (Scott, 1914, p. 229). According to Pallasmaa, “Constant high levels of lighting, leaving no room for mental retreat or privacy, is an effective method of mental torture; even the dark interior of the self is exposed and violated” (Pallasmaa, 2016, p. 60). Dim light and shadows suppress the sharpness of vision, paving the way for clear thinking; they render depth and distance indistinct, activating unconscious peripheral vision and tactility (McCarter & Pallasmaa, 2012, p. 154).

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Table 2. Representation of the quality of light and shadow at the 12th International Architecture Exhibition.

	How? (What are the tools?)	How is it represented?	How is it experienced?
Cloudscapes	An artificial cloud with different layers of air, where the air temperature increases significantly depending on the altitude, and a ramp surrounding the columns of the main space.		Through the artificial cloud created in the exhibition space, the natural light entering the building is screened, the cloud layer makes the road invisible and at some moments people can only see other people through the cloud. The atmospheres above and below the cloud have different qualities of light, temperature and humidity, seperating the spaces with a light filter effect.
Your split second house	Curtains that disconnect the space from natural light, spontaneous flashing electronic flashes and the water element		In the room where the installation is located, the exhibition space is cut off from daylight and the room is darkened. Thus, the volumetric and textual details of the main exhibition space are pushed to the background, while the natural connection between the visitor and time is severed through "lack of light".
Piazzasalone	Artificial lighting of different qualities such as car headlights, table lamps, ambiguous objects to create a variety of shadows		While naturlal light is not interfered with, artificial lighting and the use of various objects to produce shadows create an atmosphere that moves visitors between private and urban interiors.
Work-Place	Vertical lighting elements emulating the columns of the main space, models, drawings and furnitures		Traditional forms of production and craftsmanship skills are considered as a process in which components such as local materials and real-life conditions are interpreted together, and the exhibition space is transformed into a workshop environment representing this process.

Crucially, the light-shadow effect experienced throughout the exhibition is not confined to installations where this quality is the primary representational subject. The decision to preserve the original window openings of the Arsenale's main exhibition hall—a deliberate curatorial choice rather than a practical default—means that natural light varies in quality, direction, and intensity across the full spatial sequence of the exhibition. This has a direct analytical implication: the light-shadow quality is not only represented in specific installations but is embedded in the representational medium itself. Figure 3 documents this variation across different sections of the exhibition route, demonstrating that the spatial experience of light and shadow is a continuous, pervasive condition throughout the exhibition rather than an isolated curatorial gesture.



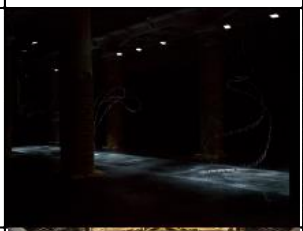
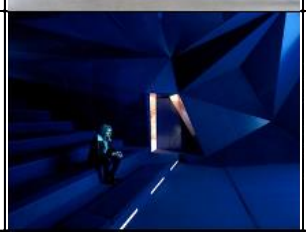
Figure 3. Variations of light and shadow in different parts of the exhibition.

Acoustic-Sound

Space is audible; we hear the sounds it reflects. This sound gives us an idea of the space's form and material. In other words, the sense of hearing structures the experience of space. For this reason, each space should have its own acoustic effects. Thus, it becomes possible to create an auditory impression of the space and to become aware of its characteristic sound; the qualities of space, such as size and form, can be grasped through the sense of hearing (Rasmussen, 2010, pp. 227-228; Pallasmaa, 2016, p. 64). Neutra writes that, whether we are conscious of it or not, the built environment appeals to or harms us as a complex aural phenomenon and is often effective even in its smallest reverberations (Neutra, 1954, p. 142).

According to Schafer, the high reverberation levels of Gothic and Renaissance churches (6-8 seconds) slow down the modulation and weight of both music and speech, whereas in today's smaller rooms, speech happens faster (Schafer, 1994, p. 219). Interiors are like large elements that collect, amplify, and transfer sound. This quality is related to the form specific to each space and the surfaces of the materials contained, and the way these materials are applied (Zumthor, 2006, p. 29). The sounds and vivid reflections within a stone cathedral heighten our awareness of the space's width, geometry, and material. However, if the same space is designed in an acoustically softened way, it may lose its spatial and experiential dimension. It is necessary to redefine space by shifting our attention from the visual to how it is shaped by the vibrations of resonant sounds, materials, and textures (Holl, 2007, p. 87).

Table 3. Representation of the quality of acoustic/sound at the 12th International Architecture Exhibition

	How? (What are the tools?)	How is it represented?	How is it experienced?
Your split second house	Curtains that disconnect the space from natural light, spontaneous flashing electronic flashes and the water element		While moving along the axis where the installation is located, visitors hear both the sound of electronic flashs and the sound of water flowing through the hoses in a moving manner. In this way, multiple senses such as sight, hearing and touch are activated to sense the flowing seconds, structuring the subject's experience within the space.
40 part motet	40 speakers strategically placed in the space, where Tallis' Spem in Allium is individually recorded		The 40 voices on the recording penetrate the space as individual fragments or as a collective whole, transforming the performance of a choir into a performance of objects sitting in a large, empty room. The space draws its visitor into a sonar and textural environment. The wooden skeleton of the Arsenale vibrates as bodies of the visitors move through the space (Lopez Serfozo, 2018, p. 91).
Çavа, Prefabricated movie theater	Prefabricated structure based on a primitive cave depiction		The displacement between the exhibition space and the movie theater is a transition from a polyphinic space to the normal rhythm of the Arsenale and then to a new space that sets its own acoustic boundaries.

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Silence is as important as acoustics in the experience of space. According to Pallasmaa, the most important auditory experience a space can create is silence. Space can create an intense experience to the point of suppressing external noise and directing our attention to our own existence (Pallasmaa, 2016, p. 64). A meaningful experience of place cannot be limited to moving through it, looking at its forms and materials, touching its surfaces; the encounter also invites us to listen to its characteristic and unique silence. It is a silence that awakens mental and sensory awareness (McCarter & Pallasmaa, 2012, p. 185).

Ratio-Scale

Intuitively, humans could perceive simple mathematical ratios in their environment (Rasmussen, 2010; Holl, 2007). Scale and proportional relationships are effective qualities in the experience of space. However, it is difficult to discuss a fixed-ratio system used in architecture. While designing Villa Foscari, Palladio used a proportion system found in music. Le Corbusier develops his own system of proportions, the moduli. In other buildings, it is seen that proportions are created based on different units, as in the example of tatami in Japanese culture. At this point, Wölfflin's inclusive approach should be mentioned. According to Wölfflin, proportion is the relationship between the parts that make up the space, and it is not correct to consider proportion as a purely formal factor. Stating that the principle of proportion should be handled through organic construction, Wölfflin illustrates this situation through the human body and emphasizes that proportion is a concept related to the basis of the structure rather than form (Wölfflin, 2015, p. 47).

Table 4. Representation of the quality of ratio-scale at the 12th International Architecture Exhibition.

	How? (What are the tools?)	How is it represented?	How is it experienced?
Balancing Act	Metal springs and structural element		The two structural elements placed longitudinally in the Arsenale act as a bracket that transforms the original space. The new elements introduced into the space play with the rhythm of the building, creating a new order and changing the scale of the space.
Decay of a dome	Bamboo and pine woods		The dome produced in the exhibition space plays with the scale of the existing volume, suggesting a new height in the interior space. Visitors following the exhibition route pass through this wooden dome. In this way, they experience two different volumes in the interior space and establish a proportional relationship between them.

To put it another way, in architectural culture, proportion is based on a natural balance, and space is scaled proportionally to human beings (Holl, 2007, p. 116). This is why Zumthor (2006) calls scale levels of intimacy. For him, scale is not a fixed mathematical fact but the distance

between the elements of space and our body. All the elements of space are spatially in a relationship of proximity and distance to our body. Zumthor explains these relations through the structure of the church. The interior of a church is quite large compared to our bodies, and our bodily smallness before it makes us feel frightened. However, as we climb the church tower, the proportional difference between our bodies and the space closes. In contrast, the interior of Villa Rotondo, another gigantic and monumental building, has a sublimating effect; one does not feel fear, but rather a sense of the body expanding. Thus, we feel that we breathe more easily (Zumthor, 2006, pp. 51-53).

Color-Texture

It can be said that color and texture are material-specific qualities. Rasmussen (2010) illustrates the spatial effects of color through the city of Venice. According to Rasmussen, the colorful buildings of Venice appear lighter than the other buildings we know. The city does not look heavy and massive, with its buildings painted in vibrant colors, but rather exudes a seductive effect through its joy and mobility (Rasmussen, 2010, p. 88).

Differences in the reflectivity of glossy and matte surfaces, differences between opaque and transparent colors, and the unique properties of reflected and transmitted colors suggest an enormous range in the phenomenology of color. The impact of color on the experience of space is amplified by its variation according to available light and other variables (Holl, 2007, p. 58).

The materiality of the details that make up an architectural space is revealed, making the tactile field visible. Thus, the sensory experience intensifies. The holistic experience of space depends on the tactile reality of materials and details (Zumthor, 2006, p. 25). Today, with the use of artificial materials produced by industrial methods, the sense of touch becomes dull, and the texture and essence of the material and its details are displaced (Holl, 2007, p. 91).

Throughout the exhibition, visitors encounter a wide variety of textures and colors. In the majority of the Arsenale rooms, texture and color qualities are represented, including installations using traditional means of representation. Figure 4 presents a collage of material and chromatic conditions encountered across the exhibition route and functions here as evidence for a specific analytical claim encompassing natural materials (stone, wood, vegetation), industrial materials (transparent concrete, metal mesh, reflective surfaces), and the Arsenale's own historically patinated brick and timber. This material diversity has a phenomenological consequence that goes beyond visual variety. As Zumthor (2006, p. 25) argues, the holistic experience of space depends on the tactile reality of materials and details; the range of textures documented in Figure 4 means that the exhibition activates the haptic field—the sense of touch and its anticipation—across virtually its entire length. The historical material of the exhibition space itself,

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visible in the vaulted brick ceilings and worn stone floors, adds a further layer: a texture that carries temporal information and tactile quality, linking this section of the analysis back to the quality of temporality.

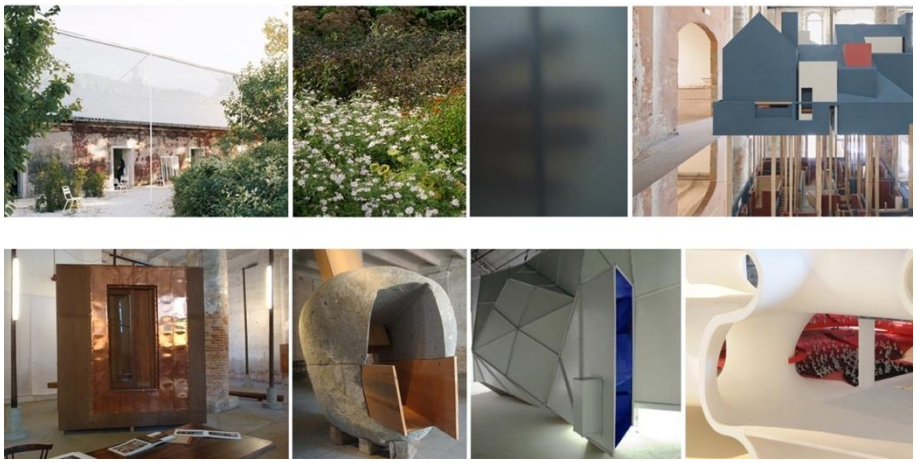


Figure 4. Examples of color and texture variations from the exhibition.

Movement

The most important feature that distinguishes architecture from other arts is that it enables bodily movement. The experience of space is not limited to the gaze, where the body is kept at a certain distance. In the absence of a space in which we can move, the existence of space is doubtful. As Moholy-Nagy defines it, space is the sum of the spatial relations of bodies/volumes. In this definition, what is meant by the word' relationship' is the relationship between boundaries, endings, and openings. This relationship between positions is controlled by movement, that is, by changing the position; it is also verified with the help of other senses. Movement is the most directly effective means of experiencing space (Moholy-Nagy, 2005, p. 163).

According to Scott, the human being, as a breathing creature, has the physical memory of movement. Space is therefore expected to respond to the need for expansion through movement, in all our bodily movements and, most importantly, in our breathing (Scott, 1914, p. 228). The image of space alludes to action, to the moment of the actional encounter, that is, space promises a function. The resulting bodily response is integral to the experience of space (Pallasmaa, 2016, p. 78).

In his book Atmospheres, Zumthor (Zumthor, 2006, p. 11) says: “Quality architecture to me is when a building manages to move me.” It is worth emphasizing here that the relationship between space and movement is bidirectional. Beyond the effect of movement on the perception of space, space should direct us toward a certain action and encourage us to move.

Table 5. Representation of the quality of movement at the 12th international architecture exhibition.

	How? (What are the tools?)	How is it represented?	How is it experienced?
The boy hidden in a fish	Granite rock and cedar		It is difficult to grasp this space from a single point of view. Experiencing the wooden space built into the rock necessiates the movement of the body around the ass and this movement ends with the act of lying down.
Balancing Act	Metal springs and structural element		In the installation, two structural elements are placed diagonally to the existing structural layout of the space, dividing the space in two and changing the scale of the volume and the itinerary of the space. This intervention allows visitors to change direction and expands the movement in the space.
Cloudscapes	An artificial cloud with different layers of air, where the air temperature increases significantly depending on the altitude, and a ramp surrounding the columns of the main space.		In Cloudscapes, visitors are invited to walk on the ramp surrounding the columns of the Arsenale. This movement allows both an interaction with the artificial cloud, the main element of the installation, and an experience of the main exhibition space from the different perspectives. The visitor loses clarity of vision and at the same time is repositioned in the space through defined architectural conditions.
Work-Place	Vertical lighting elements emulating the columns of the main space, models, drawings and furnitures		The tools used are placed in such a way thet visitors can move between objects and spend time here using the furniture that is part of the installation. The objects in space are foreign but tactile. The person entering the space can sit on a wooden chair or enter an enclosed space that seems to have been cut out of a shed. The lack of a single focus brings about continious movement between all objects.
Piazzasalone	Artificial lighting of different qualities such as car headlights, table lamps, ambiguous objects to create a variety of shadows		In this installation, which is a representation of a square, the presence of objects of different scales gains character as they move through the space, and the viewer journeys between the urban interior and a private interior experience.
Decay of a dome	Bamboo and pine woods		The dome built in the exhibition space invites visitors to look at it from all sides. This permeable structure, which suggests a cicular or repetitive movement in the room where the installation is located, allows the existing space to be re-experienced from different perspectives.
Ça va, Prefabricated movie theater	Prefabricated structure based on a primitive cave depiction		Ça va, a prefabricated movie theater, welcomes visitors through a narrow passage from the main exhibition space. And directs them to sit and watch in its own interior space.

As bodily movement is a necessity of the perception process, it also plays an important role in the experience of space. Spatial experience is the totality of displacements within the volume and actions triggered through space. The spatial nature of the exhibition necessitates the movement of the body, independent of the exhibition object. While in

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traditional methods of representation, the communication between the viewer and the object is usually established through the movement of the eye, installations specific to the exhibition space can mobilize the body.

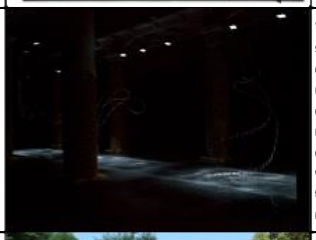
Temporality

The values attributed to temporality in the experience of space cluster around three distinct but related concerns. The first is biological rhythm: Lynch (1972, p. 117) observes that human beings are embedded in natural cycles of light, sound, and season, and that environments which disrupt these cycles damage bodily integrity. Quality architectural space should therefore reflect, rather than suppress, the temporal flow of the natural world. The second is the accumulation of memory in material: Pallasmaa (2016, p. 40–41) argues that the transformation of material over time—patina, wear, the visible inscription of age—communicates the enriching experiences of historical duration and sustains the sensory relationship between inhabitants and temporal reality. Architecture, on this account, should function as a "time museum," making the historical flow visible and enabling an encounter with a cycle that transcends the individual lifespan (Pallasmaa, 2016, p. 65). The third concern is existential continuity: McCarter and Pallasmaa (2012, p. 51) argue that human beings are historical beings whose formation reaches into deep time, and that built environments should reflect this historicity by reconnecting inhabitants with their causal and experiential reality. If architectural space can serve as a measure of experienced time, then the convergence of material, form, and site-specific conditions can produce what Holl (2007, p. 74) calls a "combined spatial resolution" of multiple temporal registers.

In these views under the heading of temporality, temporality experienced through space is interpreted in three different ways. The first of these is to be able to read the enriching experiences of time on the structure. A space should compare the individual with the traces of infinite time that transcends its own lifespan and mediate the maintenance of collective memory. The second is to be aware of the time of day by perceiving the change in daylight in the space. The third is to travel to our existential origins through space. Space should fuse human beings with their reality by activating the mental and psychic residues that guide human behavior.

However, the experience of the quality of time in the exhibition is not limited to the installations featured in Table 6. Traces of the shipyard's historical past accompany the exhibition. During the exhibition installation, the relationship between the main exhibition space and natural light is preserved. Natural light is seen as a tool that connects the space to the times of the day. The change in light throughout the day can be felt along the entire route through the main exhibition space, allowing the temporal change to be felt.

Table 6. Representation of the quality of temporality at the 12th International Architecture Exhibition.

	How? (What are the tools?)	How is it represented?	How is it experienced?
The boy hidden in a fish	Granite rock and cedar		The shelter-space carved into the rock refers to the mother's womb, the first place of our existence in the world. The mother's womb, which is characterized as the first place and safe place of existence, evokes peaceful, calm and safe shelter. Designers create a sense of warmth by covering the space inside the rock with cedar wood.
If buildings could talk...	3D film about the Rolex Learning Center		In the film, while the building is visited by cameras, the voiceover communicates with the audience by speaking through the mouth of the building. In the image quoted from the installation, attention is drawn to the perceptibility of the transformation of day and night in the space through the opening that separates the floor and ceiling. The space connects its users to the times of the day by utilizing natural light; users move in space and time.
Your split second house	Curtains that disconnect the space from natural light, spontaneous flashing electronic flashes and the water element		"Your split second house is the space between two seconds...This space seems static, frozen in time. Nothing changes in it. What can change is the way we relate to it. The usual coordinates we normally control, such as subject and object, inside and outside, gravity and anti-gravity, are released. The sensation of reconstituting the way we experience the world can come suddenly with a jolt, as if it were not occupying a graspable period of time. We don't feel the split second, only later realizing that we have lived one (Eliasson, 2010, p. 144)."
Il giardino delle vergini	Various plants		The phototropism and photonasty movements of the plants that make up the garden in relation to light are effective in changing the plant texture and thus the experience of space depending on the time interval.

The relationship between landscape

According to Alvaro Siza, the seamlessness between interior and exterior spaces is a requirement of architecture. Architecture extends from an object to a space, and from space to the connections between spaces until it connects with nature (Siza, 2015, p. 50). The relationship of the building with the place, its surroundings, and nature constitutes an important part of the experience of space. Referring to Merleau-Ponty's term in-between reality, Holl (2007) states that architecture is a multi-layered experience beyond physicality and functionality created for a specific program. It is not only the juxtaposition of events, things, and activities that constitutes space, but something more abstract that emerges in the continuity of overlapping spaces, materials, and details. And place is part of this continuum. The moment when the other elements of the continuum begin to lose their clarity and merge with the ground is like that indicated by the term "in-between reality". The architectural synthesis of foreground, middle ground, and distant view, together with all the subjective qualities of material and light, forms the basis of the completed perception, and all these overlapping elements are critical in the creation of architectural space (Holl, 2007, p. 45). A window, the light that enters through it, and the landscape visible are

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meaningful together. The way in which the place is presented to our gaze through the space, and the relationship of the space to the place, are important parts of the experience of space.

Table 7. Representation of the quality of the relationship with landscape at the 12th International Architecture Exhibition.

	How? (What are the tools?)	How is it represented?	How is it experienced?
Il giardino delle vergini	Various plants		A wide path invites people to wander through this garden, inviting visitors to stop, sit or linger for a while in this space. The choise of plants, colors and textures here reproduces the place by creating scenes for a particular sensory quality, shaping the perspectives of the distant image perceived by the subject.
Enjoy the view	Steel structure and transparent concrete block		The front end of the eight-meter-long piece is positioned on the stone shore, without support or railings, inviting the visitor to look out to sea, at passing ferries, motorboats plying the waters of the lagoon, or a cruise ship being dangerously pulled towards.

Another name that draws attention to the concept of place in the experience of space is Peter Zumthor. With the existence of space, place is divided into inside and outside. The tension or transition between inside and outside strengthens the spatial experience. As we move inwards, we become aware of what surrounds us, we feel surrounded, and vice versa as we move outwards. We experience the moment of encounter with the landscape consciously constructed by the space (Zumthor, 2006, pp. 47-49). According to Norberg-Schulz, place is an integral part of existence, and it is meaningless to imagine any phenomenon without reference to the qualities of place. With the word place, Norberg-Schulz refers to a totality of concrete things with material substance, shape, texture, and color. All these properties together determine an “environmental character” that is the essence of place, and place is given as such a character or “atmosphere” (Norberg-Schulz, 1991, p. 6).

The effects of landscape on human character, behavior, and thought are underestimated, yet landscape is a key component of our experience. Landscape is not only the context of place. It is internalized as a mental landscape and structures our experiences, thought processes, and emotions. Place-specific qualities also provide the context for architectural spaces, including space, form, rhythm, material, and color. Spaces are in dialogue with both natural places and man-made arrangements (McCarter & Pallasmaa, 2012, p. 365). A space with depth always enhances, clarifies, and strengthens the legibility of the surrounding landscape, endowing it with special meaning. Landscape and architecture intertwine; landscape frames architecture, and architecture frames or emphasizes landscape (McCarter & Pallasmaa, 2012, p. 366).

CONCLUSION

The idea of "experiencing architecture" that forms the starting point of the 12th International Architecture Exhibition, the participants being asked to create atmospheres, and the aim of creating a multi-sensory environment with rich materiality are related to this fiction. As mentioned in the previous sections of the study, it is the qualities of the represented object or idea that structure the representational experience. Based on this, within the scope of the study, the qualities possessed by the space, in other words, the qualities that give character to the spatial experience, were defined as "experiential qualities of the space," and the exhibition as a whole, accepted as the medium of representation, was examined through its ability to represent these qualities.

The main exhibition space is divided into rooms, with each participant curating the space assigned to them; the spaces are left open, without being detached from their context. The exhibition's structure, which leaves the space open, ensures both the continuity of the experience between the installation and the visitors by connecting the rooms, which have no direct relationship with each other, and by integrating the sensory environment into the representational experience. For example, preserving the window openings in the exhibition setup allows the context of the main exhibition space and the effect of daylight in the interior spaces to be felt. Thus, both the effects of light and shadow on the spatial experience and the relationship with the times of day are represented throughout the exhibition, regardless of the installations.

In the rooms where traditional media of representation (photographs, drawings, models) are used, representation is limited to proportions and color-texture qualities (Figure 4). However, the exhibition is spatial, with bodily movement throughout. The Arsenale's unique textural and material qualities and its temporality, which is sensed through the historical traces these qualities carry, are part of the exhibition. Another point that stands out in the rooms where traditional representational media are used is the intervention of bodily movement in the presentation of the representation. The medium of representation is not presented in the traditional way, that is, on a pedestal or on a wall surface. In the 12th International Architecture Exhibition, traditional means of representation are constructed alongside various equipment elements, such as tables and chairs, and visitors are directed to experience the qualities specific to these elements through bodily movement (Figure 5). In this way, other experiential qualities, such as movement, light and shadow, and temporality, become part of the representational experience. These parts of the exhibition are differentiated by developing alternative methods for experiencing traditional representational environments. The interaction between the viewer and the object of representation is transformed in favor of bodily

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sensation, and the increased duration of interaction makes it possible to experience other qualities inherent to the exhibition space.



Figure 5. Examples of how traditional mediums of representation are exhibited (Sejima, 2010).

The study utilizes the concept of experiential representation to clarify the relationship between architectural representation and spatial experience and argues that experiential representations should include the experiential qualities of space. The architectural exhibition, which is accepted as an alternative representation medium that can convey the experience of space in the face of criticisms against architectural representation environments, is examined within the scope of the study through the set of qualities that we can list as light-shadow, acoustics-sound, ratio-scale, color-texture, movement, temporality, and the relationship with landscape, which are proposed as a tool that we can use to understand representation environments. In this context, the 12th International Architecture Exhibition serves as a model, revealing the exhibition's conveyance of the experiential qualities of space. The study expands representation theory beyond traditional modes by demonstrating that the exhibition, as a form of representation, can convey the experiential qualities of the space. In addition, the study analyzes the concept of experiential representation within the framework of its ability to represent the experiential qualities of representational space, explicitly relating it to phenomenological theories of spatial experience. This method could create a framework that includes experiential spatial qualities as analytical categories for architectural representation.

Considering the exhibition as an experiential representation environment that can embody spatial ideas is also an answer to the problem of how architecture will be exhibited. The exhibition experience, built around the concept of atmosphere, reveals the relationships among perception, time, and the body, which are the basic modes of existence. In other words, this experience encourages conscious perception. Due to its potential to represent spatial experience, the architectural exhibition can serve as an intermediary to achieve aims such as communicating spatial knowledge, understanding space, and understanding our own spatiality. At this point, the exhibition, as an experiential medium of representation, can support the production of experience-oriented environments by mediating understanding of space. The findings on how the experiential qualities of space are represented in the installations, and on the different approaches to the exhibition of traditional representational environments, can guide studies to strengthen the relationship between representational tools and spatial experience.

Therefore, the study's contribution to the literature can be summarized as expanding the concept of experiential representation by explicitly relating it to phenomenological theories of spatial experience, creating a framework that includes the experiential qualities of space as analytical categories for architectural representation, and extending representation theory beyond traditional visual media by treating architectural exhibitions as representational environments capable of offering embodied spatial experiences.

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Resume

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The Use of Terminology Regarding the Protection of Interior Designs as "Designs" under Industrial Property Rights: An Evaluation through the Stakeholders' Perspectives

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Abstract

Throughout history, similar but different terms have been used for decoration/interior decoration, interior design, and interior architecture. The literature indicates that there are certain differences between the scope and outputs of the terminology in question. However, both in theory and in practice, it is observed that terms such as interior design and decoration/interior decoration are still frequently used, and their scope and outcomes are often confused. It is thought that the prejudices that have emerged in this process have led to the terminology of interior design, which is a discipline distinct from decoration/interior decoration, to be approached in a reductionist manner in terms of scope and outputs. In particular, in the "design" protection, the term "interior design" is not included in regulatory texts such as the Locarno Classification System and the Turkish Patent and Trademark Office (TÜRKPATENT) Design Examination Guide; instead, terms such as "presentation (get-up)," "interior layout," and "interior arrangement" are used. This study addresses the problems created by the terminology used in regulatory texts regarding the protection of interior designs as "designs" under the Industrial Property Code No. 6769 (IPC) and the effects of these problems in practice. The study uses a qualitative research method; patent and trademark attorneys involved in design registration application processes, court experts involved in evaluation processes, judges currently serving or who have served at the Intellectual and Industrial Property Rights Court, and experts from the TÜRKPATENT Design Department and Copyright General Directorate. The data obtained through semi-structured interviews with a total of 32 participants was analyzed using content analysis, focusing on terminology usage, and the findings were grouped under three different themes. It was determined that the terminology used could lead to an incomplete or misleading perception of interior designs. In this context, alternatives and a systematic approach to terminology usage were proposed.

Keywords:
Design protection, Industrial property rights, Intellectual property law, Interior design

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INTRODUCTION

Interior design, positioned at the intersection of art and science, is not limited to pragmatic purposes or its products; it is a practice rooted in holistic knowledge production that emphasizes user experience and context" (Cross, 1982; Nelson & Stolterman, 2012). In the literature, "interior design" has been conceptualized as both a professional activity and its outputs, leading to various definitions within interior architecture. Historically, concepts such as "interior design" and "interior decoration/decoration" have overlapped significantly. However, from a contemporary perspective, it is asserted that the terminologies "interior design" and "interior decoration/decoration" differ in scope and output (Adams & Tancred 2000; Dedek, 2022; Gronberg, 1992; Havenhand, 2004; Sparke, 2008). Nevertheless, the term "interior design" is still sometimes equated with "interior decoration," or even with mere "arrangement and placement" activities and their respective outputs. This reductionist approach fails to reflect the actual nature of interior design practice and its outcomes, potentially leading to a conceptual narrowing that goes beyond academic discussions. Such narrowing can overlook the relationship between the abstract and tangible components of interior design and may foster a misleading perspective that paves the way for various complications.

In this context, although interior designs may qualify for protection as "works" under Law No. 5846 on Intellectual and Artistic Works, the narrow interpretation of interior design practice and its outputs results in these products being either excluded from protection or granted only limited protection (Bezci & Elibol, 2021). Considering these issues within the domain of intellectual and artistic works one of the two main pillars of intellectual property rights similar problems may also arise under the other pillar, i.e., industrial property rights, in terms of protecting interior designs as "designs." In particular, the current system under the Industrial Property Code No. 6769 (IPC), the Locarno Classification System, and the Turkish Patent and Trademark Office (TÜRKPATENT) Design Examination Guidelines use terms such as "interior layout," "get-up," and "interior arrangement" in relation to interior design. These terminological choices give rise to conceptual ambiguities. Although the definition of "design" under industrial property rights clearly outlines the scope of protection, the terminology used in the current system blurs the boundaries of what aspects of interior design are protected and what are excluded. Furthermore, such ambiguities may lead to conceptualization issues for stakeholders during practical processes, adversely affecting registration and post-registration procedures. Thus, this issue affects both professional practice and the protection of interior designs under the IPC.

This study investigates how the terminology used for "interior designs" within IPC-based design protection affects both registration and post-registration practices. Drawing on the literature and

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regulatory texts, a conceptual framework is established and qualitative interview data from stakeholders are analyzed through content analysis to develop theory-informed, practice-oriented recommendations.

Positioned at the intersection of interior design and industrial property rights, this study aims to provide theory- and practice-based contributions to IPC design protection by addressing terminological issues, offering policy guidance, and strengthening the status of interior design within the intellectual property system.

CONCEPTUAL ANALYSIS

Since the 1700s, the term "decoration" has been used historically, with "interior decoration" becoming common in the U.S., Europe, and Turkey (Martin, 1998; Buldaç, 2015). While Rice (2007) traces its wide use to the early 1800s, Piotrowski (2001) notes its establishment in the early 20th century. A notable shift in its use occurred in the first half of the 20th century, especially by mid-century (Martin, 1998; Tate & Smith, 1986). Following World War II, the term "interior design" increasingly replaced "interior decoration," marking a more systematic and definable field (Tate & Smith, 1986; Martin, 1998; Piotrowski, 2001). Meanwhile, with the profession's institutionalization and the start of professional practices in the early 20th century in the U.S., the term "interior architecture" also gained recognition (Özsavaş, 2011; Rice, 2007).

The Turkish Language Association (TDK, n.d.) defines the term "iç mimarlık" (interior architecture) as "designing a structure in terms of use and aesthetics according to the physical and psychological characteristics of humans; interior architecture, decorating." Özdamar (2019) describes interior architecture as a field fundamentally based on the activity of designing, while Hasol (2008) defines it as the profession and art of designing and implementing interior finishes and furniture work of a building. Kaçar (1998) defines the term as a professional field addressing interior spaces in terms of practical, aesthetic, and symbolic functions to meet user needs, producing designs suitable for human physical and psychological attributes and actions. The term is recognized not only in a historical context but also in national and international regulatory definitions. The Council for Interior Design Qualification (CIDQ) defines interior design as the planning and design of interior spaces, while the International Federation of Interior Architects/Designers (IFI) emphasizes it as a discipline aimed at enhancing human–space interaction and quality of life (CIDQ, 2019; IFI, 2011). The Chamber of Interior Architects within the Union of Chambers of Turkish Engineers and Architects (TMMOB), which joined TMMOB as its 18th chamber on May 7–8, 1976, also treats interior architecture as a specialized professional field (Chamber of Interior Architects, n.d.).

The scope of services and design activities related to the term "interior architecture," as recognized by national and international authorities, was defined in the Regulation on the Practice, Registration, and Professional Supervision of Freelance Interior Architecture

Services, published in the Official Gazette No. 26999 on 16.09.2008 by the Chamber of Interior Architects (Türk Mühendis ve Mimar Odaları Birliği İçmimarlar Odası Serbest İçmimarlık Hizmetlerini Uygulama, Tescil ve Mesleki Denetim Yönetmeliği, 2008). Notably, the regulation distinguishes between the terms "decoration/interior decoration" and "interior design" as separate activities within the profession.

Havenhand (2004) distinguishes interior design from interior decoration, yet historically they have been conflated through the gendered bias that equates the interior with the feminine and the decorative. As Vanhee et al. (2021) show, this association rooted in pre-modern domestic practices continues to shape perceptions of interior design as secondary or inferior.

Supporting this argument, Moorman (2008) highlights how media, especially television shows labeled as "design," misrepresent interior design as superficial decoration, obscuring its knowledge base. Similarly, Martin (1998) notes that interior architecture and by extension interior design is publicly perceived as closely tied to decoration. The terminological issues discussed in the literature persist today; however, while the terminologies of "decoration/interior decoration" and "interior design" share certain aspects, they differ in terms of scope and outputs. Accordingly, this study offers a conceptual analysis of these terminologies.

The term "interior decoration" denotes the aesthetic and functional arrangement of interior elements and surfaces through limited, reversible interventions such as furniture or fixture changes emphasizing material, color, and visual integrity (TDK, n.d.; Coates et al., 2009).

Interior decoration is defined as the conscious arrangement of superficial and complementary elements such as color, furniture, textures, and accessories within an existing interior shell, without altering the structural layout, in order to enhance the space's aesthetic and visual value (McCorquodale, 1988). It emphasizes non-structural additions (e.g., wall coverings, movable furnishings) that can be easily integrated into the environment (Pile, 1995). In this sense, interior decoration is understood as a practice based on visual harmony among objects, focusing on ornamental and complementary aspects rather than structural interventions (Ramstedt, 2020; Travis & Anderson, 2024; Wood & Burbank, 2004).

Brooker and Stone (2007) state that the term "interior design" has traditionally been used to describe all kinds of interior arrangement activities, ranging from decoration to complete reconfiguration. Historically, it was often associated with arranging furniture and accessories within a specific space. However, Coates et al. (2009) emphasize that the term encompasses a broader scope beyond mere arrangement of furnishings.

According to CIDQ (2019), interior design prioritizes user health, safety, and well-being. It supports user experience by addressing

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physical, mental, and emotional needs, while employing scientific and artistic methods grounded in human behavior research. Solutions are developed to be holistic, technical, creative, aesthetic, and contextually appropriate, with designs evaluated within cultural, demographic, and political contexts to ensure durability, sustainability, and adaptability.

Dodsworth and Anderson (2015), however, draw attention to the fact that the scope of the term interior design, in the context of any design problematic, may contain a certain meaning and interpretation that differs from interior decoration. The fundamental reason for this difference can be said to be the concept of "design" contained within the term and the scope of this concept. In the literature, "design" is defined from various perspectives: Archer (1968) sees it as problem-solving, Alexander (1964) as identifying correct physical components, and Owen (1993) as a creative activity using tools and language. Bilir (2013) emphasizes design as creating what does not exist, a process where concepts from experience are mentally transformed into objects, serving as a person-specific guide. Within this view, interior design is both a creative activity shaped by individual interpretation of concepts and its resulting product. Alawad et al. (2022) highlight these two dimensions of interior design. These dimensions are defined as the formal dimension that can be physically perceived and the implicit dimension that can be sensually felt. This distinction points to the multi-layered and multi-dimensional structure of the term "interior design."

Bozdayı (1996) argues that what distinguishes interior design from other artistic creations is its ability to achieve aesthetic unity and atmosphere aligned with functions and requirements. Cordan (2017) adds that such atmosphere created through elements like surfaces, materials, light, color, furniture, textiles, landscape, and details can at times emerge from a single dominant feature, but more often from the holistic integration of all components, producing distinctive and memorable atmospheric spaces.

At this point, Kaptan (2001) presents an approach regarding how interior designs differentiate and acquire an original quality. According to this approach, the user's needs, comfort expectations, habits, and aesthetic experience in an interior design are among the fundamental design inputs that determine the quality of the atmosphere the designer aims to create in that space and make the space livable. While the designer shapes the organization and composition of the space in accordance with these inputs, he/she can make his/her designs distinguishable from similar ones through original and creative approaches.

Dodsworth and Anderson (2015) state that the fundamental design input of interior design is the volumes defined and enclosed by structural components. This approach allows for an inference that the void in interior space is bounded and defined through the physical components of the architectural structure. In this context, Ching and Binggeli (2012) express floor, ceiling, wall, column, beam, window, door,

stair, furniture, and accessories as components of interior space, specific to the discipline of interior architecture. Although some of these mentioned components belong to the architectural structure, when considering interventions that can be made within the scope of interior design without interfering with the externally perceived identity and therefore character of the architectural structure, it is an undeniable fact that interior space may also have components that can be appropriated.

Based on these definitions by Ching and Binggeli, interior space components can be classified under five basic headings: surfaces, structural elements, fixtures, furniture, and accessories. According to this classification, surfaces can be addressed in two groups as horizontal and vertical; horizontal surfaces encompass the floor and ceiling, while vertical surfaces include partition walls. Structural elements can be defined as columns, beams, and load-bearing walls; fixtures include components such as windows, doors, and stairs located in an interior space. Furniture can be examined in two subgroups as movable and fixed. Finally, accessories, which are the fifth component of this classification, are also considered as complementary elements of interior space. However, in interior design, interior space components alone only define spatial elements and do not form a meaningful whole by themselves.

According to Gestalt theory, the whole is something other than the sum of its parts (components) (Koffka, 2013). Designers must transform these parts into meaningful wholes (spaces) by establishing original relationships between certain forming (design) principles, design elements, and interior space components in interior design practice. In this context, interior architects, in interior design practice, transform these parts into holistic, functional, and aesthetic spaces by establishing original and meaningful relationships between forming (design) principles (such as balance, harmony and unity, rhythm, emphasis and focus, contrast and variety, proportion and scale), design elements (point, line, surface, and volume, etc.) and the qualities of these elements (form, texture, color, light, material, etc.), and interior space components.

Based on the explanations made by theorists and authorities, a fundamental reading can be made regarding the scope of interior design terminology. Interior design can be understood as the outcome of a process where space components, design elements, and principles are transformed into a multi-layered physical and semantic structure. In this sense, the scopes and outputs of “interior decoration” and “interior design” differ within the profession of interior architecture.

THE USE OF TERMINOLOGY REGARDING INTERIOR DESIGNS IN DESIGN LEGISLATION

In the IPC, design is defined as “...the appearance of the whole or a part of a product or its ornamentation resulting from features such as lines, shapes, forms, colors, materials, or surface textures...” (IPC No.

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6769, Art. 55/1). In this context, it can be said that in the IPC, design and product are not the same concepts; the product is considered an instrumental object to which design can be applied. Furthermore, it is understood that design can be applied not only to the entirety of a product but also to a specific part or surface of it. At this point, in the product definition made within the scope of the IPC, the products to which designs can be applied are explained as "...any object produced industrially or by hand, excluding computer programs; as well as composite products or their constituent parts, objects such as packaging, presentations of multiple objects perceived together, graphic symbols, and typographic characters..." (IPC No. 6769, Art. 55/2). Although there is no direct reference to the term "interior design" or interior space in the "design" and "product" definitions included within the scope of the IPC, when the scope of the product definition is examined, it is seen that it covers a quite broad area in terms of product diversity.

Although the law does not explicitly mention interior designs, regulatory instruments issued by competent authorities such as the Locarno Classification System and the TÜRKPATENT Design Examination Guide together with design registration records in the TÜRKPATENT Design Search Database indicate that interior designs are treated as protectable designs under industrial property law.

Established under the 1971 Locarno Agreement, the Locarno Classification System organizes the products to which industrial designs may be applied and is central to design registration practice. It comprises 32 main classes, 223 subclasses, and over 6,000 product categories, and is periodically updated by WIPO (Suluk, 2003; WIPO, n.d.-a).

In the 2025 version of the Locarno Classification System, referred to as "Loc15" by WIPO (n.d.-b), when looking at the terminology usage in line with the purpose and objectives of the study, it is seen that it is addressed under Class 32 under the heading "Graphic Symbols and Logos, Surface Patterns, Ornamentation, Arrangement of Interiors and Exteriors." This class is divided into two subheadings: under code "32-01," graphic symbols, surface patterns, and ornamentations; under code "32-02," arrangements of interiors and exteriors. Regarding the subclass coded 32-02, noted as "interior and exterior arrangements involving the placement of fixed objects," various spaces are defined through the expression "arrangement of...," with examples including parks, sports fields, vehicle and boat interiors, educational facilities, offices, restaurants, shops, rooms, trains, and window displays (WIPO, n.d.-b).

In the previous version of the Locarno Classification System used by TÜRKPATENT (n.d.-a), Class 32 appears under the heading "Graphic Symbols and Logos, Surface Patterns, Ornamentation." Under this class, all elements are presented as a list under code 32-00 without any sub-classification. The expressions included in this list are as follows: "Get-up (arrangement of boat interiors)," "Get-up (arrangement of restaurant

interiors),” “Get-up (arrangement of shop interiors),” “Get-up (arrangement of the interior of a room),” “Get-up (arrangement of train interiors),” “Get-up (arrangement of window displays),” “Graphic designs (two-dimensional),” “Graphic symbols,” “Graphic symbols (comic figures),” “Logos,” “Ornamentation,” and “(Surface patterns)”. Separate from WIPO’s current list regarding the Locarno Classification System, Class 32 is not divided into subclass codes, and both “...arrangement” expression and the “get-up” expression are used together. As Turkish equivalents, the terminology “sunum” and “… içi düzenlemesi” has been used.

Another regulatory text is the “Design Examination Guide” published by TÜRKPATENT. The Design Examination Guide contains both binding and advisory guidance information regarding the application, expressing the necessary requirements and points to be considered for applicants during the design registration application process. Although the IPC does not include interior design terminology and a clear explanation directly expressing interior design, the expression “...presentations of multiple objects perceived together...” in Article 55/2 of the IPC is stated in the Design Examination Guide to correspond to examples such as “interior spaces, stores, vehicle arrangements, etc.” (IPC No. 6769, Art. 55/2; TÜRKPATENT, 2025). In this way, a general framework is presented through an indirect expression to encompass interior designs as well. When the guide is examined in terms of terminology usage within the context of the study scope, it is seen that sometimes the expressions “interior space arrangement” and sometimes “interior design” are used. However, explanations regarding design applications related to interior space are placed under the heading where the term “interior space arrangement” is used (TÜRKPATENT, 2025). Another noteworthy point is the specification that for design registration applications to be made for interior spaces, the upper class coded 32-00 of the Locarno Classification System must be used. Furthermore, when specifying the product name during application, it is emphasized that instead of using the terminology “interior design (iç mekan tasarımı),” “design (dizayn),” or “concept (konsept),” examples such as “restaurant, store, room, train” should be given and the expression “arrangement of … interior (… iç mekan yerleşimi)” should be added at the end (e.g., arrangement of kitchen interior (mutfak iç mekan yerleşimi), preferring usage in the form of “arrangement of … interior” (TÜRKPATENT, 2025).

Another practical indicator is the TÜRKPATENT Design Search Database, which contains records of registered designs searchable by criteria such as designer, applicant, or Locarno class. A search of all records between 1996 and 2023 yields 204,454 registered designs, reflecting the scope of design protection under the IPC (TÜRKPATENT, n.d.-b).

In the research conducted by entering the upper-class code 32-00 related to interior spaces in the Locarno Classification System, it was

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observed that 32,241 records were included within the class coded 32-00. However, since the upper class coded 32-00 in the Locarno Classification System used by TÜRKPATENT does not have a special class or subclass code defined specifically for interior spaces, all 32,241 records related to interior spaces that could fall within the scope of interior design activity were examined individually. In this examination, it is understood that commercial spaces such as perfumery, technology, glassware, food, restaurants, cafes, bars, beauty salons, markets, gas stations, entertainment centers, and spas are predominant; additionally, interior spaces used for various activities such as metro stations, wet areas (toilets, kitchens, bathrooms, etc.), hotels, vehicles, mosques, and fair stands have been subject to design registration (Chamber of Interior Architects, 2008; TÜRKPATENT, n.d.-b).

A noteworthy point in this examination is that, although the Design Examination Guide recommends the term "arrangement of the interior," applicants and patent attorneys frequently use alternative and non-standard product designations such as "decor," "decoration," "design," "concept," "appearance," and "exterior space arrangement" in design registration applications (TÜRKPATENT, n.d.-b).

In sum, the Locarno Classification, Design Examination Guide, and TÜRKPATENT Database indicate that designs encompassing interior spaces are protectable as industrial designs, even though "interior design" is not explicitly named. This protection extends not only to interior design works but also to spatial layouts and volumetric arrangements arising from decoration, arrangement, and placement practices.

METHOD

The findings presented in the research are based on the doctoral thesis study conducted by the first author under the supervision of the second author, and the data obtained during the research process carried out within this study, with the necessary permissions obtained in accordance with the decision numbered E-35853172-663.08-00002356461 taken at the meeting of Hacettepe University Senate Ethics Committee on August 9, 2022.

The qualitative research method (Yıldırım & Şimşek, 2021; Tanyaş, 2014), in which qualitative data collection techniques such as observation, interview, and document analysis are used and comprehensive and detailed data are obtained in terms of information diversity through a purposefully selected sample, is the basic approach adopted in this study. The "case study" method, one of the qualitative research approaches that can cover various subjects such as individuals, processes, groups, and places, and whose purpose is to describe, understand, predict, and/or control phenomena (Creswell, 2013; Yin, 2008; Woodside, 2010; Gerring, 2006; White & Cooper, 2022), was preferred. Among the cases addressed in accordance with the research approach and the design types determined based on their structure, a

holistic single-case design was used. Additionally, explanatory and descriptive research designs that allow for the detailed examination of a specific case within its real-life context and aim to examine how and why a phenomenon occurs in complex real-world situations (Yin, 2008; Yin, 2017) were utilized in the research.

In the conducted research, since sampling does not aim to represent the entire universe, non-probability sampling was preferred in determining participants in accordance with the research purpose. In the preferred sampling method, classifications were made using expert and criterion sampling methods to reach in-depth and meaningful data; the snowball sampling method was used to reach participants.

"Interview" was preferred as the data collection technique. In these interviews, a semi-structured question technique (Yıldırım, 1999; Merriam, 2009) consisting of open-ended questions was used around the research problematic axis to collect data.

The collected data were analyzed using the content analysis method. Within the scope of the study, the procedure related to content analysis was structured by adhering to the general framework in the literature.

The procedure followed in the content analysis process is as follows: classification of data, labeling of participants, transcription, immersion in data, coding, creating categories, and reaching themes (Rose, 2012; Merriam, 2009; Yıldırım & Şimşek, 2021).

Interviews were conducted face-to-face or online. The sample group of the research consists of Patent or Trademark Attorneys (referred to as "attorneys" in the text) who make registration applications on behalf of applicants wishing to obtain design registration, court experts involved in legal processes, judges who are serving or have previously served in intellectual and industrial property rights courts, and experts from TÜRKPATENT Design Department and General Directorate of Copyright. The criterion for court expert was determined as actively serving as court expert for at least 10 years. The criterion for attorneys was also determined as having at least 10 years of experience in the field. In the interviews, audio recordings were made with the permission of the participants.

Interviews were conducted with a total of 32 participants. The distribution of the 32 participants according to sample groups is given in Figure 1. A total of 20 hours, 3 minutes, and 23 seconds of audio recording data were obtained from the conducted interviews. The audio recordings obtained from participants were transcribed using an online transcription application. Unlike the doctoral thesis study from which the study data were obtained, the transcriptions were re-examined using the content analysis method in line with the purpose and objectives of this study, and four themes were reached.

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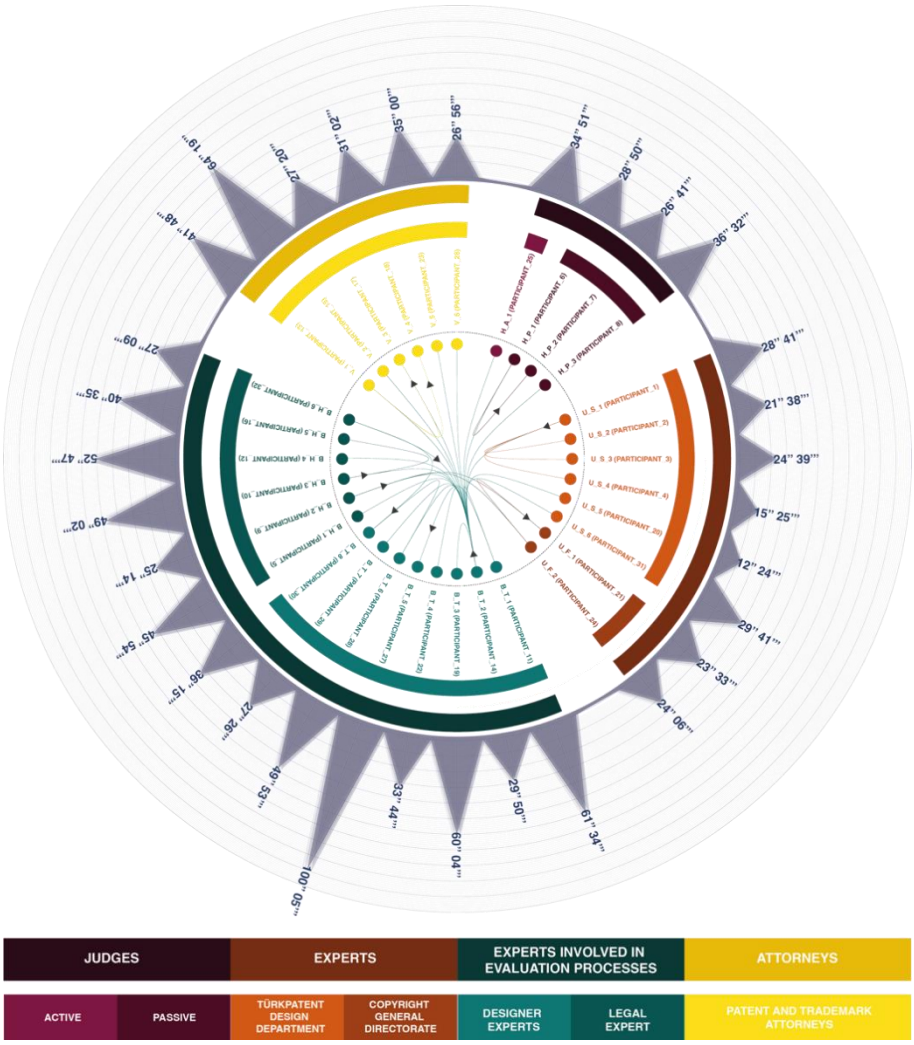


Figure 1. Labeling of participants and general reflection of indicators related to interview data.

FINDINGS

The audio recordings were transcribed using an online tool and reanalyzed through content analysis, yielding four themes, which are presented with their respective categories in the following sections.

Theme 1: Protection of Interior Designs as Designs Under the Industrial Property Code No. 6769

Industrial property experts stated that interior designs are expressed with terms such as "interior space arrangement," "arrangement design," "interior arrangement of a space," and "get-up" within the scope of the IPC; that they are included in Class 32 of the Design Examination Guide and Locarno Classification System, and that they can receive protection as designs within this scope. Similarly, some court experts also stated that these designs are evaluated as "arrangement," "organization," and "design."

Some participants attempted to explain what is protected in interior spaces that may be subject to design protection under the IPC in terms of the terminology used. While one judge stated that this legal protection is provided through "appearance," he emphasized that to clarify the framework specifically for interior spaces, it is not the

appearance of the elements contained in an important interior space, but the appearance of the whole created by these elements coming together. With a similar view, a designer court expert also stated that within the scope of protection, the "general perception" created by the elements forming the interior design as a whole is protected. One expert and another judge emphasized that the appearance in an interior design stems not from the volume or elements in the space, but from the "ambiance" and "atmosphere" created by these elements coming together, and that within the scope of the IPC, interior designs can be protected when their appearance providing this "general ambiance" and "atmosphere" meets the conditions of "novelty" and "distinctive character."

Theme 2: Problems Related to Terminology Usage in Legislation, Design Examination Guide, and Locarno Classification System

Participants generally noted that the terminology used in the IPC, the Design Examination Guide, and the Locarno Classification System gives rise to various practical and theoretical problems.

Some experts stated that there is no specific distinction for interior designs in the Locarno Classification System. Therefore, it was noted that applicants cannot easily determine whether designs similar to or identical to their own interior designs exist through the Official Design Bulletins and Design Search Database published by TÜRKPATENT at regular intervals. Similarly, some attorneys also emphasized that they experience difficulties due to the Locarno Classification System when researching interior designs in the design registration processes they conduct as representatives.

In addition to this situation, some participants noted that using different expressions such as "...interior arrangement" and "get-up" in the Locarno Classification System, and "...interior space arrangement" in the Design Examination Guide instead of "interior design" as the product name can cause problems for applicants in determining product names and can be reflected in the registration process in various ways. An expert who substantiated this situation stated that applicants generally use terms such as "concept," "design," and "decoration," other than the names included in the Design Examination Guide.

Some attorneys stated that they experience difficulty in searches conducted by entering 'product name' to reach interior spaces that have been subject to design registration among all designs included in this class, particularly through the TÜRKPATENT Design Search Database used as a practical method in research, due to no distinction being made in Class 32. It was noted that this difficulty stems from applicants using different expressions than the terminology specified in the Design Examination Guide.

Participants stated that there are various problems in the legislation, the Locarno Classification System, and the Design Examination Guide regarding terminology usage. It was expressed that due to the lack of

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explicit inclusion of the term "interior design," the preference for different expressions instead, and the indirect nature of explanations, stakeholder perception regarding the subject is negatively affected, and this can lead to various problems. In this context, it was emphasized that the use of expressions such as "... interior space arrangement" used when determining product names in the Design Examination Guide, and "... interior arrangement" and "get-up" in the Locarno Classification System, without using the term "interior design," can create a perception that interior spaces that are the output of activities other than design are being protected.

One expert stated that the use of terms "arrangement" and "organization" can lead to debates about what is the subject of protection in interior spaces and conceptual uncertainty for all stakeholders. A judge noted that the definition of "design" in the legislation is based solely on the "appearance" characteristics of design, and that considering this definition together with the expressions "arrangement" and "organization" used for interior designs in IPC practice can affect the perception of protection provided by the IPC. According to the participant, expressions such as "organization" and "arrangement" do not suggest evaluating an interior space as a design in terms of quality; they can only cause a false perception that it would be sufficient for an interior space created through such activities to meet the "novelty" and "distinctive character" conditions envisioned for designs. Similarly, a designer court expert also expressed that a perception is formed that only the appearance created by the differentiation of arrangement or organization related to an interior space is protected.

One participant stated that he/she evaluates the expression "...presentations of multiple objects perceived together..." in the product definition in the IPC as an explanation that includes interior designs within the scope of protection. However, he/she emphasized that this expression was difficult to understand even by TÜRKPATENT in the early years of work conducted within the scope of industrial property rights, and that attempts were made to clarify it through explanations made in the Design Examination Guide regarding protection during the process. In this context, another expert who stated that they experienced hesitation about what would be protected when the first interior design application came, expressed that it could not be understood whether fixtures or another element would be protected; at this point, they drew similarities with showcase designs and evaluated in this way. He/she stated that in showcase designs, the elements inside the showcase are generally not protected, and they look at "the ambiance created by the composition formed with those elements within that volume." Although it may be perceived as "arrangement" or "organization," he/she expressed that it should not be an "ordinary" arrangement and organization.

A designer court expert stated that due to the terminology and explanations used, the scope of protection is limited to the appearance of an interior space created solely on the axis of "organization" and "arrangement." However, he/she drew attention to the fact that interior spaces designed with existing elements may differ, particularly in terms of "proportion" and "floor plan," which can also affect appearance. Most participants also expressed from a similar perspective that in the act of creating a similar or identical interior design, that is, attempting to imitate a design, these designs can be perceived as different due to different floor plans. It was emphasized that the terms "arrangement" and "organization" are open to interpretation in design registration practice and therefore can lead to misdirection. In this context, one participant commented through a hypothetical example; he/she stated that, for example, he/she created a conference hall arrangement in a circular space and made an interior arrangement by placing seating elements with a specific arrangement logic, and that this met the design protection conditions under the IPC. However, he/she noted that if the same arrangement were applied to an area with a different floor plan, it would inevitably have a different appearance, and in this case, he/she thought that the interior design could not be protected.

Similarly, another court expert stated that, particularly due to differences in floor plans, interior spaces resulting from "arrangement" and "organization" activities carried out in interior spaces show similarity rather than being identical, and that this situation is frequently encountered. He/she expressed that these similarities may stem from existing elements used within the interior spaces in question, even if the floor plans are different; therefore, attention should be paid to both the overall impression and the elements used in evaluations. Another participant sharing the same view stated that the overall impressions created by compared interior designs on the informed user may differ, and the elements used play a determining role in the formation of this difference.

Another participant expressed that in the "distinctive character" evaluation made during the design comparison process, even if the floor plans are different, when viewed holistically, the overall impression created by the identified differences on the informed user is important. Within the scope of this evaluation, he/she noted that colors, materials, some furniture, and fixtures can be copied and used in an interior space with a different floor plan; despite differences in "floor plan" and "arrangement layout," the "atmospheres" formed in the whole can be similar.

On the other hand, another view shared by participants is that due to the terms used in the current system, it is not clearly stated that the elements (furniture, fixtures, accessories, etc.) included in interior design must belong to the applicant, and this situation leaves room for interpretation. It was expressed that problems may be experienced due

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to the elements it contains in a design registration application for an interior arrangement or organization structured in this way.

Experts stated that applicants or attorneys making applications on their behalf can use elements belonging to others or already existing elements in interior spaces that are the subject of design registration. While these elements may belong to a single person or only one company in some cases, it was stated that in some applications, numerous elements belonging to different persons or companies are seen together. Additionally, attention was drawn to situations where interior spaces subject to application can contain elements belonging both to the applicant and to different persons or companies together. It was expressed that this situation is thought to be dependent on the terminology used and the explanation of "interior space arrangement."

Another court expert participant mentioned another dispute issue. He/she stated that furniture located in an interior space protected by design registration can have similar items used by third parties in commercial activities. In this context, he/she expressed that furniture included in an interior design can be furniture belonging to another person that is under protection by design registration. Therefore, he/she emphasized that a partial invalidity decision could be made for the registered interior design.

An expert and an attorney stated that when making design registration applications in the face of such situations, regarding the method they follow, they think that every element included in an interior space that will be subject to design registration should be designed specifically for that space. For this reason, they expressed that they request applicants to make applications by removing visual representations of elements such as tables, chairs, armchairs, and accessories that do not belong to them.

Other points where both participant groups meet on common ground were identified as: most interior designs subject to design registration do not have design characteristics, and applicants either have no knowledge about the subject or have very limited knowledge.

Experts and attorneys stated that applicants experience a significant knowledge gap regarding design registration. It was expressed that applicants can make applications without thinking about questions such as "What is a design?", "How should it be?", "Do I have an interior space that can be subject to design registration?". Some participants related to the subject emphasized that the protection system is open to everyone; however, due to this knowledge gap, applications that contradict the basic logic of the IPC can also be made. Some experts and attorneys stated that applicants can even apply for design registration for the appearance they obtain by simply "placing" only a chair and a table within a volume with four walls in the most general terms.

Regarding the subject, an attorney stated that applicants may want to make design registration applications with interior designs consisting of elements not belonging to them.

Although the fundamental reason for the problems expressed in the responses given by participants was stated as the knowledge gap of applicants, some participants emphasized that this situation essentially stems from terminology usage.

Theme 3: Views and Recommendations Presented Regarding Legislation, Design Examination Guide, and Locarno Classification System

Many participants agreed that the absence of the term "interior design" in the legislation leads to interpretive differences and practical uncertainty.

One expert stated that he/she evaluates the expression "...presentations of multiple objects perceived together..." in the product definition in the IPC as an explanation that includes interior designs within the scope of protection. However, he/she expressed that this expression is difficult to understand, and that this issue was attempted to be clarified through explanations made in the Design Examination Guide regarding protection during the process. He/she still stated that the expression does not carry complete clarity and that the uncertainty should be eliminated by adding the expression "interior design" through an arrangement to be made.

Along with a similar view, some participants stated that although there are explanations that the expression "...presentations of multiple objects perceived together..." in the current legal text covers interior designs, both this expression and the explanations are insufficient, and the concept of "interior design" should be explicitly included.

Some participants with legal backgrounds stated that problems regarding terminology related to "interior designs" can be resolved not directly through the IPC, but through arrangements to be made specifically in the Design Examination Guide and Locarno Classification System. A legally trained court expert emphasized that law operates with general rules rather than a casuistic (case-based, detailed rule-based) method, and that arrangements made in this way would be contrary to the legal system.

Participants generally drew attention to the inadequacy of expressing interior designs, particularly as "arrangement." It was expressed that this situation causes focus only on placement methods rather than the holistic effect of elements forming the interior space and therefore may produce erroneous results in the evaluation process. It was emphasized that the terminology needs to be reconsidered in this context.

Some participants stated that even when the same elements are used, interior spaces may differ in floor plans, arrangements, and organization. They noted that interior designs meeting the criteria of novelty and distinctive character can therefore be protected under the IPC. In this context, it was emphasized that dominant elements may determine the distinctive character of a design, and that another interior

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created by copying or adding to these elements may produce a similar overall impression. Accordingly, although the terms "arrangement" and "organization" are used, differences in layout alone should not be decisive in evaluating interior designs.

Participants stated that due to the nature and structure of interior design, using some existing elements is a necessity. Indeed, in parallel with the views that this situation may also constitute a rights violation, they presented various recommendations regarding such interior spaces that will be subject to design registration.

Some participants expressed that it should be determined whether the elements used in an interior space belong to the applicant or not, and whether this affects the "overall impression" of the design in question. If this overall impression stems from elements not belonging to the applicant, it was stated that an interior space created only through "arrangement" and "organization" activities may not meet the protection conditions.

Some attorneys and experts stated that obtaining permission documents for the use of elements not belonging to the applicant in design registration applications could be a solution. However, it was also expressed that the practical applicability of this method is low.

Therefore, the absence of elements not belonging to the applicant in design applications was presented as an alternative recommendation. Thus, it was expressed that basing the evaluation to be made solely on the appearance belonging to the applicant would yield healthier results.

A designer court expert sharing a similar view stated that this method could both reduce the possible risk of rights violation and more clearly determine whether the remaining design elements have "novelty" and "distinctive character."

Theme 4: Participants' Conceptualization Problems Regarding "Interior Design" Terminology

Some participants made various explanations regarding interior design during the interviews conducted. These explanations present perspectives on how and in what way participants approach interior design.

Some participants' statements during the interviews reveal how they approach and conceptualize interior design. Most participants defined interior design solely as bringing together and organizing existing elements. While some limited this process to furniture arrangement (armchair, sofa, bed, etc.), one participant expressed that new compositions are created by selecting different colors and materials from catalogs. A legal court expert stated that interior design is generally conducted with imitative approaches such as "combination," "harmonization," "collage," and "patching." A designer court expert emphasized that such activity and the production resulting from this activity cannot be design. With a similar perspective, some participants expressed that the concepts guiding interior design activity are

"fashion" and "trend," that everything is shaped according to these concepts, and that the activity performed is not a design but rather a decoration activity performed solely to meet these concepts. In this context, another participant expressed from a different perspective that interior design activity is an activity that only seeks solutions to functional problems.

Some participants stated that interior spaces are arranged like mathematical operations through template plans and their derivatives are organized; another participant noted that "type projects," which he/she referred to as "copy projects," make interior designs non-original because they can be applied repeatedly; they are variations of each other or identical.

CONCLUSIONS AND RECOMMENDATIONS

In the theoretical framework established in the conceptual analysis section of the study, it can be said that there is a reductionist approach that leads to a conceptual narrowing in terms of the scope and outputs of "interior design" terminology due to transitions experienced in the historical process and prejudices accompanying these transitions. In the literature, it can be stated that these terminology-based problems also exist in the field of design protection provided under industrial property rights; the absence of "interior design" terminology in regulatory texts and the preference for expressions such as "get-up," "arrangement," and "placement" instead can cause conceptual uncertainties and practice-oriented problems in design registration processes.

In interviews conducted with court experts, experts, attorneys, and judges who have served or are serving in Intellectual and Industrial Property Rights Courts, it was determined that some of the participants generally view the term "interior design" as equivalent to decoration/interior decoration in terms of scope and outputs; they can even define interior design in some cases as "patching," "harmonization," "collage," or "combination" made using existing elements.

Participants express that due to the nature and structure of interior design, floor plans will inevitably be different. It is thought that arrangements, organizations, and presentations located within different plans - even if existing elements are similar - can be evaluated as different; this situation may be subject to design protection. It is understood that, particularly the vast majority of applicants, with this perception, perceive the concept of "interior design" as an activity such as merely placing furniture and fixtures within a volume. The registered interior space examples in TÜRKPATENT Design Search Database records and the product naming preferences in these applications can also be accepted as concrete indicators of this perception break.

Regarding interior designs, a view emerges that "design" protection provided under industrial property rights should be granted only to interior spaces created with elements belonging to the applicant and

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meeting the criteria of "novelty" and "distinctive character." The basis of this view lies in some participants evaluating applications made using existing elements as decoration/interior decoration activities; and others viewing the inclusion of elements belonging to others (registered, unregistered, or in the public domain) in an interior space subject to registration as a violation of industrial property rights or a situation conflicting with the principles of these rights. It can be said that this perspective emerges from the evaluation of interior spaces intended to be subject to registration on the axis of the literal meanings of these terms, due to the use of terms such as "... interior space arrangement," "... interior arrangement," and "get-up" in interior design registrations. However, this approach does not align with the nature and structure of interior design. Because the use of existing elements is one of the natural reflexes of this design practice. The point to be noted here is that this usage should align with the scope and outputs of the "interior design" activity. That is, results emerging solely from arrangement and placement activities should not be evaluated as interior design by themselves.

The currently used terms "... interior space layout," "... interior arrangement," "get up" and "presentation" are inadequate in expressing what a multi-layered design practice like "interior design" entails and its output; these expressions also fail to correspond to certain perspectives adopted in "novelty" and "distinctive character" assessments. It is understood that the concept of "atmosphere" mentioned in the literature regarding the scope and outputs of interior design is also taken into consideration by experts and some court experts during the evaluation processes related to design registration. In this context, it is stated that in the current system where the same principles apply to all designs, within the framework of "novelty" and "distinctive character" evaluation, when interior designs contain elements that are not physically interconnected and existing elements are utilized, evaluators examine the resulting "ambiance" and "atmosphere" to perceive the design holistically. However, it is understood that the terms used in the current system are insufficient in reflecting the spaces created through the design action that lies at the core of interior design. The fact that the term "interior space layout" is particularly more associated with physical positioning indicates that the evaluation is conducted based on placement arrangement.

Another perspective involves the concern that the perception created by the terms "... interior space layout," "... interior arrangement," "get up" and "presentation" may weaken the protection of interior spaces subject to design registration. The foundation of this concern lies in the argument that interior spaces will inevitably differ due to variations in their floor plans; therefore, interior spaces formed within the framework of layout and arrangement terms will not be identical, and these differences may even be considered as distinctive characteristics, meaning that the overall impressions created by compared interior

spaces on informed users may differ. It is believed that this situation could undermine applicants' confidence in the protection provided by the IPC.

Another perspective is that the terms used in the regulatory texts of the current system reduce the scope and outputs of "interior design" activity to a certain level; moreover, the absence of a separate subclass definition in the Locarno Classification System further reinforces this perception. On the other hand, it is understood that inconsistencies among regulatory texts regarding terminology usage and the absence of subclasses in the Locarno Classification System can negatively affect design registration processes.

On the other hand, the interviews revealed that applications for interior designs are classified under the superclass coded 32-00; however, this class also encompasses products quite different from interior design, such as graphic symbols, logos, and surface patterns. This situation creates both conceptual and functional difficulties for individuals conducting research in databases and may also pose problems in terms of the perception it creates. At this point, it is recommended that the term "interior design" be added to this class through a regulatory amendment.

It is also suggested that an indicator be used by defining the field of activity and that the expression "interior design" be added thereafter.

Through these proposed arrangements, the "design" protection provided under industrial property rights specifically for interior spaces will begin to express a product that corresponds to the scope and outputs of interior design, beyond mere physical placement. This will ensure consistency between the perspectives adopted in the registration process and subsequent evaluations and the expressions in regulatory texts; conceptual ambiguities and implementation problems caused by terminology will be prevented. Moreover, with the proposed classification arrangements, it will be possible to classify applications specific to interior design more accurately, establishing a more equitable system for both applicants and evaluators. This approach aligns with the innovation-encouraging purpose of Industrial Property Code No. 6769 and enables the development of the protection system for interior designs.

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Research Article

A Taxonomy of Object/Building Oriented Viewpoint Selection Methods in Architecture: A Systematic Review

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Abstract

This study systematically examines 3D viewpoint selection techniques, focusing on object- and building-oriented methods. The research aims to fill the research gap created by the fact that different disciplines in literature (computer graphics, architecture, and urban planning) have addressed viewpoint selection in isolation, and to integrate these methods under a holistic taxonomy. Conducted in accordance with PRISMA guidelines, the methodology involved a search of the Web of Science, Scopus, and Google Scholar databases covering a broad time span from 1988 to 2025. The search utilized the keywords "viewpoint research method", "viewpoint selection algorithms/methods", "classifications of viewpoint selection methods" and "viewpoint selection"; out of over 7,000 sources, 38 foundational studies with the highest methodological suitability were included in the detailed analysis. The methods were classified into six main categories: geometric, aesthetic, visual features, semantic, deep learning, and architecture/urban model based. The findings indicate that geometric and entropy-based methods dominate in object-oriented approaches, while GIS (Geographic Information Systems)-based spatial analyses and GPU-accelerated real-time visibility calculations take precedence in building-oriented approaches. The analytical value provided by this proposed classification lies in its clearly identifying the most appropriate computational strategy for each domain by differentiating methods based on the scale of application (from individual objects to urban fabrics). This study contributes to literature by providing a fundamental reference point for viewpoint determination systems in hybrid fields such as smart cities and interactive digital museology.

Keywords: *Architectural visualization, Holistic taxonomy, Systematic review, 3D scene analysis, 3d viewpoint selection*

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INTRODUCTION

Viewpoint selection is the process of determining the most appropriate camera position and orientation within a three-dimensional (3D) scene or object to maximize visual clarity, information transmission, and aesthetic value. This concept is of critical importance in many different disciplines, such as computer graphics, scientific visualization, architectural design, urban planning, photography, and museology. Presenting complex 3D data which is difficult to comprehend in two dimensions from the correct viewpoint reduces visual clutter, enhances data reliability, and strengthens the user's spatial perception. In this context, viewpoint selection methods documented in literature are discussed in chronological order.

In the early stages of technological development, researchers often used geometric methods to evaluate viewpoints. By examining the quantity of minimally degenerate faces in orthogonal projection, Kamada and Kawai adopted a methodology (Kamada & Kawai, 1988). To get goodness viewpoints, Roberts and Marshall used the morphological graph method (Roberts & Marshall, 1998). Kamada's method was refined by Plemenos & Benayada (1996), who also suggested a good view measurement based on projected area. A novel approach to virtual camera location based on scene visibility and viewpoint quality was put forth by Fleishman (Fleishman et al., 2000). Barral created an algorithm that uses the best viewpoints to automatically direct the camera through a 3D scene (Barral et al., 2000).

These have led to the creation of some effective methods, including the viewpoint entropy method by Vázquez et al. (2001), the silhouette stability method by Gooch et al. (2001), the mutual information theory, viewpoint, information theory-based shape analysis algorithm by Feixas (2002) and Page et al. (2003), and the graph-based image segmentation method for viewpoint exploration by Felzenszwalb & Huttenlocher (2004).

In 2005, several new techniques emerged because of advances in information theory and visual perception. Katz et al. (2005) proposed a mesh segmentation algorithm based on feature point extraction, Lee et al. (2005) proposed a mesh saliency method, Plemenos et al. (2005) proposed a relative entropy method and Polonsky et al. (2005) proposed an inductive method for viewpoint selection.

The mesh saliency and mesh segmentation technology also deeply affected viewpoint calculation. Attene et al. (2006) conducted a comparative study on the grid segmentation algorithm, Shilane & Funkhouser (2007) analyzed the special region of 3d surface. Fu et al. (2008) conducted research on 3D object posture and position in relation to viewpoints. Laga (2010) developed a semantic-driven approach to automatically choose the optimal viewpoint of a 3D object, and Vieira et al. (2009) developed an intelligent viewpoint learning method for 3D scene understanding. In addition, The Leibler (vSKL) distance method was used to measure viewpoint significance (Serin et al., 2011), and Biedl

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et al. (2011) adopted an efficient viewpoint selection method that used a convex polyhedral silhouette.

Network saliency and region of interest have gradually attracted the attention of scholars after 2011. Han et al. (2014) researched a saliency-based viewpoint selection method, Serin et al. (2013) used representative images to select the best viewpoints and segmentation, and Leifman et al. (2016) proposed a viewpoint selection method based on region of interest. A new avenue for viewpoint research was made possible by Xing's heuristic algorithm for surface reconstruction based on visual perception (Xing et al., 2013).

With the development of deep learning, after 2014, viewpoints research also tends to use neural networks. Su et al. (2015) used 3D models to train the convolutional neural network (CNN) for the viewpoint estimation, Francisco Massa et al. (2016), designed a multi-task CNN to realize viewpoint estimation. George Leifman et al. (2016), selected viewpoint clusters based on the visually interesting part of the network, while Jeong & Sim (2017) used a semi-regular grid to find a saliency region. Multi-viewpoints also garnered interest. To accomplish a recursive estimation in 3D scene reconstruction, Engler & Wuensche (2017) employed multi-pair virtual cameras. A method for correlation, retrieval, and reconstruction in large-scale 3D scenes based on numerous views was created by Rahul Sawhney et al. (2018).

Regarding the building-focused viewpoint, the central focus of the study is the skeleton line extraction method, a widely used GIS technique that forms the basis for viewpoint selection, was employed (Chen & Qian, 2022; Lewandowicz & Flisek, 2020). In addition, the Efficient Precise Viewpoint Selection (EPVPS) method (Tang et al., 2025), which aims to select the optimal viewpoint for the maximum field of view within a given area, was applied. The starting point for the method, which offers a multi-viewpoint option, was the Empty Circles-based K-means (ECKM) technique (Biswas et al., 2023; Ikotun et al., 2023). Similarly, methods such as intelligent systems capable of performing image analysis from multiple viewpoints (Ma et al., 2023; Civicioglu & Besdok, 2024), Apache Spark's multi-level distributed technology (Dong & Zhang, 2023), and GPU parallel computing capabilities (Xiao et al., 2024) are also among the techniques used.

Early studies in literature are generally object-oriented and focus on the visibility of objects in architectural spaces and the selection of the optimal vantage point. Current approaches, however, generally focus on specific application areas (computer graphics, architectural viewpoint selection methods, or GIS-based urban analyses). These methods, which have been used from the past to the present, have not been addressed holistically within an interdisciplinary framework. This situation prevents the establishment of a methodological bridge between objects on the micro scale and urban buildings on the macro scale. This gap in the existing literature constitutes a fundamental research gap that makes it

difficult for researchers to select the most appropriate method for different scales and objectives.

This study was conducted to address this research gap and to consolidate the methods scattered throughout the literature under a systematic taxonomy. With the advancement of technology (such as deep learning, smart cities, and interactive museum applications), the need for viewpoint determination systems is growing rapidly. The primary objective of this study is to bring together methodological approaches from different disciplines under a common terminology, thereby providing a comprehensive and practical reference point for future research. Accordingly, the objective of this study is to classify 3D viewpoint selection techniques into two main categories object-oriented and building-oriented strategies and to highlight the analytical value of these methods.

Within this framework, the study seeks to answer the following key questions:

RQ1: How can the 3D viewpoint selection techniques in literature be systematized under object-oriented and building-oriented paradigms?

RQ2: What are the key methodological differences between object-oriented and building-oriented approaches, and in which areas do they each have an advantage over the other?

RQ3: In this process, which spans from traditional geometric methods to modern deep learning models, what are the current approaches that yield the most effective results at the architectural and urban scales?

To classify viewpoint selection methods within this scope, comprehensive research was conducted through a building literature review on articles from different disciplines, theses on the subject, book chapters, algorithms written for method improvements, tools used and methods developed. Based on the data obtained, the methods were categorized into two main groups according to their focus, the types of solutions they offer, and the types of tools and data they use. The main object-oriented and building-oriented approaches are also divided into six headings according to the type of system they are based on. These headings are elaborated on topics such as information production methods, visual perception patterns, deep learning techniques, aesthetic concerns, and urban and architectural connections. Viewpoint selection methods, which are handled with an interdisciplinary approach, offer solutions that can be integrated into different areas of use with developing technological systems.

A METHODOLOGICAL OVERVIEW of VIEWPOINTS

The methodologies were organized into two principal categories predicated on their focus and the nature of the data utilization:

Object-Oriented Methods: These methodologies ascertain optimal viewing angles through the examination of an object's geometric properties, visual characteristics, or semantic representations.

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Building-Oriented Methods: These methodologies are employed in contexts such as urban environments or architectural buildings, wherein viewpoint selection is contingent upon spatial data, visibility assessments, and patterns of user mobility. Within each primary category, subcategories were delineated based on their fundamental strategies (e.g., geometric analysis, entropy assessment, visual attention modeling, machine learning applications, GIS-based techniques). Furthermore, implementation tools and software, including MATLAB, ArcGIS, OpenGL, or neural network frameworks, are documented to identify common development trends.

DATA ANALYSIS

This study is a systematic review and taxonomic classification examining object- and building-oriented 3D viewpoint selection techniques. In accordance with the PRISMA guidelines for systematic reviews (Page et al., 2021; Rethlefsen et al., 2021; Elsman et al., 2024; Torre-López et al., 2024), methods for selecting the optimal viewpoint have been classified in the fields of architecture, urban planning, photography, museology, and object design.

For a systematic review and taxonomic classification, we conducted a search in the Web of Science, Scopus, and Google Scholar databases covering studies from 1988 to 2025 using the keywords “viewpoint research method”, “viewpoint selection algorithms/methods”, “classifications of viewpoint selection methods” and “viewpoint selection.” The sources obtained from this search are presented in Figure 1.

After rigorous screening for relevance, age, accessibility, and methodology, we processed 1,079 WOS sources (excluding 422 irrelevant, 75 old/inaccessible/unclassified), 2,862 Scopus sources (excluding 296 duplicates, 1,059 out-of-scope, 1,024 for other reasons), and 3,490 Google Scholar sources (excluding 1,840 off-topic, 1,482 for inaccessibility/duplicates/outdated technology). The reasons for excluding “outdated” or ‘inaccessible’ sources are detailed as follows:

- **Age Criterion:** Studies published before 1988, as well as “obsolete technologies” that do not form the basis for current 3D computing environments, digital spatial analyses, and modern rendering technologies, have been excluded.
- **Accessibility Criterion:** Sources for which the full text is not accessible via institutional databases or that do not contain sufficient methodological data for classification have been excluded to ensure the reliability of the analysis.

- **Methodological Suitability:** Studies that remain purely theoretical and do not present an applicable algorithm or mathematical model have been excluded from the scope.

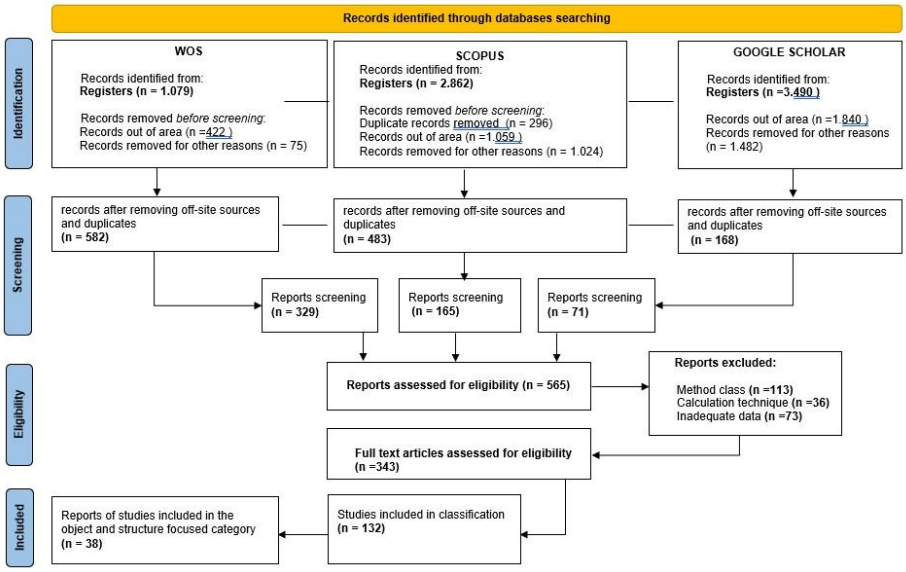


Figure 1. Process for systematic review and taxonomic classification of object and building-oriented viewpoint selection methods (sourced by authors)

Based on these criteria, the number of sources was reduced to 565. The process of narrowing down the remaining sources to 38 is as follows, step by step:

1. Initial Classification: As a result of preliminary screenings based on abstracts, methods, and research fields, 565 sources (329 WOS, 165 Scopus, 71 Google Scholar) were identified.

2. Method and Technical Filtering: In this stage, 113 sources were excluded due to inconsistency in method classification, and 36 sources were excluded due to insufficient computational techniques.

3. Insufficient Information Screening: During the review, an additional 73 sources that did not provide detailed data were excluded, and 343 full-text articles were selected for detailed analysis.

4. Taxonomic Focus: While 132 of these texts contributed to general classification, the 38 core studies presented in Table 1 were selected as those with the "highest methodological suitability," as they directly provided methodological data and algorithms for object- and building-focused approaches.

In addition, the screening and coding processes for this study were conducted independently by the authors, and any disagreements were resolved through joint review.

SYSTEMATIC LITERATURE REVIEW

In the study, viewpoint selection methods and algorithms including object-oriented and building-oriented approaches (Table 1) were classified into six main categories under method-specific subheadings. This table forms the framework of the taxonomy and explains why the selected 38 sources were considered "core sources" by highlighting the specific algorithms and methods they present.

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Table 1. Viewpoint selection methods and algorithms using systematic review method (sourced by authors)

Source	Method / Algorithm	Explanation
Kamada, T.& Kawai, S. (1988)	Method based on geometric knowledge	The least number of degenerate faces in the orthogonal projection is examined as part of a methodology.
Roberts, D.R. & Marshall, A.D. (1998)	morphological graph method	A description of the object's model and the visibility of its faces serve as a planning system for choosing viewpoints.
Plemenos, D. & Benayada, M. (1996)	Method based on the projected field	Plemenos and Benayada developed Kamada's method and proposed a measure of opinion.
Fleishman, S.et al. (2000)	Based on quality of viewpoint	A novel method for virtual camera placement based on scene visibility and viewpoint quality was presented by Fleishman.
Barral, P.et al. (2000)	Use of virtual camera based on 3D scene visibility	Barral developed an algorithm that automatically moves the camera through a 3D scene by utilizing the best viewpoints.
Vázquez, P. P.et al. (2001)	viewpoint entropy method	To calculate entropy, a probability distribution function must be used.
Gooch, B.et al. (2001)	silhouette stability method	To determine the format, viewpoint, and arrangement of a picture of a three-dimensional object, a method based on heuristic composition rules is described.
Feixas, M. F. (2002)	mutual information theory	The degree of correlation or dependency among all points or components of a scene is known as mutual information.
Page, D. et al. (2003)	information theory-based shape analysis algorithm	A method for calculating shape information for 3D triangular meshes and 2D planar contours is introduced.
Felzenszwalb, P. F.et al. (2004)	graph-based image segmentation method	One important aspect of the method is its ability to preserve detail in low-variability image regions while ignoring detail in high-variability image regions.
Katz, S., Leifman, G.et al. (2005)	a mesh segmentation algorithm based on feature point extraction	The algorithm presented here generates hierarchical segmentations into meaningful components of orientable meshes.
Lee, C. H.et al. (2005)	method of mesh clarity	Low-level cues from the human visual system served as the inspiration for the salience concept.
Plemenos, D., Sbert, M.et al. (2005)	relative entropy method	The method is based on selecting the view that minimizes the Kullback-Leibler distance between the mixture of the distributions of all selected viewpoints and the actual field distribution.
Polonsky, O.et al. (2005)	An inductive method	The descriptors of the model consist of 3 principles: a descriptor based on an accepted measure of geometric complexity for a 3D shape, a descriptor based on inherently appearance-dependent features, and a descriptor that assigns values to some semantic part of the model.
Attene, M.et al. (2006)	grid segmentation algorithm	The main idea of the algorithm is to first find meaningful components while keeping the boundaries between components fuzzy.
Shilane, P.et al. (2007)	shape-based surface separation calculation	Shilane analyzed a specific region of the 3D surface.
Fu, H., Cohen-Or D.et al. (2008)	A supervised learning approach on orthogonal orientation of 3D model	Fu has studied the location and pose of 3D objects in relation to viewing angles.
Serin, E., Doger, C.et al. (2011)	distance method	Viewpoint importance was assessed using the Leibler (vSKL) distance approach.
Vieira, T.et al. (2009)	Learning approach with support vector machines	Vieira, Laga, and Biedl used a convex polyhedral silhouette as an efficient viewpoint selection technique.
Leifman, G., Shtrom, E.et al. (2016)	A viewpoint selection method based on interesting region	The technique suggests a novel approach for identifying surface areas of interest.

Serin, E.et al. (2013)	Greedy view selection integrated vSKL	Serin used representative images to select the most appropriate viewing angles.
Han, H., Li, J.et al. (2014)	a viewpoint selection method based on significance	Han suggested a novel approach to saliency segmentation-based view selection.
Xing, L.et al. (2013)	efficient remeshing framework	Xing's surface reconstruction based on visual perception was made possible by the heuristic algorithm.
Su, H.et al. (2015) and Shi, N.et al. (2019)	Convolutional Neural Network (CNN)	A convolutional neural network (CNN) for viewpoint estimation was trained using 3D models.
Massa, F.et al. (2016)	CNN based algorithm for systematic foundation design selection	For viewpoint estimation, Francisco Massa created a multitask CNN.
Leifman et al. (2016)	Surface interesting region detection with triangulated mesh model	The visually appealing area of the mesh is used to choose viewpoint clusters.
Jeong, S. W.et al. (2017)	a unified detection algorithm saliency for three-dimensional mesh models	Jeong used a semi-regular grid to find a saliency region
Engler, T.et al. (2017)	feature based sparse stereo algorithms	Torsten used multi-pair virtual cameras to perform a recursive estimation on 3D scene reconstruction.
Sawhney, R.et al. (2018)	macro-scale 3D structural geometry approach	A method for correlation, retrieval and reconstruction in large-scale 3D scenes based on multiple views is established.
Chen, G.et al. (2022) and Lewandowicz, E.et al. (2020)	skeleton line extraction (GIS algorithm)	Two well-known methods for vector data skeleton line extraction that depend on image processing technology are enhanced constrained Delaunay triangulation (CDT) and raster data skeleton line extraction.
Tang, G.et al. (2025)	Multiple Viewpoint Selection Method	Efficient Precise Viewpoint Selection (EPVPS) algorithm is utilized.
He, J., Zhou, W.et al. (2016)	Riemannian metric	Once this metric is established, individuals' preferences regarding viewpoints are effectively validated through K-medoids clustering.
Llobera, M. (2003)	Multipoint Field of View Analysis Method (GIS based)	The algorithm used in digital elevation model (DEM) based field of view analysis was utilized.
Deinzer, F.et al. (2006)	A viewpoint selection method based on reinforcement learning	A merging approach based on the Condensation Algorithm is used.
Gu, C.et al. (2019)	deep metric learning method	An object-centered viewing sphere with a constant radius is proposed.
Hosseininaveh, A.et al. (2021)	Imaging Network Design Method	A new photogrammetric approach to imaging network design is proposed.
Shirani-Mehr, H.et al. (2009)	PTD (participatory tissue documentation) method	PTD is implemented in two steps: viewpoint selection and viewpoint assignment.
Neuville, R.et al. (2019)	Flythrough creation algorithm (FCA)	A theoretical and operational method for automatically determining the best viewpoints to control congestion is described.

CLASSIFICATION OF VIEWPOINT RESEARCH METHODS

According to the data obtained because of the literature review, viewpoint selection methods are classified into six categories. These categories are basically as follows:

1. based on geometric information (field)

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2. based on aesthetic information (surface curvature)
3. based on visual features
4. based on semantics
5. based on deep learning
6. based on architectural and urban models

1. Methods based on geometric information

These techniques evaluated viewpoint using measurements including curvature, silhouette, projected area, geometric area, etc. "General Position" theory: The idea of a "general position," which denotes a favorable viewpoint position, was first proposed by (Kamada et al.,1988). The extrinsic problem of projection direction vectors replaces the "canonical appearance" problem in the viewpoint.

2. Methods Based on Aesthetic Knowledge

2.1. Viewpoint research based on artistic composition

As a result of extensive studies, the foundations of the concept of the "golden section" were laid (Sander et al., 1932). Building on artistic principles, Feiner et.al. (1991) created images, while Kawai et.al. (1988) presented an automatic lighting reconstruction method based on artistic composition. Karp et.al. (1990) also developed a technique for generating animation sequences using artistic composition. Kowalski et.al. (2001) proposed a method to assist users in creating artistic pieces.

Gooch further advanced this area by developing a plan rooted in creative composition. This involved producing patterns using orthogonal projection and calculating them via a silhouette intensity procedure (Figure 2).

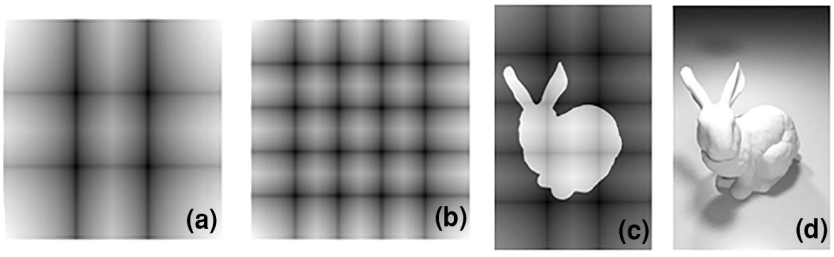


Figure 2. (a) The one-third rule of intuitive composition; (b) The one-fifth rule of intuitive composition; (c) layout template; (d) shaded result (Adapted from Gooch et al. (2001))

2.2. Estimated area-based viewpoint method

Low Level Image Quality Assessment Method: The strategy originated with Kamada and Kawai's "80-ties" method (Kamada et al.,1988). Plemenos & Benayada (1996) later proposed an approach based on the estimated visible surface area. Kamada's settings were later adjusted to maximize viewpoint projection by Barral and colleagues (2000). Plemenos & Benayada (1996) used the projected fraction of visible areas to assess visual quality.

High-level viewpoint quality assessment method: A low-level viewpoint quality assessment approach cannot cover a wide scene. Sokolov invented a high-level assessment method (Sokolov et al.,2006).

2.3. Octree Based Viewpoint Selection Method

Colin (1988) established an eight-tree building-based methodological framework for viewpoint selection. Building on this, Plemenos et al.

(1996) developed an iterative technique for autonomous viewpoint selection. This method centers on a spherical volume encapsulating the scene's spatial organization, with its surface representing all possible observational angles (Figure 3).

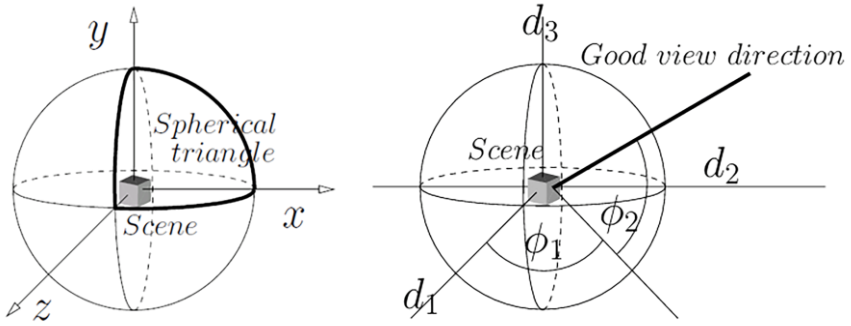


Figure 3. (a) A sphere divided into 8 global triangles - Octree method; (b) good direction of view (d1=d2=d3=The three most appropriate viewpoints

2.4. Method for assessing viewpoint quality based on information entropy

Method based on viewpoint entropy: A technique based on Shannon entropy was proposed by Vazquez & Feixas, who subsequently dubbed it the viewpoint entropy method (Vázquez et al.,2001). In particular, the entropy value is used to measure the projected fields as a unit of information.

Method based on curvature entropy: Page used silhouette and curvature to develop the viewpoint entropy approach (Page et al.,2003). The detail and depth information of the observations determined the curvature entropy. However, it has sometimes led to negative results when there are overly symmetric buildings.

Method based on depth and silhouette entropy: Vázquez et al. (2001) obtained silhouette entropy and depth entropy after observing 320 points of view. Warmer hues and larger dots indicate higher (better) values, which are the best viewpoints based on them (Figure 4).

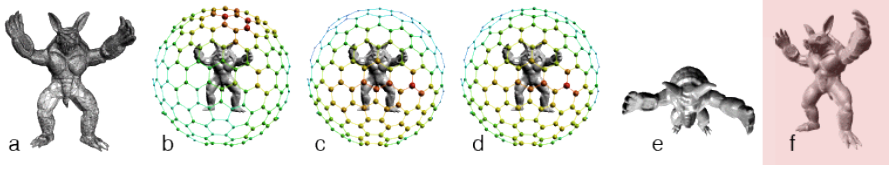


Figure 4. (a) Mesh; (b) Depth; (c) Silhouette; (d) Depth Silhouette; (e) Depth best; (f) Results: Best view (Adapted from (Vázquez & Andújar, 2007)).

Other methods of information entropy: Vazquez suggested a multiscale method based on the Gull & Skilling (1985) entropy because the Shannon entropy would result in certain intractable reduction issues.

2.5. Method based on Kullback-Leibler distances

Sbert proposed a viewpoint selection method based on the K-L Distance (Kullback-Leibler Distance) to find the fewest representative points of view (Sbert et al.,2005) (Figure 5).

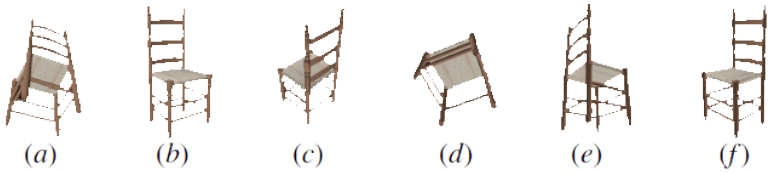


Figure 5. The six most representative views of the chair object selected by the KL algorithm (Adapted from (Sbert et al.,2005)).

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3. Methods Based on Visual Features

Techniques relying on visual aspects are primarily influenced by features such as volume, mesh salience, silhouette, and curvature. Feixas (2002) introduced a novel object recognition theory that has subsequently influenced numerous algorithms, including Mortara's semantic segmentation (Attene, Mortara et al.,2006), Shilane's saliency-region-based semantic viewpoints (Shilane & Funkhouser,2007), and Fu's vertical-direction-based characteristic semantic method (Fu et al.,2008). More recently, novel algorithms have emerged, such as Leifman's intriguing area-based semantic technique (Leifman et al.,2016), Sokolov's speculation-based selection method (Sokolov et al.,2006), and Chen's Schelling point-based method (Chen et al.,2012).

3.1. Viewpoint assessment method based on visual perception theory

Loken (1984) posited that human visual perception integrates a scene holistically rather than as isolated elements. Kucerova et al. (2012) further explored this by combining Gestalt psychology and visual perception theory to evaluate viewpoint quality and the influence of human intuition in virtual tours.

Visual Attention Model: Stemming from research on early primate neural architecture and visual behavior, Itti et al. (2002) introduced the prominent "central containment mechanism," a method applied to linear center wrapping (Noser et al.,1995). Kucerova et al. (2012) presented three different approaches for selecting the best view of 3D objects: a geometry-based method (maximizing the number of visible vertices), a visual attention method, and mapping a 3D scene to a 2D image using entropy (Figure 6). They then compared these approaches using a questionnaire.



Figure 6. (a) Geometry based method; (b) Visual attention method; (c) Entropy based method; (d) Questionnaire (Adapted from (Kucerova et al., 2012)).

Visual perception model based on visual preference: Polonsky et al. (2005) pioneered the concept of standard view descriptors or viewpoint attributes, which can be integrated into a single measuring function. Expanding on this, Vieira et al. (2009) employed support vector machines to classify view descriptors for optimal viewpoint selection. Secord et al. (2011) developed a global measuring function by combining various view quality descriptors, categorized into five types: region, silhouette, depth, curvature, and semantic.

3.2. Curvature-based viewpoint evaluation method

Barral & Noser used histograms to examine the visible surface's properties (Barral et al.,2000; Noser et al.,1995). Based on Barral's method, Sokolov proposed a viewpoint quality estimation method based

on total curvature (Barral et al.,2006). Computing efficiency is increased by employing the "point-to-point" strategy rather than the "point-to-region" method.

3.3. Viewpoint evaluation method based on viewpoint complexity

Plemenos found a way to determine viewpoint complexity based on the quantity, size, orientation, and separation of discernible patches (Plemenos & Benayada,1996) .

3.3.1. Histogram-based view complexity calculation

Plemenos assigned a different hue to each patch to determine viewpoint complexity using a histogram approach. This approach might be used to calculate the scene's proportions of each color.

3.3.2. Information theory-based computation of viewpoint complexity

Viewpoint selection has been extensively studied across various disciplines, including volume rendering and object recognition, often leveraging an information theoretical framework.

In computer graphics, diverse criteria assess viewpoint quality. Koenderink & Doorn (1979) introduced the "view graph" in the 1970s to delineate viewing regions around objects. Arbel et al. (1999) proposed a measure of uncertainty for belief distributions, guiding online navigation with offline entropy maps. Following Vázquez et al.(2001)'s introduction of Viewpoint Entropy (VE), similar methods gained prominence, especially in volume rendering.

Jensen-Shannon Entropy (Cover & Thomas,1991; Blahut,1987), a core concept in information theory, quantifies the uncertainty of a random variable.

Viewpoint Entropy (VE), as asserted by Vázquez (2003), is a highly suitable factor for viewpoint selection. Consistent with Fleishman (2000), various metrics are compared, including basic ones like the number of correctly captured faces. Originally proposed by Vázquez et al. (2001), VE quantifies the information captured by a viewpoint, considering both projected area and face count. Rigau et al. (2002) developed a comparable metric for analyzing the visibility complexity of 2D scenes.

3.4. Viewpoint selection method based on network salience

Building on Koch & Ullman's (1987) concept of salience drawing visual attention, Itti et al. (1998) proposed an efficient center-periphery mechanism for salience calculation. Researchers have further explored visual salience through various methods: Tsotsos et al. (1995) utilized visual attention cues and attentional analysis, while Milanese et al. (1994) employed a nonlinear relaxation method to identify salient regions. Privitera et al. (1999) introduced an automatic pre-recognition approach for computing interesting regions and later proposed an automatic thumbnail cropping method based on image salience by extracting these regions. Chen et al. (2012) developed a visual perception model to modify visual attention space. Additionally, DeCarlo & Santella (2002) suggested a stylization technique for Suh et al. (2003), and Santella & DeCarlo

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(2004) used saliency areas to simplify networks and create abstract visuals.

3.5. Method of selecting viewpoints based on mutual information between viewpoints

Vázquez created an information network for viewpoint information and introduced a system for evaluating viewpoints (Vázquez et al.,2001). The VMI technique was able to aggregate the most representative viewpoints to get a suitable set of viewpoints with the least amount of mutual information. Figure 7 displays the six best images that the VMI algorithm generated.

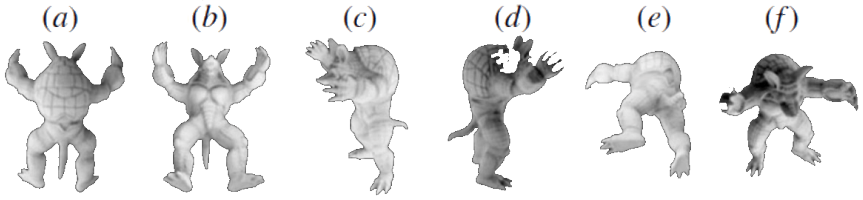


Figure 7. Six armadillo model views were chosen using the VMI technique (Adapted from (Bonaventura et al., 2018)).

4. Understanding-Based Viewpoint Selection Method

The semantics-driven approach to viewpoint selection utilizes semantic segmentation to evaluate viewpoints, incorporating scene semantics and synthetic labels as evaluation features. Attene et al. (2006) developed an efficient annotation method for virtual 3D objects using a hybrid segmentation approach that allows user input. Takahashi et al. (2005) proposed a feature-driven method to identify optimal viewpoints, integrating semantic information into an assessment function. Similarly, Mortara et al. (2009) used semantic features to calculate network saliency in specific orientations.

4.1. Semantic-based network segmentation

Polonsky positioned a semantic component of the model to maximize the visible projected area and identify the ideal view (Polonski et al.,2005). Mortara introduced a semantic segmentation technique that relies on aesthetic standards (Mortara & Spagnuolo (2009).

4.2. Semantically based viewpoint selection

Following the use of several unique viewpoints evenly distributed around the item, Mortara et al. (2004) developed an assessment function and thoroughly examined the scene's salience and semantic aspects. In a separate study by the same author in collaboration with other researchers, a set of viewpoints was defined on a viewing sphere surrounding the object. By applying the Loop subdivision scheme twice, an equal distribution of 162 viewpoints surrounding the shape was achieved (Mortara & Spagnuolo, 2009) (Figure 8).

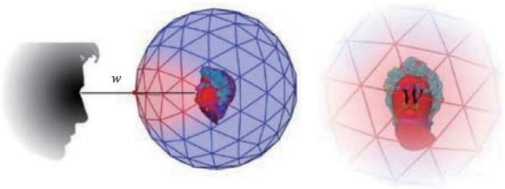


Figure 8. According to Mortara's definition, the viewing sphere: its vertices are the admissible viewpoints (Mortara & Spagnuolo, 2009).

5. Viewpoint Selection Method Based on Deep Learning

George Leifman chose points of view using the "Regions of Interest (ROI)" technique, which was put forth (Leifman et al., 2016). Leifman's algorithm is used to automatically select the most interesting collection of viewpoints for a mesh surface. The main steps are generating candidate viewpoints, calculating the Region of Interest (ROI) observed by each candidate, and optimizing this selection to improve its quality by selecting the viewpoint that provides the most information.

Leifman compared four conventional multiple viewpoint selection methods with this method (Figure 9). These four classic methods are Lee's et al. (2005) Mesh Saliency technique, Mortara's & Spagnuolo (2009) Semantics-driven Best View of 3D Shapes, Yamauchi's Towards a Stable and Salient Multi-view Representation of 3D Shapes (Yamauchi et al.,2006), and Secord's Perceptual Models of Viewpoint Preference (Secord et al., 2011).

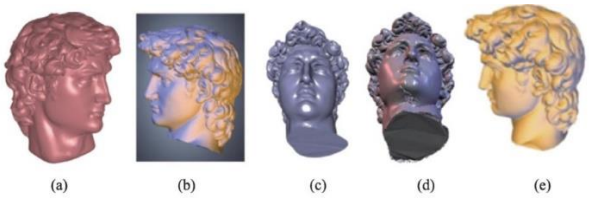


Figure 9. Comparison of Leifman's viewpoint selection algorithm with four traditional viewpoint selection algorithms (Adapted from (Leifman et al., 2016)).

6. Viewpoint Selection Method Based on Architectural and Urban Model

6.1. Method of Choosing a Viewpoint Suitable for Architectural Heritage's Visual Impact

A quantitative, GIS-based spatial analysis approach is used to select relevant viewpoints for assessing the visual impact of architectural history.

Visual Impact Assessment: Selecting appropriate viewpoints, also known as survey, observation, or sample points, is crucial for conducting quantitative visual impact assessments and evaluating dispersed areas (Mohseni et al.,2020; Zhao et al.,2020). The chosen viewpoints significantly influence the objectivity and accuracy of the assessment (Qi et al., 2013).

Viewpoint Selection: Methods for viewpoint selection vary; for example, Qi et al. (2014) and Xu et al. (2021) uniformly select sample points along circular routes, while Daniel (2001), randomly chooses assessment points along forest roads.

Skeletal line extraction is a common GIS technique underpinning viewpoint selection (Chen & Qian, 2022; Lewandowicz & Flisek, 2020). This method defines the central axis of geometric forms and is frequently applied to analyze stripe-like features in architectural heritage landscapes. While viewpoints are typically aligned with street or courtyard axes, larger areas may necessitate additional viewpoints along the central axis, often within the spatial boundaries of the courtyard's skeleton lines. The skeleton line's midpoint represents its central form, its endpoint signifies its origin, and its intersections indicate changes in direction.

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6.2. Viewpoint selection method based on multiple viewpoints

Terrain viewpoint selection aims to identify optimal viewpoints within a given area for maximum visibility. The Efficient Precise Viewpoint Selection (EPVPS) method (Tang et al., 2025) offers a valuable framework for multi-viewpoint planning. This method first employs the Empty Circles-based K-means (ECKM) technique (Biswas et al., 2023; Ikotun et al., 2023) to determine initial cluster centers for candidate viewpoints. Next, it introduces the Weighted Coverage Overlap Metric (WCOM), a new evaluation metric that quantifies visibility by segmenting the candidate points' field of view into overlapping and coverage contribution points. These results are then stored. Finally, the clusters of coverage and overlap contribution points are refined by including and excluding viewpoints. Visibility analysis is categorized into single-viewpoint and multi-viewpoint analysis, depending on the number of viewpoints examined.

Single Viewpoint Analysis Method

Single viewpoint analysis focuses on continually improving algorithms like R3, XDraw (Franklin et al., 1994), and reference plane methods (Wang et al., 1996), which often struggle to balance accuracy and efficiency. To address this, researchers have proposed the view tree technique. This involves reconstructing Digital Elevation Model (DEM) data (Wang et al., 2023) and utilizing projection viewpoint to build the Proximity-Direction-Level-Line (PDERL) (Wu et al., 2021) and XPDERL (Guan et al., 2022) coordinate systems. Overall, the development of single-view watershed analysis algorithms is relatively advanced.

Multi-view Analysis Method

Unlike single-viewpoint analysis, multi-viewpoint analysis requires determining the positions and number of different viewpoints to optimize resource utilization or achieve specific objectives. Recent multi-viewpoint problem-solving strategies broadly fall into two categories:

Computational Approaches: This category utilizes intelligent algorithms (Ma et al., 2023; Civicioglu & Besdok, 2024), Apache Spark's multi-level distributed technology (Dong & Zhang, 2023), and GPU parallel computing capabilities (Xiao et al., 2024) to conduct view analysis on multiple viewpoints based on terrain data.

Feature-Based Selection: This approach selects potential viewpoints from featured terrain points within terrain files. While peaks are commonly chosen as potential viewpoints (Rana, 2003), practical implementations necessitate alignment with specific application scenarios. For example, a study selecting sites for fire lookout towers considered elevation values, slope, and accessibility (Sakellariou et al., 2022).

6.3. Point of View Selection Method in Architectural Photography

This approach focuses on identifying optimal vantage points for architectural photography. To understand user preferences in this context, the viewpoints associated with various images were analyzed

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(He et al., 2016). A novel Riemannian metric was introduced to quantify the dissimilarity between viewpoints, considering the viewpoint space as a Riemannian manifold with Matrix Lie Group properties. This metric subsequently enabled the effective use of K-medoids clustering to validate observed preferences for viewpoints.

6.4. Multipoint Field of View Analysis Method

Line-of-sight (LOS) analysis is a spatial analytic technique in Geographic Information Systems (GIS) used to determine visible target regions from one or more viewpoints, aiding spatial cognition studies (Llobera, 2003). A Graphics Processing Unit (GPU)-based method then computes a visibility index for the resulting multidirectional space. Initially, an algorithm, informed by the field of view, generates parameters to facilitate the identification and quantification of buildings. The algorithm's effectiveness in DEM-based LOS analysis can be enhanced by optimizing candidate LOS locations (Tabik et al., 2013) or selecting optimal viewpoints (Wang & Dou, 2020; Yu et al., 2016).
The methodologies defined in this method include (Figure 10):

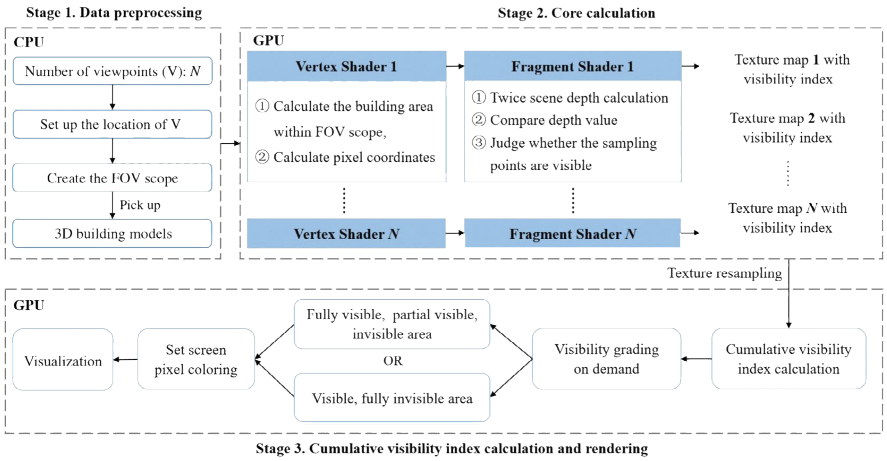


Figure 10. Flowchart of algorithms (Chen and Chen, 2021)

6.4.1. FOV-based scoping for view analysis

The horizontal radian angle of the line of sight (LOS), the vertical elevation angle of the LOS, and the maximum viewable distance from the observer are the three main components that determine a 3D field of vision (FOV). These parameters define a stereoscopic region that mimics a person's field of vision, with the observer at the origin. In Figure 11, the observer's horizontal field of view is shown in blue on the left, while the vertical field of view is shown in orange. On the right is the resulting field of view when three observers observe the same building from different positions.

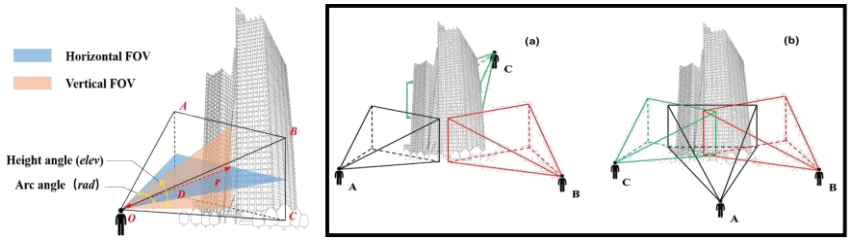


Figure 11. Scope based on FOV (left); 3 observers with a common area (right (a)), 3 observers without a common area (right (b)) (Adapted from (Chen and Chen, 2021)).

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6.4.2. An algorithm for parallel multipoint vision analysis based on shadow maps

This method employs GPU-based graph drawing, using the GPU's programmable pipeline to accelerate visualization and enable parallel processing. This technique has inspired various shadow rendering algorithms, which have been integrated into the viewpoint analysis methods outlined in (Chao et al., 2011; Zhao et al., 2013; Feng et al., 2015).

Field of View Analysis Using Shadow Mapping: Shadow mapping, introduced in (Williams, 1978), is a real-time technique that renders shadows by comparing data from two views. First, a depth map is generated by rendering the scene from the light source's viewpoint, where each pixel represents the closest surface depth (*D*). As shown in Figure 12, an object beneath the light source casts a shadow on the ground, illustrating this principle.

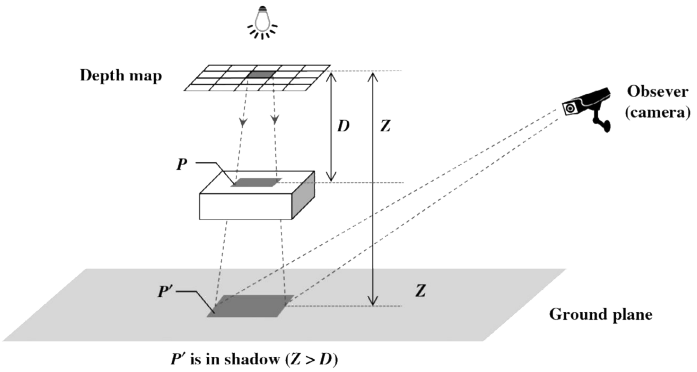


Figure 12. Algorithm for shadow maps (Williams, 1978).

Depth Computation Aligned with FOV: The algorithm begins by generating two depth maps of the target scene and comparing their depth values. It considers the viewpoint position, viewing direction, and target coverage to define the field of view (FOV). These parameters adjust the spotlight location, light direction, and depth range. Algorithm 2 (see (Chen and Chen, 2021)) combines these inputs to calculate scene depth.

Cumulative Visibility Index: As described in (Wheatley, 2022), a cumulative viewshed is created by merging multiple viewshed maps using basic map algebra. This technique supports the analysis of 3D building environments from multiple viewpoints.

6.5. Integrated Viewpoint Fusion and Selection Method for Best Object Recognition

This approach uses a reinforcement learning-based viewpoint selection method for active object recognition (Figure 13). The fusion strategy is based on the Densification Algorithm (Isard & Blake, 1998), with prior applications in viewpoint selection, image segmentation (Deinzer et al., 2003; Madsen & Christensen, 1997), and 3D reconstruction (Lehel et al., 1999).

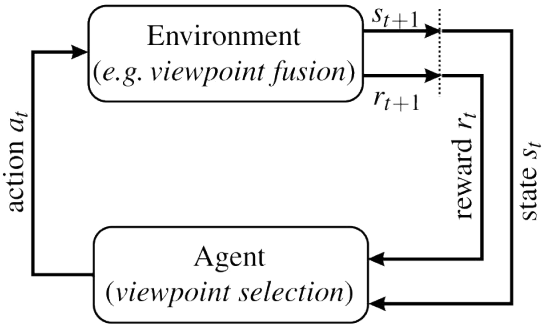


Figure 13. Reinforcement learning loop (Deinzer et al., 2006)

6.6. Viewpoint Selection Method with New Viewpoint-Based Selection Strategy

This method uses a deep metric learning approach to address viewpoint estimation. To try extract more discriminative and strong features, the viewpoint estimation problem has recently been tackled by convolutional neural networks, or CNNs (Su et al., 2015; Qi et al., 2016). According to recent studies, metric learning (Wang et al., 2017) appears to be a good fit for tasks involving viewpoint estimation and can also be used to learn spatial relationships.

6.6.1. Creating a Dataset

CNN-based supervised learning models require large amounts of labeled images. To reduce data collection efforts, synthetic images are generated from CAD models, which are widely available in industrial settings and closely resemble real objects (Wang et al., 2016). Following prior studies, an object-centered view sphere with a fixed radius is used (Zhang et al., 2017).

6.6.2. Method

Viewpoint-based input selection strategy: The distinction between views is used to identify positive and negative examples in a novel viewpoint-based triple input selection approach. Next, from one viewpoint, the Euclidean distance between the two samples was determined. Figure 14 presents the selection strategy in a more comprehensible manner**.**

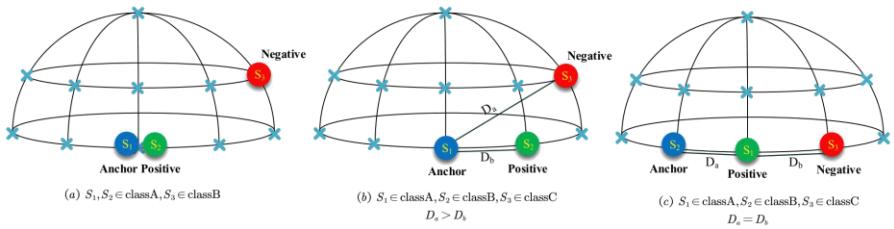


Figure 14. The illustration of the input selection strategy (Gu et al., 2019).

Data preparation: The data set for viewpoint estimation consists of five distinct workpieces, each photographed from multiple angles. These workpieces exhibit common industrial features such as uniform color, symmetry, and low texture. To capture varied conditions, each workpiece rotates around its central axis during imaging. Each image is systematically labeled with the corresponding viewpoint class based on the virtual camera's position.

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6.7. Imaging Network Design Method for UGV-Based 3D Building Renovation

This methodology introduces a novel photogrammetric approach for designing image networks in 3D building reconstruction (Hosseininaveh & Remondino, 2021). It involves two main steps: generating candidate viewpoints and selecting and grouping them. The first step includes identifying initial viewpoints, filtering them within an optimal range, and determining their orientation. The second step proposes four strategies—facade marking, center marking, hybrid, and combining center and facade marking.

Materials and Methods

The general building of the developed methodology consists of four main stages (Figure 15):

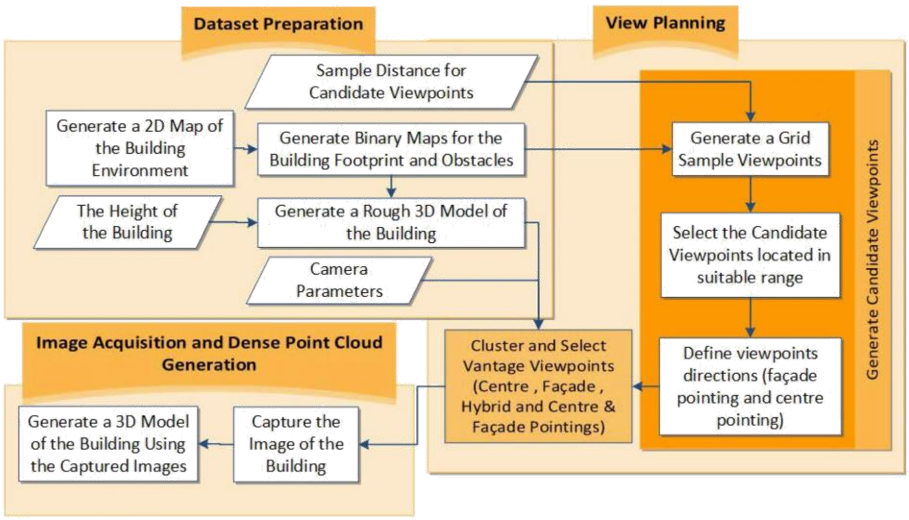


Figure 15. The proposed methodology for imaging network design for image-based 3D reconstruction of buildings (Hosseininaveh & Remondino, 2021)

Candidate viewpoints are generated through three steps: determining viewing direction, selecting candidate viewpoints, and creating a sample viewpoint grid.

Viewpoint Selection: Grid points corresponding to buildings or obstacles (black pixels) are removed. Views outside the camera's effective range are also excluded, based on photogrammetric constraints such as imaging scale (D_{max} scale), resolution (D_{max} Reso), depth of field (D_{near} DOF), and field of view (D_{max}/D_{min} FOV) (Hosseininaveh & Remondino, 2021).

Clustering and Selecting Advantageous Viewpoints: To select optimal views, a visibility matrix and viewpoint clustering are used. For each point on the rough 3D building model, a four-zone cone aligned with the normal surface is defined, following the method in (Ahmadabadian et al., 2017).

6.8. Efficient Viewpoint Selection Method for Urban Fabric Documentation

Participatory Texture Documentation (PTD) is a collaborative method for collecting urban texture data using mobile phone cameras. PTD consists of two phases, where important urban locations for texture capture are identified and viewpoints are distributed according to

participants' preferences and constraints (Shirani-Mehr et al., 2009).

6.9. 3D Viewpoint Selection Method in Urban Planning

This method offers a theoretical and practical approach to automatically selecting optimal viewpoints to manage occlusion (Neuville et al., 2019). It introduces a Fly through Generation Algorithm (FGA) that computes effective camera paths for clear visualization of key 3D objects.

Camera Settings: The viewpoint management algorithm identifies optimal camera positions and orientations to observe target objects. Since it supports only parallel projection, the camera focal length is set to infinity. Although Camera 2 provides a wider field of view in Figure 16, the obstruction caused by the large building in the viewpoint projection (left) is greater than in the orthogonal projection (right).

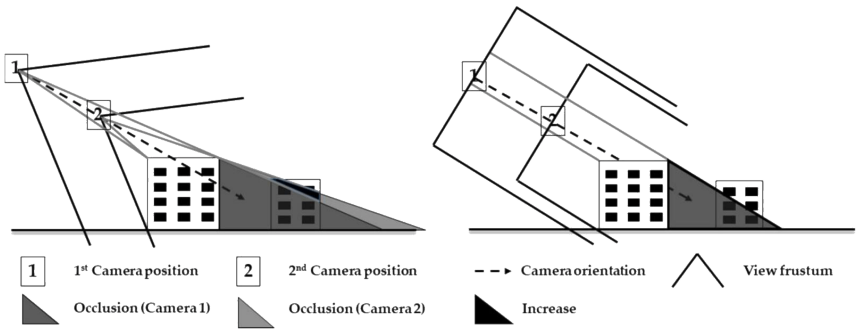


Figure 16. Viewpoint projection (left); parallel projection (right) (Neuville et al., 2019).

Viewpoint Selection: Several view descriptors have been developed to help choose optimal viewpoints, including view area, visible area ratio, surface area entropy, silhouette length and entropy, curvature entropy, and mesh saliency (Page et al., 2003; Polonsky et al., 2005).

Method: In the filtering phase, users first identify objects of interest within the visualization environment. Then, during mapping and rendering, the environment and objects are processed. Finally, the styles and objects are loaded into a 3D computational scene.

DISCUSSION

This study has consolidated the various viewpoint selection techniques found across different disciplines in the literature into a systematic taxonomy in accordance with the PRISMA guidelines. The key discussion points identified in the context of the research questions (RQ) are as follows:

- **Systematization and Taxonomy (RQ1)**

The methods in the literature are divided into six main categories: geometric, aesthetic, visual features, semantic, deep learning, and architecture/urban model based (Table 2). This classification provides a comprehensive methodological framework that spans from micro-scale objects to macro-scale urban fabrics.

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Table 2. The classification and comparative analysis of viewpoint selection methods (source by authors)

CATEGORIZATION OF VIEWPOINT SELECTION METHODS			
Object-Oriented Selection Methods and Algorithms			
Categories	**Method Name**	**Calculation Method**	**Tool / Program Used**
Methods Based on Geometric Knowledge	"General Position" Theory	Molecular visualization	curvature, silhouette, projection/ geometric area
Aesthetic Evidence-Based Methods	A Study of Viewpoint Based on Artistic Composition	Molecular visualization	silhouette
	Estimated area-based method (Low Level)	"80-ties" method	Geometric data, lines, planes
	Estimated area-based method (High Level)	Object predictability parameter	Geometric formulas / Mathematical algorithms
	Octree-based selection method	Visibility calculation parameter	Projected area of the surface
	Methods Based on Information Entropy		
	- The Viewpoint Entropy Method	The entropy value of the projection areas	Open/closed stage area (3D)
	- Curvature Entropy Method	Curvature entropy	3D model
	- Depth and Silhouette Entropy	-	Depth / silhouette
	- Other Entropy Methods	Wave transformation coefficients	3D model
	A method based on Kullback-Leibler distances	Conditional probability matrix	Mathematical algorithms
Methods Based on Visual Features	Theory of Visual Perception (Visual attention model)	The linear center wrapping process	MATLAB, 3D models
	A visual perception model based on visual preferences	Global measurement function	Mathematical algorithms
	Curvature-based evaluation method	Visible surface characteristics	Histogram / Mathematical algorithms
	Complexity-based assessment		
	- Histogram-based complexity	Patch painting	Histogram / Equation
	-Information theory-based complexity	Jensen-Shannon entropy	Probability transition matrix
	- Viewpoint Entropy (VE)	The relative area of projection surfaces on the sphere	Logarithms / Mathematical Equations
	Network Visibility-Based Selection	Mutual information)	Mathematical algorithms
	Vendor-Managed Inventory (VMI)-based selection	Polygon analysis	Mathematical algorithms
Semantic-Based Methods	Semantic network segmentation	Hybrid segmentation algorithm	Virtual 3D object models
	Choice of semantic viewpoint	The image-based annotation process	Mathematical scoring function
Deep Learning Methods	Viewpoint by region of interest (ROI)	Neural Gas Networks	3D densification model
Building-Oriented Selection Methods and Algorithms			
Categories	**Method Name**	**Calculation Method**	**Tool / Program Used**

Architectural and Urban Model-Based Methods	The optimal viewing angle for the visual impact of architectural heritage	Visual Impact Assessment (VIA)	ArcGIS software / C++ / GIS spatial analysis
	Skeleton-based view selection	Extraction of skeleton lines / Delaunay triangulation	ArcGIS software / C++
	Multi-viewpoint-based methods		
	- Single-Viewpoint Analysis	EPVPS algorithm	ArcGIS / Mathematical algorithms
	- Multi-Viewpoint Analysis	K-means algorithm	ArcGIS / Land data
	Choosing a Viewpoint in Architectural Photography	SfM (Building from Motion) / 3D point cloud model	Digital cameras / Smartphones / Image-based models
	Multi-point viewshed analysis	FOV-based coverage / GPU acceleration	3D spatial buildings / Geographic information
	Integrated viewpoint fusion (for object recognition)	The reinforcement learning loop	Mathematical algorithms/ functions
	A new viewpoint-based entry selection strategy	CNN-based algorithms	Global coordinate system / Virtual camera / CAD
	3D Building Reconstruction Using UGVs (Unmanned Ground Vehicles)		
	- Creating a sample viewpoint grid	Photogrammetric algorithm	Simulated UGV
	- Filtering by viewpoint within a specified range	The G-mapping algorithm	UAV / Python or C++
	- Clustering and the selection of a favorable viewpoint	SLAM algorithm	ROS / Building map / 3D model
	Method for documenting the urban fabric	EPVPS algorithm	DEM (Digital Elevation Model)
	3D Viewpoint Management in Urban Planning	FCA (Flythrough) / VMA (Management) algorithms	3D Geo-visualization/ OpenGL API / Virtual Camera

- **Methodological Differences and Areas of Advantage (RQ2)**

Object-oriented approaches are advantageous for maximizing visual clarity and information transfer by analyzing the geometric and semantic properties of individual objects. Building-oriented approaches, on the other hand, stand out for their ability to conduct spatial visibility assessments in complex urban scenarios by integrating GIS and user movement models.

In terms of accuracy and computational cost, while geometric and entropy-based methods are precise in identifying the mathematically "optimal" point, they can yield misleading results in buildings with high symmetry. In contrast, deep learning (CNN) models offer high adaptability and accuracy; however, they require large datasets and intensive GPU support.

- **Current Technological Approaches (RQ3)**

Today, CNN-based adaptive strategies in object analysis, and the EPVPS algorithm combined with GPU-accelerated real-time visibility

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analysis at the urban scale, are the modern approaches that yield the most effective results.

CONCLUSIONS AND RECOMMENDATIONS

This study, which presents a systematic synthesis of 38 foundational works spanning the years 1988 to 2025, has resulted in the development of an analytical framework that highlights evolution, methodological trends, and scales of application of viewpoint selection techniques. This framework underscores the technological, temporal, conceptual, and methodological changes within the field.

1. Temporal Trends and Technological Transformation

Viewpoint selection methods have gone through three main phases over the past 35 years:

- **Geometric Foundations (1988–2000):** His early works focused on orthogonal projections and purely mathematical criteria such as the "least distorted surface." This period is characterized by limited computational power, yet it saw the introduction of fundamental optimization formulas.
- **Information Theory and Visual Perception (2001–2013):** With the introduction of concepts such as Shannon entropy and "Viewpoint Entropy" (Vázquez), the "amount of information" provided by an object has become the primary criterion. During this period, "saliency" models that mimic the human visual system were also developed.
- **Deep Learning and Large-Scale Analyses (2014–2025):** With methods such as CNN models and GPU-accelerated real-time urban visibility analyses, approaches have evolved from static analysis to dynamic and adaptive systems.

2. Comparative Analysis of Methods (Feasibility and Computational Cost)

The methods examined are summarized in Table 3 in terms of their scope of application and efficiency.

Tablo 3. A comparative summary of the methods examined in terms of their scope of application, computational cost, and analytical focus (sourced by authors)

Category	Analysis Scale	Main Advantage	Limitations / Computational Cost
Geometry & Entropy	Micro (Object)	Mathematical precision, universal applicability	Misleading results in symmetric buildings, high computational power requirements
Visual Perception & Semantics	Micro-Meso	Human-centered aesthetic values, interpretation	Subjectivity based on user preferences, the need for labeled data
Deep Learning (CNN)	Flexible (Hybrid)	Adaptive learning, high accuracy	Very large training datasets and GPU dependency
Architecture & Urban Planning (GIS/GPU)	Macro (Architecture/City)	Real-time analysis, spatial efficiency	Sensitivity to data quality (DEM/CAD), complex algorithmic intrabuilding

The comparative analysis yielded the following results:

- **Accuracy and Precision:** Geometric and entropy-based methods are effective at finding the mathematically "optimal" point, but they may lose accuracy in highly symmetric buildings. Deep learning methods, on the other hand, offer much higher adaptability and accuracy depending on the training data.
- **Computational Cost:** While traditional geometric methods can run on low CPU power, modern urban analyses (GIS-based) and deep learning models require intensive GPU support and large datasets.
- **Application Scale:** While object-oriented methods are effective in micro-scale contexts such as museum and product design, building-oriented methods (GIS, SfM) are applied at macro-scale contexts such as urban landscapes and architectural heritage.

Table 4. Summary table: Comparative synthesis of methods (sourced by authors)

Category	Analysis Focus	Basic Tools	Application Advantage
Object-Oriented	Geometry, Entropy, Aesthetics	MATLAB, 3D Models	Museum exhibitions, product design
Building-Oriented	GIS, GPU Analysis, Urban Data	ArcGIS, C++, Python	Urban planning, architectural heritage
Modern Approaches	Deep Learning (CNN), Semantics	GPU, Neural Networks	Adaptive and intelligent selection systems

The distribution of the 38 core studies examined shows that object-oriented methods (geometric, entropy, semantic) have a longer history in the literature, while building-oriented methods have gained momentum over the past decade thanks to technological advancements (GIS, GPU) (Table 4). Based on these findings, the methodological framework of the study, the proposed technological action plan, and its contribution to the literature are outlined below:

- **Methodological Bridge:** While object-oriented methods answer the question "what should be looked at" through aesthetics and information density, building-oriented methods answer the question "from where one should look" through spatial visibility and user movement.
- **Action Plan:** In hybrid fields such as smart cities and digital museology, combining the adaptive capabilities of deep learning with the spatial precision of GIS emerges as the most effective strategy.
- **Future Perspective:** Rather than a statistical synthesis (meta-analysis), this study presents a qualitative and taxonomic synthesis of literature. It is recommended that future studies quantitatively compare the computation times and user satisfaction rates of these methods.

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The Transformation of Urban Leisure Culture in İstanbul: The Case of Florya as a Cultural Landscape

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Abstract

This article evaluates the modern summer leisure culture that developed along the southwestern coastal line of İstanbul, focusing on the Florya Atatürk Marine Mansion and its surrounding summer leisure facilities. This assessment is conducted through consideration of the historical and social parameters following the proclamation of the Republic. In this framework, the settlement is examined through an integrated approach encompassing all its spatial and social facilities. The study aims to demonstrate that in addition to its role as a recreational area, Florya also served as a space for public transformation, embodying the Republic's ideals of modern life. The complex was designed and used as an area reflecting modern summer leisure culture. Designed by Seyfi Arkan, incorporating the rational architectural approach of the period with the principles of functionality, simplicity, openness and integration with nature, the project was completed in 1935. It produced different scenarios of public life with the beach, changing cabins, promenades and the casino designed around the mansion. Within this scope, the Florya Marine Mansion and leisure facilities demonstrated that architecture is not merely a product of its time but rather a stage where the public could express themselves physically, culturally and socially. In this context, the study examines the settlement with all its summer leisure facilities by evaluating these aspects. Through an examination of both social and spatial production dimensions, the area is defined as a cultural landscape where the principles of modern architecture intersect with public life, nature and leisure culture and through which Türkiye's modernization story can be read through space.

Keywords: *Cultural landscape, Florya Atatürk Marine Mansion, Modern architecture, Modern leisure culture, Public space*

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INTRODUCTION

Summer leisure areas can be defined as places designed for the temporary escape from urban life. However, this concept should not be limited to this definition specifically for İstanbul. These areas should be considered reflection of redefined public life, differentiated social hierarchies and the evolving relationship between the public and nature along the coast. Therefore, in this study, the concept of "leisure" is used within both a spatial and a cultural framework.

When evaluated particularly for İstanbul, summer leisure areas served as spaces where city dwellers could escape the routines of daily life and experience renewal. This concept stands out for its diversity, considering the development and transformation of modern architecture is often interpreted through housing. When all the elements of modern summer leisure areas are examined, it becomes evident that these areas were increasingly distanced from the centre of İstanbul at the time, and that the functional diversity in these areas was increased. This diversity, emphasized in the definition of modern architectural heritage, is also related to the way these spaces define their own modernity while existing in different regions.

These areas, with their distinctive summer leisure culture, continued to develop from the mid eighteenth century to the late twentieth century. At the beginning of the twentieth century, especially during the Republican era, these areas not only exemplified the architectural characteristics of the period but also became part of the cultural life. Therefore, the formation of the modern coastal leisure concept should be considered not only as an architectural transformation but also as a broader restructuring of daily practices and social behaviour.

The first traces of this culture began in İstanbul with the palace elite and the upper classes and remained closed to the public. It is important to consider that this leisure lifestyle became particularly prominent in the Bosphorus, Kadıköy, Florya and the Princes' Islands with sea baths, piers, hotels and gardens serving as semi-public social areas. The development of summer leisure culture was evident in the period when housing started with seaside mansions, rented residences and garden houses, when transportation to the Bosphorus, the Princes' Islands, Yeşilköy and Kadıköy regions was provided by ferries with the establishment of Şirket-i Hayriye, and when urban/intercity coastal transportation increased with the opening of suburban lines. Ultimately, summer leisure areas increasingly expanded beyond the city center. Summer houses on the Princes' Islands reflected the city's cosmopolitan character, mansions in Moda and Fenerbahçe represented new bourgeois lifestyles and the waterfront residences along the Bosphorus shores represented the social visibility of modernization. These areas, collectively, reflect the transformation of urban identity through the experience of modernity.

After the proclamation of the Republic, this transformation took on a more ideological dimension, as coastal planning became a tool for expressing the modern nation-state's vision of progress and urban

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reform. The system based on private property has acquired a public character and it was opened to a wider public through the social life policies of the state and local governments. In this process, the planning and publicization of coastal areas became indicators of the legitimacy of the new regime. These varying leisure functions led to the formation of public beaches and other facilities beside private properties, particularly along İstanbul's southwestern coastal line, and large-scale leisure complexes began to appear in these areas. The evolution of swimming, which started with bathing culture -from isolated sea baths to open public beaches- constituted a symbolic step towards modern urban life. During the early Republican period, private summer housing function gained a more organized and publicly oriented spatial dimension. In this context, the Florya Atatürk Marine Mansion and its public beach, designed by Seyfi Arkan, stands out as one of the pioneering examples of this transformation. Florya, with its simple yet compelling design, has integrated nature with urban life and redefined leisure as a collective and modern experience rather than an exclusive privilege (Figure 1).



Figure 1. The southwestern coastal line of İstanbul and the location of Florya (Harita İstanbul, 2025).

This study aims to evaluate the development of the Florya Atatürk Marine Mansion and its surrounding leisure facilities, which hold a central place in the development of summer leisure on the southwestern coast of İstanbul. In line with the aforementioned conceptual and historical framework, the study examines Florya as a cultural landscape, while also emphasizing the settlement's multidimensional structure at the intersection of the Republic's modernization policies, its modern architectural heritage and changing coastal usage patterns. Thus, this study reveals how Florya became both a symbol and a concrete example of modern life in early Republican Türkiye, addressing evolving themes such as functionality, spatial diversity and public accessibility.

2. SUMMER LEISURE AS A MODERN WAY OF LIFE: THE EMERGENCE OF A NEW PUBLIC SPHERE ON İSTANBUL'S COASTS

Building on this historical and ideological framework, the concept of "leisure" derives from the Latin verb "licere", meaning to be free or permitted. It was used as "loisir" in French and became "leisure" in English, meaning free time, generally free from obligations. Corbin

(1994) explains that coastal settlements first emerged in the eighteenth century as seasonal retreats for the aristocracy and later evolved into more collective and public forms of leisure. The term "sayfiye", which was used in Ottoman Turkish in the nineteenth century is derived from the word "sayf" in Arabic meaning summer. "Sayfiye" can be defined as a coastal settlement for recreation visited during the summer. In its early periods, this culture was a tradition for the palace elite and upper income groups and was largely not open to the public. Over time, it contributed to the social and spatial modernization of the city.

As mentioned above, both international and national literature demonstrates that summer leisure was not just a recreational area but also a spatial expression of social transformation. This transformation demonstrates continuity with both earlier practices and modern reinterpretations. Beginning in the eighteenth century in Western Europe, leisure culture emerged as an aristocratic practice through seasonal stays in rural or coastal areas. With the rise of the bourgeoisie in the nineteenth century, this privileged model, while retaining some aspects of elite culture, evolved into a collective and more public form of leisure (Corbin, 1994). In his book examining modern urban leisure culture and the processes of its restructuring through contact with nature, Urry defines this concept, which spread in European cities from the nineteenth century onward, as a temporary space where urban individuals could escape the city, reconnect with nature and experience physical and mental renewal (Urry, 1990). Thus, leisure functioned not only as a reflection of modernization but also a site of negotiation and contestation where daily practices could challenge and reproduce dominant social norms.

With the development of modernism and concepts of free time, sea baths based on health and nature ideologies became widespread, particularly in England and France. These developments accelerated the production of functional and nature compatible structures in modern architecture and increased the number of recreational areas. The perception of the sea as a source of health and nature redefined the relationship between the body and the coastal environment.

During the Ottoman period, the culture of leisure began to develop in areas such as the Bosphorus, the Princes' Islands, Kadıköy and Florya, and they became places of socialization through spatial arrangements such as hotels, sea baths and piers. As can be observed, summer leisure areas were not built solely for housing. They became spaces where social life and culture coexisted. With the development of ferry lines and coastal transportation, they expanded beyond the city center of the period. These new spaces, which opened up on İstanbul's social and spatial map, diversified with their housing and related functions.

The post-Republican modernism era was driven not only by economic and political reforms, but also by new spatial interventions. This agenda was explicitly articulated in space. The method employed in summer leisure areas was to manage the relationship with nature in a planned

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manner. Planning approaches and legal regulations diversified coastal use; areas that had been primarily private property were transformed into public use. Public health and recreational areas gained importance, and in addition to spatial transformations, the foundations for a social transformation were started. Together with the socio-economic developments, planning and legal developments were other factors that influenced this period. Although unregulated before, the 1926 Civil Law permitted the construction of a single house on a single plot, addressing private ownership, thus shaping patterns of ownership and access. This made it more difficult for the middle class to own a house, but it accelerated the construction of detached houses along the coastal line (Tekeli, 2013). In his 1936 planning studies, Henri Prost approached the city as an integrated whole for the first time, designing espaces libres to organize the relationship between public and private realms. He distinguished between two forms of public space: one political, representing the presence of citizens in public life, and another administrative and legal, defining the public realm within the urban fabric (Akpınar, 2024). In this context, the distinction between planned and lived space, later conceptualized by Henri Lefebvre, becomes relevant -revealing how the official design of public areas and their everyday social practices could diverge in meaning and use-. Public beaches, green spaces and parks planned and implemented during this period demonstrate the efforts made to enrich the coastal line with public character. Thus, the middle class became integrated into summer leisure culture; concurrently, multifunctional coastal programs -housing, recreation and services- expanded.

The 1943 ten-year development program included numerous decisions affecting the coastal line including the redesign of Florya Municipal Beach and the opening of Bağdat Avenue. The change in the Notary Law in 1954 increased housing construction by cooperatives and built-and-sale businesses (Yağan, 2015). When liberal economic policies began to take hold, transportation axes were developed with the 1954 Master Plan and new housing areas began to appear. During this period, when the middle class could also afford housing, state-planned public facilities began to appear along the southwestern coastal line. The land expropriation laws intended to be enacted during the implementation of the Prost plans were only enacted in 1956, granting municipalities the authority to expropriate land. With the rapidly growing population, land subdivisions were undertaken along İstanbul's coastal line, particularly the east-west coastal axis. Development projects during the Democrat Party era are notable for the roads built along various axes. These roads had a significant impact on summer leisure areas, broadening access while reconfiguring patterns of use and class-based presence.

The 1964 Floor Regulation Plan increased floor heights in some areas, and the 1965 Property Ownership Law allowed unit based ownership, facilitating the entry of small investors and increasing construction and sales. The most dramatic change during this period was the transition

from single summer houses to apartment buildings. Rapid population growth and migration during these years led to an increase in the number of informal settlements and the city's landscape began to change. With the emergence of new destinations, summer leisure areas gradually developed. For example, Kilyos in the northwest, Dragos, Bayramoğlu and Yalova in the southeast, and Kumburgaz, Güzelce and Silivri in the southwest became popular. These new areas, reflecting diverse social structures, demonstrated that coastal leisure was no longer reserved for the elite.

The Coastal Law (1972) ensured the protection of the coastal line and the Bosphorus Law (1973) restricted construction along the Bosphorus. The master plan prepared in 1973, which imposed height restrictions on apartment buildings, significantly impacted summer leisure areas. The Bosphorus Bridge and the connecting roads were opened that same year, and this infrastructure transformation, along with other factors, redefined access to coastal areas and reshaped leisure.

With its multilayered historical structure and geographical location, İstanbul has become a distinctive city with diverse summer leisure areas and cultures since the nineteenth century. This culture is reflected in its spatial forms, from waterside residences along the Bosphorus, the summer residences on the Princes' Islands, the mansions on the eastern shores and the coastal settlements along the southwestern coasts. However, by focusing on the southwestern coastal line and centering on Florya, this study will highlight the visibility of the social, ideological and spatial transformation of summer leisure areas during the process of modernization. In this context, Florya is not considered a singular representation of modernity, but rather a component of the multiple modernities that shape İstanbul's coastal landscape.

3. THE FORMATION OF MODERN LEISURE CULTURE ALONG THE SOUTHWESTERN COASTAL LINE

The southwestern coastal line of İstanbul stands out as an area on the edge of the city, characterized by spaces of high social diversity. It is an area where leisure culture has been spatially shaped in a dynamic manner. This dynamism has made coastal areas increasingly accessible, collectively experiential and socially visible. From this perspective, these coasts can be evaluated as public arenas where modern public culture is produced. Each reflects different versions of modern life and exemplifies the coexistence of multiple modernities within İstanbul's evolving cultural landscape.

Completed in 1871, extending from Yedikule to Küçükçekmece, the suburban line initiated the development of the surrounding neighborhoods. When the line was extended to Sirkeci in 1872, it further integrated these districts with the city centre, becoming a fundamental factor in the development of the southwest coastal line. As transportation infrastructure continued to expand along this line, the section of the İstanbul-Edirne-London highway was put into operation in 1937. The

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route started from Topkapı and extended to Lüleburgaz, further strengthening the connection between the city center and the southwestern coastal line. In 1956, some sections of the highway were widened, some sections were extended to a shorter distance to Topkapı and the route was reopened under the name İstanbul-Edirne State Highway (Marshal Boulevard) (Üngür, 2018). These roads were directly connected to the southwestern leisure line in a way influencing daily and seasonal transportation (Figure 2). In addition to their spatial impact, these infrastructural improvements also served as key factors in the democratization of leisure. By expanding access to the coastal areas, they facilitated new forms of mobility and participation that reshaped both the geography and the social structure of modern leisure practices.

During this period, Bakırköy was a densely populated settlement between the railway and the sea. With its planned and modern housing projects, beaches, camping areas and motels, Ataköy became one of the areas that best reflected the new perspective on leisure. Although designed as a planned modern settlement, Ataköy's identity was reshaped by the daily life practices of the middle class, reflecting the tension between conceived and lived space. Especially after the 1950s, planning in this area allocated the coastal area for public use and the landward side for social housing. Yeşilköy's summer leisure culture, which had existed since the Ottoman era, continued with single summer houses and apartment buildings until the 1960s. This area, whose development accelerated with the opening of the airport, rapidly transformed into a residential area with the enactment of the Property Ownership Law. After the 1970s, as seasonal use gave way to permanent residences, the area gradually began to lose its character. The Çınar Hotel, located in this area, with its sea-integrated structure, swimming pool, ballroom and restaurant, has become a significant representative of modern leisure architecture, popular culture and social memory. In addition to its architectural features, the hotel combines elite and public entertainment. It reflected the new lifestyle where architecture meets social identity.

Küçükçekmece and Avcılar, on the other hand, have grown in popularity with their lake and seashore locations. In addition to residential functions, municipal beaches and recreational areas have become places where social life and entertainment culture intersect. This intersection emphasizes the multifunctional nature of the residences, along with their supporting functions.

Meanwhile, the coastal residential texture was prominent in almost all neighborhoods of Büyükçekmece. Particularly Kumburgaz and Güzelce gained popularity as easily accessible destinations after the 1960s. Silivri, on the other hand, became a district where leisure facilities, complexes and sites became prominent. Multifunctional leisure complexes held a particularly significant place in social life and leisure culture, and their place in collective memory reinforced this significance. These facilities have become a part of the region's cultural landscape, where memory and

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daily life converge to form a collective modern identity. Among these newly emerging leisure environments, Florya stands out as a unique example of the intersection of state planning and public recreation. Located between Yeşilköy and Avcılar on the southwestern coastal line, Florya has become a designed representative space of the Republic, an experimental environment that embodies the foundations of modern leisure culture in İstanbul.

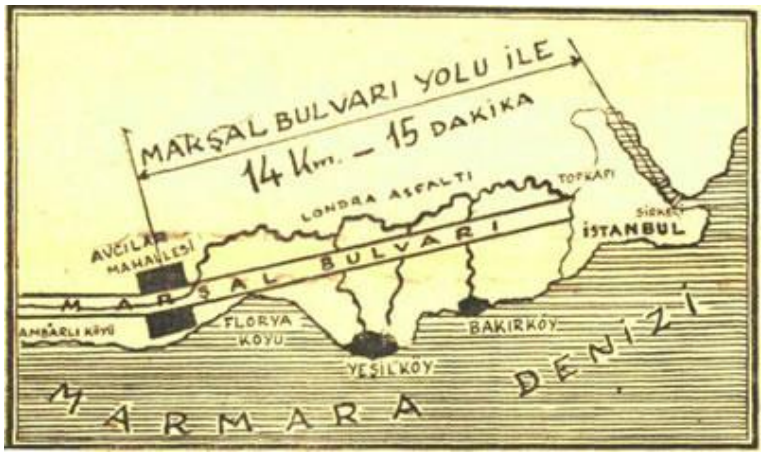


Figure 2. Relationship between the transportation axes (Cumhuriyet, 29.11.1953).

4. FLORYA AS THE STAGE OF MODERN LEISURE: A READING THROUGH ITS ARCHITECTURAL, SOCIAL AND CULTURAL LANDSCAPE DIMENSIONS

Florya, located in the southwestern coastal line between Yeşilköy and Avcılar, became a state-planned representative area of the Republic. Therefore, it can be considered as the foundation of modern leisure areas. Rather than serving as a single model of modernity, it served as a symbolic intersection within multiple modernities. The public space along İstanbul's southwestern coastal line became a space where different versions of urban modern life coexisted, interacted and were enacted.

The bath culture, which began with sea baths in İstanbul, evolved into public beaches along this coastal line. This has led to a reassessment of public space in modern leisure use. The coastal line has become a space where new modern identities and collective life intersect. The custom of segregating men and women in sea baths began to be abandoned, and beaches began to appear in these areas. Especially from the 1930s onward, the publicization of these coastal areas accelerated under the direct influence of Mustafa Kemal Atatürk, transforming the area from the vacation spot of the leader of the modern Republic to a showcase of modern life. Bozdoğan argues that the Florya Atatürk Marine Mansion was nourished by the symbolic codes of creating the modern individual: hygiene, naturalness, openness, simplicity and controlled publicity (Bozdoğan, 2001). At the same time, although this state-led publicization expanded public access, the experience of leisure remained socially stratified. Therefore, while Florya functioned as an elite representation,

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it simultaneously operated as a semi-public sphere -a setting where the ideals of modern life were both performed and observed. This duality between representation and participation also informed the architectural program of the surrounding complex, where spatial design itself became a medium through which the ideals of modern life were performed and observed.

Henri Lefebvre's triadic model of the social production of space provides a useful conceptual foundation for interpreting Florya's spatial perspective. Space is produced through the interaction of these three dimensions: conceived, perceived and lived space (Lefebvre, 1991). Conceived space expressed the representations and plans produced by architects, planners and the state -the mental and ideological construction of spatial order-. Perceived space is linked to the material and sensory dimension of spatial experience -the networks, movements, and physical practices that shape daily perception-. Lived space embodied the space of social experience and imagination, where symbols, emotions, and daily practices converge. As a modern summer leisure landscape, Florya rendered the intersection of these three dimensions legible as a form of social space. The conceived space was produced within the Republic's modernization ideology and the design framework by Seyfi Arkan, one of the leading architects of the period, in collaboration with other prominent architects discussed in other sections. While perceived space manifests itself through the area's transportation systems, coastal infrastructure and leisure facilities, lived space is shaped by the embodied practices of modern leisure and the controlled visibility of public life, exemplified by the public presence of the leader himself.

Building on this conceptual framework, the Florya complex exemplified the reinterpretation of post-Republican summer leisure as a "planned public space" where architecture and landscape collectively staged the codes of modern life. The interrelationship between form, function and ideology was reinforced by a series of facilities -mansion, beaches, seaside casino (gazino: a seaside entertainment hall) and the promenade-. Improved transportation networks further integrated this coastal landscape into the city, expanding public participation. The result was not only coastal architecture but also a pedagogical stage for modern life along the coast.

The mansion was completed in 1935 following Atatürk's visit to Florya, his request for the development of this area, and the quick implementation of Seyfi Arkan's design. It is known that the General Secretariat and Adjutancy buildings were added to the site after the mansion's completion, forming part of a unified complex of buildings. The inventory fiche prepared by the Regional Council for the Conservation of Cultural Property (No.1) states regarding the selection of the project "(…) selected as one of three projects participating in the competition. (…)" (Aşık, 2017). Seyfi Arkan describes Florya Atatürk Marine Mansion in his book detailing his own projects, "special competition" under the "contests" heading (Arkan, n.d.). This supports the claim that a

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competition was held. In the same book, Seyfi Arkan mentions the Çankaya Hariciye Köşkü (Foreign Affairs Pavilion in Ankara) project competition in the Atatürk section, stating, "Atatürk, satisfied with the construction of the pavilion, appointed Seyfi Arkan as his special architect for the Florya Marine Mansion, the General Secretariat and the Adjutancy buildings, and other structures." Another source reports that instead of a competition, projects were requested from three architects ("Florya Cumhurbaşkanlığı Deniz Köşkü", 2012). Esra Akcan, referring to the three participants, including Berlin Municipality Zoning Director Wagner, who was the İstanbul consultant at the time, stated, "The reason Seyfi Arkan's project was chosen was that the overall design scheme included a public beach that the public could also use." (Baytar, 2008). According to this understanding, the Mansion and its surroundings represent the architectural expression of the collapse of the hierarchy and symbolically suggested the democratic re-establishment of modern Türkiye.

At the same time, the mansion's design reflects international programmatic and design affinities. Evidence of this orientation can be found in the municipal publication Güzelleşen İstanbul (1944), which observes that "in some European cities not located on the seaside -such as Wansee in Berlin- artificial lakes were constructed, surrounded by beaches, cabins, and casinos that enabled tens of thousands of people to bath. In coastal European and even Balkan cities, beaches such as those in Varna and Constanta were preserved as well-organized and modern recreational facilities" (İstanbul Belediyesi, 1944). This comparison highlights how Florya's coastal design conceptually aligned with European practices that framed leisure, hygiene, and recreation as integral components of modern urban life. Therefore, these designs can be considered a blending of universal functions with local morphology and a demonstration of the open, semi-open and closed spaces that Seyfi Arkan skilfully integrated in his designs. Designed based on the Republic's vision of spatial modernization, the Florya Atatürk Marine Mansion and its associated leisure complex of beach, cabins, casino and motel embody the function oriented principles of modern architecture. It clearly demonstrates that summer leisure areas should be considered not only for accommodation purposes but also as a complex of functions and culture. Therefore, this place, through its planning, presents a model of life disciplined and integrated with nature. The mansion and its surrounding facilities are also part of the same ideological organization. They have become tangible tools of the public lifestyle produced by the state. When interpreted from architectural, sociocultural and cultural landscape perspectives, its spatial configuration reveals the interrelationship between representation, physical form and daily spatial practices.

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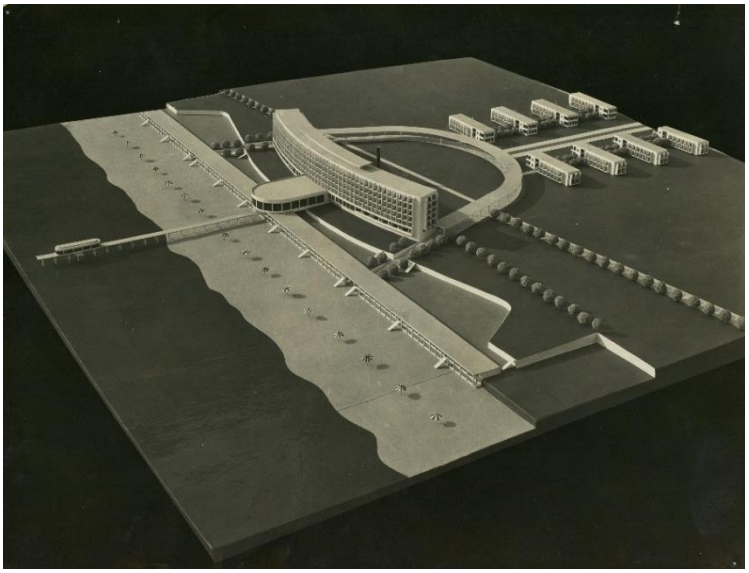


Figure 3. The model of Florya Beach (Salt Research, n.d.).

In this context, Seyfi Arkan's 1935 research trip to Europe marked a significant milestone in the conceptualization of Florya as part of a broader modern coastal strategy. After examining European coastal facilities, Arkan devised a comprehensive program of hotels, a gaming hall, health and recreation parks, pensions, beach cabins and a market, all coordinated within Henri Prost's citywide planning vision (Figure 3). Prost's project aimed to create an uninterrupted coastal boulevard from Sirkeci to Florya, integrating the coast into İstanbul's life and positioning the city as a potential "international coastal city." However, only the first stage of this ambitious plan -the reinforced concrete beach structures, the market area, and the road improvements- was implemented (Figures 3-4). ("Florya Halk Plajı Evleri…", 2012).



Florya 3 senede dünyanın en asrî plâjı olacak

Floryadan sonra Kilyosta da bir plâj yapılacak ve iki banyo birbirine bağlanacak

DENİZ

Florya üç sene sonra bu hali alacak

Güzel Sanatlar Akademisi Şehircilik profesörü mimar Seyfi Arkanın Florya plâjı için yaptığı proje İstanbul Belediye[si] yeniden gözden geçirilerek kabul edilmiştir. Bu plâna esas olmak üzere bu

Floryanın bayındırlık projesi hazırlandı

Floryada dört otel, parklar, küçük pansiyonlar yapılacak

Floryanın bayındırlık planı için Avrupa plâjlarında incelemeler yapan mimar Seyfi dün şehrimize dönmüştür. Floryadaki deniz köşkünün planını yapmış olan mimar Seyfi, Avrupa gezisi hakkında bir muharririmize şunları söylemiştir:

— Floryada vücuda getirilecek inşaata aid projenin esaslarını evvelce hazırlamıştım. Avrupa plâjlarını dolaşarak projeyi tamamladım. Bu hususta tanınmış Fransız şehircilik mütehassısı B. Prostun da fikirlerini aldım. Yakında tatbikata geçmek mümkün olacaktır.

[Devamı 4 üncü sahifede]

Mimar Seyfi

Figure 4. News about Florya Coast ("Florya Halk Plajı Evleri…", 2012).

The design of the mansion and its immediate surroundings offer a spatial experience shaped by functional rationality, the interconnectedness of the volumes, and overall composition with nature. This group of structures laid the foundation for Florya's strong summer leisure identity, setting a significant example for İstanbul as a whole. It vividly demonstrates that summer leisure should be considered not only for housing, but as a complex of functions and cultures. Although some of them have lost their integration with the public through changes over

time, they still retain their traces. The authentic facilities reflect every stage of modern summer leisure culture: the entrance, cabins, park, casino, beach and the mansion. The cabins mediate the bodily visibility within publicized leisure time; shade shelters and showers support health-hygiene ideals; and the beach functions as an active point of direct contact with the sea and the axes that can be defined as a promenades have become social stages of viewing, encountering and socializing. Therefore, this place, through its planning, presents a model of life disciplined and integrated with nature. The mansion and its surrounding facilities are also part of the same ideological organization. They have become tangible tools of the public lifestyle produced by the state.

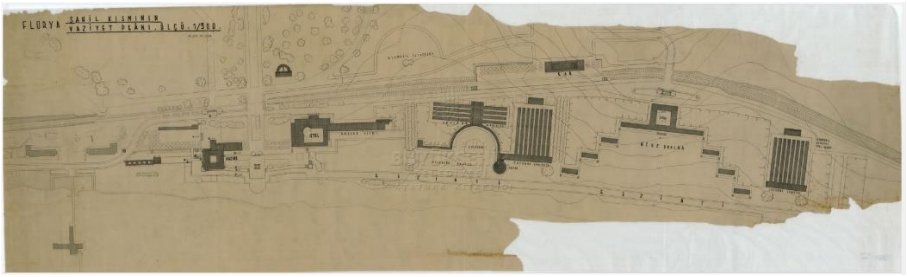


Figure 5. Florya Site Plan (İBB Atatürk Kitaplığı, n.d.).

The first accessible but undated site plan of the area (Figure 5) shows the General Secretariat and the Adjutancy buildings, the red, white and blue mansions, the public beach, the service buildings and the comprehensive layout of the Florya Casino, which was planned further down the road, in the immediate surroundings of the mansion.

However, because the drawing for Güneş Beach, located to the east of the site, reflects an unimplemented design, it would be correct to interpret this site plan as a document produced for the design of the Florya leisure area. Although undated, the plan is likely from 1938 given its similarities to Rüknettin Güney's Florya Casino drawings and the absence/presence of specific structures.

Another base map (Figure 6), which provides an idea of the topography and the design of the coastal area of Florya, is undated, but is thought to indicate a period after the previous site plan (Figure 5) due to the absence of the White Mansion.

Accessibility has been a defining factor for Florya. In addition to the suburban/bus lines, the continuity of the pedestrian-shore connection has made these amenities both useful and public-facing. In fact, the "designed modern summer leisure area" definition mentioned above could be added to the definition of "scheme of public life". Yahya's Casino, already a key indicator of the existence of a summer leisure in this area, is indicated in the drawing set of the mansions and general secretariat building at Figure 7. The İstanbul Encyclopedia states that this casino was established in the 1930s "as a place where intellectuals, high-ranking officials, members of parliament and foreign diplomats could peacefully reside and be properly entertained. It was successfully operated by founder Mr. Yahya Baydar until 1966." (Koçu, 1973). The owner of the

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restaurant -which would later be demolished during road construction- said in an interview in 1966, "(...) for thirty-six years we have served Atatürk, İnönü, Celal Bayar, Menderes, Şükrü Saraçoğlu, Ali Çetinkaya, Kılıç Ali, Yunus Nadi, Yahya Kemal and hundreds of other well-known figures whose names I can't recall right now. Countless diplomats have always stopped by and eaten our meals when they visited Florya. (...) Isn't it the so-called tourism industry -which develops countries- what we do? (...) While the idea of this place being preserved after us is to be formulated, a lawsuit is being filed against us for its demolition." (Koçu, 1973). These documents are the most concrete evidence that this place was used as an entertainment and recreational area.



Figure 6. 1/2000 Base Map of İstanbul (İBB Atatürk Kitaplığı, n.d.).

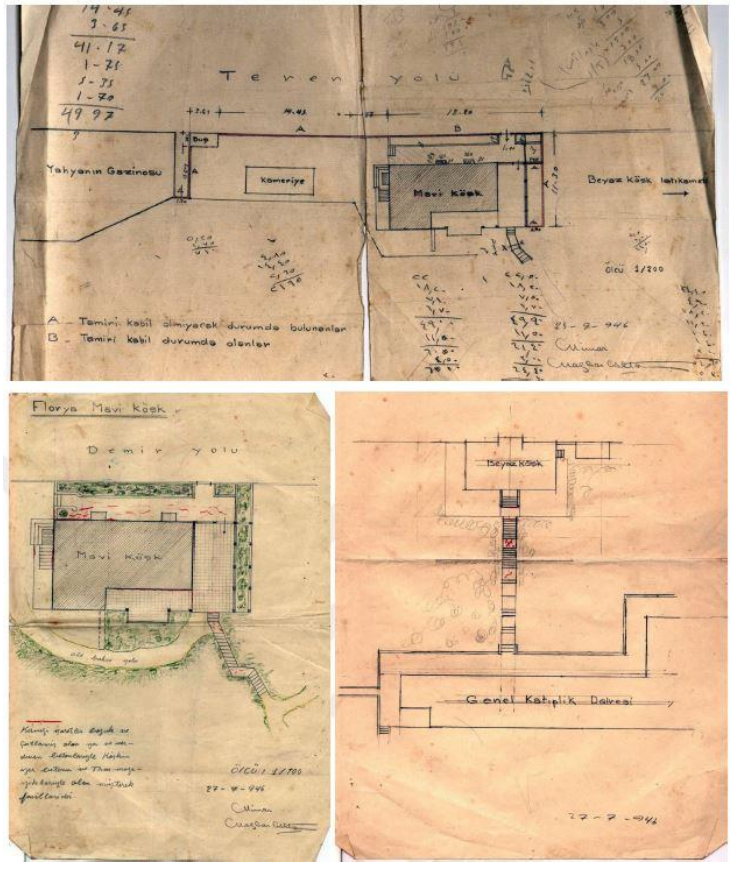


Figure 7. Yahya's Casino at the sketches of the other facilities (Aşık, 2017).

Over time, this area evolved into a cultural landscape reflecting modern leisure culture, with activities like sunbathing, swimming and strolling during the day, and enjoying the scenery, music and gathering in the evening. The authenticity and uniqueness of the mansion, designed over the sea, also influenced the surrounding building complex, and this same approach was continued, even in designs by other architects (Figure 8).



Figure 8. Florya Atatürk Marine Mansion (Şipka, n.d.).

Following the mansion and its annexes, the construction of the "private cabins" now known as the "Municipal Building", can be seen in photographs taken in 1936. Similarly, details of the general secretariat building and the private cabins at the rear can be seen in photographs taken of Atatürk with his adopted daughter Ülkü (Figure 9). Although still under construction in 1936, these private cabins are part of the overall planning scheme.



Figure 9. Atatürk, Ülkü and the municipal building under construction in the background (Aşık, 2017).

The drawings referred to as "changing closets" added to the side of the aforementioned municipal building (private cabins) (Figure 10); the drawings of the structures referred to as "changing cabins" added to the landward side of this building (Figure 11) were signed by Leman Tomsu and approved by Prost in 1936. In addition to these, the drawings of the sports and recreational equipment in front of this building are dated 1937 and signed by Rüknettin Güney (Figure 12). However, the information

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about the implementation status of the structures on the seaward side is limited.

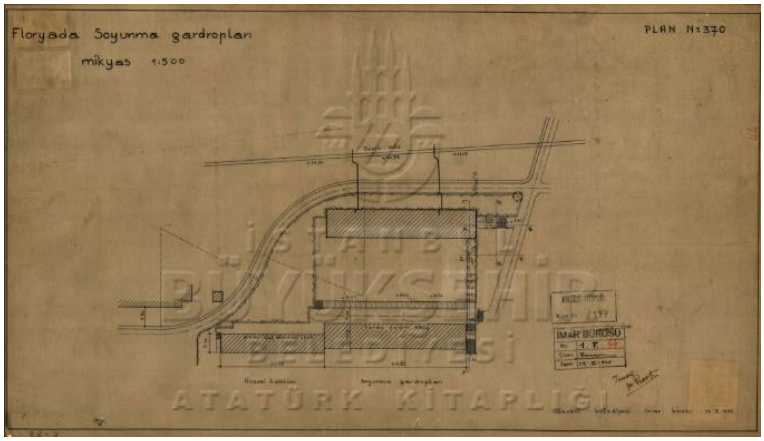


Figure 10. Changing closets, Leman Tomsu, 1936 (İBB Atatürk Kitaplığı).

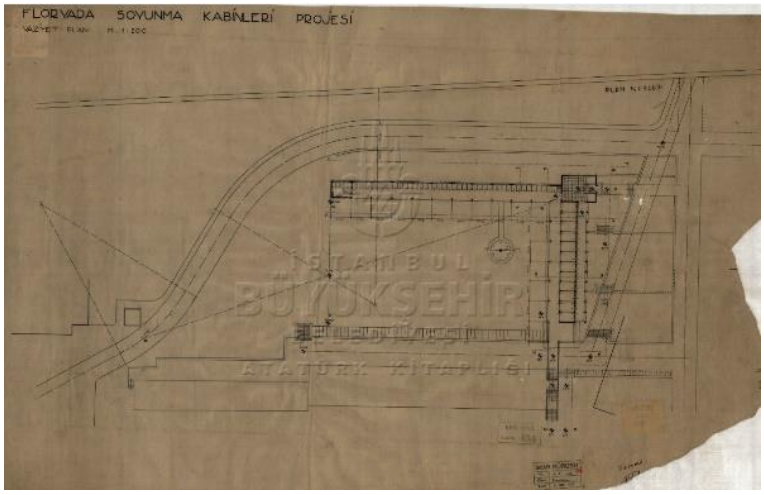


Figure 11. Changing cabins, Leman Tomsu, 1936 (İBB Atatürk Kitaplığı).

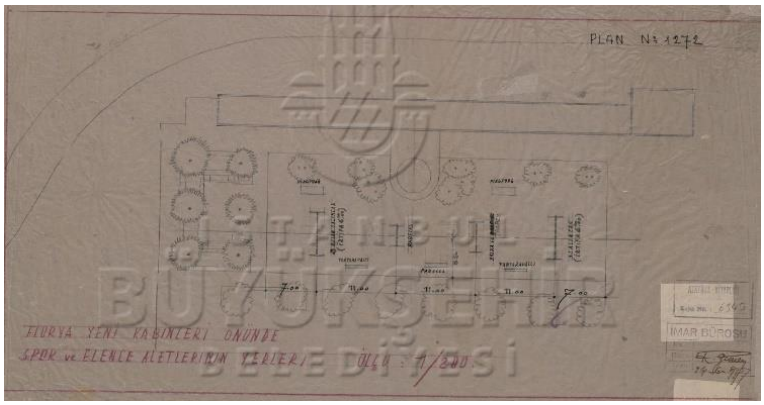


Figure 12. The sports and recreational equipments, Rüknettin Güney, 1937 (İBB Atatürk Kitaplığı)

The presence of the Rüknettin Güney-designed Casino, which would later be added to the area, and its design, which allowed for day and night use, improved the area's dynamism. In addition to these two uses, the Casino also served as a public entertainment and socializing space where citizens could make an appearance, alongside the elite representation of state officials. This shared the concept of "controlled publicity." Events such as recitals, balls, and teatimes fueled seasonal or daily social life. Figure 13 shows the structure of the municipal building (private cabins)

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and provides clues about the integrity and use of the Florya Casino and its changing rooms.

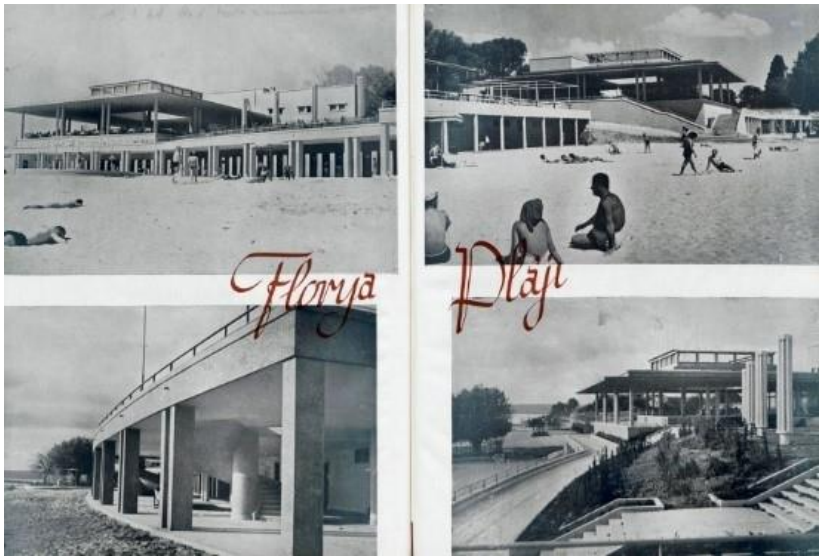


Figure 13. Florya Casino and its immediate surrounding (Daver, et al., 1943).

Later periods were marked by certain milestones, such as the first documented comprehensive restoration of the Mansion in 1968 and its transfer to the Directorate of National Palaces in 1988. The site underwent many changes between these periods. It is known that the White and Blue Mansions were demolished to construct what is now Çekmece İstanbul Street, that the changing rooms at Menekşe Beach were expanded, and that after 1956, a project for the Florya coastal line was commissioned by Sedad Hakkı Eldem and a 25-person committee, in collaboration with the Tourism Bank and the İstanbul Municipality to design for both İstanbul residents and visitors from outside the city (Evren, 2000) (Figure 14).

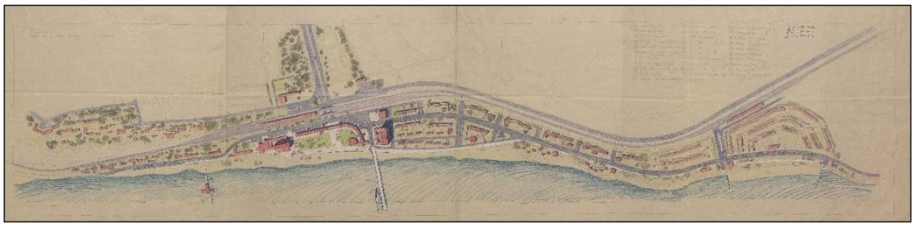


Figure 14. Florya coastal line master plan, Sedad Hakkı Eldem (Gürel, 2018).

Regarding the project mentioned, the master plan can be seen in the Figure 14, encompassing the Florya Atatürk Marine Mansion and surrounding structures, extending from the Menekşe train station toward Yeşilköy. This includes the structures of Menekşe Beach, located southwest of the site, and various structures incorporated into the site. However, not all of the structures depicted in this drawing were realized. The project, approved in 1956, allowed for the construction of two motels, a camping area, and daily beach cabins (Aşık, 2017). With such initiatives, the functions serving the modern summer leisure were diversified, the surrounding area expanded, the infrastructure for the

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public summer leisure was established, and the area was used extensively by both residents and tourists.

During the road construction process, the aforementioned Yahya's Casino and other smaller units were demolished, a retaining wall was added, and with the demolition of Red Mansion, a building called Guesthouse (directorate when built) was added to the site. Significant changes were also seen within the mansion during this period. For example, the mansion's steel stilts (vertical marine steel structural system supporting the building above the sea) were converted to reinforced concrete, the terrace roof was converted to a hipped roof (Figure 15), and numerous smaller prefabricated structures were added to the site.



Figure 15. The changes at Florya Atatürk Marine Mansion, 1968 (National Palaces Administration Archives, n.d.).

The 1982 aerial photograph (Figure 16) of the site shows the General Secretariat and the Adjutancy buildings, the municipal building and its annex, the guest house, prefabricated structures and the casino. In this photograph, the municipal building appears to have been converted into its current form of accommodation. Similarly, after the mansion was transferred following the 1988-1994 restoration, the General Secretariat and the Adjutancy buildings are believed to have been rebuilt, largely preserving their seafront elevations. This situation is legible when the 1952 Mazhar Günaltan survey drawings are compared with present drawings, and the following statements: "These single-story, timber-framed buildings were demolished between 1992 and 1995 and reconstructed (…) between these two buildings, which are currently used as the TBMM Social Facilities, a new building, not included in the original plan, was constructed by the Directorate of National Palaces for restaurant purposes." (Kaya, 2000).

The group of buildings repurposed as the TBMM Social Facilities was planned primarily as accommodation units, and the coastal line no longer serves as a public beach. The changing rooms were removed, the Menekşe Beach located to the west of the area was expanded by filling the ground, and a park was created (Figure 17). The Casino Building was

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separated from the area. Following these changes, the Mansion was opened as a museum, and the area's use was limited/controlled.



Figure 16. Aerial photograph, 1982 (İBB Şehir Haritası, 1982).





Figure 17. Menekşe Beach (Arkitera, n.d. & Sedad Hakkı Eldem'i Anla(t)mak II: 1950-1980)

This area intersects with the modern architecture's codes such as transparency, simplicity, as well as the Republic's goal of a new society. Florya served as a place where this goal was tested in daily life. The ideological form of the designed space has been mentioned above. Perceived space can be revealed through the facilities and transportation network. Florya's physical layout directs the user relationship established with this layout. The connection between the cabin, park, promenade, mansion, and train combined with the permeable, continuous, and open nature of the coastal line, shapes the visual relationship. Therefore, Florya's design should not be considered merely a backdrop; it should be read as a guide to social behavior. Walking, swimming, sitting, watching, dancing, and sunbathing here have become the modern citizen's learning practice of existence. Thus, daily practices here transformed the space's intended ideology into everyday life. Scenes such as Atatürk interacting with the public, swimming and rowing, along with the train transportation, time spent on the beach and daytime and evening entertainment at the casino, created the "lived" meaning of the space. These experiences enabled the social meaning -the internalization- of modern architectural forms. Therefore, Florya can be considered the earliest systematic example of modern summer leisure culture in Türkiye.

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The evaluation of this area as a cultural landscape, as discussed above, has been shaped by the following definition by UNESCO: "Combined works of nature and humankind, they express a long and intimate relationship between peoples and their natural environment." (UNESCO World Heritage Centre, n.d.). The natural morphology of the coast and the formal construction of modern architecture combine to create a designed cultural landscape. Here, nature, rather than being a directly experienced element, has been transformed into a designed space of experience. Over time, this designed experience evolved into a shared memory, gaining continuity and meaning. Therefore, instead of evaluating this area solely based on the physical features of the mansion, it is necessary to consider it as an integrated cultural landscape.

Building upon UNESCO's definition, the evaluation framework for cultural landscapes also considers factors beyond purely natural values, including "the presence of important natural and semi-natural ecosystems; (…) the presence of sustainable land-use practices; and the existence of outstanding scenic beauty arising from the contrast between natural and artificial elements in the landscape" (Fowler, 2003). In Florya's coastal context, biodiversity-related criteria are less central; however, sustainable coastal use practices and the scenic contrast between the natural coast and designed architectural elements are particularly relevant, reinforcing its status as a designed cultural landscape at the interface of nature and modern urban life.

In this context, recommendations for Florya include preserving the integrity of the landscape and spatially preserving the relationship between physical elements; maintaining public access to the coast to offer public function through continuity of use; maintaining the museum's functional interactive use in a way to reflect its impact on the development of Florya's modern leisure culture; and opting for scientific approaches to documentation and interventions. In fact, what needs to be preserved is not just the form, but the experience itself.

Florya is the embodiment of modern architecture's claim to build new life in the coastal line: a mansion on the sea, a beach open to the city, a visible leader, and a participatory populace. This combination has ensured that Türkiye's modernization narrative remains significant not only as a concrete and spatial experience but also as a historical context.

In this regard, Florya should be included within multiple modernities shaping İstanbul's coastal landscape. It should not be considered as a singular model, but rather as a visible pedagogical stage where modern architecture shapes daily practices.

4. CONCLUSION

Leisure culture in İstanbul became not just a summer practice but also a tool reflecting the city's social and cultural development. This culture, rooted in elite life during the Ottoman era, underwent a transformation, particularly on İstanbul's southwestern coast, with developments in the late nineteenth century. With the transformation of socio-economic

conditions and legal regulations, leisure areas began to take shape in order to appeal to a broader public. This transformation demonstrates a profound shift in the city's social geography. Coastal areas, once privileged by the elite, have become public and accessible. These areas have transformed into spaces of collective experience. After the proclamation of the Republic, their modern social nature also acquired an ideological dimension. Summer leisure areas were no longer only places of entertainment; they became pedagogical stages where modern life was observed and practiced. These areas reflected a cultural landscape that revealed the multilayered nature of modernization. Considered in this context, Florya has become a symbol of modernity brought by the Republic as well as a modern coastal settlement.

Designed by Seyfi Arkan in 1935, the Florya Atatürk Marine Mansion can be described as a space where Arkan combined modern architectural principles such as functionality, simplicity and openness with the Republic's ideals of public life. The structure, notable for its design situated on the sea, reflects a design approach that utilized nature within a rational order. The mansion functioned both as the leader's living space and as a publicly visible stage. Thus, the image of the Republic's leadership became spatialized. Mustafa Kemal Atatürk's visits to the mansion, both during the construction process and after its completion, the time he spent there and his other activities including the hosting of important guests, meetings, swimming and rowing with the public on the beach demonstrate the symbolic proximity between the modern leader and the public. The other structures surrounding the mansion -including the beach, changing rooms and promenade system- possess a comprehensive design approach that complements this ideology. Here, architecture functioned as a guide to social behavior. Within these spaces, people learned new forms of bodily discipline, engagement with nature, social interaction and leisure practices. In addition to reflecting the social ideals of the Republic, Florya has also taken its place in international discourses of leisure culture. Therefore, Florya can be interpreted as a bridge between local experience and the international context. It has become a national symbol of modern leisure culture and a reference settlement. İstanbul's southwestern coastal line should be considered a place that exhibits the most significant spatial and social reflection within the scope of the Republic's modernization. To understand these leisure areas, a multifaceted analysis that examines cultural, spatial and social structures together is necessary. Only in this way İstanbul's modern leisure architecture that is shaping social behavior, identity and daily practices, as well as its architectural form, can be understood.

These transformations, particularly when considered for Florya, can be interpreted within the framework of ICOMOS's 20th Century Historic Thematic Framework (Theme 8: Popular Culture and Tourism) through its subthemes "Growing Access to Leisure" and "Development of Visitor Service Facilities" which reflect social and spatial transformations (Marsden & Spearritt, 2021). This approach not only established a spatial

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and social discipline for Türkiye but also established Florya's place within international leisure culture. Located on the southwestern coastal line, this spatial composition helped create a controlled discipline between leisure, public and daily life. Men and women were able to swim together; entertainment spaces became more socially accessible and contact with nature was redefined. Therefore, it can be argued that this area reconstructed the social goals of modernization. In this context, Lefebvre's concept of "the production of space" offers a useful analytical perspective. The transformation of this cultural landscape into both an object and a tool of modernity exemplifies the conceived, perceived and lived space within this area. The social environment created by the development of these three spaces also contributes to the evaluation of Florya as a visible stage. Publicity is not only a reflection of freedom but also a structured visibility here. The relationship between the body and nature is established, and this can only be transformed into action within the relationships determined by the design.

The authenticity of Florya is not only its architectural form. Its integration with İstanbul's broader leisure landscape also underscores its uniqueness. This landscape has been continuously shaped by public involvement. Therefore, it should be considered as more than an architectural project. In this context, Florya, in line with UNESCO's definition of cultural landscape, is a crucial example that presents the interrelationship between human and nature and deserves international consideration. Its rational planning approach, integrating topography, social life and nature, ensures the area's place and continuity in the global discourse on modern leisure heritage.

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Resume

Münevver Aygün Aşık is a Research Assistant in the Department of Architecture at Altınbaş University. She completed her undergraduate studies in the Department of Architecture at the Faculty of Engineering and Architecture, Anadolu University. She received her master's degree from the Building Survey-Restoration Graduate Programme at Yıldız Technical University with a thesis entitled "Conservation and reuse of modern houses: Florya Atatürk Marine Mansion" She is currently a PhD candidate in the same programme. She is a member of DOCOMOMO International and DOCOMOMO Turkey.

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Urban Design and Experience in Ancient Sources: The Examples of Vitruvius and Pausanias (A Brief Assessment of Architectural Theories and Experience)

Cihangir Aldemir *

Abstract

This study examines the relationship between the theoretical design principles of ancient cities and narratives based on the use of built spaces through a comparative analysis of Vitruvius' De Architectura and Pausanias' Periegesis Hellados. The methodological approach of the research is based on the thematic analysis of urban elements in both texts, focusing on sacred spaces, the forum/agora, harbours, the relationship between the acropolis and the lower city, baths and palaestra/gymnasion complexes, and theatres. Vitruvius' text approaches the city as a rational and generalizing system shaped by site selection, climatic and environmental conditions, orientation, proportion, building typologies, and engineering principles. Sacred spaces are defined through architectural order, orientation, and hierarchical placement; the forum is regarded as the centre of legal and economic activity, while harbours are considered as technical infrastructure components associated with waves, winds, and defensive elements. By contrast, in Pausanias the city is conveyed through a descriptive narrative unfolding along walking routes, articulated through the sequencing of sacred stations, mythological references, cult continuity, and local memory. The agora is presented as a public space in which ethical and identity-related meanings are concentrated; the harbour as a significant place charged with religious and political representations; and the acropolis as a higher space where historical and sacred meanings converge. While structures such as baths, gymnasia, and theatres are defined in Vitruvius through criteria of technical functionality, health, and performance, in Pausanias these spaces are associated with cult practices, social identity, and acts of remembrance. In conclusion, the study demonstrates that the ancient city should be evaluated not solely through planning and architectural principles, but also in relation to ritual practices, social memory, and spatial experience. The study argues that a combined reading of Vitruvius' normative framework and Pausanias' descriptive narrative offers a holistic approach to the study of ancient cities.

Keywords: *Ancient sources, Pausanias, Urban design, Vitruvius*

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INTRODUCTION

In antiquity, cities developed not only through planning principles but also through a complex process shaped by social rituals, religious practices, public activities, and processes of cultural representation. As a natural consequence of this process, theoretical approaches aimed at explaining the design of ancient cities and descriptive narratives and writings concerned with the experience of space have also emerged. These narratives demonstrate that studies of ancient cities should be conducted not only on the basis of tangible archaeological evidence, but also through the representational forms offered by historical texts. In this context, ancient texts provide two fundamental types of information: first, theoretical narratives that articulate the criteria governing the design of spaces in ancient cities; and second, descriptive and topographical narratives that convey the experience of urban space. This study evaluates, within a comparative framework, the texts of the Roman architect Vitruvius and Pausanias, one of the most important representatives of the Periegesis tradition, with the aim of bringing these two dimensions together (Drijvers, 2018). Although the two authors lived in different periods, when considered together they offer an important perspective on ancient cities at both the theoretical and experiential levels. In De Architectura, Vitruvius discusses architecture within a systematic theoretical framework that extends from site selection to building typologies, from the use of materials to urban design. The work explains numerous technical components, ranging from the positioning of temples to the concepts of proportion and order, from the acoustic principles of theatres to the factors determining the health conditions of cities. In contrast, in Periegesis Hellados (Description of Greece), Pausanias travels through different regions beginning with Attica, conveying urban components such as sacred sites, temples, statues, stoas, harbours, tomb monuments, and roads together with their associated narratives, mythological references, and practices. By making visible the everyday use of urban space, its religious orientations, and its topography, Pausanias' account reveals, in a sense, the cultural counterparts of Vitruvius' theoretical scheme as manifested in the field.

The present study has been structured with the aim of establishing a framework for understanding perceptions of the city and space through a comparative examination of Vitruvius' and Pausanias' conceptions of the ancient city. First, brief information is provided on the lives of Vitruvius and Pausanias. This is followed by an examination of the principal components upon which the theoretical models employed by Vitruvius to define the ancient city and architecture are based, namely the principles that constituted urban morphology in Antiquity. In parallel, the study seeks to identify what types of experiential data Pausanias offers regarding urban space in his narrative of ancient Greek geography, and how this narrative enables a reading of urban topography and building functions. A combined reading of these two texts aims to reveal the framework formed by the theoretical (normative) model and the

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observational (descriptive) model of the ancient city. Within this context, how urban elements are represented in both authors' texts and how these representations support each other in various ways are also central topics of discussion in this study.

VITRUVIUS AND PAUSANIAS: THEIR LIVES AND WORKS

Vitruvius (Marcus Vitruvius Pollio) (90-20 BCE) was a military engineer and architect who lived during the final phase of the Roman Republican period. Nearly all information regarding his life is derived from his own writings. Vitruvius spent his early career as a military engineer in the army of Julius Caesar, where he specialized in war machines, catapults, and ballistae (Yegül, 1993). In the later stages of his life, he devoted himself to scholarly work and completed De Architectura around 27-25 BCE. This work, written in the later years of the Roman Republic, is a fundamental text on architecture and engineering that has survived in its entirety. De Architectura elevates architecture beyond a purely technical craft, positioning it as an integral component of the humanities. Consisting of ten books, this work offers extensive information on ancient cities, ranging from principles of city planning and the proportional systems of temple construction to public building typologies, water structures, and mechanical devices (Baldwin, 1990; Reitz-Joosse, 2016). Accordingly, Vitruvius' text contains both formal principles (proportio, symmetria, and decor) and applied knowledge related to urbanism and topography. Vitruvius also addresses the education required of an architect, the principles to be considered in the foundation of cities, the proportional and orientational rules governing temples, the ideal placement of public buildings, and construction techniques (Scranton, 1974; Kołoczek, 2022).

Pausanias (110-180 CE) was a writer, historian, and geographer who travelled through, observed, and described the ancient geography of Greece. In the second century CE, Pausanias journeyed across Greece and recorded cities, sacred spaces, monuments, rituals, and aspects of daily life in his ten-volume work Periegesis Hellados (Description of Greece). His narrative is characterized by a descriptive and experience-based mode of writing (Hutton, 2005; Pretzler, 2007). The work portrays ancient Greek geography not merely as a topographical whole, but also through cult practices, ritual activities, mythological narratives, and local traditions (Elsner, 1992). In terms of geographical scope, Pausanias focuses on regions such as Attica, Corinth, Laconia, Messenia, Elis, Aetolia, Achaia, Boeotia, Phocis, and Arcadia. In the political context of his era, Pausanias emerges as a figure tracing Greek cultural heritage under Roman rule. While observing Greek cities governed by Rome, he relegates contemporary political structures to the background and directs his attention primarily toward the monuments of the Archaic and Classical periods (Hutton, 2005; Daubner, 2022).

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A GENERAL OUTLINE OF THE THEORY OF ARCHITECTURE AND THE URBAN MODEL IN VITRUVIUS

Vitruvius' approach to the ancient city is grounded in a theoretical framework that situates architecture not merely as a building activity, but as a system harmonized with social, natural, and religious order. According to him, the principal subject of architecture is shaped around the concepts of firmitas (stability), utilitas (functionality), and venustas (beauty), and buildings must therefore be durable, function appropriately, and possess a harmonious aesthetic quality (Bianco, 2023). These concepts express general principles applicable to all building types. Vitruvius' architectural theory extends across a comprehensive range of scales, from the foundation of cities to temple design, from the organization of public buildings to residential typologies (Scranton, 1974). The city is conceived as a unified whole that incorporates robust fortifications ensuring military and civic security, functional public buildings accommodating daily life, and aesthetic and ritual values expressing the order of sacred spaces associated with the gods (Vitruvius, I.III.1). Accordingly, Vitruvius' text seeks to construct its descriptions of the city in a systematic manner through decisions related to planning, proportion, orientation, topography, and cult.

The first step Vitruvius identified for founding a city is choosing the location and determining its orientation. The suitability of a city's location in terms of health conditions is evaluated with regard to water resources, air circulation, climate, and topographical advantages (Vitruvius, I.IV.1-5). In this context, he argues that streets should be oriented to receive sunlight in order to avoid the harmful effects carried by winds, that defensive structures should be adapted to the topography, and that monumental buildings should be constructed so as not to coincide with wind corridors. He further notes that streets should be planned in a way that does not block wind flow, and that avenues directly exposed to winds increase the risk of disease (Vitruvius, I.V.1, I.VI.1-8; I.VII.1). This approach demonstrates that harmony with nature was accepted as a fundamental principle in ancient urban planning, and that environmental factors affecting health and comfort were regarded as essential design criteria. Furthermore, Vitruvius places particular emphasis on the quality of urban water sources, recommending that spring waters be evaluated according to their taste, smell, and physical characteristics (Vitruvius, VIII.I.1-7).

Regarding sacred spaces, Vitruvius states that temples should be designed in accordance with both the attributes of the gods and the requirements of cult practices (Vitruvius, IV.V.1). Furthermore, for public spaces within the city, he formulates rules determining the ideal locations of buildings such as the forum, basilica, theatre, bath, and palaestra (Vitruvius, V.I.1-10). He explains this approach as follows: *"Having laid out the alleys and determined the streets, we have next to treat of the choice of building sites for temples, the forum, and all other public places, with a view to general convenience and utility. If the city is on the sea, we should*

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choose ground close to the harbour as the place where the forum is to be built; but if inland, in the middle of the town. For the temples, the sites for those of the gods under whose particular protection the state is thought to rest and for Jupiter, Juno, and Minerva, should be on the very highest point commanding a view of the greater part of the city… Mars outside the city but at the training ground, and so Venus, but at the harbour" (Vitruvius, I.VII.1). Issues such as the placement of the forum to protect it from climatic effects, the dual commercial and juridical function of basilicas, the acoustic properties of theatres, and the hygienic conditions and distribution systems of water structures constitute technical details regulating urban space in the ancient city (Vitruvius, V.I; V.III; V.V). In particular, the location of the forum is linked to climatic factors such as wind and sunlight. The positioning of the theatre has been described through an approach that takes into account both acoustics and the surrounding landscape (Vitruvius, V.I.1-10). Vitruvius' statements regarding the organization of the city and sacred spaces demonstrate that he conceptualizes architecture as an integrated discipline encompassing the relationships between nature, cult, and society. The city is understood as a coherent whole not only through its buildings, but also through their orientations, elevations, proportions, rituals, and modes of use. In the context of harbours, factors such as wind directions, wave movements, and defensive elements gain particular importance (Vitruvius, V.XII.1-7). When addressing residential architecture, Vitruvius takes into account both economic distinctions and climatic conditions. He does not describe the atrium-type domus in detail, noting instead that it represents an aristocratic residential model (Vitruvius, VI.III). On the other hand, the multi-storeyed and contiguous insulae type is regarded as a necessary solution for cities with high population density (McKay, 1998).

THE GENERAL OUTLINE OF URBAN PERCEPTION AND TOPOGRAPHY IN PAUSANIAS

Pausanias' approach to the ancient city differs from the model articulated by Vitruvius in that it is grounded in how the city is experienced, traversed, and remembered. As Pausanias was neither an architectural theorist nor an urban planner, his work presents cities as narratives that intertwine monuments with the stories behind them, the continuity of cult practices, and the geographical configuration of space. Unlike Vitruvius, Pausanias does not address the question of how cities or buildings should be constructed. Instead, his texts are structured around what is seen, how it is named, and which myth or cult it is associated with. For this reason, Pausanias' city is not constructed through plans or drawings, but through a topography shaped by cultural and geographical traces (Jones, 1918). In this manner, the sacred structures and public spaces of cities are documented through an observational perspective. Pausanias' mode of describing the city is based on a walking order that follows his travel itinerary. Beginning in Attica, he proceeds through different regions of Corinth, and then onward to

Boeotia, Phocis, and other Greek cities. Along this route, temples, altars, statues, stoas, agoras, harbours, acropoleis, and burial areas are presented as a sequence of interconnected elements (Elsner, 1992). While introducing sacred spaces in various cities, Pausanias establishes a spatial transition between the harbour and the acropolis, thereby making visible the geographical hierarchy of sacred and civic areas within the city. This approach demonstrates that the experiential organization of the ancient city takes precedence over monumental architecture, and that practices of use constitute the memory of space. In a passage describing the city of Elis, Pausanias notes that *"another way out of the gymnasium leads to the market-place, and to what is called the Umpires' Hall beyond the tomb of Achilles, and it is by this way that the Umpires are accustomed to enter the gymnasium"*. In another passage, he states that *"and the market-place at Elis is not like that of the Ionians, or of the Greek cities in Ionia, but is built after a more antique type, with porticoes and streets at regular intervals"* (Pausanias, VI.XXIV). These descriptions exemplify Pausanias' manner of depicting urban space. Moreover, Pausanias' perspective on the city is selective in terms of timeframe. His tendency to place the Roman domination of his own second-century CE context largely in the background, to focus instead on the monuments of the Archaic and Classical periods of ancient Greece, and to mention Roman building activities only in limited contexts constitutes a clear indication of this selectivity (Bergmann, 2001).

THE EVALUATION OF CITIES AND THEIR STRUCTURES IN ANTIQUITY: THE THEORETICAL MODEL IN VITRUVIUS AND THE EXPERIENTIAL TOPOGRAPHY IN PAUSANIAS

Although the texts of Vitruvius and Pausanias belong to different fields of knowledge, they address similar themes when explaining the components of the ancient city. In Vitruvius, the city is conceived as a theoretical composition defined through architectural proportion, knowledge of materials, building typologies, and principles of order. In Pausanias, by contrast, the city appears as a narrative topography constructed around sacred spaces, altars, statues, roads, harbours, and marketplaces. The location of the city, the relationship between temples and altars, the organization of public spaces, and the connection established with topography are represented in both texts in ways that both overlap and diverge.

The Temple and the Perception of Sacred Geography

Vitruvius approaches temples from an architectural perspective and defines three fundamental criteria in their design: orientation, proportion, and order (Vitruvius, III.I, IV.V) (Figure 1). When establishing the relationship between temple and altar within a city, Vitruvius takes ritual orientation as his point of departure and transforms it into a technical principle. As he states, *"the quarter toward which temples of the immortal gods ought to face is to be determined on the principle that, if*

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there is no reason to hinder and the choice is free, the temple and the statue placed in the cella should face the western quarter of the sky". He further explains the purpose of this arrangement: *"This will enable those who approach the altar with offerings or sacrifices to face the direction of the sunrise in facing the statue in the temple, and thus those who are undertaking vows look toward the quarter from which the sun comes forth, and likewise the statues themselves appear to be coming forth out of the east to look upon them as they pray and sacrifice"*. On the other hand, Vitruvius adds that *"But if the nature of the site is such as to forbid this, then the principle of determining the quarter should be changed, so that the widest possible view of the city may be had from the sanctuaries of the gods"* (Vitruvius, IV.V.1-2).

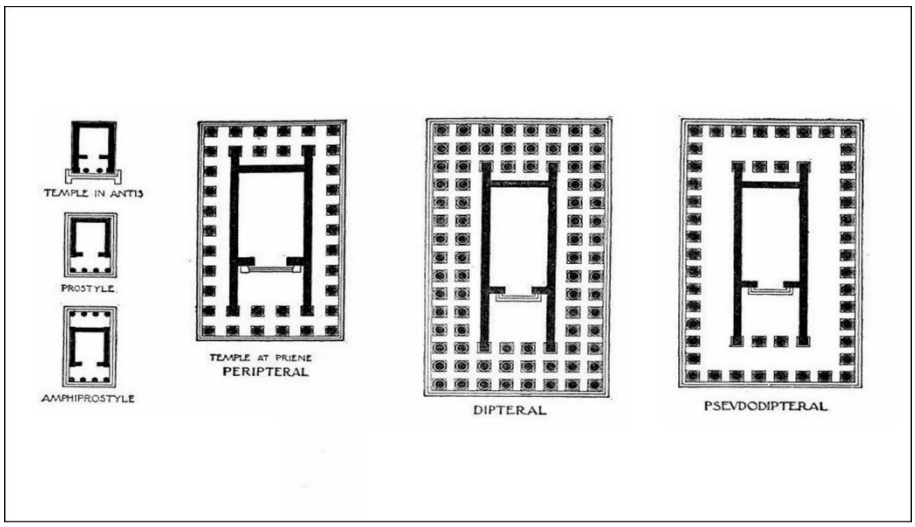


Figure 1. Temples according to the arrangement of their columns (Vitruvius, III.II)

Vitruvius articulates the relationship between temple and altar in a city by exploring the position and sensory experience of the worshipper during ritual practice. Architectural order thus becomes an instrument that consciously directs the bodily and visual orientation of sacred action. This formulation demonstrates that temple orientation is determined through the interplay of nature, ritual practice, and celestial movement. Orientation, therefore, constitutes a functional component of sacred space (Incerti, 2013).

Vitruvius integrates not only orientation but also visual and ritual routes into the architectural design. He further argues that sacred buildings should be located along the main circulation axes of the city or at points that dominate these axes (Figure 2). In this way, temples remain continuously within the field of vision of individuals moving through public space, rendering religious practice a visible component of everyday urban experience (Vitruvius, I.VII.1).

In Pausanias, temples and sacred spaces are not described on the basis of orientation or architectural principles, but through the walking routes traced within the city's topography, the sequencing of sacred stations, and the experiential relationships established between these locations

(Wycherley, 1986; Elsner, 2001). In his description of Piraeus, the spatial organization that embodies the ritual and political significance of the area is conveyed as follows (Figure 3): *"Now of all the things in the Piraeus best worth seeing is the temple of Athene and Zeus; both their statues are of gold, and Zeus has a sceptre and Victory, while Athene is armed with a spear. Here, too, is a painting by Arcesilaus of Leosthenes and his sons..."*



Figure 2. The Acropolis of Athens and the surrounding structures (URL-1)

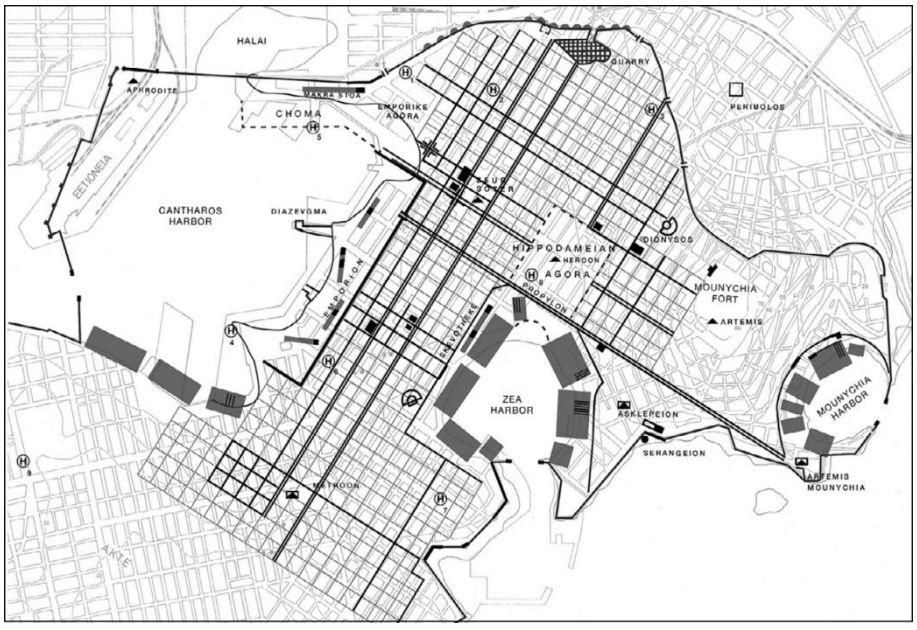


Figure 3. The Harbour of Piraeus (Steinhauer, 2021)

In the continuation of the same passage, a triangle formed by harbour, portico, and agora is described: *"...it is in the long portico, where those near the sea have their market, (for there is another market for those more inland), and in the back of the portico near the sea are statues of Zeus and Demos, the design of Leochares"* (Pausanias, I.I). This narrative does not focus on the orientation of the temple, but rather on the position of the

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sacred structure within the urban topography and on the spatial relationships established between public spaces such as the harbour, agora, and stoa, and the cult symbols represented by statues and altars. The same approach becomes even more explicit in the description of the cult of Aphrodite at Knidos: *"…near the sea is a temple erected to Aphrodite by Conon, after his victory over the Lacedemonian fleet off Cnidus in the peninsula of Caria. For Aphrodite is the tutelary saint of the men of Cnidus, and they have several temples of the goddess; the most ancient celebrates her as Doritis, the next in date as Acraea, and latest of all that which everybody else calls Athene of Cnidus, but the Cnidians themselves call it Athene of the Fair Voyage"* (Pausanias, I.I). Pausanias emphasizes the intensity with which the Knidians honoured the goddess and the existence of multiple temples dedicated to her. This sequence is not based on the orientation of the temples, but on topographical and ritual criteria such as elevation (Acraea), the relationship with the harbour and maritime context (Fair Voyage), and the continuity of historical sacredness (Doritis). Thus, in Pausanias, the relationship between sacred spaces and the city is established not through architectural principles, but through the continuity of cult within the urban geography.

In De Architectura, Vitruvius states that *"Altars should face the east, and should always be placed on a lower level than are the statues in the temples, so that those who are praying and sacrificing may look upwards towards the divinity"* and adds that even this difference in height varies according to the attributes of the gods. *"They are of different heights, being each regulated so as to be appropriate to its own god. Their heights are to be adjusted thus: for Jupiter and all the celestials, let them be constructed as high as possible; for Vesta and Mother Earth, let them be built low"* (Vitruvius, IV.IX). In this way, temple architecture in Vitruvius emerges as a consciously designed sacred space structured around orientation, spatial hierarchy, and the ritual qualities of the gods, directing worship practices in both bodily and visual terms (Karababa, 2022). In Pausanias, by contrast, the relationship between altar and deity is not explained through technical criteria to the same degree. Instead, an experiential classification appears, based on the division of ritual space according to different deities. While describing the sanctuary at Sikyon in the Peloponnese, Pausanias notes that the altar is divided into sections, stating: *"And the altar has five divisions: one belongs to Hercules and Zeus and Paeonian Apollo, and another is dedicated to heroes and heroes' wives. And the third belongs to Vesta and Hermes and Amphiaraus and the sons of Amphilochus... And the fourth division of the altar belongs to Aphrodite and Panacea... And the fifth has been set apart for the Nymphs and Pan..."* (Pausanias, I.XXXIV). Here, criteria such as elevation, orientation, or architectural axes, which are decisive in Vitruvius, are not mentioned. Instead, Pausanias conveys, through observation, in whose name sacrifices are made, which god or hero occupies which part of the sacred area, and how the cultic order is organized in practice. This distinction reflects not a simple architectural arrangement, but a classification

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related to the hierarchical organization of cults (Barker et al., 2023). Elsewhere, Pausanias remarks that the Athenians are more devoted to religion than other peoples and draws attention to the cult of Athena Ergane and the placement of Herms as examples (Pausanias, I.XXIV). He also describes the cult of Artemis Amarysia in rural Attica by establishing connections between local festivals, place names, and epic traditions (Pausanias, I.XXXI). These examples demonstrate that sacred topography extends beyond the urban centre, forming an integrated ritual geography through surrounding villages and roads.

Vitruvius states that temples should be oriented toward the rising sun, so that morning rituals may take place together with light (Vitruvius, IV.V.1). According to him, the orientation of temples is not merely a spatial preference, but an integral component of ritual order. For this reason, temples oriented toward the east, west, or south acquire distinct cultic meanings depending on the deity. The issue of proportion is explained through the concept of symmetria. For Vitruvius, temple architecture achieves beauty through mathematical harmony and proportional coherence (Smith, 2003). Accordingly, the relationships between column diameter, stylobate width, intercolumniation, and façade height are determined through geometric ratios (Figure 1). Temple orders are classified as Doric, Ionic, and Corinthian. Vitruvius defines the formal, proportional, and aesthetic differences among these orders, characterizing the Doric as more rigid and austere, the Ionic as more elegant and slender, and the Corinthian as the most elaborate and ornate (Lefas, 2000). When stating that altars should be placed lower than the cult statues within temples, Vitruvius emphasizes the need to establish a hierarchical spatial order so that those who pray and offer sacrifices may look upward toward the deity. This statement demonstrates that Vitruvius deliberately designs ritual experience within architectural order, directly linking changes in spatial elevation to cultic behavior. Moreover, as expressed in his assertion that *"…for we must not build temples according to the same rules to all gods alike, since the performance of the sacred rites varies with the various gods"*, he maintains that the plan schemes and dimensional proportions of temples must vary according to the function and cultic character of each deity (Vitruvius, IV.VIII.6).

By contrast, in Pausanias, even the fact that part of a sacrificial ritual dedicated to Herakles is directed to the god and part to the hero indicates a distinction in status between deity and hero. However, Pausanias does not formalize this as a rule, but merely records the practice (Pausanias, I.XXXII). Thus, Vitruvius' normative approach that the height of the altar varies according to the god and Pausanias' experiential account that the altar area is divided according to the god demonstrate that the same cult space is conceptualized on two different levels. This distinction becomes even more pronounced when the issue of sacred topography is considered. In Vitruvius, the location of sacred spaces is described in relation to wind conditions, climate, and public accessibility. His

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statement that *"...houses of the gods on the sides of public roads should be arranged so that the passers-by can have a view of them and pay their devotions face to face"* transforms ritual visibility into an architectural design criterion (Vitruvius, IV.V.2). This approach suggests that sacred structures are not positioned as background elements within the urban fabric, but are instead deliberately opened towards visible areas and integrated into public use.



Figure 4. The Ancient City of Corinth and the surrounding structures (URL-2)

Consequently, in Vitruvius, orientation and location become technical principles that anticipate and direct ritual behavior, forming integral components of architectural order (Lefas, 2000). In Pausanias, spatial organization is understood through walking routes traced between the harbour, acropolis, hilltops, marketplaces, and sacred spaces. In examples such as the placement of the sanctuary at Sikyon within a triangle formed by the gymnasion, agora, and altar, or the narration of sanctuaries around Corinth as connected from the harbour toward the acropolis, spaces are linked not through architectural hierarchy, but through relationships of religious meaning (Pausanias, II.III; Owens, 2000) (Figure 4).

Forum and Agora: Legal-Spatial Order and Social Memory

The forum and the agora were public spaces in ancient Greek and Roman cities that fulfilled similar functions. Established at, or defining, the urban centre, agoras and forums met a wide range of commercial, administrative, and social needs for citizens (Wycherley, 1986) (Figures 5-8).

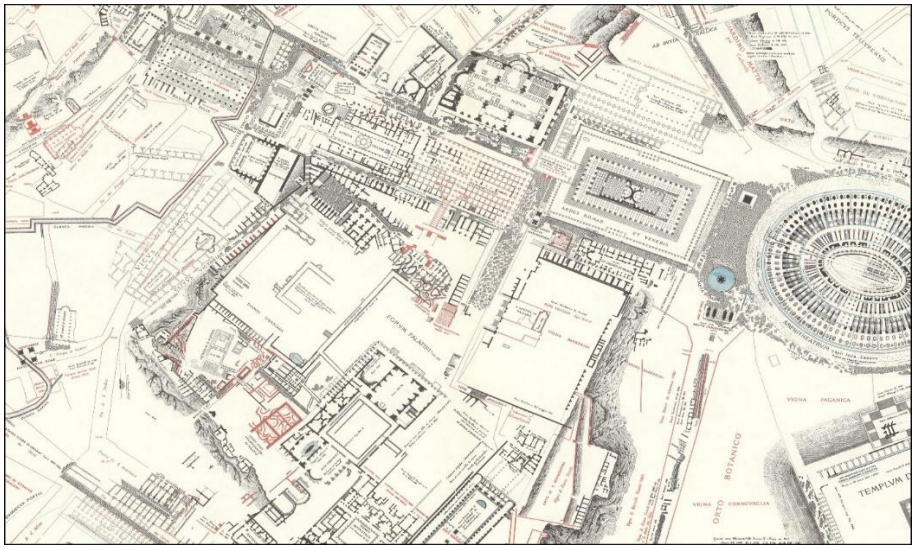


Figure 5. Ancient Rome, plan of the forum and surrounding structures (Lanciani, 1901)



Figure 6. The Roman Forum and the surrounding structures (URL-3)

Vitruvius defines the forum as the centre of the ancient city and describes it primarily as a public space in which judicial decision-making processes and commercial activities were carried out in an orderly manner (Owens, 2000; Yaylı & Küçük, 2011). When discussing the principles governing the location of forums, Vitruvius states that *"...the size of a forum should be proportionate to the number of inhabitants, so that it may not be too small a space to be useful, nor look like a desert waste for lack of population",* and then notes that basilicas should be arranged in close proximity to the forum (Vitruvius, V.I.2) (Figure 5). He further explains: *"Basilicas should be constructed on a site adjoining the forum and in the warmest possible quarter, so that in winter business men may gather in them without being troubled by the weather... This is because the two middle columns on that side are omitted, in order not to obstruct the view of the pronaos of the temple of Augustus (which is built at the middle of the side wall of the basilica, facing the middle of the forum and the temple of Jupiter) and also the tribunal which is in the former temple, shaped as a hemicycle whose curvature is less than a semicircle. The open side of this*

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hemicycle is forty-six feet along the front, and its curvature inwards is fifteen feet, so that those who are standing before the magistrates may not be in the way of the business men in the basilica" (Vitruvius, V.I.4, 7-8).

Here, the basilica is presented as a public building associated with judicial and administrative activities, and Vitruvius thus defines the forum normatively through law and architectural order (Flohr, 2020; Gates, 2021). In contrast to this, Pausanias' accounts of the agora differ fundamentally from those of Vitruvius. Pausanias does not present technical principles regarding the plan or organization of the agora; instead, he conveys the meanings it carries in terms of memory, identity, and cult (Barker et al., 2023).

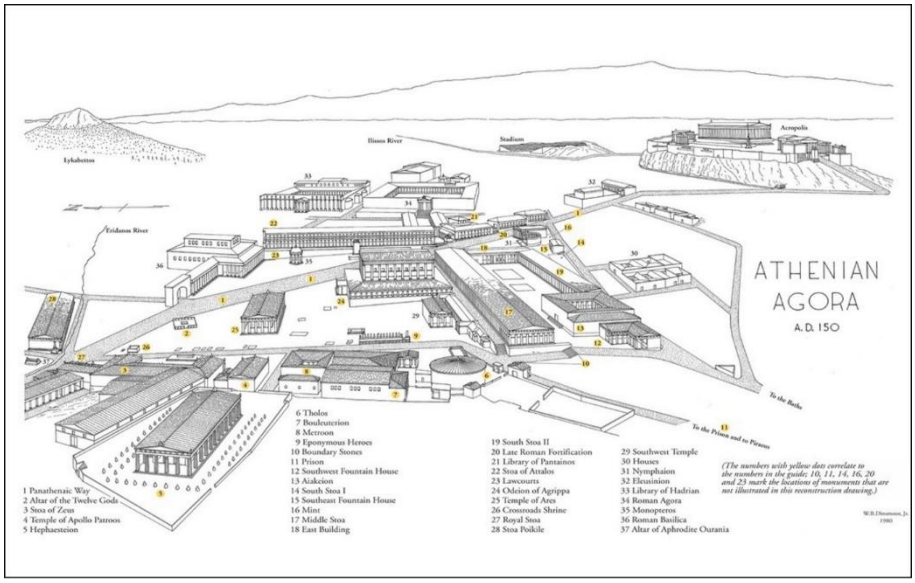


Figure 7. The Agora of Athens (Dinsmoor, 1980)



Figure 8. General view of the Athenian Agora (URL-4)

While describing the Athenian Agora, he records the following observation (Figures 7-8): *"…the Athenians have in the market-place among other things not universally notable an altar of Mercy, to whom,*

though most useful of all the gods to the life of man and its vicissitudes, the Athenians alone of all the Greeks assign honours. And not only is philanthropy more regarded among them, but they also exhibit more piety to the gods than others. For they have also an altar to Shame, and Rumour, and Energy" (Pausanias, I.XVII). In this context, the agora is associated with custom and virtue, and its function is perceived not as the exchange of goods but as a moral reminder. Thus, Pausanias' depiction of the agora is constructed through a cultural and identity-based perspective rather than a juridical or commercial one, in contrast to Vitruvius' account. Whereas Vitruvius describes the forum as a legal-economic space in which transactions are regulated, guarantees are recorded, and debts are registered, Pausanias presents the agora as a scene of memory and cult, where mercy is honoured and an ethical bond between gods and humans is made visible (Elsner, 1992). This distinction is also evident in the surrounding elements of the agora and forum. Pausanias further defines the agora in relation to stoas, statues, and altars. In Piraeus, he refers to *"...it is in the long portico, where those near the sea have their market, (for there is another market for those more inland)..."* thereby treating the space not only as a commercial area but also as a topographical one (Pausanias, I.I; Wycherley, 1986) (Figure 3). His mention of the statues of Zeus and Demos located behind the stoa indicates that the agora also functioned as a space of political representation and cult symbolism. Moreover, the presence in the Athenian Agora of altars dedicated not only to gods but also to abstract concepts such as Aidos (Shame), Pheme (Rumour), and Orme (Energy) demonstrates that the space of the agora was deeply intertwined with ethical, religious, and social components (Pausanias, I.XVII).

Harbour - Sacred Area Connection

Vitruvius treats harbours as an integral part of architectural and engineering knowledge and evaluates these structures entirely within the context of technical infrastructure. In his descriptions of harbours, he emphasizes wave movements, wind directions, natural shelter, and the technical norms governing the structural elements to be constructed, defining the harbour as an engineering system based on functionality and durability (Iossifidis, 2024). In this context, wind regimes, wave action, and defensive features become decisive factors. Vitruvius recommends that harbours be established in natural bays or protected inlets and discusses engineering solutions such as moles and breakwaters to mitigate wave action: *"The subject of the usefulness of harbours is one which I must not omit, but must explain by what means ships are sheltered in them from storms. If their situation has natural advantages, with projecting capes or promontories which curve or return inwards by their natural conformation, such harbours are obviously of the greatest service. Round them, of course, colonnades or shipyards must be built, or passages from the colonnades to the business quarters, and towers must be set up on both sides, from which chains can be drawn across by machinery"*

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(Vitruvius, V.XII.1). In this framework, the harbour is treated primarily as an infrastructural element serving military and economic functions. It is conceived as a system of transport, trade, and protection (Vitruvius, V.XII.3-7). For Vitruvius, therefore, the harbour is not associated with ritual or sacred geography, but rather constitutes an engineering entity intertwined with military logistics, defence, and commerce. For Pausanias, by contrast, the harbour is not merely a structure of transportation and protection, but also a place where cult practices are enacted (Figure 9). Describing the harbours of Corinth, Pausanias states: *"The Corinthian seaports got their names from Leches and Cenchrias, who were reputed to be the sons of Poseidon by Pirene the daughter of Achelous… And there is at Lechaeum a temple and brazen statue of Poseidon, and as you go to Cenchrae from the Isthmus a temple of Artemis, and old wooden statue of the goddess. And at Cenchrae there is a shrine of Aphrodite and her statue in stone, and next it, on the breakwater near the sea, a brazen statue of Poseidon. And on the other side of the harbour are temples of Aesculapius and Isis"* (Pausanias, II.II).



Figure 9. The Harbour of Lechaeum (Preiser-Kapeller & Ginalis, 2021)

Through this account, Pausanias emphasizes that the harbour is not solely a commercial zone, but a space where divine and political representations intersect. What is particularly striking here is the formation of a sacred iconographic environment surrounding the harbour. In Pausanias' perspective, the harbour is interpreted within a framework of state identity, divine protection, and urban circulation. A similar situation appears in his description of Limera. Pausanias notes: *"And on the road from Boeae to Epidaurus Limera there is a temple of Artemis called by the Epidaurians Limnas. The town is at no great distance from the sea, and is built on an eminence: and the sights worth seeing here are the temple of Aphrodite, and a statue of Aesculapius in stone erect, and*

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a temple of Athene in the citadel, and in front of the harbour a temple of Zeus Soter" (Pausanias, III.XXIII). In another passage, he states: *"…at Zarax there is nothing remarkable but a temple of Apollo at the end of the harbour, and a statue of the god with a lyre"* (Pausanias, III.XXIV). In Pausanias' narrative, the harbour thus emerges as a sacred medium. Whereas for Vitruvius the harbour is a technical system defined through waves, moles, breakwaters, winds, and structural components designed to provide protection against natural forces and grounded in functionality (Owens, 2000); in Pausanias it appears as a ritual landscape endowed with religious and ideological dimensions, shaped by gods, heroes, and political symbols.

The Acropolis (Upper City) and the Lower City: Hierarchy and Memory

Although Vitruvius does not explicitly employ the term acropolis, he nonetheless treats the notions of elevation and dominance as technical principles directly governing the placement of public buildings. In his discussions of the positioning of structures within the city, he emphasizes the need to evaluate suitable locations with care (Wycherley, 1986; Gates, 2021). In a similar manner, his insistence that temples should be located along public roads and in visible positions aims to establish religious dominance within urban space through visual perception (Vitruvius, I.VII.1). In Pausanias, the acropolis becomes a focal point embodying the triad of historical, mythical, and cultural memory. Pausanias frequently structures his accounts of entering a city along the axis of the harbour, lower city, and acropolis. In his narrative of Attica, he underscores the sacred character of the Athenian Acropolis, making both its topographical and cultural distinctiveness explicit (Pausanias, I.XXII) (Figure 2). A similar approach is evident in his description of Piraeus, where the route begins at the harbour and proceeds through the lower city level, with its stoas, statues, and altars, to the sacred areas located above (Pausanias, I.XXIX; I.XXX). This spatial sequencing demonstrates that, in Pausanias, the acropolis is not merely a "high place," but also a ritual destination. Accordingly, the acropolis is understood through the interrelation of elevation, sacredness, and historical depth. When these two authors are considered in comparison, it becomes clear that the relationship between the acropolis and the lower city is articulated in different ways. In Vitruvius, the elevation on which the acropolis is situated is justified through technical criteria such as acoustics, visibility, and accessibility; decisions such as placing the theatre on a slope or ensuring the visibility of a temple along a road are organized in terms of architectural functionality.

In Pausanias, however, elevation is interpreted through cult, myth, and memory; the acropolis functions as the bearer of gods, heroes, archaic remains, and the collective memory of the community (Barker et al., 2023). The former defines the acropolis within an engineering framework, while the latter situates it within the category of cultural

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memory. Within this distinction, the lower city likewise assumes different roles: in Vitruvius, it is the space of a public network furnished with forums, basilicas, baths, and theatres; in contrast, Pausanias' depiction of the lower city as a ritual zone of transition is characterised by harbours, stoas, agoras, statues, and altars.

Bath-Palaestra/Gymnasion: Functional Typology and Educational-Cultural Space

Vitruvius addresses baths and palaestrae within the framework of the physical and hygienic requirements of urban planning (Yegül, 2006). When explaining the internal arrangement of palaestrae, he describes in detail the colonnades surrounding the space, changing rooms, oiling rooms, and areas of earth and sand. He clearly specifies the relationships between these units and their spatial dimensions with statements such as: *"The square or oblong peristyle in a palaestra should be so formed that the circuit of it makes a walk of two stadia… Let three of its colonnades be single, but let the fourth, which is on the south side, be double, so that when there is bad weather accompanied by wind, the drops of rain may not be able to reach the interior. In the double colonnade let the rooms be arranged thus:…the anointing room… the cold bath room… the furnace… a Laconicum…"* (Vitruvius, V.XI.1-2) (Figure 10).

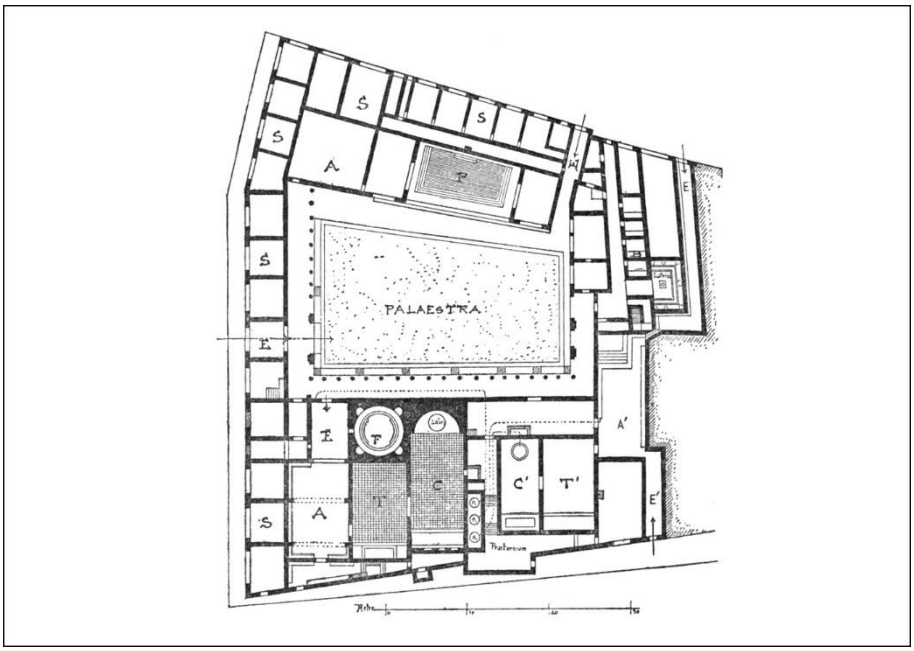


Figure 10. Plan of the Stabian Baths at Pompeii (Vitruvius, V.X)

Adjacent units such as areas for javelin and discus throwing, running tracks, and sand courts appear in Vitruvius as spaces organized in direct relation to the connection he establishes between athletic activity and bodily health (Nielsen, 1990). Baths, on the other hand, are significant in terms of engineering calculations concerning the heating of water, the arrangement of hot and cold rooms, the positioning of pools, and the elements used in heating systems, such as tubuli, spacer tubes, and

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tegulae mammatae (Rook, 1978). Vitruvius states that *"...the hot rooms should be protected from the north winds"* and explains the flow of water and the distribution of heat using technical terminology. He further notes: *"In the first place, the warmest possible situation must be selected; that is, one which faces away from the north and northeast. The rooms for the hot and tepid baths should be lighted from the southwest, or, if the nature of the situation prevents this, at all events from the south, because the set time for bathing is principally from midday to evening"*. He also mentions the technical features of the heating system by stating that *"...three bronze cauldrons are to be set over the furnace, one for hot, another for tepid, and the third for cold water..."* (Vitruvius, V.X.1). In this way, the Roman bath emerges in Vitruvius as an architectural typology shaped by considerations of health, cleanliness, and bodily discipline. On the other hand, the terminological problem between gymnasion and palaestra is also encountered in the works of ancient authors. While Vitruvius never uses the term gymnasion in his descriptions of athletic spaces (Vitruvius, VI.II.1), Pausanias explicitly states that the gymnasion and the palaestra differ from one another in functional terms (Pausanias, V.XV). Setting aside terminological differences, although the distinction is not always clear, it is evident that there are certain fundamental differences between the two structures. First, the gymnasion has the character of a public and official building or area, whereas the palaestra is more often associated with private use. Moreover, while gymnasia stand out as multifunctional spaces in which citizens of all ages received both intellectual and physical education, palaestrae were primarily dedicated to activities focused on physical training (Wycherley, 1986) (Figure 11). Although both structures served educational purposes, palaestrae could be constructed either as components within a gymnasion complex or as independent buildings.



Figure 11. Stabian Baths of Pompeii (URL-5)

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In Pausanias, descriptions of gymnasia and baths are situated primarily within a social and cultural context rather than focusing on structural characteristics. As he notes: *"... there are several baths in various parts of Corinth, some erected at the public expense, and others by the Emperor Adrian. And the most famous of them is near the statue of Poseidon. It was erected by Eurycles a Spartan, who beautified it with various stones, amongst others by the stone they dig at Croceae in Laconia. On the left of the entrance is a statue of Poseidon, and next to him one of Artemis hunting"* (Pausanias, II.III).

Pausanias frequently records where gymnasia are located in various cities, to which deity or hero they are dedicated, and which statues are associated with these spaces. In the section describing Phocis, he states: *"There are also two gymnasiums, one contains baths, the other opposite to it is an ancient one, in which is a bronze statue of Xenodamus, a native of Anticyra, who, as the inscription states, was victor at Olympia among men in the pancratium"* (Pausanias, X.XXXVI).

Likewise, in his account of Corinth and its surroundings, Pausanias writes: *"And as you go hence to the gymnasium, on the right is the temple of Pheraean Artemis: the wooden statue of the goddess was, they say, brought from Pherae. Clinias built this gymnasium, and they educate boys there still. There is an Artemis also in white stone, carved only down to the waist, and a Hercules in his lower parts like the square Hermae"* (Pausanias, II.X).

In these narratives, Pausanias places particular emphasis on the figures in whose honour these spaces were dedicated. The gymnasion thus appears not merely as a place for the physical training of youth, but as a setting in which hero cults, local pride, and civic identity are made visible. When a gymnasion contains a statue dedicated to a specific god or hero, Pausanias records this fact; by contrast, he does not engage with details concerning the plan, dimensions, or construction techniques of the building. This distinction highlights a fundamental difference in perspective: whereas in Vitruvius the palaestra is treated as a space organized for physical exercise and bodily care in the service of health, in Pausanias the gymnasion emerges as a place closely associated with identity, cult, and remembrance. Accordingly, while Vitruvius considers factors such as heat, air, water, and circulation in relation to bodily health, Pausanias interprets the body within the broader frameworks of education, virtue, and citizenship.

Theatre

Vitruvius approaches theatres by structuring the entire discussion around acoustic science, geometry, and engineering (Sear, 2006). He begins by emphasizing the importance of site selection and positioning, asserting: *"After the forum has been arranged, next, for the purpose of seeing plays or festivals of the immortal gods, a site as healthy as possible should be selected for the theatre, in accordance with what has been written in the first book, on the principles of healthfulness in the sites of cities. For*

when plays are given, the spectators, with their wives and children, sit through them spellbound, and their bodies, motionless from enjoyment, have the pores open, into which blowing winds find their way. If these winds come from marshy districts or from other unwholesome quarters, they will introduce noxious exhalations into the system. Hence, such faults will be avoided if the site of the theatre is somewhat carefully selected" (Vitruvius, V.III.1).

In subsequent sections, Vitruvius explains in detail the semicircular plan, the tiers of seating, and the inclinations of walls that enhance acoustic performance (Figure 12). According to Vitruvius, placing the theatre on a slope is not merely a topographical convenience, but a physical necessity that facilitates the natural transmission of sound (Vitruvius, V.III.1). He defines the theatre primarily through the circulation of sound and does not engage with its festival or ritual context (Haddad, 2026).

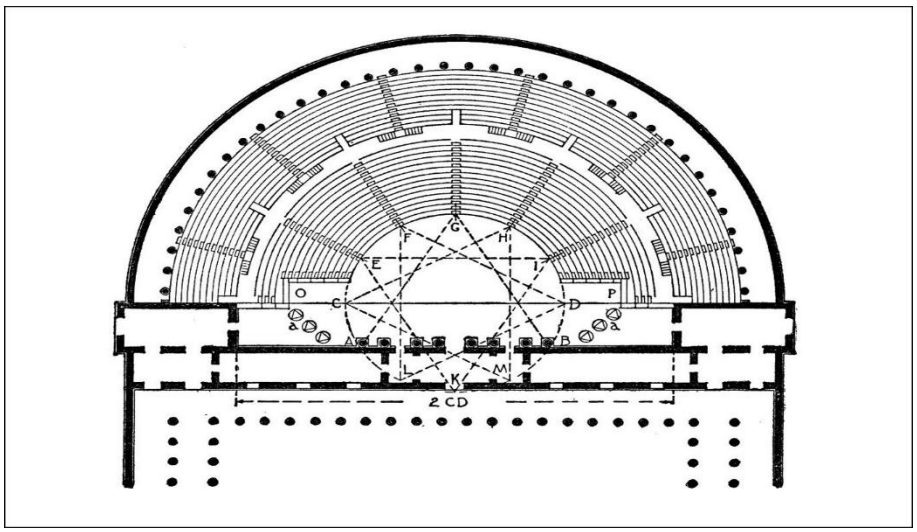


Figure 12. Theatre plan in Vitruvius (Vitruvius, V. VII)

Pausanias addresses theatres not through their technical characteristics but largely within a cultural and festival-oriented framework. In his account of Corinth, he notes: *"... in the present citadel there is a temple to Fortune Dwelling on the Heights, and next it one to the Dioscuri. Both these and the statue of Fortune are of wood. And in the theatre built under the citadel the person represented on the stage-curtain is, they say, Aratus the son of Clinias. And next to the theatre is a temple of Dionysus: the god is fashioned in gold and ivory, and near him some Bacchantes in white stone"* (Pausanias, II.VII). In another passage (Figure 13), he remarks: *"...the Epidaurians have a theatre in their temple, especially well worth seeing in my opinion: for the Roman theatres beat all in the world in magnificence, and for size the Arcadian theatre at Megalopolis carries the day: but for beauty of proportion what architect could compete with Polycletus? And Polycletus it was that designed this theatre and round building"* (Pausanias, II.XXVII).

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Figure 13. Theatre of Epidaurus (URL-6)

Similarly, the Theatre of Dionysos in Athens is directly associated with the cult of Dionysos (Wycherley, 1986) (Figure 14). In these accounts, the theatre emerges as a point of intersection between ritual, performance, and civic identity. Pausanias presents theatrical spaces across different sections of his work, most often within the context of the Dionysian cult. Moreover, when referring to a small temple associated with the transmission of the Dionysos cult (Pausanias, I.XXIX), he offers an indirect narrative indicating that theatrical activities were embedded within a cultic framework.



Figure 14. The Theatre of Dionysus in Athens and the Acropolis (URL-1)

CONCLUSION

The evaluations of ancient cities demonstrate that the design principles of urban space and its experiential dimensions are addressed through different modes of knowledge production. In De Architectura, Vitruvius approaches the city within a framework of universal, rational, and normative principles, largely excluding historical and geographical particularities, and treats architecture and urban planning as systematic and rule-based practices. In contrast, Pausanias' Periegesis Hellados presents the cities of Greece within diverse historical layers and local contexts, conveying them through cult practices, ritual continuities, and mythological-historical memory. This distinction reveals that the ancient city could be designed as an abstract theoretical model on the one hand, and that cities become meaningful through concrete spaces and local narratives on the other. In Vitruvius, the city is understood as a technical system that must be designed in harmony with natural and social order, with architecture functioning as the regulatory instrument that ensures the continuity of this system. In Pausanias, the city is not constructed through predetermined planning principles, but emerges as an experienced and holistic topography articulated through narratives that move along sacred spaces, stoas, agoras, harbours, funerary monuments, and roads. His narrative foregrounds not the technical rationale of spaces, but the ways in which they acquire meaning within cultural and ritual contexts. This methodological divergence becomes particularly evident in the treatment of sacred spaces. In Vitruvius, temples and sanctuaries are defined through architecturally controllable criteria such as orientation, hierarchy, and ritual visual alignment; the relationship between temple and altar is the result of a deliberate design decision intended to regulate the bodily and visual orientation of worship. In Pausanias, sacred space is articulated less through orientation than through topography, sequences of stops, and cult continuity. Thus, while the sacred in Vitruvius forms a component of a planned urban order, in Pausanias it appears as an integral element of urban memory and lived experience. The comparison of the agora and the forum further reinforces this distinction. In Vitruvius, the forum is treated as a centre regulating legal and economic processes and is defined within a typological and functional unity through structures such as the basilica. In Pausanias, the agora is represented less through technical organization than as a public stage where ethical, political, and cultural meanings are concentrated. The same type of space is thus understood in one text as the spatial counterpart of institutional order, and in the other as a bearer of social memory and symbolic representation. A similar divergence is observed in the example of the harbour. In Vitruvius, the harbour is an engineering problem resolved in terms of protection and functionality, closely related to natural forces such as waves and winds, with military and economic infrastructure taking precedence. In Pausanias, however, the harbour becomes a threshold space where political and religious representations intersect; cult practices and expectations of divine protection constitute

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fundamental elements shaping its meaning. This demonstrates that even infrastructural components of the ancient city must be evaluated not only in technical terms, but also through their ritual and representational dimensions. The relationship between the acropolis (upper city) and the lower city is likewise articulated differently in the two texts. In Vitruvius, elevation is justified as a rational design principle based on criteria such as dominance, visibility, and functionality. In Pausanias, elevation is treated as a focal point woven from mythical, historical, and cultural memory, playing a decisive role in the formation of ritual destinations within the city. The same topographical feature thus functions, in Vitruvius, as a design rationale, and in Pausanias as a place of memory that generates meaning. Spaces dedicated to bodily practices, such as baths, palaestrae, and gymnasia, also clearly reflect this divergence in approach. In Vitruvius, these structures are defined through technical criteria such as orientation, light, heating systems, and interrelations between spatial units, with hygiene and order taking precedence. In Pausanias, the same spaces derive their significance less from plan and measurement than from dedication, cultic context, and the visibility of civic identity. Similarly, while the theatre in Vitruvius is resolved according to principles of acoustics, geometry, and engineering, in Pausanias it is situated within the framework of festival cycles, ritual practices, and local identity. This comparative reading clearly demonstrates that the ancient city cannot be explained through a single theoretical framework. While Vitruvius' text provides a normative and foundational schema for the ancient city, Pausanias' narrative makes visible how this schema was lived and interpreted in different cities and historical contexts. In conclusion, the ancient city should be understood as a multilayered whole formed through the interrelation of architecture, cult, topography, and memory. When Vitruvius' generalizing and theoretical framework is read together with Pausanias' place-based, historical, and experiential narrative, it becomes evident that the city was both a designed and a lived construct. This holistic perspective offers a methodological foundation for ancient urban studies that foregrounds not only architectural solutions, but also urban experience and cultural continuity.

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Resume

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From Philosophical Method to Architectural Silence: An Analytical Reading of the Wittgenstein House

Rıza Fatih Mendilcioğlu *

Abstract

In twentieth-century philosophy, the limits of language and the scope of meaning were addressed together with the question of how thought regulates its own field of operation. While Ludwig Wittgenstein's early and later texts reveal different aspects of this debate, approaches that treat the two periods as wholly opposed tend to relegate to the background the methodological orientations that display continuity in his thought. This study examines how the orientations of delimitation, descriptive orientation, relational order, and reticence, which become apparent in Wittgenstein's philosophical method and show continuity between his early and later periods, are concretized in the façade, plan, and interior organization of the Wittgenstein House, designed between 1926 and 1928. Rather than adopting the assumption that philosophical content is directly transferred into architecture, the study aims to explain analytically the structural parallels between the ways in which thought limits itself and the strategies of spatial organization. Text-based close reading and analytical architectural analysis are employed together: in the first stage, Tractatus Logico-Philosophicus and Philosophical Investigations are examined in order to identify the four orientations; in the second stage, the building is evaluated in terms of proportional relations, spatial hierarchy, and representational intensity. In conclusion, the correspondences of these four orientations at the levels of façade, plan, interior, and detail are presented through a comparative table. The study interprets their convergence as a form of architectural silence grounded not in aesthetic minimalism but in the deliberate restriction of representation, and offers an analytical framework for approaching the relationship between Wittgenstein's philosophical method and the practices of architecture and interior architecture through structural parallels.

Keywords: *Architectural silence, Interior organization, Philosophy and architecture, Spatial analysis, Wittgenstein House*

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INTRODUCTION

In twentieth-century philosophy, language, meaning, and the limits of discourse became central questions. Ludwig Wittgenstein reshaped these debates through both his early logic-centered writings and his later analyses of ordinary language, and he remains one of the key figures of analytic philosophy. His work is especially important because it redefines both the scope of philosophical analysis and the point at which philosophy must stop.

Published in 1921, Tractatus Logico-Philosophicus grounds the relation between language and world in logical structure; "The limits of my language mean the limits of my world" (Wittgenstein, 2010, §5.6) and "Whereof one cannot speak, thereof one must be silent" (Wittgenstein, 2010, §7) formulate this position concisely. Philosophical Investigations (1953), by contrast, relocates meaning in use rather than logical form. "Language-games" and "family resemblances" show that meaning cannot be reduced to a fixed definition (Wittgenstein, 1953/2005, §§43, 65–67). Taken together, these two formulations show that the question of limit remains central in both periods, even though it is grounded in different conceptions of language and meaning.

This shift matters not only for periodization but also for philosophical method. Although the two texts were long treated as marking a radical break (Ayer, 1946; Hacker, 1986), that view underestimates Wittgenstein's continuing concern with the limits of thought and the regulation of explanation. Diamond (1991) and Baker and Hacker (1980) instead emphasize the persistence of certain methodological orientations across both periods.

This article examines how delimitation, descriptive orientation, relational order, and reticence—orientations linking Wittgenstein's early and later thought—become concrete in the Wittgenstein House (1926–1928). It does not claim that philosophical content is translated directly into architecture; rather, it identifies structural parallels between thought's self-limitation and strategies of spatial organization.

The study proceeds in two stages. First, Wittgenstein's primary texts are read closely to identify these four orientations and their textual contexts. Second, the house is analyzed through façade order, plan organization, interior configuration, and detail. The argument thus joins textual and architectural analysis through structural parallelism.

Given the limited body of research on the house and the functional changes it has undergone, this reading does not propose a causal model of influence. It asks instead whether the forms of self-limitation visible in Wittgenstein's thought have architectural correspondences in the building's spatial decisions.

RESEARCH METHOD

This study adopts a qualitative analytical approach in order to examine the relationship between Wittgenstein's philosophical method and the spatial organization of the Wittgenstein House. Its aim is not to

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argue that philosophical content is directly transferred into architecture, but to identify structural parallels between the ways thought limits itself and the ways architectural order is established.

The research proceeds in two stages. In the first stage, *Tractatus Logico-Philosophicus* and *Philosophical Investigations* are examined through close reading in order to identify four recurring methodological orientations: delimitation, descriptive orientation, relational order, and reticence. In the second stage, the Wittgenstein House is evaluated through analytical architectural reading at the levels of façade, plan, interior, and detail. Particular attention is given to proportion, hierarchy, threshold, alignment, and representational intensity.

The study therefore combines textual analysis and architectural analysis within a comparative interpretive framework. Its methodological purpose is limited but clear: not to establish a direct causal relation between philosophy and architecture, but to determine whether comparable principles of self-limitation, order, and restraint can be read across both fields.

WITTGENSTEIN AND HIS PHILOSOPHICAL POSITION

"Philosophy is not a body of doctrine but an activity."
(Wittgenstein, 2010, §4.112)

Ludwig Wittgenstein (1889–1951) shaped twentieth-century philosophy less by constructing a system than by redefining what philosophy can and cannot do. What matters most in his writing is not the sum of its theses, but its insistence on where thought must stop. As Grayling notes, "Wittgenstein's aim was not to construct philosophical theories but to clarify the limits within which meaningful discourse can occur" (Grayling, 2001, p. 13). Philosophy thus appears not as the production of new explanations, but as an activity that clarifies the limits of thought and language.

Tractatus Logico-Philosophicus, the only book published during Wittgenstein's lifetime, grounds the relation between language and world in logical structure. "The limits of my language mean the limits of my world" (Wittgenstein, 2010, §5.6) and "Whereof one cannot speak, thereof one must be silent" (Wittgenstein, 2010, §7) define philosophy less as theory-making than as the drawing of the line between sense and nonsense. As Grayling writes, "The propositions of philosophy are not theories about the world but attempts to show the limits of sense" (Grayling, 2001, pp. 24–26). This formulation is important because it defines philosophical activity not in terms of adding new content, but in terms of clarifying the boundary conditions of meaningful discourse.

The radicality of the Tractatus lies in placing metaphysics not in the category of false knowledge, but in that of nonsense. If a proposition does not correspond logically to the factual structure of the world, one must remain silent about it (Wittgenstein, 2010, §§6.54, 7). Although the

Vienna Circle treated the book as foundational for scientific language, Wittgenstein's aim was not to build a metaphysics but to show its limit (Monk, 1990, pp. 54–56). What matters here is that the critique of metaphysics is directed not toward replacing it with another doctrine, but toward exposing the limits within which meaningful propositions can still be maintained.

Believing that the Tractatus had resolved philosophical problems, Wittgenstein withdrew from academic philosophy for a time. When he returned to Cambridge in 1929, however, he began to rethink his position. In Philosophical Investigations (1953), meaning no longer depends on logical form but on use: "The meaning of a word is its use in the language" (Wittgenstein, 1953/2005, §43). "Language-games" situate meaning within practice, while "family resemblances" show that concepts work through overlapping similarities rather than fixed definitions (Wittgenstein, 1953/2005, §§65–67). Philosophy thus becomes a critical and therapeutic activity directed toward dissolving conceptual confusion.

At first glance, this change appears radical: logical structure and precision dominate the early period, while use, context, and everyday practice dominate the later one. Yet the two periods also share a concern with limits and with the scope of explanation. As Soykan suggests, despite the evident differences between the two periods, certain philosophical orientations remain unchanged or continue in modified form across Wittgenstein's work (Soykan, 2002, p. 42). The continuity at stake is therefore methodological rather than doctrinal.

Interpretive history often treats Wittgenstein's philosophy as divided into two separate periods. The influential view of a sharp rupture between Tractatus Logico-Philosophicus and Philosophical Investigations (Ayer, 1946; Hacker, 1986) contrasts the early Wittgenstein with the later one; more recent readings instead stress continuity in the orientations that regulate thought's relation to its own limit.

METHODOLOGICAL ORIENTATIONS OF THOUGHT IN WITTGENSTEIN

> "We must do away with all explanation,
> and description alone must take its place"
> (Wittgenstein, 1953/2005, §109)

Wittgenstein's thought is often framed as a break between early and later phases. The methodological difference between Tractatus Logico-Philosophicus and Philosophical Investigations is undeniable, yet it does not erase an underlying continuity: in the early period it appears as logical analysis, in the later period as description of language use. In both, however, philosophy remains marked by a sensitivity to the limits of thought and explanation. As Glock notes, "For Wittgenstein, philosophy does not produce theories but clarifies the use of our concepts" (Glock, 2008, p. 205).

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Wittgenstein's philosophical method can therefore be read not as a sequence of theoretical systems but as a descriptive orientation that makes visible how concepts are used. Within this framework, four fundamental methodological orientations emerge.

Delimitation

Delimitation is explicit in the early Wittgenstein. "The limits of my language mean the limits of my world" (Wittgenstein, 2010, §5.6) shows that meaning can be constituted only within a logical framework, while "Whereof one cannot speak, thereof one must be silent" (Wittgenstein, 2010, §7) marks the point that must not be exceeded. Delimitation is thus not an ontological obstacle, but the condition of meaningful discourse.

The Tractatus seeks not to construct a new theory, but to make the limits of thought visible. In this sense, delimitation is also the conscious determination of the scope of philosophical activity. As Grayling writes, "Philosophy for Wittgenstein is not a theory about reality but an activity that clarifies the limits of meaningful discourse" (Grayling, 2001, p. 18). Delimitation should therefore be understood not only as a logical boundary, but also as a practical discipline that regulates the extent of philosophical intervention.

In the later period this orientation takes a different form. Philosophical Investigations presents philosophy not as explanation, but as conceptual discipline (Wittgenstein, 1953/2005, §124). In both periods, delimitation remains a methodological principle concerning where thought must stop.

Descriptive Orientation

In Wittgenstein's philosophy, descriptive orientation means the restriction of theoretical expansion. In the Tractatus, the distinction between what can be said and what can only be shown narrows the scope of explanation (Wittgenstein, 2010, §4.1212). Philosophy must not move beyond what can be said in order to make metaphysical claims.

In the later period this orientation becomes even clearer: "The clarity that we are aiming at is indeed complete clarity. But this simply means that the philosophical problems should completely disappear" (Wittgenstein, 1953/2005, §133). Philosophy is thus positioned not as theory production, but as the dissolution of conceptual confusion.

Relational Order

Another methodological orientation in the later writings is the weakening of conceptual hierarchies. In Philosophical Investigations, "family resemblance" (Wittgenstein, 1953/2005, §§65–67) shows that meaning does not derive from a single essence or central principle. Concepts function through patterns of use rather than around a fixed core (Baker & Hacker, 1980). Relational order thus names not sameness, but the coexistence of different fields of use within a horizontal order.

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Reticence

In Wittgenstein, reticence is not passive silence but conscious methodological positioning. “My ideal is a certain coolness” in Culture and Value (Wittgenstein, 1998) suggests a measured stance rather than self-display. Grayling similarly notes that philosophy acts therapeutically by dissolving error rather than constructing systems (Grayling, 2001, p. 95). Reticence therefore names a discipline of restraint through which philosophy preserves its own limit.

LUDWIG WITTGENSTEIN – THE WITTGENSTEIN HOUSE: SPATIAL CORRESPONDENCES OF PHILOSOPHICAL METHOD

The building at Kundmanngasse 19 in Vienna’s third district was constructed between 1926 and 1928 for Margarethe Stonborough-Wittgenstein (Figure 1). Initially entrusted to Paul Engelmann, a student of Adolf Loos, the project was progressively reshaped by Ludwig Wittgenstein, who—despite not being an architect—became its decisive figure. As Macarthur notes, “Wittgenstein was in the highly unusual position of having a very sympathetic client and almost unlimited time and money to realise his intricate designs” (Macarthur, 2014, p. 125). Wittgenstein’s intervention did not merely revise Engelmann’s scheme; it restructured the building in terms of proportion, axis, massing, and façade relations. As Şentürk puts it, “He reduces the ridge height to a minimum, conceals it behind the parapet, and ensures volumetric continuity” (Şentürk, 2008, p. 255). From the outset, the building is thus defined less by stylistic display than by an intensified discipline of proportion and formal control.



Figure 1. General façade view of the Wittgenstein House (Kundmanngasse).
Source: Wittgenstein Initiative (n.d.).

Wittgenstein’s interventions went well beyond minor corrections. Volumetric proportions, vertical–horizontal balance, and façade organization were all reconsidered. As Leitner notes, “The house is remarkable for the rigor with which proportions, alignments and details

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were controlled during the design process" (Leitner, 2000, p. 18). The façade follows a logic of order that avoids classical axial symmetry while preserving strict proportional alignment. Window openings do not gather around a single center; their slight shifts maintain balance without producing a dramatic focal point. As Wijdeveld observes, "there is a strong discipline of alignment in the placement of the openings; however, this order cannot be reduced to a classical compositional scheme" (Wijdeveld, 1994, p. 87). The façade therefore functions less as a representational surface than as an ordered field governed by proportional relations.

Another key intervention was the removal of the attic floor and the minimization of the ridge height behind the parapet; as Şentürk notes, "He removes the attic floor, shortens the main façade, and thus frees Kundmanngasse from 'crowning'" (Şentürk, 2008, p. 255). This decision reduces vertical emphasis, strengthens horizontal continuity, and limits the mass's representational claim.

A comparison with Adolf Loos is instructive here. In his 1908 essay "Ornament and Crime," Loos criticizes ornament as a sign of cultural backwardness and links modernity to the elimination of decoration (Loos, 1908/1970). Wittgenstein, however, is driven less by aesthetic ideology than by proportional discipline. In Loos, the façade remains a field of public representation; in Wittgenstein, it is deliberately withdrawn. As Macarthur remarks, "His taste in architecture, despite the modernist appearance of the House's unadorned, somewhat asymmetrical white cubic geometries, is decidedly anti-modernist" (Macarthur, 2014, p. 125). The house's simplicity should therefore be read not as Loosian minimalism repeated, but as a measured strategy for limiting representation. As Leitner also notes, "While the cubic exterior may recall Loos, the spatial organization and detailing of the house were reconsidered from the ground up" (Leitner, 2000, p. 26). The decisive issue is therefore not formal resemblance to Loos, but the transformation of that resemblance into a stricter order of spatial and proportional regulation.

The plan likewise avoids a distinct representational center. Most rooms are rectangular, often close to 3/4 or 4/5 proportions, while square spaces remain exceptional. This preserves stability without producing a dramatic core. Although the main hall is larger than adjoining volumes, proportional relations are controlled so that no strong hierarchy emerges. As Last notes, the plan neither generates identical repetitions nor produces a sharp leap between spaces (Last, 2008, pp. 48–51). At the level of the floors, variation in window sizes similarly differentiates the façade without turning it into a dramatic hierarchy; as Şentürk notes, "Using only vertical subdivisions in the windows, Wittgenstein shortens the upper-floor windows so as to make them square" (Şentürk, 2008, p. 255). This intervention is significant because it differentiates the façade without allowing proportional variation to harden into expressive hierarchy.

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At the level of detail, the design attains almost mechanical precision. As Leitner writes, “Every detail of the house was subjected to repeated adjustment, sometimes involving millimetric corrections to achieve the desired precision” (Leitner, 2000, p. 32). Column claddings, window joinery, door handles, and locking systems were repeatedly recalibrated. Detail is therefore not ornament, but the technical bearer of proportional discipline. As Wijdeveld suggests, this attitude treats architecture not as a practice of adding, but of eliminating what is wrong. Zou likewise notes that comparing Wittgenstein’s philosophical writings with the house allows “the matrix of meaning of the work” to emerge (Zou, 2005, p. 31). The building may thus be read as a concrete search for order at the architectural scale.

The building’s later history reflects the effort to preserve this disciplined character. Margarethe Stonborough-Wittgenstein did not live there for long; after the Second World War the house served military and bureaucratic functions during the Soviet occupation, later became associated with the Bulgarian Embassy, and by the 1970s faced serious deterioration. Restoration in the 1980s preserved the building, now used as the Bulgarian Cultural Institute (Last, 2008, pp. 18–23). These interruptions altered its context, yet its architectural character remained largely legible.

The Wittgenstein House should therefore not be reduced to a biographical anecdote or a brief episode in Wittgenstein’s life. As Last notes, “Wittgenstein’s architecture is thus not merely coincident with the house he designed but must be understood within his engagement with the practice of architecture” (Last, 2008, p. 92). The building is significant because it makes that engagement materially legible.

As Hui Zou argues, Wittgenstein’s architecture is directed less toward expressive gesture than toward a “crystal order” grounded in proportional precision and bodily experience rather than formal display (Zou, 2005, pp. 29–30). What is at stake is not abstract rationality but an order experienced through the body and concretized at the spatial scale.

Zou’s notion of “embodied order” also clarifies why precision in the house cannot be reduced to technical meticulousness (Zou, 2005, p. 31). Millimetric corrections, recalculated window proportions, and exact door mechanisms are the spatial counterpart of preserving thought’s own limit.

Within this framework, the four methodological orientations acquire concrete architectural correspondences: delimitation in the prevention of a dramatic center and the keeping of proportions within range; descriptive orientation in the refusal to turn the façade into ideological discourse; relational order in the avoidance of hierarchical leaps; and reticence in the simplification of the mass and the non-assertive character of detail.

These correspondences do not imply a direct transfer of philosophical content into architecture. Rather, they indicate a structural parallel between thought’s self-limitation and spatial organization, and clarify

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why the Wittgenstein House should be read less as an instance of aesthetic minimalism than as a disciplined practice of measure, restraint, and delimitation.

Delimitation: From the Line of Language to the Architectural Threshold

In Wittgenstein's philosophical method, "delimitation" (Grenze) is a principle that remains visible across both periods. In Tractatus Logico-Philosophicus, it appears as the condition of "meaningful discourse": "The limits of my language mean the limits of my world" (Wittgenstein, 2010, §5.6). This proposition defines delimitation not as a metaphysical line beyond the world, but as the condition that determines the field in which meaning can be constituted. As Diamond emphasizes, the point is not to speak about what lies beyond the world, but to show where speaking must end (Diamond, 1991, pp. 181–183). Delimitation is therefore not just a thesis, but a discipline through which thought restrains its own overflow.

In the later period, delimitation is conceived less as an absolute line than as a distinction drawn within use. In Philosophical Investigations, the example of "game" shows that concepts work through practical distinctions that can be drawn or loosened as needed (Wittgenstein, 1953/2005, §68). Both periods thus share a methodological concern with halting the uncontrolled expansion of meaning.

In the Wittgenstein House, this awareness of delimitation appears not through symbolism, but through structural lines and junctions. The corner line is treated not as something dissolved between surfaces, but as a sharp and explicit line (Figure 2). In this sense, the corner is not a zone of softening or cover, but an architectural decision in its own right. Delimitation therefore functions less as decoration than as an ordering mechanism that controls compositional overflow and restrains formal rhetoric.



Figure 2. Corner line, threshold, and surface junction details in the Kundmanngasse House. Source: Soucek (2018) and Wijdeveld (1994, p. 114).

The experiential dimension of delimitation is concentrated in the entrance portal (Figure 3). Projecting slightly from the façade plane, it

establishes the distinction between inside and outside as a bodily sequence of approaching, pausing, and passing through. Wijdeveld notes that the entrance is shifted away from the center, drawing the composition deliberately out of balance (Wijdeveld, 1994, p. 97). As Last suggests, this threshold regulates the process of approach and guides the user's experience in a measured way (Last, 2008, pp. 104–105). Delimitation is therefore produced through movement, not simply shown.



Figure 3. Experiential construction of the inside - outside threshold at the door opening.
Source: Adapted from Architizer (2021) and Wijdeveld (1994, p. 25).

The most technical form of delimitation appears in the interior door thresholds and locking mechanisms (Figure 4). As Wijdeveld notes, the espagnolette system locks into a slightly raised threshold (Wijdeveld, 1994, p. 128). Delimitation thus becomes a mechanical distinction activated through closure and renewed in use, not a line drawn once and left behind. As the door closes, the difference between spaces is reinforced as a functioning mechanism rather than remaining an abstract boundary.

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Figure 4. Mechanical construction of delimitation in the door handle and Espagnolette
Source: Author's compilation based on Wijdeveld (1994, pp. 128, 134).

Taken together, these examples show that delimitation in the Wittgenstein House is not a decorative sign but a multi-layered operation: geometric precision at the corner, bodily threshold at the portal, and mechanical closure at the door. It determines how far architecture will go and prevents overflow. Delimitation in the house should therefore be read not as a search for formal rigidity, but as an order of decision that disciplines the field of the "sayable/buildable." As Last writes, "The juncture specifically ties together Wittgenstein's aim in the Tractatus to designate the scope and limits of language-philosophy with an understanding that such a goal is a spatial practice" (Last, 2008, p. 180). Delimitation in the house therefore operates not as symbolic reference, but as a materially organized practice of threshold, measure, and restraint.

Descriptive Orientation: The Withdrawal of Narrative in Plan Organization and Spatial Configuration

In Wittgenstein's philosophical method, descriptive orientation limits theoretical expansion and resists multiplying conceptual confusion. In Philosophical Investigations, philosophy is asked to content itself with "description" rather than produce theory (Wittgenstein, 1953/2005, §68). As Wittgenstein states, "Philosophy may in no way interfere with the actual use of language; it can in the end only describe it"

(Wittgenstein, 1953/2005, §124). Descriptive orientation thus emerges here as a method of holding interpretation back and allowing order to appear through use rather than explanatory excess.

This attitude finds a clear architectural correspondence in the plan of the Wittgenstein House. The more symmetrical and representational order associated with Engelmann's initial design was transformed by Wittgenstein into a restrained spatial organization. As Leitner writes, "Wittgenstein's interventions in the design progressively eliminated representational symmetry in favour of a more restrained spatial order" (Leitner, 2000, p. 27). Wittgenstein also displaced the entrance from the symmetry axis, making it harder for the plan to "explain itself" through a single center (Şentürk, 2008, pp. 255–256). This was not merely a geometric correction, but a change in the representational logic of the plan (Figure 5).

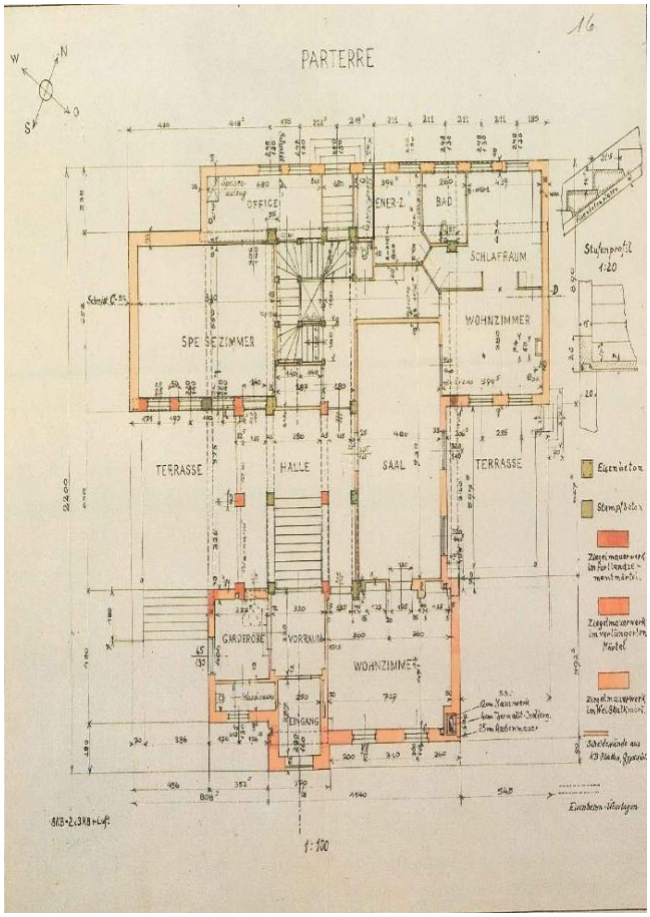


Figure 5. Belétage plan of the Kundmanngasse House: displacement of the entrance axis
Source: Wijdeveld (1994, p. 102).

When the plan is examined, the spaces do not produce a dramatic axis or ceremonial climax. As Leitner notes, "The plan does not organize the house around a dominant centre but distributes the rooms in a carefully balanced arrangement" (Leitner, 2000, p. 29). Even the main hall does not establish a representational hierarchy; instead, continuity is produced through proportional relations. As Last observes, the plan "displays a balanced distribution that does not gather around a single emphasis" (Last, 2008, pp. 45–48). Description, in this sense, does not empty the plan of order; it prevents that order from becoming a self-explanatory representational scheme.

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The organization of circulation reinforces this reading. Rather than creating theatrical sequences, movement through the house maintains continuity between rooms (Leitner, 2000, p. 30). Corridors are not elongated for perspectival effect, and transitions rely on proportional balance rather than axial display (Figure 6). Wijdeveld's plan analyses likewise indicate that the connections between spaces depend on measured relations rather than ceremonial emphasis.



Figure 6. Non-dramatized circulation and an order of proportional continuity in the library Source: Wijdeveld (1994, p. 121).

This descriptive orientation is visible not only in the geometry of the plan, but also in the atmosphere it produces. Differences in size exist between volumes, yet they are not dramatized into representational superiority. Order is established through internal consistency of measure rather than through symmetry or historical reference, close to what Zou calls a "crystal order" (Zou, 2005, p. 28). The plan therefore remains within its own system of measure rather than relying on additional narrative to explain itself.

A similar attitude appears at the level of detail. Door, locking, and window mechanisms are specially designed, but not turned into aesthetic emphasis; functional exactness remains decisive (Wijdeveld, 1994, p. 132). Detail thus appears not as display, but as an element of architectural discipline operating across scale (Figure 7).

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Figure 7. Door handle and locking mechanisms designed by Wittgenstein. Source: Wijdeveld (1994, p. 134).

The claim here is not that Wittgenstein's philosophical theses are directly transferred into the plan. Rather, both his later thought and the house's plan reveal a shared methodological line: avoiding a center, resisting dramatic concentration, and keeping order internal to itself. The plan may therefore be read less as a representational composition than as a configuration that becomes clear in use and coherent through the measured relation of its parts.

Relational Order: Decentered Order in the Façade, Plan, and Interior

In Wittgenstein's later thought, meaning is treated not as a closed system derived from a single essence, but as a structure distributed across patterns of use. In Philosophical Investigations, concepts are connected through "family resemblances" rather than fixed essences (Wittgenstein, 1953/2005, §§65–67). Order is therefore understood not as a system derived from a singular center, but as a structure emerging through relations among different elements. As Last states, "As such, the Stonborough-Wittgenstein House is no longer an object in comparison to philosophy, but a process that as with the philosophy of the Tractatus and the Investigations, is concerned with a series of topics, including boundaries, limits, visuality, spatiality, inner-outer relationships, rule-following, meaning, representation, and so on" (Last, 2008, p. 94). The house should therefore be understood less as a closed formal whole than as a relational organization operating through the interconnections of its elements.

The façade is the first visible field of this decentered order (Figure 8). As Leitner notes, "The façade avoids monumental emphasis and instead establishes a measured balance between openings and wall surfaces" (Leitner, 2000, p. 35). The window openings do not produce a pronounced center, as in classical axial compositions, nor is any opening positioned so as to establish representational superiority over the others.

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They do not form a system of modular repetition; yet their differences are balanced so that no dramatic hierarchy emerges. This decentered order then continues in the interior through the sequences of windows (Figure 9).



Figure 8. A window sequence in the interior that does not produce a center and displays a proportional distribution. Source: Wijdeveld (1994, p. 26).



Figure 9. The openings are designed in a non-modular manner, without producing a center and without establishing hierarchy among themselves. Source: Wijdeveld (1994, p. 13).

This distribution can also be traced in the discipline of proportion. The roughly two-to-one ratio between floor height and window height limits the dramatization of vertical effect. As Leitner notes, the building's decisive proportions arise not from adherence to a system, but from an intuitive process of balance: "The most significant thing about the building is its proportions—certainly the most mysterious determinants of architectural quality. (...) It is intuition that determines the proportions" (Leitner, 2000, p. 42). Likewise, although the ratio of solid to void varies from façade to façade, it remains within a narrow range, preventing the composition from concentrating on a single focal point.

Proportion here is not a stylistic reference, but a means of controlling visual overflow.

The principle of relational order becomes even clearer in the plan (Figure 10). Differences in size exist between spaces, but they do not produce a representational hierarchy. The main hall is wider than the adjoining volumes, yet the proportional relations are not sharpened enough to create dramatic superiority. This indicates an order in which spaces are interdependent while carrying comparable weight.

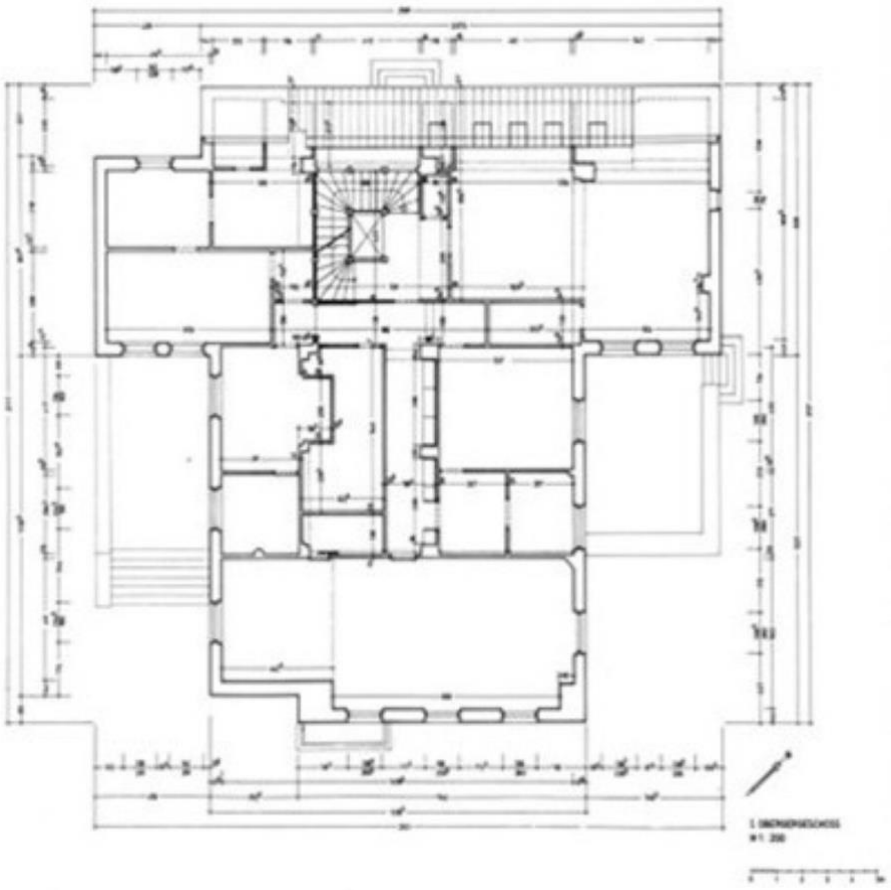


Figure 10. The orientation of relational order can be read not only on the façades, but also through the spatial distribution of the upper floor. Source: Author's AutoCAD redrawing based on Wijdeveld (1994).

A similar proportional balance is evident in the interior as well (Figure 11). Door openings and passage axes do not produce a single perspectival focal point. The close relation between volume heights and opening proportions prevents dramatic dominance between spaces. Relational order in the house operates through this internal consistency: spaces are not reduced to a single principle, yet their relations remain governed by a discipline of measure. Order thus emerges not around a singular center, but through proportional relations among spatial elements.

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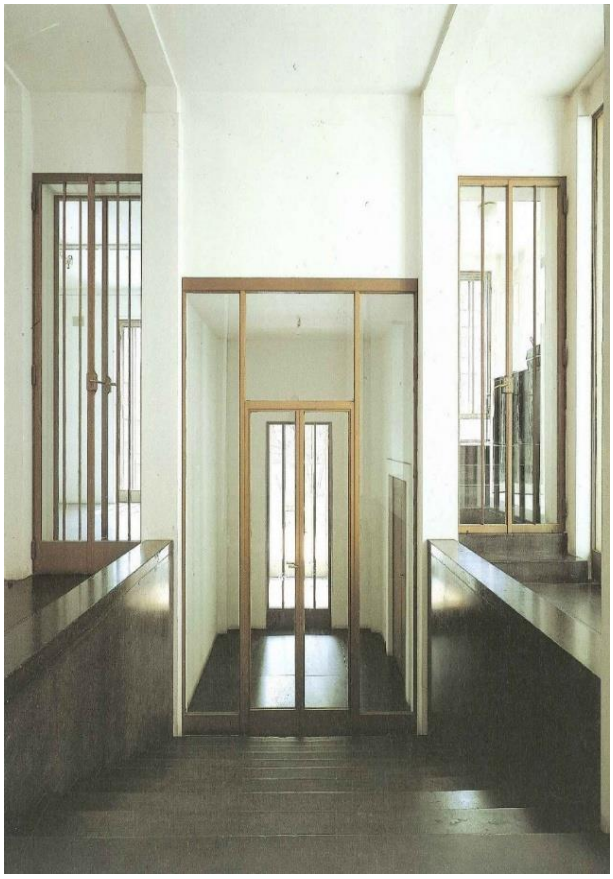


Figure 11. An order based on optical balance in the rear entrance design.
Source: Wijdeveld (1994, p. 37).

Relational order is therefore not merely a preference of façade composition. It is a methodological attitude operating through proportion, volumetric distribution, and spatial configuration. There is order, but no central emphasis; hierarchy is weakened, yet the building is not arbitrary. This balance establishes a structural parallel with Wittgenstein's understanding of meaning not as a fixed essence but as a relational distribution. In Philosophical Investigations, the statement that "the meaning of a word is its use in the language" likewise indicates that meaning emerges not from a singular center, but within a relational context (Wittgenstein, 1953/2005, §43). Meaning is thus understood not through a single defining essence, but through the relations among different uses.

The reading proposed here does not claim that philosophical concepts are directly translated into architectural form. Rather, it argues for a methodological parallel between the two fields insofar as order is established not around a singular center, but within a network of relations. In both Wittgenstein's later thought and the Wittgenstein House, a shared understanding of order can be observed: avoiding a singular center, dispersing concentration, and sustaining order through internal relations. Relational order thus becomes not an aesthetic preference, but a principle that distances spatial organization from a singular center.

Reticence: Architectural Attitude as the Reduction of Representational Burden

In Wittgenstein's thought, philosophy is defined less as the construction of systems that produce comprehensive explanations than as an activity attentive to its own limits. The ideal of coolness expressed in Culture and Value implies a stance distanced from excessive emphasis and self-imposing expression (Wittgenstein, 1998). In this context, reticence is not passivity, but measured self-positioning. Macarthur interprets this attitude as follows: "the House and its aesthetics of simplicity and coolness serve the same ends—to lead one along the path of ethical self-knowledge" (Macarthur, 2014, p. 130). Thought does not absolutize itself; it consciously limits its own field. This methodological attitude is first legible on the façade surface of the Wittgenstein House (Figure 12).



Figure 12. Façade order characterized by volumetric withdrawal and reduced representational intensity. Source: Wijdeveld (1994, p. 8).

The façade neither produces representation through historical reference nor constructs an ideological modernist manifesto. As Leitner notes, "The house avoids the rhetoric of architectural representation and instead pursues a restrained clarity of form" (Leitner, 2000, p. 37). Rather than constructing a symbolic narrative, it withdraws into proportional order and formal simplicity. The arrangement of openings is measured and balanced, yet creates neither a dramatic center nor symbolic concentration.

This attitude continues at the level of the plan (Figure 13). Differences between volumes are not turned into dramatic superiority. The spatial configuration does not force the user into a predetermined narrative; instead of direction, it privileges continuity. The building's spatial organization presents a balanced distribution without central pressure. Reticence thus appears not only as a formal, but also as an organizational decision.

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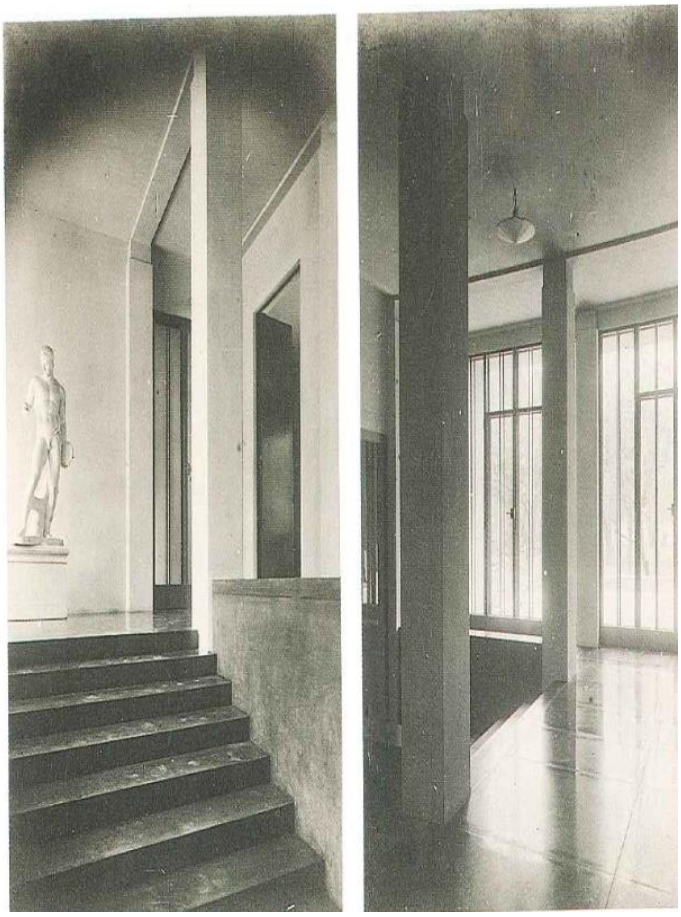


Figure 13. A spatial configuration in which the sculpture does not produce a dramatic center.
Source: Wijdeveld (1994, p. 118).

In the interior, reticence takes on a more technical dimension (Figure 14). Although the door fittings, window shutters, and mechanical systems were specially designed, they do not produce display. Leitner describes this situation as follows: “Even the smallest fittings, such as handles and window mechanisms, were designed with extreme precision yet without decorative emphasis” (Leitner, 2000, p. 48). This approach aims not to make detail produce visual emphasis, but to sustain the building’s technical and proportional discipline. Detail here is not a field of imagistic emphasis, but one of technical discipline. Accuracy, rather than visibility, becomes decisive.



Figure 14. Designs of specially made, non-showy doors and windows for the house. Source: Leitner (2013).

This technical discipline corresponds to the measure-based understanding of order that Hui Zou identifies in Wittgenstein's architecture (Zou, 2005, p. 31): "Wittgenstein's architecture can be understood as the pursuit of a 'crystal order' grounded in precision and restraint." What is at stake here is not a gesture that produces representation, but the preservation of measure as crystallized order.

Compared with Adolf Loos's anti-ornamental approach, this attitude is more cautious. In "Ornament and Crime," Loos treats ornament as a cultural problem and defines modernity through liberation from decoration (Loos, 1908/1970). In Wittgenstein, by contrast, the issue is less polemical: simplicity functions as a way of reducing representational burden rather than as an ideological end in itself.

In the Wittgenstein House, reticence thus appears not as formal subtraction, but as a way in which architecture positions itself in the background. The reduction of representational burden at the levels of façade, plan, and detail prevents the building from assuming an assertive stance toward the user.

Considered together, delimitation, descriptive orientation, relational order, and reticence appear in the Wittgenstein House not as isolated preferences, but as manifestations at different scales of the same understanding of order. The building should therefore be read not as an example of aesthetic minimalism, but as a measure-based architectural discipline in which representation is deliberately restricted.

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CONCLUSION

"Whereof one cannot speak, thereof one must be silent."
(Wittgenstein, 2010, §7)

In the history of philosophy, some thinkers are defined by the systems they construct, others by their refusal to construct them. Wittgenstein belongs to the latter group. What matters in his texts is less the sum of their theses than their insistence on where thought must stop. The Tractatus draws the limits of meaningful discourse (Wittgenstein, 2010), while the later writings ask philosophy to content itself with description rather than explanation (Wittgenstein, 1953/2005). In both, philosophy appears less as theory-building than as a clarificatory activity that dissolves conceptual confusion. As Wittgenstein writes, philosophy "leaves everything as it is" (Wittgenstein, 1953/2005, §124).

This study has argued that this discipline can be read through four methodological attitudes: delimitation, descriptive orientation, relational order, and reticence. These are not isolated concepts but different manifestations of an understanding of order directed toward limiting representation. Their value as an analytical framework lies in making it possible to compare textual and architectural structures without collapsing one into the other.

As shown in Table 1, these attitudes operate simultaneously at the levels of façade, plan, interior, and detail. The point is not direct transfer from philosophy to architecture, but a shared disciplinary logic that can be observed in both domains.

Table 1. Correspondences of "structural orientations" at the level of architectural components in the Wittgenstein House and the resulting structural effects.

Structural Orientation	Facade	Plan Organization	Interior Space	Detail	Emerging Structural Impact
Delimitation	Surface that does not produce an axial center; sharp corner joints	Absence of dramatic axes; threshold-based transitions	Measuring the balance between public and private transitions	Clear definition of boundaries at corners, thresholds, and frames	Framing meaning and representation
Descriptive orientation	No narrative or symbolic facade language	Plan without a hierarchical center	Spaces are not dramatized; functional continuity	Technical solutions do not turn into aesthetic display	Purification of architecture from explanatory rhetoric
Relational order	Decentralized distribution of window proportions	No representative superiority in room proportions	Proportional proximity; a distribution that does not produce typology	No hierarchical distinction between details	Exclusion of hierarchy
Reticence	Surface purified of rhetoric	Does not impose a plan experience	Spatial guidance is minimized	Detail does not demand visibility	Deliberate suppression of representational intensity

The Wittgenstein House shows how this discipline operates architecturally. Its façade does not produce a center, its plan avoids dramatic axes, its interior does not establish representational superiority, and its detail avoids display. The building is precise without becoming dramatic, and controlled without becoming symbolic.

What is decisive here is not minimalism. Rather than an aesthetic reduction, what is at issue is the disciplining of architecture's expressive capacity through measure and delimitation. When delimitation, the dispersal of concentration, and the reduction of representational burden operate together, what emerges is a structural self-discipline that may be described as architectural silence.

In Wittgenstein's thought, silence is not deficiency but a conscious withdrawal of excess and an insistence on preserving the limit of thought itself. "Whereof one cannot speak, thereof one must be silent" (Wittgenstein, 2010, §7) marks one form of this limit; in the later period, philosophy "leaves everything as it is" (Wittgenstein, 1953/2005, §124).

In the Wittgenstein House, this attitude takes architectural form. The façade does not construct a symbolic narrative; the plan does not produce a dramatic center; the interior does not force a single interpretation; and detail does not turn into display. Architectural silence thus names not absence, but a measured decision about how much representation will be produced.

The house should therefore be read not as a representation of Wittgenstein's philosophy, but as a material reorganization of thought's self-limitation. It provides a concrete example of architectural silence structured through measure, delimitation, and controlled representation, and suggests a methodological way of reading architecture and philosophy together through structural correspondences rather than symbolic equivalence.

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Resume

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