3D MODELLING AS A TOOL FOR HERITAGE PRESENTATION: DIGITAL RECONSTRUCTION OF 19TH CENTURY GÜLBAHÇE, URLA, İZMİR

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by
Beylem Doğa TABUR

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İZMİR

We approve the thesis of **Beylem Doğa TABUR**

Examining Committee Members:

Prof. Dr. Mine TURAN
Department of Conservation and Restoration of Cultural Heritage,
İzmir Institute of Technology

Assoc. Prof. Dr. Kaya OĞUZ
Department of Computer Engineering,
İzmir University of Economics

Assoc. Prof. Dr. Fatma Nurşen KUL
Department of Conservation and Restoration of Cultural Heritage,
İzmir Institute of Technology

12 July 2024

Assoc. Prof. Dr. Fatma Nurşen KUL
Supervisor, Department of Conservation and Restoration of Cultural Heritage,
İzmir Institute of Technology

Prof. Dr. Mine TURAN
Head of the Department of Conservation
and Restoration of Cultural Heritage

Prof.Dr. Mehtap EANES
Dean of the Graduate School

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ABSTRACT

3D MODELLING AS A TOOL FOR HERITAGE PRESENTATION: DIGITAL RECONSTRUCTION OF 19TH CENTURY GÜLBAHÇE, URLA, İZMİR

The aim of this thesis is to digitally reconstruct Gülbahçe, a wealthy town centre in the 19th century, where the town's wealth shaped its built environment. Currently, most of these unique characteristics have disappeared. The purpose of this project is to interpret and present the lost heritage of Gülbahçe in a digital environment. The 19th century Gülbahçe was modelled using a geometry-based modelling method with the specific aim of achieving this final result. In order to ensure the reliability of the model, all the literature and archival sources in Turkey and Greece were examined, and information about Gülbahçe was compiled. As a result, the three-dimensional digital model effectively presented the inaccessible lost heritage, providing a comprehensive view of the built environment and cultural landscape at the settlement scale. Furthermore, the presentation method developed according to the degree of reliability of each digitally reconstructed building goes beyond the creation of digital copies, as recommended in the London Charter, and ensures that the visualisation processes and results can be properly understood and evaluated by participants.

Key Words: *Lost Heritage, Heritage Presentation, Virtual Reality, Digital Reconstruction, Gülbahçe*

ÖZET

MİRAS SUNUMUNDA BİR ARAÇ OLARAK 3B MODELLEME: 19. YÜZYIL GÜLBAHÇE, URLA İZMİR'İN DİJİTAL REKONSTRÜKSİYONU

Bu tez, 19. yüzyılda varlıklı bir nahiye merkezi olan ve bu zenginliğin yapılı çevreyi de şekillendirdiği; ancak günümüzde bu özelliklerini büyük oranda kaybetmiş olan Gülbahçe'nin kaybolan mirasını yorumlamak ve sunmak amacıyla dijital ortamda yeniden inşa edilmesini amaçlamıştır. Bu doğrultuda, 19. Yüzyılın Gülbahçe'si geometri tabanlı modelleme yöntemi ile modellenmiştir. Modelin güvenilirliğinin sağlanabilmesi için Türkiye ve Yunanistan'da bütün literatür ve arşiv kaynakları taranarak Gülbahçe'ye dair bilgiler derlenmiştir. Bunun sonucunda üç boyutlu dijital model, yerleşim bütünü ve etkileşim içinde olduğu çevresini de kapsayarak ve günümüzde artık var olmayan öğeleri de içerecek şekilde gerçekleştirmiştir. Bunlara ek olarak bu çalışma dijital rekonstrüksiyonu gerçekleştirilen her bir yapının güvenirlilik derecesine göre geliştirilen sunum yöntemi ile Londra Tüzüğü'nde önerildiği gibi, yalnızca dijital kopyaların oluşturulmasının ötesine geçerek görselleştirme süreçlerinin ve sonuçlarının kullanıcılar tarafından doğru şekilde anlaşılabilmesini ve değerlendirilebilmesini sağlamaktadır.

Anahtar Kelimeler: *Kaybolan Miras, Miras Sunumu, Sanal Gerçeklik, Dijital Rekonstrüksiyon, Gülbahçe*

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LIST OF ABBREVIATIONS

AR: Augmented Reality

CAMS: The Centre for Asia Minor Studies

CGA: Computer Generated Architecture

COE: The Council of Europe

GBM: The Geometry-Based Modelling

GEEAYK: The Superior Council for Immovable Antiquities and Monuments *(Gayrimenkul Eski Eserler, Anıtlar Yüksek Kurulu)*

IBM: Image-Based Modelling

ICAHM: The International Committee for the Management of Archaeological Heritage

ICOM: International Council of Museums

ICOMOS: International Council on Monuments and Sites

IZTECH: İzmir Institute of Technology *(İzmir Yüksek Teknoloji Enstitüsü)*

İZKA: İzmir Development Agency *(İzmir Kalkınma Ajansı)*

LiDAR: Light Detection And Ranging

MFA: Republic of Türkiye Ministry of Foreign Affairs *(Türkiye Cumhuriyeti Dışişleri Bakanlığı)*

MMOW: A Massively Multiplayer Online World (Virtual World)

MSV: Multi-Stereo View

OED: Oxford English Dictionary

RBM: Range-Based Modelling

QR Code: Quick Response Code

SfM: Structure from Motion

TKGM: Tapu ve Kadastro Genel Müdürlüğü *(General Directorate of Land Registry and Cadastre)*

UNESCO: United Nations Educational, Scientific and Cultural Organization

UNESCO WHIPIC: International Centre for the Interpretation and Presentation of World Heritage Sites under the auspices of UNESCO

V-MusT: The Virtual Museum Transnational Project

VR: Virtual Reality

CHAPTER 1

INTRODUCTION

Gülbahçe[1] is located to the west of the Urla Peninsula, which protrudes from the coast towards the Aegean Sea. It is to the northwest of the isthmus where the peninsula connects to the mainland. Gülbahçe has a long and culturally significant history dating back to the Palaeolithic period. It had been an important port on the Urla Peninsula and had played a significant role in transporting valuable merchandise from the Aegean coasts to the islands, making it a key commercial hub in the region. In the 19th century, the Gülbahçe port, facilitated direct economic interactions with Lesvos, Foça, Çanakkale, İzmir, Chios, and Samos (CAMS). The marine trade involved the transportation of commodities such as wood, coal, livestock, and raisin (CAMS). Pavlidis' research reveals that the majority of people who live in Gülbahçe[2] derived their livelihood mainly from agriculture. According to Pavlidis, the households where agriculture is not the primary source of income possess either modest or large plots of agricultural land and typically cultivate vineyards (ΑΝΤΩΝΗΣ 2010). Before 1922, the people who lived in Gülbahçe were mainly Ottoman Greeks who lived on viticulture, wheat and bean farming, livestock, and fishing. The people grew Sultani and Razaki grapes (HOMEACROSS 2023).

As a result of these commercial activities and rich agricultural production, Gülbahçe was one of the prominent settlements in the Urla peninsula prior to the Greco-Turkish War. The settlement stood apart from neighbouring villages with its port,

[1] The HOMEACROSS project has received funding from the European Research Council (ERC) under the European Union's Horizon 2020 research and innovation programme (grant agreement No. 950178). HOMEACROSS examines the material legacies of the 1923 Exchange of Populations between Greece and Türkiye in İzmir and Attica, two provinces that received large numbers of immigrants (for comprehensive information, see https://homeacross.eliamep.gr/?page_id=606&lang=en).

[2] According to the OSMANLI YER ADLARI, publication number 26, issued in 2017 by T.C. Başbakanlık Devlet Arşivleri Genel Müdürlüğü, Gülbahçe was identified as the central location of the town centre (Nâhiye) that included the villages of Yağcılar and Demircili in 1924. The Gülbahçe Nâhiye was abolished on 09.10.1029/3505 S.B.K.K. Consequently, Gülbahçe was designated as the village of the Urla district in the province of Izmir (Sezen 2017). In 2012, the Law No. 6360 in Türkiye established the provincial property limit as the borders of metropolitan municipalities (On Dört İlde Büyükşehir Belediyesi ve Yirmi Yedi İlçe Kurulması ile Bazı Kanun ve Kanun Hükmünde Kararnamelerde Değişiklik Yapılmasına Dair Kanun [1]. 2012). As a result, the villages inside these borders lost their legal status as independent entities and were converted into neighbourhoods. In the context of this thesis, the author has chosen to refer to Gülbahçe as a village due to its predominantly rural characteristics.

religious buildings, educational, and production facilities, various shops and residential buildings.

After the Turkish War of Independence, Turkish and Albanian[3] immigrants were settled in Gülbahçe in accordance with the Convention of the Lousanne Peace Treaty Concerning the Exchange of Greek and Turkish Populations. In the first phase, Turkish immigrants from Crete's Chania and Heraklion regions were settled in 1924. After that, immigrant families came from Thessaloniki, Florina, Drama, and Pristina. Immigrant Albanians who came from Thessaloniki and Piriştina were settled in Konya at first, and then they were settled in Bağarası. However, they were moved from Bağarası to Gülbahçe due to malaria. The homes that the deported Ottoman Greeks left abandoned were now home to these immigrants. However, the narratives of the current inhabitants reveal that a significant number of structures were demolished during the war upon the arrival of the immigrants (HOMEACROSS 2023). So the first comers either repaired the demolished buildings or constructed new buildings with the salvaged materials of the ruins. Some of the buildings were continued to be used with their original functions, whereas others were not. Some of them were refunctioned in accordance with the requirements of the immigrant population. As an example, although the immigrants still utilised the village square and its adjacent cafes and commercial buildings for their intended functions, the Hadjidiamanti house situated on the square was converted into a primary school due to its durability and advantageous location within the settlement. Additionally, the immigrants derived their sustenance from engaging in agricultural activities and the breeding of sheep and goats. When they arrived in Gülbahçe, they had no knowledge or experience in viticulture or the process of producing raisins. As a result, they uprooted the vineyards and substituted them with the agricultural products they were accustomed to growing (HOMEACROSS 2023). In order to establish everyday life conditions in Gülbahçe, they avoided making significant alterations to the rural characteristics of the

[3] According to the Bir Tasfiye ve Örtülü Sürgün Metodu Olarak Balkanlar'dan Türkiye'ye Göçler (1923-2004) by H. Yıldırım Ağanoğlu, during the meetings of the Exchange Sub-Commission working on the Exchange Convention in Lausanne, the issue of Albanians within the borders of Greece was also discussed. The Greek delegate, Caclamanos stated that they did not consider including Albanians in the scope of the exchange. Nevertheless, the Greek government included Muslim Albanians in the exchange and subjected them to forced migration. The Turkish government was forced to accept the Albanian settlers into its country after the Miscellaneous Exchange Commission considered the Muslim Albanians within the scope of the exchange. Consequently, approximately 55 thousand people from the Çamerya region, which was close to Albania but left to Greece, were included in the scope of the exchange and sent to Türkiye. A survey conducted in 1925 found that a significant proportion of Albanians were among the Turks who migrated from Greece as part of the exchange program (Ağanoğlu 2023).

physical environment. Despite changes in the population, the physical environment of the community has remained conserved for a long time.

1.1. Problem Definition

Gülbahçe preserved its characteristics until the 1970s, as evidenced by both historical aerial photos and historical photographs taken at different times (see figures 1.1., 1.2., and 1.3.). The transformation of the cultural landscape started in 1950s with increasing number of second homes. However, the transformation gained momentum after the 1970s. Subsequently, in the 1990s, the Çeşme highway was opened, and IZTECH's Gülbahçe Campus was established. Due to the COVID-19 pandemic that started in 2019, the Aegean Sea earthquake on October 30, 2020, and the Kahramanmaraş earthquake in 2023, Gülbahçe as in many other coastal towns, has become an attractive location for those looking for living in a low-density settlements away from the cities. This situation resulted with an uncontrolled and rapid destruction and transformation of the authentic built environment which was largerly preserved until the 1970s. Today, the 19th century settlement and landscape characteristics of Gülbahçe are no longer recognizable due to significant destruction, changes and alterations over the years due to the briefly summarised reasons mentioned above.

Figure 1. 1. Viewpoint of Gülbahçe (Source: Çamlıbel 2019)

Figure 1. 2. Viewpoint of Gülbahçe in 1970 (Source: [Photographs of D**** Y*****] 1970)

Figure 1. 3. Viewpoint of Gülbahçe in 2023 (Source: HOMEACROSS 2023)

1.2. Aim, Research Questions and Objectives

Gülbahçe no longer represents its 19th century settlement characteristics. Reconstruction of lost buildings is scientifically and practically incorrect and impossible since the reliability regarding the original conditions of the lost buildings are controversial and new buildings are already constructed in the place of lost heritage buildings.

For this reason, digital tools are the only means of presenting information about the lost 19th century heritage of Gülbahçe. In this respect, this thesis aims to digitally reconstruct the lost 19th century heritage of Gülbahçe, allowing an immersive experience that is no longer accessible in physical form. With this aim, the thesis would endeavour to respond to the following research questions:

1. How could the lost heritage of Gülbahçe can be presented?
2. What are the methods of presentation of the lost heritage?
3. What are the advantages of presenting the lost heritage with the digital reconstruction method?
4. How can the reliability degrees of lost heritage assets be represented in 3D model?

As stated above, this thesis aims to produce a digital reconstruction of 19th century Gülbahçe. The varied sources for each building resulted in differing conclusions regarding the reliability of their original conditions. These discrepancies in reliability were intended to be conveyed in the digital model.

Three-dimensional modelling programmes serve other functions beyond converting the structure into a digital format. The primary objectives include the high accurate dimensions of the modelled item, comprehensive capture of modelled item details using of the modelling tools, cost-effectiveness and time compared to physical reconstruction, portability in the virtual environment, ability to obtain photorealistic visuals of the final product, application flexibility with other software, and an efficient model size while fulfilling these objectives. Nevertheless, it is unachievable to simultaneously accomplish all of these objectives using a single method. Hence, the primary objective of the thesis is to utilise digital presentation methods to present information about Gülbahçe in the 19th century with highly reliable features of the model.

1.3. Scope and Limits

The physical environment of the 19th century Gülbahçe will be presented with digital reconstruction tools within the scope of this thesis. Instead of focusing only on the monumental building and their surrounds, the digital reconstruction will cover the whole settlement and nearby landscape, thus providing a holistic understanding of the built and cultivated landscape.

However, although the thesis aims to address the built environment together with the surrounding landscape that constantly interacts with each other, only the closeby landscape is covered due to the time limitations of the study and time consuming nature of the model creation process.

Another important point that this thesis aimed was to document the existing buildings with image-based and range-based methods and immerse this data into the virtual environment where the lost heritage and its landscape were reconstructed using geometry-based methods. In such a hybrid model, the existing and lost buildings could be easily differentiated due to different modelling techniques. However, the buildings that remains from the 19th century have experienced significant alterations. Therefore, the visuals acquired by the IBM or RBM methods will not provide precise insights into the architectural characteristics of the 19th century. Given to the unavailability of essential visual data for IBM and RBM in the digital modelling phase, the existing cultural assets and lost heritage elements were modelled using the same method. The difference between lost and existing heritage was established during the rendering phase, rather than the modelling phase.

1.4. The Method

The method of this thesis is comprised of literature review, archival research, field survey, oral study, 3D modelling and evaluation. The method of 3D modelling is given in the Chapter 4. in detail.

1.4.1. Literature Review

The literature review is done to understand the lost heritage and the digital presentation of lost heritage concept. Literature review is utilized to provide clarification on the following points:

- development of cultural heritage presentation methods
- presentation methods of lost heritage sites by reconstruction methods
- virtual reality of lost heritage and determination criteria of the digital reconstruction tools by ratio of lost in heritage site.

This thesis discusses the reconstruction tools used in the digitisation of lost heritage and the reliability of the final product of each tool used in this field. The knowledge derived served as a basis for determining the thesis' 3D digital modelling method.

In addition, literature survey is conducted to understand the historical background of Gülbahçe and how the settlement transformed afterwards.

During the site surveys, it has been observed that extensive construction of second home for tourism-related activities ad apartments with many small flats for students accommodation, is the main reason of the transformation and deterioration of 19th century. The research focused on analysing articles, unpublished theses and symposium papers that examined Urla's construction practices gained appeal as an attractive option for second homes during the period from the 1950s to the 1970s in coastal locations. The aim was to acquire insights into the current changes that have occurred in the settlement. Also, these sources have attracted a ttention on negative impacts of infrastructure projects such as the Çeşme highway and IZTECH Gülbahçe Campus in 1990s on changes in the case study area.

The literature sources giving information on the built characteristics of Gülbahçe are discussed in Chapter 4.1.1.4.

1.4.2. Archival Research

Archive research is utilized to provide clarification on the following points:

- available detailed information on the settlement characterictics and structures in the 19th century.

- to ascertain the current condition and level of intervention on the 19th century buildings.
- identification of the 19th century bıildings that dissappeared due to various reasons.

Various archival sources are utilized to clarify the above mentioned aspects. These sources and the information coming from them are presented in Chapters 4.1.1.3, 4.1.1.5 and 4.1.1.6.

1.4.3. Site Survey

In 2023, a building and environmental scale site survey was conducted. In terms of the environmental scale, the geographical features, and the location of the very first settlement were considered. In the context of the building scale, architectural and spatial characteristics, construction techniques, and functions of the buildings were examined in order to understand their construction period and condition state. The findings of the site survey related to existing and lost buildings is discussed in chapter 4.1.1.1.

1.4.4. 3D Digital Modelling Process

As the London Charter explicitly states in its principles, computer-based modelling in cultural heritage sites should be carried out when necessary. Given the high costs and potential damage to other layers that reconstruction in a multi-layered settlement such as Gülbahçe entails, the digital reconstruction method is the optimal solution. The main purpose of making the digital 3D model of the 19th century Gülbahçe is to show the viewers the lost heritage within the context of the settlement.

The digital 3D model is designed to create a visual representation of the heritage elements of the period, rather than a photorealistic experience of the settlement. Consequently, a more figurative but comprehensive modelling method was selected for the 3D modelling of the landscape. The 19th century Gülbahçe was reconstructed using digital tools and the Geometry-Based Modelling method. The reasons behind selecting this model and its method is detailed in Chapter 2.7. The method of the 3D model is explained in Chapter 4.1.2.

1.5. Obstacles

During the site survey, the rapid transformation of the Gülbahçe settlement was observed. For instance, following the site survey conducted in May 2023, a 19th century building that was confirmed as existing, was classificed as lost in March 2023. Therefore, this thesis did a comprehensive analysis to understand the built environment of Gülbahçe in 19th century, using multiple sources. Nevertheless, the literature sources on Gülbahçe is quite limited, and the existing ones provide little and limited information mainly related with its history.

A variety of visual materials have been obtained from multiple sources giving information on the original condition of the buildings that have been lost or changed significantly (see Chapter 4.1.1.) Although this visual data provided invaluable information for understanding the original characteristics of the buildings, their insufficient resolution posed problems to understand the details of the buildings.

One of the great contributions of this research is the collection of all the Ottoman, Turkish and Greek bibliographic and archival materials related to Gülbahçe. However, the author is unfamiliar with the Greek and Ottoman Turkish languages, which constituted the majority of these sources. One of these sources, the photos and graphics obtained from the book "Ο Γχιουλμπαξες Ερυθραίας" by ΑΝΤΩΝΗΣ in 2010 have served as a valuable resource for the historical investigation of Gülbahçe. Kalliopi Amygdalou the principal investigator of the HOMEACROSS Project has translated the important parts of this book into English. Similar obstacles arose while examining the oral history archives from the CAMS Archive and the Ottoman maps from the Directorate of State Archives. The researchers of the HOMEACROSS Project resolved this obstacle by translating and/or transcribing the sources into English.

1.6. Thesis Structure

The thesis is composed of five chapters: introduction, presentation of cultural heritage, general characteristics of Gülbahçe, digital reconstruction of the 19th Century Gülbahçe and conclusion.

Chapter 1 explains the problem definition with the comparing photographs. Detailed clarifies aim, research questions, objectives, scope and limits, and the method of

the study. Lastly, the obstacles of the study are explained detailed as well as the content of the thesis.

Chapter 2 explains the definition, and international and national perspectives of heritage presentations. The evolution of cultural heritage presentation methods is also presented it. Detailed explanation was provided regarding the methods used to present lost heritage, with a particular focus on digital reconstruction tools. Lastly, different digital reconstruction methods are compared and evaluated for understanding the most appropriate method for digital reconstruction of 19th century Gülbahçe.

Chapter 3 focuses on the general characteristics of Gülbahçe. The climatic, landscape and topographical characteristics, historical background, socio-cultural and economic characteristics are revealed.

Chapter 4 states the phases of digital reconstruction of 19th century Gülbahçe. The sources utilised to digitally reconstruct 19th century Gülbahçe, with a focus on a comprehensive analysis of each individual building. A criterion has been set by determining the extent to which these factors impact the reliability of the buildings in the digital reconstruction process. The reliability of the digitally reconstructed buildings was assessed based on the sources utilised.

Chapter 5 evaluates the results of the thesis.

CHAPTER 2

PRESENTATION OF THE CULTURAL HERITAGE

The collective ownership of the spaces and buildings that society uses to live creates villages and cities. The rapid destruction of cultural and natural environmental features due to urban growth in the 19th century prompted cultures to develop a heightened awareness and concern for conservation (Erder 2020). Extensive study, documentation, and restoration efforts have been conducted in accordance with national and international laws and regulations to preserve, restore, and transfer cultural and natural heritage to future generations since the 20th century. The effectiveness of sustainable conservation relies on the awareness, consciousness, and education of each person, who is the main actor in achieving conservation goals. In this process, interpretation and presentation informed people about heritage assets and enabled them to better understand the site in light of the information.

The significance of 3D modelling presentations for cultural heritage sites has been growing on both international and national levels. The main reasons of 3D digital reconstruction in heritage sites are: documenting heritage sites and assets to facilitate the efficient restoration of heritage that have been damaged by various factors, such as natural calamities or conflicts; developing educational resources aimed at the requirements of students and heritage researchers; reconstructing lost heritage sites and assets; and enhancing virtual tourism and museum exhibitions. Nevertheless, research on lost cultural heritage has received less attention compared to other reasons, especially when examining settlement scale. Because when it comes to more specific approaches to the lost heritage sites, there appears a need for more research. In the present day, the approach is centred on the lost monumental building and its surroundings rather than the presentation of the entire settlement of the lost heritage site.

2.1. Definition of Presentation and Interpretation

The Oxford English Dictionary defines “presentation” as “the action of offering something for acceptance, esp. formally or ceremoniously; handing over, delivery; bestowal, giving. Also: an instance of this.” (OED 2024a). The term "presentation" originates from the Latin word "praesentare" and has undergone linguistic modification over time, now referring to its current meaning as documented by the Oxford English Dictionary (OED 2024c). In the present day, the concept of cultural heritage presentation involves well-conceived communication of interpretive content of cultural heritage that is arranged by people’s approach, interpretive information and an interpretive facility structure (UNESCO WHIPIC 2022).

According to the Oxford English Dictionary, the term “interpretation” means “The action of interpreting or explaining; explanation, exposition.” (OED 2024a). The term "interpretation" originates from the Latin word "interpretari" and has undergone linguistic modification over time, now referring to its current meaning is explain, expound as documented by the Oxford English Dictionary (OED 2024b).

Freeman Tilden is widely regarded as the pioneering figure in the development of basic principles of cultural heritage interpretation during the 1950s, earning him the title of the father of heritage presentation. In 1957, Tielden defined the interpretation of cultural heritage as *“an educational activity aimed at uncovering meanings and relationships through the use of authentic objects, first-hand experience and descriptive media. to convey factual information” ”*(Tilden 1957; cited in Nowacki 2012). Although Tilden is considered the key figure in the heritage presentation field, Enol Mills explores interpretation theory and techniques before him. (Nowacki 2012). Additionally, Ham distinguished between interpretation and information in 1992, highlighting that the interpretation goes beyond presenting facts by incorporating marketing, advertising, and journalism strategies to create a compelling and motivating learning experience (Ham 1992; cited in Nowacki 2012). On the other hand, Ham explained the difference between interpretation and information in 1992.[4] In the present day, the definition of cultural

[4] Ham explained the difference between interpretation and information in 1992 as follows; *“Information is just facts and interpretation uses information with marketing and advertising techniques, journalism strategies, and a host of other tools to deliver an interpretive outcome. Successful interpretation is a motivating recreational learning experience. However, the interpretation is never an education”* (Ham 1992; cited in Nowacki 2012).

heritage interpretation is explained as increased public awareness and understanding of cultural heritage comprehensive potential activities (UNESCO WHIPIC 2022).

2.2. Perspective of International Charters and Guidelines on Heritage Presentation

The conservation, presentation and interpretation of cultural heritage is mainly based on studies on archaeological heritage conservation, interpretation and presentation. While these studies on archaeological heritage began in the first half of the twentieth century, it wasn't until the end of the twentieth century that international documents regarding the presentation and interpretation of archaeological material were established. The most important and comprehensive international document on the interpretation and presentation of cultural heritage sites is the ICOMOS Charter on the Interpretation and Presentation of Cultural Heritage Sites – 2008. This Charter recognises the concept of authenticity as central to the presentation and interpretation of cultural heritage. This acceptance lays out seven principles of interpretation and presentation of the heritage item, covering conservation, education and management plans.

Each time analysing the historical development of how cultural heritage is presented, it is important to consider the international charters. One significant document in this regard is the Recommendation on International Principles Applicable to Archaeological Excavations, which was created by UNESCO in 1956. This document laid the foundation for subsequent international charters and guidelines that establish principles for safeguarding and showcasing archaeological heritage sites. This document highlighted the fact that archaeological heritage serves as a valuable source of knowledge regarding human history. Within this framework, the significance of public interest and ownership of the archaeological heritage was also emphasised in relation to its preservation. During the process of establishing guidelines for the organised execution of archaeological excavations, it was recognised that it is important to create reserve collections and museums to showcase archaeological artefacts. Additionally, it is crucial to disseminate archaeological knowledge to the public through printed publications, exhibitions, lectures, and guided tours, and to promote public visits to archaeological sites (UNESCO 1956). Articles related to these requirements are detailed under the headings of Formation of central and regional collections and Education of the public. While

Article 14 of the Venice Charter states, *"Special care must be taken in areas where monuments are located to preserve their integrity and to ensure that they are properly cleaned and displayed"* focused on planning the presentation of sites and architectural structures (The Venice Charter 1964). The first international work in which presentation was defined as an integral part of cultural heritage conservation was the Convention for the Protection of the World Cultural and Natural Heritage adopted by the UNESCO General Conference in 1972. It was determined that the primary responsibility of each state party to this convention is to identify, protect, conserve, preserve, present and transmit the cultural and natural heritage to future generations. Thus, the concept of heritage protection has been extended to include the interpretation and presentation of heritage and the comprehensive public presentation of its social and cultural values. The Charter for the Protection and Management of the Archaeological Heritage (Charter of Lausanne), which was prepared by the International Committee for the Management of Archaeological Heritage (ICAHM) and approved by the 9th General Assembly in Lausanne in 1990, defines comprehensively the first time on conditions, goals and principles of archaeological preservation. In addition, it is emphasized that presentation and information, which constitute one of the basic steps of archaeological site management, should be considered a popular interpretation of existing scientific data and should be constantly updated. Accordingly, they focused on improving the scientific and didactic presentation of archaeological sites to visitors (The Charter of Lausanne 1990). The aim of the European Convention for the Protection of the Archaeological Heritage, published by the Council of Europe in 1969 and revised in 1992, is to protect the archaeological heritage as a source of European collective memory and as an instrument of historical and scientific study. In this context, it is proposed to raise and develop public awareness of the values of this heritage. Therefore, it is noted that educational activities, public access to archaeological sites and the public display of a suitable selection of archaeological objects should be encouraged. It also emphasises that presentations and information activities are important to ensure interaction with the public in archaeological heritage sites. The Regulation states that the opening of archaeological sites to visit where the construction works to be carried out for the entrance of a large number of visitors should be carried out without damaging the archaeological and scientific quality of these sites and their surroundings (COE 1992). On the other hand, the Nara Document of Authenticity suggested the presentation of cultural heritage sites from the perspective of heritage authenticity in 1994 (The Nara Document of Authenticity 1994). The ICOMOS

Charter on the Interpretation and Presentation of Cultural Heritage Sites, adopted in 2008, defines the fundamental principles of interpretation and presentation that are essential components of cultural heritage conservation efforts. This charter aims to respond to the need for a clear rationale, standardized terminology and accepted professional principles for interpretation and presentation. Still, it also raises fundamental questions about the new complexities created by the dramatic expansion of presentation and interpretation activities in the field of cultural heritage. Furthermore, this charter underlines that interpretation and presentation should support the conservation of the authenticity of the cultural heritage site (ICOMOS Charter on the Interpretation and Presentation of Cultural Heritage Sites 2008). ICOMOS Charter on the Interpretation and Presentation of Cultural Heritage Sites – 2008 defines a presentation as *"Presentation more specifically denotes the carefully planned communication of interpretive content through the arrangement of interpretive information, physical access, and interpretive infrastructure at a cultural heritage site. It can be conveyed through a variety of technical means, including, yet not requiring, such elements as informational panels, museum-type displays, formalised walking tours, lectures and guided tours, and multimedia applications and websites"*. ICOMOS Charter on the Interpretation and Presentation of Cultural Heritage Sites – 2008 defines an interpretation site as *"Interpretation refers to the full range of potential activities intended to heighten public awareness and enhance understanding of cultural heritage site. These can include print and electronic publications, public lectures, on-site and directly related off-site installations, educational programmes, community activities, and ongoing research, training, and evaluation of the interpretation process itself"*. The Burra Charter stated that it was important to identify appropriate ways to understand the cultural significance of place and that the use of place was vital in the interpretation process (The Burra Charter 2013). The Korean government proposed the establishment of an interpretation centre for UNESCO in 2018, and WHIPIC was officially established to promote the understanding and conservation of heritage through inclusive interpretation and presentation of heritage worldwide in 2022. According to WHIPIC, the notion of presentation *"The Presentation of World Heritage refers to well-designed communication of interpretive content on cultural heritage through the arrangement of interpretive information, people's approach, or an interpretive facility structure"* (UNESCO WHIPIC 2022). Also, the notion of interpretation *"The Interpretation of World Heritage refers to a full range of potential activities to increase public awareness*

and understanding of cultural heritage" as regards UNESCO WHIPIC (UNESCO WHIPIC 2022).

In the historical development of international charters and guidelines on cultural heritage presentation, it is observed that interpretation and presentation techniques have been handled within a management plan until recent years. The dominance of technology in daily life has also manifested itself in the field of cultural heritage in the late 20th century. The new complexities brought about by rapidly developing and changing presentation techniques together with technological developments in the field of cultural heritage have led to the need for standardised terminology and accepted professional principles for interpretation and presentation. Following these requirements, there has been an increasing momentum in international charters and studies on the presentation and interpretation of cultural heritage in recent years.

2.3. Perspective of National Laws and Regulations on Heritage Presentation

The Republic of Türkiye which was founded in Anatolia, the land where the Asian and European continents, has a wide variety of cultures throughout history. The region within the borders of Türkiye has been continuously inhabited throughout history as lands of cultural interaction. As a result, it has cultural heritage sites and assets that need different conservation approaches and presentation techniques. The Republic of Türkiye has inherited a great cultural heritage from the Ottoman Empire, Seljuk, Byzantium, and other civilizations settled in Anatolia.

The effects of the Westernization movement in the Ottoman Empire on museology, a heritage presentation method, could be seen in the second half of the 19th century. Legal regulations that mainly aimed to protect archaeological assets in the Ottoman Empire were the Asar-ı Atika Regulations (Asar-ı Atika Nizamnameleri), made in 1869, 1874, 1884 and 1906. The regulations enforcement bodies are the Imperial Museum known as Müze-i Hümayun and the Ministry of Pious Foundations (Evkaf-ı Hümayun Nezareti). The articles of the 1869 Regulation stated that ancient artefacts help us learn history, that intellectuals gave importance to these artefacts, that they were exhibited in museums, and that they were found more in the Ottoman lands compared to other countries. In addition to these, a museum was considered to be established in

Istanbul, and though excavation permits could be given on the condition that one of the paired artefacts was left to the state, the regulation was not taken into consideration by those concerned. In the early Ottoman period, the main approach was to transfer artefacts unearthed during archaeological excavations to museums abroad. Therefore, many cultural assets were taken to European museums with or without permission, and special museums were built for the remains (Eres and Özdoğan 2016). When Osman Hamdi Bey became the museum director in 1881, the export of artefacts abroad was completely banned. Osman Hamdi Bey started excavations to establish the Imperial Museum, which is today the Istanbul Archaeological Museum, corresponding to its Western counterparts. Osman Hamdi Bey ensured the formation of legal regulations and the development of museology (Özdoğan and Eres 2012).

Regulations and institutions inherited from the Ottoman Empire to the Republic of Türkiye regarding the protection and presentation of cultural heritage were Asar-ı Atika Regulation in 1906, the Imperial Museum known as Müze-i Hümayun and the Ministry of Pious Foundations (Evkaf-ı Hümayun Nezareti). The Asar-ı Atika Regulation dated 1906 remained in force until the Law on Antiquities numbered 1710 was enacted a law in 1973. After that, the Law on Antiquities dated 25/04/1973 was repealed in 1983.

The first state institution established regarding antiquities during the War of Independence was the Directorate of Turkish Asar-ı Atika, affiliated with the Ministry of Education on 10 May 1920. This directorate was renamed the Directorate of Hars in 1921, and this institution constitutes the basis of the Ministry of Culture (Eres and Özdoğan 2016). On 5 November 1922, a circular titled "Instruction on Museums and Asar-ı Atika" was issued by order of Mustafa Kemal and sent to the relevant governorships. This circular explained the duties of museum directors and officers for the first time. In addition, technical information on the collection, inventory and conservation of archaeological and ethnographic artefacts was also provided (Madran and Özgönül 2005).

The first official institution responsible for developing principle decisions in the field of conservation, the Superior Council for Immovable Antiquities and Monuments (GEEAYK), was established in 1951. The priority concern which consists mostly of academics, was the inventory, documentation, registration and restoration problems of monumental buildings. The presentation of heritage has been compassed as the job of the General Directorate of Monuments and Museums in the same period (Eres and Yalman 2016).

The Republic of Türkiye officially adopted the Venice Charter dated 1964 in 1967. The Law on Antiquities dated 1973 which is the first conservation law in the history of the Republic, compatible with the Venice Charter, was enacted (Ahunbay 2010). The biggest innovation introduced by this law is the registration of antiquities and the concept of conservation sites (Ahunbay 2010). While the concept of 'sit' was defined for the first time in Law on Antiquities numbered 1710, the archaeological site (ören yeri) concepts were also defined.

The Law on Conservation of Cultural and Natural Property numbered 2863 which is still a law in force today, was enacted in 1983. The Republic of Türkiye had legislation regarding the interpretation and presentation of cultural and natural heritage sites for the first time with this law. In addition, the expression of antiquities was replaced by the definition of cultural property by international regulations in this law (Eres and Yalman 2016). At the same time, the boundaries of the concept of the archaeological site were expanded, and the concept of the archaeological site was redefined. It was stated that the landscaping project should be designed to preserve the archaeological potential of the archaeological assets, restrict the area to visitors, ensure their promotion, and solve their existing problems (T.C. Ministry of Culture and Tourism 1983).

Heritage sites and assets were the responsibility of the Superior Council for the Conservation of Cultural and Natural Property, established in 1987, together with the relevant general directorate of the Ministry of Culture (Eres and Yalman 2016). The Superior Council for the Conservation of Cultural and Natural Property of the Ministry of Culture and Tourism defined the concept of archaeological sites with the Principle Decision numbered 658 Archaeological Sites, Conservation and Conditions of Use in 1999. In addition, the site status for archaeological sites has been determined and protection and conditions of use have been determined according to the site status with this principle decision (T.C. Ministry of Culture and Tourism 1999).

The Law on Conservation of Cultural and Natural Property numbered 2863 was regulated as the Concerning to Revision of Legislation Called as Concerning to Conservation of Cultural and Natural Properties numbered 5226 in 2004. This law required a development project for a comprehensive management plan in conservation sites. This project aimed to highlight the unique value of each conservation site for interpretation and presentation. The scope of these projects was to determine contemporary methods according to the needs of the area to ensure controlled opening of the area to visitors, provision of service elements, and provision of quality routes for

visitor experience, and preparation of different details in 1/500, 1/200 and 1/100 scales architectural drawing. It was also stated that the priority in these projects for the on-site visit of heritage sites is to preserve the potential of the heritage site (T.C. Ministry of Culture and Tourism 2004).

The Circular Concerning Preparation, Presentation, Implementation, Supervision of Conservation Master Plans and Environmental Design Project dated 2005 was regulated by the Ministry of Culture and Tourism. When this circular was determined, the Venice Charter and the UNESCO Recommendation concerning the Protection, at National Level of the Cultural and Natural Heritage, were based on their principles regarding interventions for protecting and exhibiting archaeological sites. The cultural assets should have a narrative that the visitors can easily understand in the implementation and conservation work to be carried out in archaeological areas by the circular. Reconstruction or anastylosis could be carried out when necessary to present information about the function and architecture of the buildings to the visitors. Correct communication was established with the local people, and programmes were prepared to ensure ownership and increase interest during the works carried out on the site. (T.C. Ministry of Culture and Tourism 2005).

The purpose of the Regulation Concerning Entrance to Historic Sites and Information Panels dated 2014 was to regulate the principles to be complied with regarding the material, dimensions, writing technique, typeface, font, position and other characteristics of the signs to be made to create healthy, qualified environments and to prevent visual pollution caused by promotion, information, orientation, signboards (T.C. Ministry of Culture and Tourism 2014).

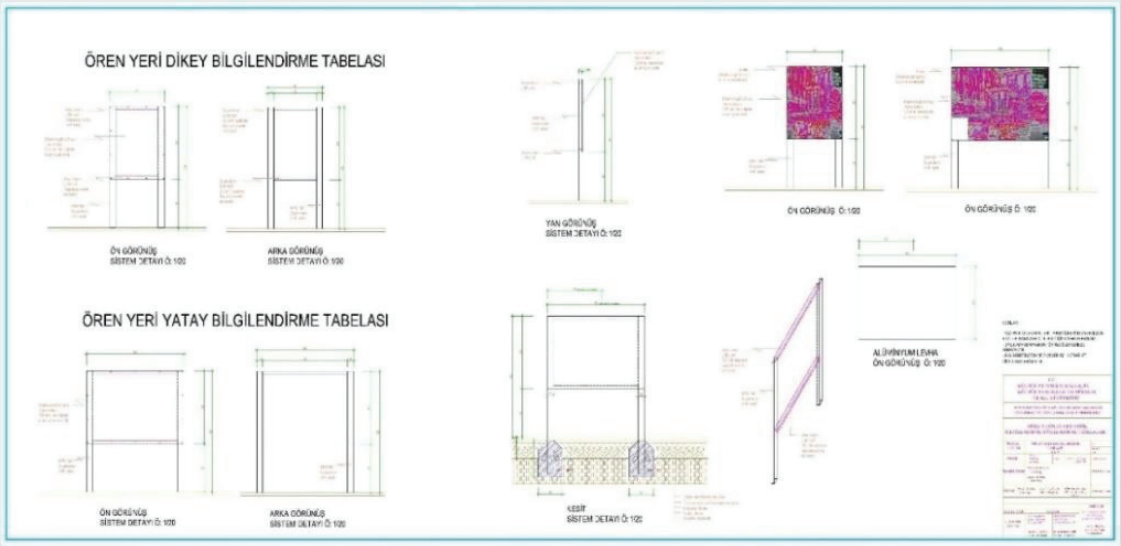

Figure 2. 1. Information Panels for historical sites proposed by the Regulation Concerning Entrance to Historic Sites and Information Panels dated 2014 (Source: T.C. Ministry of Culture and Tourism 2014)

Works on the interpretation and presentation of cultural assets in Turkey started in the second half of the 19th century, after the practices and legal regulations in the world. These studies have developed together with museology. Early works were limited to excavation in archaeological sites and the exhibition of some of the artefacts in museums within the intrastate. In the second half of the 20th century, it continued with implementations such as conservation roofs, anastylosis and reconstruction interventions, and open-air museums in classical period settlements and prehistoric sites. Especially in recent years, we also see the works of public and private institutions using virtual reality techniques in conserving, interpreting, and presenting cultural heritage. DEM Museums, Turkey's first technology-oriented historical experience museums, can be given as an example. This project takes the interactive museum concept, a technology-focused historical experience museum, leading global trends. Although there are areas where digital museums and digital reconstruction methods are used in cultural heritage studies, drawing the boundaries of cultural heritage conservation and presentation, creating management plans, and preventing the pressure of tourism activities on heritage sites, the lack of legal regulations in these areas is an important problem.

2.4. Development of Heritage Presentation Methods

Throughout history, human beings have initially been looking for a livable place for survival. In this place where people meet their basic physical needs, they start to build structures that will exhibit the traces of their culture over time. This value that a group of people add to the place where they live is an object of interest to other communities. This interest gives a new meaning to this place. In addition, some monuments were presented as symbols according to the aesthetic and artistic orientations in the earlier societies period. The Roman traveller Pausanias in the 2nd century presented a wooden beam near the Temple of Zeus in Olympia that was the last remaining artefact from a house belonging to Oinamaos. This wooden beam and the inscription giving information about it were exhibited in a square-planned building. This information demonstrates that there were some concerns about the exhibition of monuments and artefacts from earlier periods (Kaderli 2014; Erder 2020).

In the 17th century, Grand Tours began to be organised to see cultural and natural heritage in Europe, mostly for entertainment and educational purposes (Löschburg 1998). In this period, the preservation of the ancient buildings, which were the centre of interest in their original locations and open to visitors, was limited to the areas located in or near the city centres of Western Europe (Özdoğan and Eres 2012).

However, people who lived in Europe became interested in the artefacts and settlements of prehistoric cultures with the rise of Romanticism and the search for sources of raw materials at the end of the 18th century. Ancient civilisations and picturesque ruins were of great interest. In the 18th century, Spanish military engineer Roque Joaquín de Alcubierre excavated the ancient cities of Pompeii and Herculaneum. The discovery of towns with utensils and even human figures, as well as the unearthing of frescoes, had a great impact on Europe. These expeditions were extended to Anatolia mostly by scientists. The publications presented panoramas of the archaeological heritage using engravings and orthographic drawings both for research and documentation and to feed the interest of Europeans (Kuban 2016a).

The interest in the conservation of the architectural heritage of antiquity was initially motivated by religious and nationalistic concerns. The earliest examples of the restoration of monumental archaeological structures include the Colosseum in 1806 and the Titus Gate in the Forum Romanum between 1812 and 1824 (Schmidt 1993; cited in

Özdoğan and Eres 2012). After that, in situ conservation and presentation techniques were used from the consolidation of walls exposed by archaeological excavations to the reconstruction of the remains of buildings considered to be of particular importance. Besides, in the early 19th century, some megalithic monuments and cave sites of Palaeolithic art entered the public domain in Western Europe. However, in the beginning of the 19th century, an important acquisition of intellectual knowledge was necessary to transform a mere interest about the heritage of prehistoric civilizations into an aware excursion. In this context, new presentation techniques have begun to be developed to create an exhibition layout for visitors to easily perceive the remains of prehistoric cultures from the 19th century (Özdoğan 2013). In the mid-19th century, as a result of the discovery of traces of wooden piles around the Swiss Lake-sites, restitution drawings of the buildings were drawn and published by Ferdinand Keller. The difficulty in perceiving the architectural remains of the Swiss Lake Houses only by whereby visiting on-site has developed a new presentation method in the field of cultural heritage. The publication of these drawings is considered an important step in the presentation of early-period sites to the public.

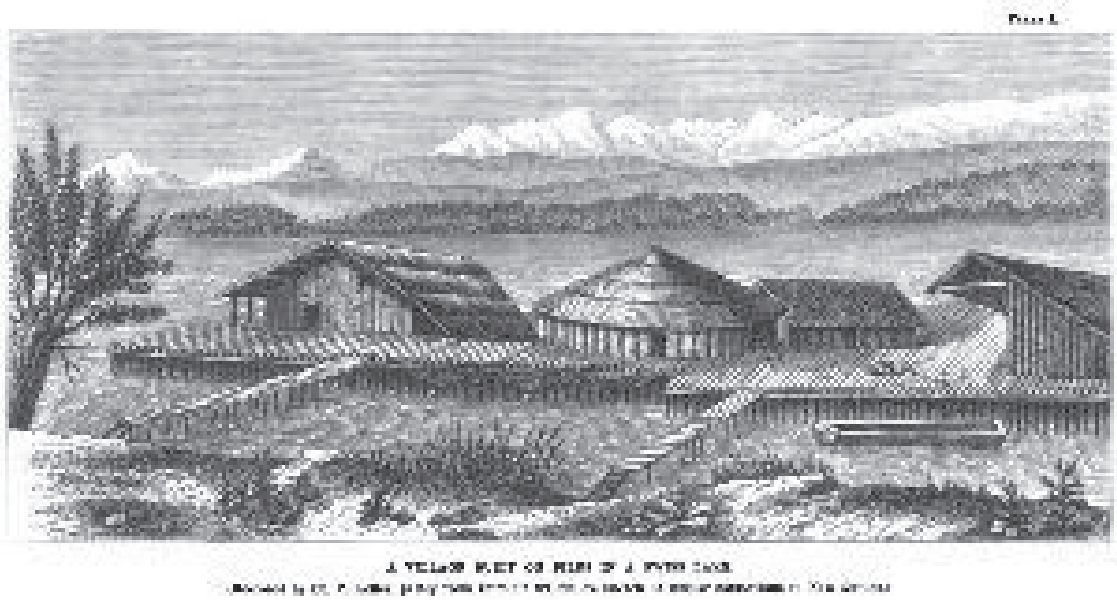

Figure 2. 2. Restitution drawing of Swiss Lake Houses dated 1854 by Ferdinand Keller (Source: Lyell 1863)

Afterwards, the 3D physical model made according to these drawings was exhibited in the museum. Thanks to this method, in the second half of the 19th century, prehistoric cultures began to be exhibited supported by restitution drawings and models in the museum.

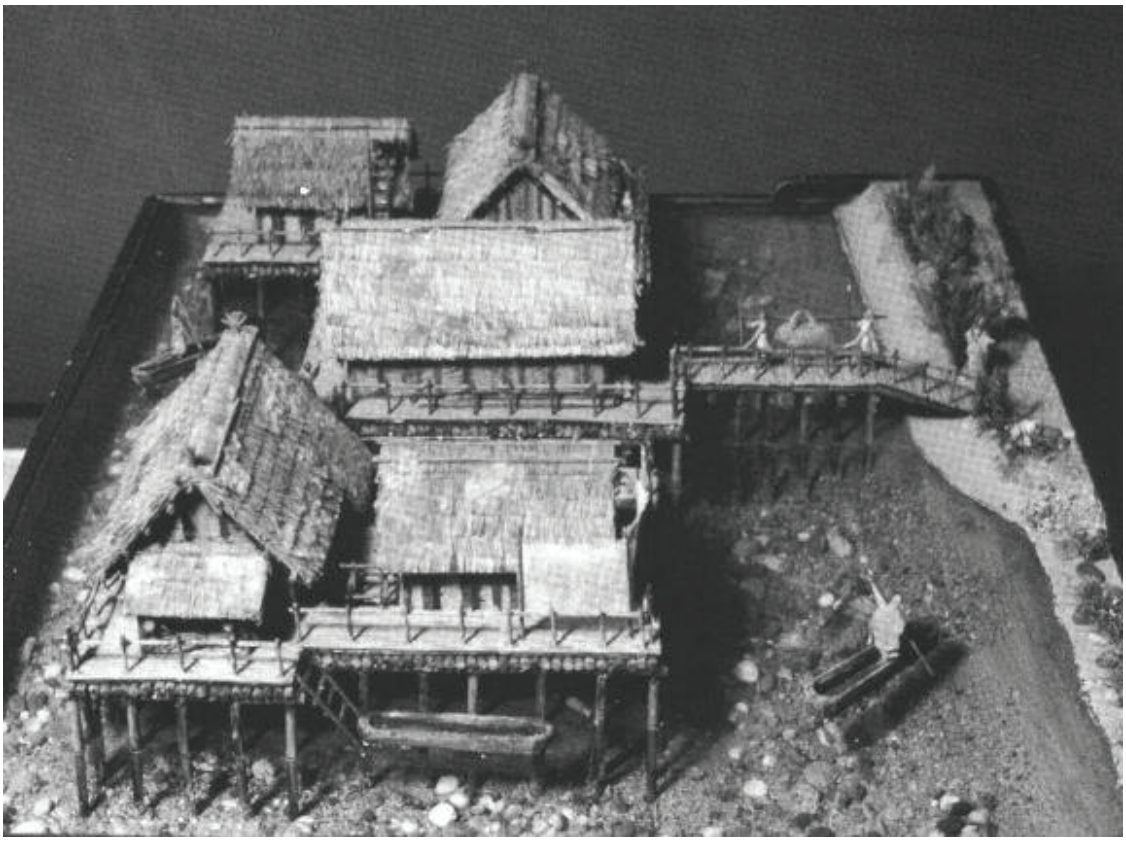

Figure 2. 3. Pile-dwelling 3D physical model made by M. Götzinger around 1870 according to restitution drawings by Ferdinand Keller taken photo by F. Mater at Museum Bern. (Source: Bandi 1979)

In addition, the sites related to heritage presentation were not limited to the presentation of archaeological sites. Studies for the presentation of traditional life have also gained an important place in world fairs. In 1873, 1/1 scale 3D physical models of farmers' houses from different regions of Europe were presented for the first time at the Vienna World Fair. In 1878, the interior of a Swedish farmer's house was reconstructed for the first time at the Paris World Fair (Eres 2010).

In parallel with these developments, in the mid-19th century, the concept of the presentation of cultural heritage met with analogue photography. Analogue photographs

with orthographic drawings, perspective drawings and engravings were the most preferred method in the presentation of cultural heritage, especially for those who could not experience it on-site. Also, in the mid-19th century, the invention of analogue photography prepared the way for photogrammetry which we use today in presentation techniques. Although, in the previous centuries, the heritage sites and monuments were made efforts for conservation and presentation in their original locations in Western Europe, these efforts were not shown in heritage sites far from the main centres of Western Europe. In the late 19th and early 20th centuries when a period of political unrest in the Middle East and Eastern Europe, some specific parts of cultural heritage, especially in the Middle East, were dismantled and transported to museums in Europe for presentation. The examples of heritage assets, the reliefs of the Acropolis of Athens in 1806 and the Pergamon Altar of Zeus in 1901 were taken out of their context for this presentation method (Özdoğan and Eres 2012).

The presentation of the cultural heritage of the geography we live in systematically started with the developments in museum studies during the Ottoman Period. In the Ottoman period, the collection of spoils of war and antiquities and consequently the creation of collections formed the basis of museology. The presentation of cultural heritage gained importance as a show of force under the influence of the Westernization Movement in the mid-19th century. For this reason, the Ottomans made a legal basis for the protection of cultural heritage and rapidly started excavations in various places of the empire. This was to enrich the museums. Thus, movable objects and some architectural elements were presented to the Imperial Museum in Istanbul (Shaw 2004). One of the most important developments in the field of museology during this period was the Âsâr-ı Atîka Nizamnâmesi dated 1874. This regulation aimed to prevent foreign countries from collecting artefacts within the empire's borders. However, it didn't achieve its purpose fully and had some problems in its implementation. A new period in Ottoman museology began with the appointment of Osman Hamdi Bey as museum director in 1881. Osman Hamdi Bey used his position as director to develop the museum. He pioneered the establishment of Sanayi-i Nefise which is the first fine arts school (Shaw 2004).

Sculptures could not be presented in situ at archaeological sites because of the high risk of looting, until the foundation of the Republic of Turkey. The first site museum was established in the town near ancient Pergamon at Bergama in 1924. The Roman temple at Asklepion was excavated, restored and opened to the public as a museum after

Mustafa Kemal Atatürk visited Pergamon in 1934. The Asklpeion is the Republic of Turkey's first official open-air site museum (Özdoğan and Eres 2012).

Museums, the primary means of displaying cultural heritage, have seen significant transformations in terms of their content, function, and types. Today, museums have dropped the idea of collecting and representation based on individual-society relationships. For this purpose, they have developed methods of presenting cultural heritage with concepts such as virtual museums[5], touchable museums[6] and mobile museums[7] by turning to tools of today's technologies that dominate our current period. Despite the various developments, the current way of presenting a site still holds great importance in terms of understanding its cultural history and its connection to its surroundings. Nevertheless, terrorism, climate change, excessive commercialization, and mass tourism pose significant dangers that accelerate the degradation and destruction of cultural assets in the site presentation (Abdelmonem, Selim, and Mushatat 2017). As the rate of lost cultural assets increases, the perception of the integrity of the site will decrease. Only a portion of the population has access to highly preserved, reconstructed, or repaired sites, resulting in limited site presentation. Nevertheless, the utilisation of digital reconstruction in virtual reality settings allows for the accessibility of cultural heritage artefacts, spanning from small archaeological remains to entire cities, to the general public. Moreover, the utilisation of contemporary technologies allows for virtual presentation techniques that quickly and effortlessly connect vast audiences with collections, exhibitions, and other cultural assets and sites.

The presentation of cultural heritage sites has evolved according to changing approaches to presentation and interpretation and advancements in new technologies. Various ways of conveying presentations have emerged today with the help of rapidly developing technologies. Today, virtual reality tools such as holograms, renderings,

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[5] The ICOM Key Concepts of Museology accentuates as virtual museum; *"The virtual museum can be seen as all the museums conceivable, or all the conceivable solutions applied to the problems answered by traditional museums. Thus the virtual museum can be defined as a "concept which globally identifies the problem areas of the museal field, that is to say the effects of the process of decontextualisation/recontextualisation; a collection of substitutes can be a virtual museum just as much as a computerised data base; it is the museum in its exterior theatre of operations"* (Deloche 2001; cited in ICOM 2010).

[6] Touchable museology is a prominent method in contemporary museology that involves the creation of tactile objects. These objects are intended to appeal to tactile learners and aid in the interpretation of artefacts. This technique is crucial for ensuring accessible interpretation (Race et al. 2023).

[7] Mobile museums provide accessibility to audiences and communities unable to physically visit a museum's location. Their innate flexibility and adaptability facilitate the development of creative and inclusive strategies for museum interaction (Eves 2023).

digital reconstructed modelling or other media help clarify the presentation of cultural heritage. Although presentation techniques have evolved, they are not a linear development, but rather an interconnected one. Even the oldest techniques are still used together with contemporary techniques.

2.5. Different Presentation Methods

Heritage presentation of cultural heritage aims to depend peoples understanding promote heritage appreciation and stewardship, and faster a sense of pride and connection to the past. Heritage presentation serves as a method for safeguarding cultural assets by generating visitor interest in the heritage item and providing significance. The heritage presentation effectively engages the intended audience by employing suitable strategies based on the categorization of cultural heritage assets and sites as tangible, intangible, or lost. A wide array of methodologies and tools have been employed throughout the course of history. Every new approach to heritage presentation has typically arisen from the necessity of conveying an authentic representation of heritage without diminishing the significance of the preceding one. Currently, we observe the convergence of many presentation techniques from different periods in the display of cultural assets. Upon analysing the historical progression of heritage presentation, it becomes evident that major presentation approaches include:

I. Archaeological remains and their in-situ presentation: In-Situ Presentation of archaeological remains serve a crucial role in safeguarding archaeological heritage sites and effectively transferring knowledge about these sites to society. These methods require to consider into account the unique characteristics, capabilities, and difficulties associated with each site (Kalfa 2017). Also, excavations in archaeological heritage sites take many years. For this reason, while the excavation works are continuing, it is still a widely used presentation technique to exhibit these works under protection and to exhibit them with landscaping without intervention.

Figure 2. 4. Archaeological Excavations and Its Presenting of Datça Knidos Archaeological Site (Source: T.C. Ministry of Culture and Tourism 2024)

II. Engravings and Orthographic Drawings: Thanks to this presentation method, which was used extensively in the years when digital tools were not available, the visuals of cultural heritage were conveyed to people who could not observe cultural heritage on-site. This method is also used for research and documentation (Kuban 2016b).

Figure 2. 5. Site of the temple of Diana at Ephesus, explored by the late Mr. J. T. Wood - Example of Presentation Method is Engravings (Source: The New York Public Library 1890-04-19)

III. Museum Exhibitions: In Article 4 of the Regulation of the Turkish National Committee of the International Council of Museums (ICOM), museums are defined as "institutions that preserve cultural artefacts and display these artefacts

collectively for study, education and aesthetic pleasure, work for public benefit, and have collections of art, science, health and technology". In Article 5 of the same regulation, "Libraries and archive centres with permanent exhibition sections, historical monuments officially open to the public, parts or outbuildings of buildings belonging to historical monuments, locations and parks of historical, archaeological and natural importance, gardens of plants and animals, aquariums and similar establishments are included in this definition." The boundaries of the definition of a museum have been expanded.

Museums, which initially protected and exhibited their collections in historical buildings, have been restructured with the understanding of modern museology over time. They have become non-formal educational institutions located in new buildings designed according to the artefacts they will keep (Atasoy 1994). In the present day, important approaches to modern museology that do not necessitate a permanent physical space include virtual museums and mobile museums. These museums provide accessibility to art and cultural heritage, while also diversifying experiences through a range of augmented reality (AR) activities.

Figure 2. 6. Example of virtual museum from Digital Darağaç[8] app experience (Source: Varinlioğlu et al. 2022)

[8] The 'Dijital Darağaç' collects and exhibits works of the Darağaç Kollektif, which produces art in the streets of their neighborhood by creation by a team of 13 people from Izmir University of Economics (IUE). A smartphone application can access and explore the project, one of Izmir's first three-dimensional virtual art museums (For comprehensive information, see to http://digitaldaragac.ieu.edu.tr/).

IV. Completion of the Remains: The completion of remains has been one of the most popular presentation methods for many years. Reconstruction and anastylosis are the most widely used tools of this method. As they provide a three-dimensional view of the heritage, visitors have an accurate understanding of the integrity of the heritage. While original materials are used for completion in anastylosis, reconstruction can be completed physically without original materials or digitally modelled. Reconstruction is also classified into two groups: complete reconstruction and partial reconstruction. In complete reconstruction, modern technologies and materials are also used in the reconstruction process because the original materials are not left or the traces are weak. Partial reconstruction is when it is sufficient to reconstruct some parts of the heritage to create a three-dimensional effect (Kalfa 2017).

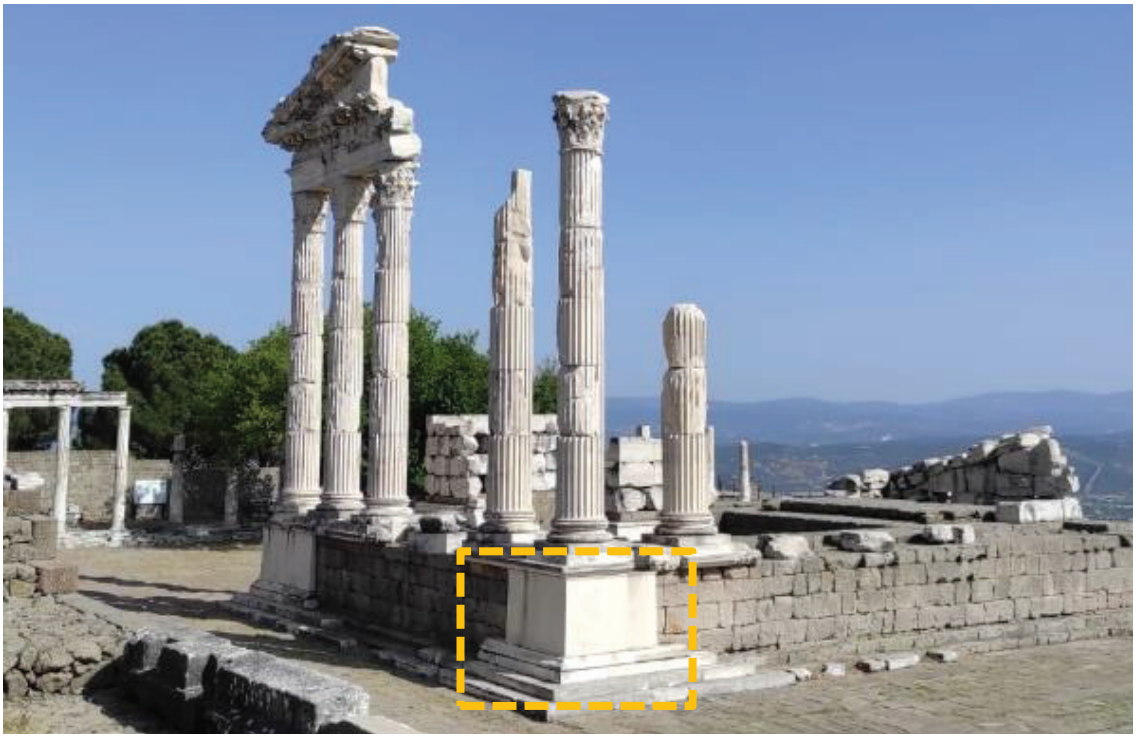


Figure 2. 7. Example of Anastylosis (yellow framework) and Partial Reconstruction in Pergamon Acropolis which is a UNESCO World Heritage Site (Source: Author 2022)

Figure 2. 8. Celsus Library - Example of Complete Reconstruction in Ephesus which is a UNESCO World Heritage Site by Niki Gail for Austrian Archeological Institute (Source: non © UNESCO 2009)

The completion method can be used as an in situ presentation and is also used in museums or virtual environments.

V. Informative Tools: Restoration works alone could not sufficiently transfer the information to society during cultural heritage presentation. For this reason, drawings, texts and visuals that will provide a complete presentation of cultural heritage information should constitute a management plan (Kalfa 2017). The team working for this purpose tries to find the most successful ways to present the research findings to different types of audiences by using virtual environments, graphic communications and traditional exhibition tools. The main tools used for this method are signboards, informative panels, routes, visitor centres and guide types.

a b

Figure 2. 9.a. Example of an audio guides from the Acropolis Museum website, b. Example of an guide from the Acropolis Museum website (Source: © Acropolis Museum 2018)

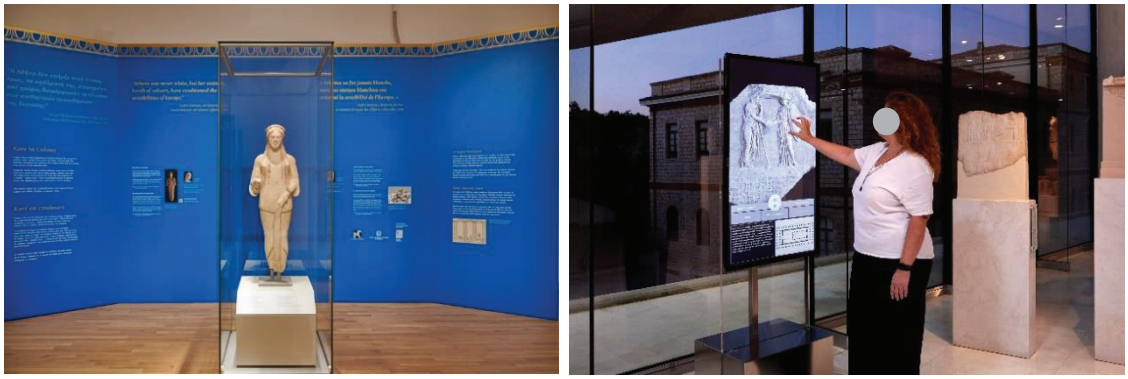


Figure 2. 10. Examples of informative panels types from the Acropolis Museum website (Source: © Acropolis Museum 2018)

Figure 2. 11. Example of a visitor centre for children at museum from the Acropolis Museum website (Source: © Acropolis Museum 2018)

VI. VR Environments: The virtual environment is created in a digital space as a copy of the real world. Virtual reality is a more specific form of a virtual environment. Thanks to virtual reality, the user is immersed in the virtual environment. This immersion capability of virtual reality promotes the feeling of presence to users in a virtual world. According to the Oxford English Dictionary, the term "virtual" means *"Inherently powerful or effective owing to particular natural qualities. Obsolete."* (OED 2024a). The term "virtual" originates from late Latin Word "virtuosus" and has undergone linguistic modification over time by the Oxford English Dictionary (OED 2024e). Most of the people apply the word virtual as things that cannot become a reality. However, the virtual was used to refer to the phenomenon of a reflected image being created when light shines on an object as virtual (Yoh 2001). The field of computer science's sense of *"not physically existing but made to appear by software"* is attested from 1959 (Online Etymology Dictionary 2024b).

According to the Oxford English Dictionary, the term "reality" means *"The real nature or constitution of something; the real thing or state of things."* (OED 2024a). The term "reality" originates from late Latin the "res" and has undergone linguistic modification over time by the Oxford English Dictionary (OED 2024d).

According to the Oxford English Dictionary, the term virtual reality means *"A computer-generated simulation of a lifelike environment that can be interacted with in a*

seemingly real or physical way by a person, esp. by means…" that is derived from the words virtual and reality (OED 2024a). The terminology, "virtual reality" was first used in 1986 by Jaron Lanier, VPL Corporation's founder (Yoh 2001). The creation of a word that combines words with contradictory meanings has caused controversy.

Virtual reality studies began practically with simulation studies in aviation in the early 1900s. Later on, related studies started to develop in military fields. In this process, it has been widely acclaimed that virtual reality was conceptualized with the event described by Ray Bradbury in The Weldt Story in 1950. However, "virtual reality" was first used in 1986 by Jaron Lanier, the founder of VPL Corporation (Yoh 2001). The terminology, "virtual reality" was first used in archaeology, referring to the three-dimensional reconstruction of assets and old buildings in 1990 by Paul Reilly (Railly 1990, Gillins 1997; cited in Delle Ricerche 2013).

Technological developments persist through investments in technology, serving as the response to the demands of all sectors that govern our current era. As a result, the affordability and compactness of technology devices have made virtual reality applications an integral aspect of everyday life. Virtual reality is currently being employed in several fields such as museology, architecture, urbanism, and cultural heritage. When there are limited remains of heritage available, virtual environment methods that rely on visual or audio elements can be utilised for presenting purposes. The main tools employed for this technique include audio guides, holograms, 3D renderings, and virtual tours. These instruments are contributing to a growing interest in heritage.

Figure 2. 12. Mixed Reality Exhibition “Ancient Olympia: Common Grounds” – Example of vr tools from the Athens Olympic Museum website (Source: © ATHENS OLYMPIC MUSEUM 2021)

2.6. Presentation of Lost Heritage

Cultural heritage assets or sites can become the subject of political and cultural arguments because of their symbolic meanings. Consequently, they may face the risk of major interventions and even destruction. The destruction of such symbolic cultural heritage assets and sites can happen in peacetime for reasons other than ideological. A collective of people supports the continuous reconstruction of the environment as communities develop and transform. Because these people hold the belief that as settlements develop and transform, structures become redundant or that there are other valuable purposes for a site. However, the loss of heritage sites is not only despair at the material cost or sadness at the deterioration of the aesthetic value for which the buildings were recognised (Bevan 2007). The reality and dependability of the human world, according to Hannah Arendt, instead depend primarily on the fact that everything around us is more durable than the activity that produced it. (Arendt 1998). Losing all that is familiar, which is the destruction of one's surroundings, is the threat of losing collective identity at the same time. Suppose the heritage sites in this situation are presented in a context different from their real context. In that case, Rodney Harrison uses the term

absent heritage to refer to sites where the absence of destroyed objects is conserved. In other words, this definition is more commonly used for the memorialization of places and objects whose significance relates to their destruction or absence (Harrison 2013; cited in Aykaç Leıdholm 2023). It covers assets and sites where tangible values, as well as intangible values, are destroyed. According to Martin Felder, absolute absence is impossible. Because the absence requires the observation of its past or future existence, heritage can appear in discourse. Then it becomes acceptable as present or lost with the awareness that it once existed (Felder et al. 2014).

Today, the term "lost heritage" typically refers to cultural assets and sites, both tangible and intangible, that were formerly known and documented but have been lost owing to factors such as conflict, natural disasters, abandonment, and deterioration. The reasoning behind the use of the term "lost heritage" instead of "absent heritage" nowadays is that it is being physically or virtually reconstructed in its original contexts and presented with the acknowledgement that it once existed.

The restitution processes of a lost heritage project, whether it involves digital reconstruction or physical reconstruction of a historic object, architecture, or landscape, follow a similar process. The first stage of the process involves conducting archival and historical research to gather information about the lost heritage, which includes well-established knowledge from prior studies on the case. These research documents contain archival information, written documents, transcribed oral history archives which are textual data; photographs, videos, maps, scanned documents which are raster data; 2D measured drawings, 3D physical or digital modellings, and lost heritage geographical locations which are vector data. The second stage is the site survey. This is fundamental for the present circumstances of the cultural asset or site itself.

At the same time, while doing site survey, cultural items from the same era that have been preserved in the same or adjacent region are identified. These items could be utilised in a comparative study approach to enhance the reliability of the knowledge of the lost heritage. The comparative study would be conducted as a result of the site survey is aimed at finding traces and information about the lost heritage and similar buildings same period and their impact on the landscape function, land use, or the urban component. In the final stage, data processing and interpretation, all collected data are analysed by professionals. The hypothesis of the lost heritage is confirmed by typological comparisons and analysis of cultural patterns. This method considers documented

elements of the lost heritage that are no longer visible today, as well as any remaining materials at the site.

Different techniques are used to reconstruct the lost heritage. In the context of presenting lost heritage, digital reconstruction appears to be more favourable than physical reconstruction in terms of permitting 3D and 4D presentation. Because 3D digital models are produced using a framework that is independent of space and time. At a certain point in time, a 3D model is made using information about the same object from earlier reconstructions (temporal dependency) and shared surface features (spatial dependency) (Doulamis et al. 2018). Time is the primary distinction between 4D and 3D presentation methods at this point. Therefore, 3D presentation is more static than 4D presentation because 3D presentation techniques do not observe how they change over time. Another distinction between 4D and 3D presentations is that 4D presentations are more virtual than 3D presentations. Thanks to 3D presentations being closer to reality, it is possible to physically interact with 3D sites and assets. However, most of the areas with lost heritage elements have been subjected to too much intervention, and therefore it is not possible to present them in context. Although the digital reconstruction and visualisation of lost heritage is an increasingly popular area of research, the surrounding landscape and its changes over time have received little attention. Therefore, it is rare to see digitally reconstructed examples of a heritage item and its surrounding built environment together. Virtual reality (VR) tools can also be integrated into the digital 3D model to interact and navigate in a detailed 4D (3D + time) scene and access digital media content of lost heritage assets and sites (Rodríguez-Gonzálvez et al. 2017). But if the digital reconstruction technique is used by these VR tools, it could also build its context. Thanks to wearable technologies, 3D digital models can be used in 3D and 4D presentations, besides 2½-D[9] [10] presentation techniques. Also, physical reconstruction is much more costly than digital reconstruction and is constructed in a long time. In addition to all these advantages, digital reconstruction is more flexible. Any updated detail with

[9] Marr explained the 2½-D representations as a result of trying for a 3D interpretation on 2D plane in 1982 as follows; *"Representations that show three spatial dimensions projected onto a 2D plane have been described as* 2½-D*"* (Marr 1982; cited in Whyte 2002).

[10] Whyte explained the 2½-D representations as a result of trying for a 3D interpretation on 2D plane in 2002 as follows; "*Because of the characteristics of screen technologies, digital 3D models viewed through single or dual 2D screen systems are essentially* 2½-D *representations. Though they are created in 3D, they are viewed in* 2½-D*. They are seen as perspectival, axonometric or isometric representations on a single 2D viewing plane or dual 2D viewing planes. Though virtual reality is described as an interactive, spatial, real-time medium, it is viewed as an inherently* 2½-D *representation"* (Whyte 2002).

new information would be revised more easily than physical reconstruction. The other advantage of revising a detailed virtual model of a lost asset or a lost site is that it supports academics to better understand urban or architectural transformations in their related studies. For example, it enables lost heritage assets and sites to be disseminated directly to wider audiences using different visualisation tools. In addition, it is not always possible to show all or a large percentage of the layers in multi-layered settlements. However, every period settlement would be modelled and presented separately with the same importance, or they would be presented at the same time with different interpretation techniques thanks to digital reconstruction.

The digital reconstruction of heritage is not as regulated as the physical construction. However, the London Charter dated 2009 aims to increase the rigour of digital reconstruction and presentation tools, especially computer-based methods used and evaluated in heritage contexts. As a consequence of this, the methods and results would promote understanding and recognition of heritage.

Figure 2. 13. KUŞ UÇUŞU: 1933 Yenişehir'ine yukarıdan bakmak - Example of Digital Reconstruction in Virtual Environment (Source: © Bir Şehir Kurmak: Ankara 1923-1933 Research Team 2016)

2.6.1. Virtual Reality as a Tool for Presentation of Lost Heritage

Most people have viewed the world through a dynamic frame since the late 20th century. The action we watch from where we sit, looking at any screen, shows us that it can happen faster than in real time and out of context with VR. The experience in these environments makes it easier to understand and use virtual reality for as Jennifer Whyte describes: *"Car travel in the real world has similarities with our experience of virtual reality – the car restricts our perception of the world to a dynamic view through a frame. We view the world through the window and, although travelling at speed, our body remains static... The idea of experiencing a world by simulating smooth movement through it makes sense to those who have learnt to navigate their cities sitting behind their steering wheels."* (Whyte 2002).

Through virtual reality tools at heritage sites, reality can be reconstructed, abstracted, and represented in other environments. When a heritage site or asset modelled in 3D with various tools in a virtual environment is presented on a 2D screen or any plane, our perception of the experience is not different from a 2D axonometric or perspective drawing (Whyte 2002). Therefore, the method of presentation is of great importance for digital reproduction in a virtual environment. Presentation methods can be paper-based architectural drawings and perspectives, physical scale models, computer-based renderings, and interactive models designed to be open to the on-site experience. This is important when deciding on implementing different presentation methods, which heritage information is to be transferred to whom. Once this aim is determined, it should be decided which tools to use accordingly. The widely used applications of virtual reality in heritage presentation today are digital reconstruction applications, in situ experiences, applications for scientific analysis, and virtual museums.

Figure 2. 14. Mixed Reality Exhibition “Ancient Olympia: Common Grounds” – An example of the representation of the three-dimensional digitally modelled heritage on a two-dimensional surface (Source: © ATHENS OLYMPIC MUSEUM 2021)

Today, the digitalization of cultural assets and recontextualizing them within virtual sites is common in cultural heritage conservation and presentation practices. As stated in the London Charter, a computer-based visualisation method for digital restoration and reconstruction should only be used when it is the most appropriate method available for the purpose. Sufficient information should be documented and resources made available to allow computer-based visualisation methods and results to be understood and evaluated of the context and purposes for which they are used. Through this sensitivity in the presentation of these methods, an intellectual and technical understanding of the implications of the use and evaluation of computer-based visualisation methods and results in heritage contexts can be achieved clearly (The London Charter 2009).

In a restoration or presentation work to be created in virtual reality, creating a digital, three-dimensional model is essential. Two different methods are used for this. In order to establish which method should be utilised, it is necessary to assess the rate at which the heritage asset or site, for which a three-dimensional model is to be constructed, is being lost. 3D modelling tools that allow the cultural heritage to be studied from the

documentation stage include digital cameras, electronic total stations, three-dimensional laser scanners and remote sensing, computer hardware, application software, and drones. Nowadays, various photogrammetric software and laser scanning are used to create two-dimensional surfaces of cultural assets and sites to create a realistic three-dimensional model.

Virtual reality aims to give the user the illusion of being in a real scene immersed in a virtual environment (O'Neil and Perez 2006; cited in Liritzis et al. 2015). Thanks to this, the virtual heritage environment would promote a historical or cultural experience. However, the digital reconstruction process would not be quality enough alone for this aim. Therefore, other digital tools are used to integrate digitally reconstructed 3D models.

A network of people with avatar representations constitutes a virtual environment, according to Bell (Bell 2008). This virtual environment could be applied to the digital reconstruction of cultural heritage. For this purpose, a massively multiplayer online world (MMOW) that participates in its activities and communicates with others in independently exploring the virtual world could be used in cultural heritage (Bartle 2003; Aichner and Jacob 2015; cited in Liritzis et al. 2015). Although the MMOW has some challenges, it is a powerful new tool for teaching and learning that presents many opportunities.

Augmented reality is used on mobile phones and tablets. Thanks to this opportunity, it could be used to view a natural environment (Liritzis et al. 2015). However, computer-based augmented sensory input like sound, video, graphics, or GPS data creates this opportunity. Information about the augmentation of heritage, which is in real-time virtual reality, could be overlaid on the real world (Graham et al. 2012; Rolland et al. 2005; cited in Liritzis et al. 2015).

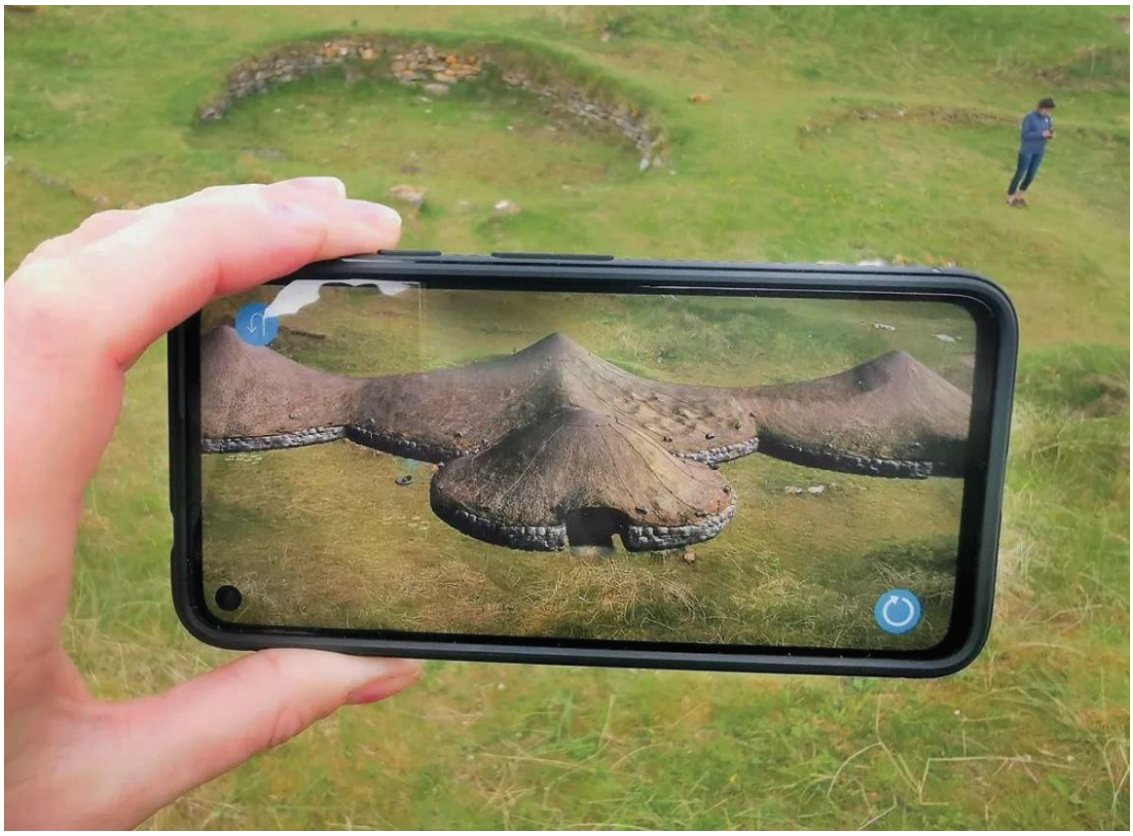


Figure 2. 15. QR codes at featured sites can be scanned using smartphones to bring archaeology to life. Here we can see the app being used at Cladh Hallan.- Example of using AR Technologies (Source: Current Archaeology 2022)

Immersion is a perception of being physically present in a virtual environment. As a result of the user being surrounded by the VR system with images, sound or other stimuli that simulate a reality total environment, immersion into VR perception is created. Immersion hardware technologies which are 3D display, holography, head-mounted display, full-dome, 3D audio effect, surround sound, haptic technology, machine olfaction, and artificial flavour are developed to stimulate the five senses to create perceptually real sensations (Liritzis et al. 2015). The software interacts with the hardware technology to render the virtual environment and process the user input to provide dynamic, real-time responses to achieve software integration components of artificial intelligence and virtual worlds (Liritzis et al. 2015).

Figure 2. 16. Ephesus Experience Museum - Example of the Immersion Technologies at Museum (Source: DEM Museums 2023)

2.6.1.1. Digital Reconstruction Methods

Virtual restoration and reconstruction are regarded as intervention strategies and are sometimes employed synonymously in the heritage area; nevertheless, conceptual clarity has not yet been attained. Virtual restoration is frequently defined in architectural restoration projects, although digital or virtual reconstruction is more frequently used in archaeological projects, according to an analysis of the academic literature regarding cultural heritage (Pietroni and Ferdani 2021). This terminological classification arose out of the definitions in the Seville Principles, which were adopted in the framework of the London Charter to develop the virtual framework in archaeological sites. The Seville Principles state that neither definition includes any information regarding virtual tools and that both present the knowledge of the old with integrity. The distinguishing point of these two concepts from each other emerges in the collection of the knowledge resources of the old. While virtual restoration involves the reordering of material remains and virtual anastylosis, virtual reconstruction refers to the concept of hypothesis as the result of a more comprehensive and interdisciplinary work of experts, not only looking at the material remains. Also, virtual reconstruction does not aim for the complementation of the heritage (The Seville Principles 2017).

The use of the term virtual or digital reconstruction in the field of archaeology is not controversial, as it emphasises the need for a more comprehensive interpretation of archaeological sites. However, in the context of cultural heritage applications, which encompass a broader scope of study than archaeological sites utilizing only the term restoration is unsufficient. Because the extant remains of cultural heritage are not always adequate for digital three-dimensional modelling. As in the discipline of archaeological heritage, digital three-dimensional models could be derived from hypotheses generated by a thorough and interdisciplinary study conducted by experts in other heritage areas. For this reason, it would not be wrong to use the concept of digital reconstruction in cultural heritage studies where the percentage of lost volumes is higher than the preserved ones and a hypothetical decision is made after the information collected in the field is filtered by experts. Therefore, while determining the conceptual definition in digital three-dimensional modelling projects, the term digital reconstruction may also be employed based on the sources utilised, particularly when working in the domain of lost cultural heritage.

The literature study conducted for the thesis examines digital reconstruction approaches, categorising them into four methods as defined by the author. The four types of modelling methods are geometry-based modelling, image-based modelling, range-based modelling, and computer generated architecture.

i. The Geometry-Based Modelling (GBM): Different techniques are used for the digital reconstruction of lost heritage. Geometry-based modelling methods refer to a modelling programme that is used to manually arrange the parts of the scene in order to represent an existing building (Debevec et al. 1996). The geometry based method for digitally constructing a 3D model involves starting from scratch and utilising CAD software, survey data, precise measurements, maps, and engineering blueprints (El-Hakim et al. 2003). When digital reconstruction modelling software is unable to utilize the visual data of the lost heritage directly, this method is used. Given the unavailability of the elements of the lost heritage, the authentic forms are only known with a certain degree of reliability in the absence of any visual data or drawings. The lost heritage should be based on preserved sources from the period in 3D modelling. These sources may include charts, engravings, maps, photographs, oral history archives, or texts. Comparisons with surviving buildings known to be similar in design can also be utilised.

The geometry-based modelling method has some disadvantages. First, the process is extremely time-consuming due to the digitization of architectural drawings, or the conversion of existing CAD data. On the other hand, it is difficult to verify that the resulting model is an accurate representation. It can be observed that the visuals of the resulting models are produced manually on the computer, although they use realistic texture mapping (Debevec et al. 1996).

The 3D digitally reconstructed model could be created with layers in CAD/CAM modelling software such as Rhinoceros, Blender, Cinema 4D, SketchUp, Autodesk Revit, and Archicad-Graphisoft. After this phase, there would be software to create renders for the representation of the digital 3D model for the visualisation phase. Software commonly used for post-production includes Unity, Lumion, 3D Studio Max, Adobe Photoshop, and Adobe Illustrator.

ii. The Image-Based Modelling (IBM): The process of creating 3D digital models using 2D images is known as image-based modelling. Image-based modelling (IBM) is based on transferring photographs in which the common points in every image are determined. Then, a serious number of the distances between each other's points in space are calculated. Finally, a three-dimensional mesh model is made as a point cloud that can be changed using different algorithms, such as structure from motion (SfM) and multi-stereo view (MSV) (Polo, Felicísimo and Duran-Domínguez 2022). Triangle meshes with texture maps are a common representation of these 3D digital models. Nowadays, the most widely used image-based modelling method, a technique called Structure from Motion (SfM), performs the first stage of 3D reconstruction. SfM algorithms create a three-dimensional digital model from a systematic sequence of two-dimensional photographs. In the early 21st century, SfM started using powerful computer vision algorithms to automatically detect matching features in images, which emerged as a new photogrammetric technique for 3D digital reconstruction (Lowe 2004; Wu, 2007; Furukawa and Ponce 2007; Hartley and Zisserman 2003; cited in Liritzis et al. 2015). The primary need for this technique is sufficient image data.

Figure 2. 17. Example of photo modelling process from Digital Darağac (Source: Varinlioğlu et al. 2022)

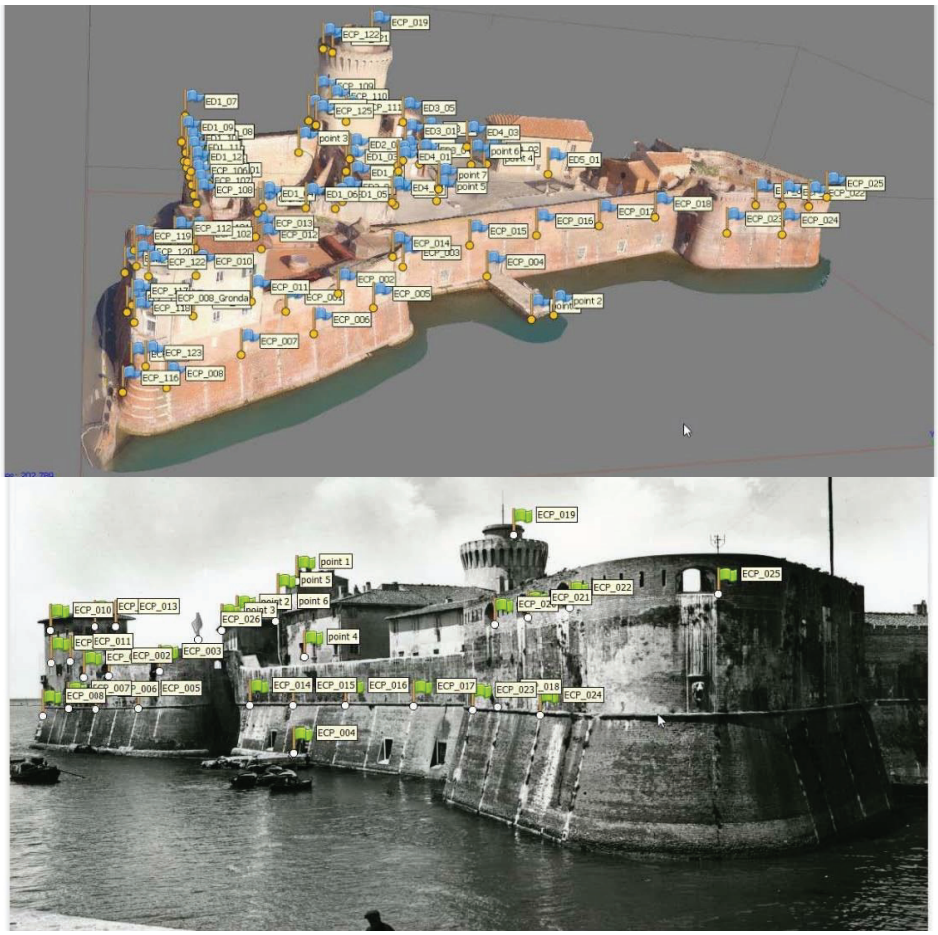


Figure 2. 18. Tie points on the 3D model (top) and on the archival image (bottom) - An example of the procedural stage is the creation of a 3D digital model of the Fortezza Vecchia using the IBM method (Source: Caroti et al. 2021)

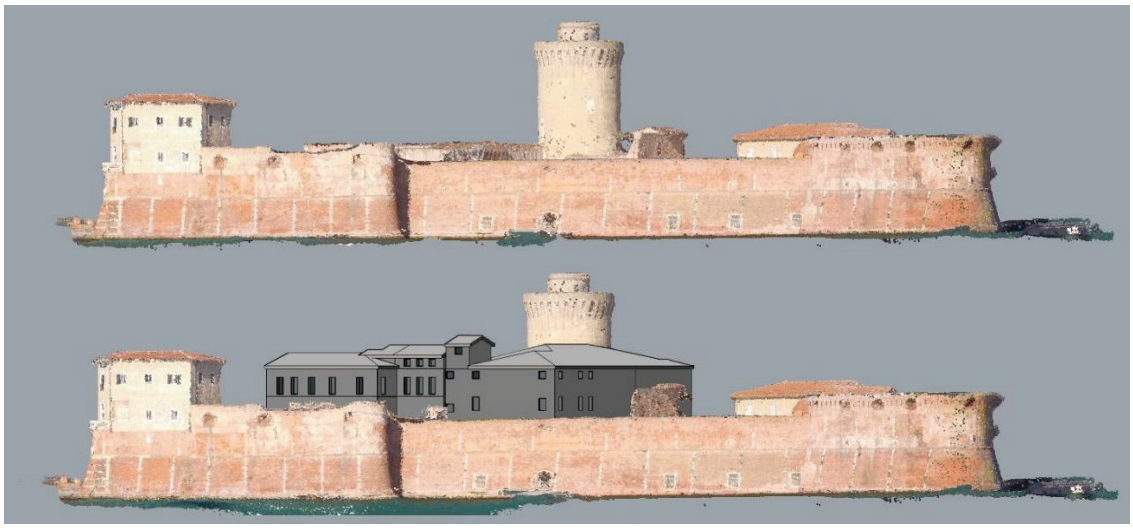


Figure 2. 19. Virtual 3D model with and without the Palazzo di Cosimo reconstruction. - An example of integration of geometry-based modelling technique with IBM technique (Source: Caroti et al. 2021)

The IBM method is the creation of digital models by using personal mobile phones, which everyone has in daily life, and photographs taken from different angles of the cultural asset, supported by low-cost or educational software versions. IBM systems can produce high-quality textures but not scaled results caused by a lack of metric information. Differences in image pixel quality impact the final product. The percentage of overlap between consecutive images can also have an impact on the outcome. For instance, if the overlap process has an accuracy below 50%, it may fail to produce satisfactory results. However, if the accuracy exceeds 60%, the model's characteristics will be sharper and more well-defined (Marshall et al. 2019).

Figure 2. 20. An example of an IBM software tool is RealityCapture (Source: RealityCapture Trainings 2024)

Examples of IBM software tools are Autodesk ReCap Pro, Metashape, RealityCapture, 3DF Zephyr, and IMAGINE Photogrammetry.

iii. The Range-Based Modelling (RBM): In the Range-Based Modelling method, data are obtained as point clouds. Alternatively, range-based modelling, sometimes referred to as range-based scanning, can be used to generate a 3D digital model. The scanned object is first represented by a point cloud created by a 3D scanner. In order to ensure topological coherence with the virtual representation, the point cloud might be transformed into a mesh. After this phase, additional software is required to complete the modelling. Some operations can be performed on both the point cloud and the mesh, such as filtering or rendering by additional software. Finally, a digital 3D model is completed by adding texture information to provide a more realistic solution (Polo, Felicísimo and Duran-Domínguez 2022). Using direct contacts such as Romer, and MicroScribe or non-contact such as x-ray, laser, and LiDaR tools, a model can be produced in range-based scanning (Butnariu et al. 2013).

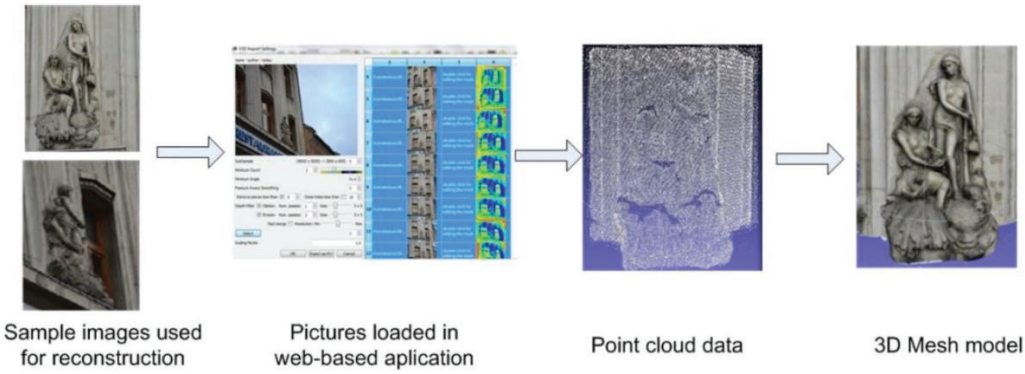


Figure 2. 21. The proposed methodology for virtual reconstruction - An example of the 3D digital reconstruction using photogrammetry (Source: Butnariu et al. 2013)

This method collects data quickly and with excellent accuracy in three dimensions. It is also used for monitoring archaeological excavations and identifying deterioration in heritage buildings. Before developing the digital reconstruction model, range-based scanning should finish the process of digitizing assets by compiling data through scanning.

Figure 2. 22. An example of the scanning procedure phase for generating 3D models of ancient works from the Acropolis Museum website (Source: © Acropolis Museum 2024)

Although, distance measurement-based systems such as range-based modelling are disadvantageous compared to IBM due to their long and exhausting processing time, RBM has advantages as being comparable to IBM in terms of detail and precision(Varinlioğlu 2020). However, this method has the advantages of low cost, easy acquisition of equipment and easy use like the photogrammetric method with the LiDAR applications that can also be used on personal mobile phones in recent years. The LiDAR laser scanning resolution is higher than the SfM point cloud resolution. Nevertheless, the SfM methods are faster, easier to perform and more accurate than past archaeological methods that relied on researchers' illustrated plans than the LiDAR laser scanning methods (Liritzis et al. 2015).

iv. The Computer Generated Architecture (CGA): The production systems of Chomsky Grammars serve as the starting point for Computer Generated Architecture (CGA). American linguist Noam Chomsky defined these grammars to characterise the syntax of formal languages (Cajthaml, Tobiáš 2016). While Chomsky's grammars work with sets of symbols to construct strings based on predetermined rules, form grammars work with sets of fundamental forms to produce more complicated geometric structures. George Stiny and James Gips originally described shape grammars in 1971 (Stiny and Gips 1971).

The Computer Generated Architecture (CGA) grammar, was initially developed for architectural modelling by Parish and Müller in 2001. Their article demonstrated how 2D polygons could be used to create basic 3D digital models of cities. In 2003, Wonka et al. presented a technique for reconstructing geometrical details. Müller described a combination of both methods was first described in 2006 (Müller et al. 2023).

Procedural modelling is a tool in CGA and is often used for the digital reconstruction of lost settlements around large-scale cultural heritage sites, such as monument complexes, in the present day. The technique of procedural modelling for the digital reconstruction of large-scale sites, such as lost settlements or big monument complexes, has become popular day by day. Procedural modelling uses a formalised set of rules, called shape grammars, to automatically generate complex and repetitive geometric shapes instead of manually creating virtual environments (Brůha et al. 2020). However, there has been a lack of research on how successful the rule, called shape grammar, is at integrating exceptional information from literature reviews while automatically producing complex and repetitive geometric shapes.

An example of the use of this method is the Roman Reborn Project, which depicts Rome in the 4th century. In this project, CGA grammar and City Engine were used to digitally model common urban areas, and AutoCAD and 3D Studio Max were used for the digital reconstruction of important monuments (Akçam Ergin 2023).

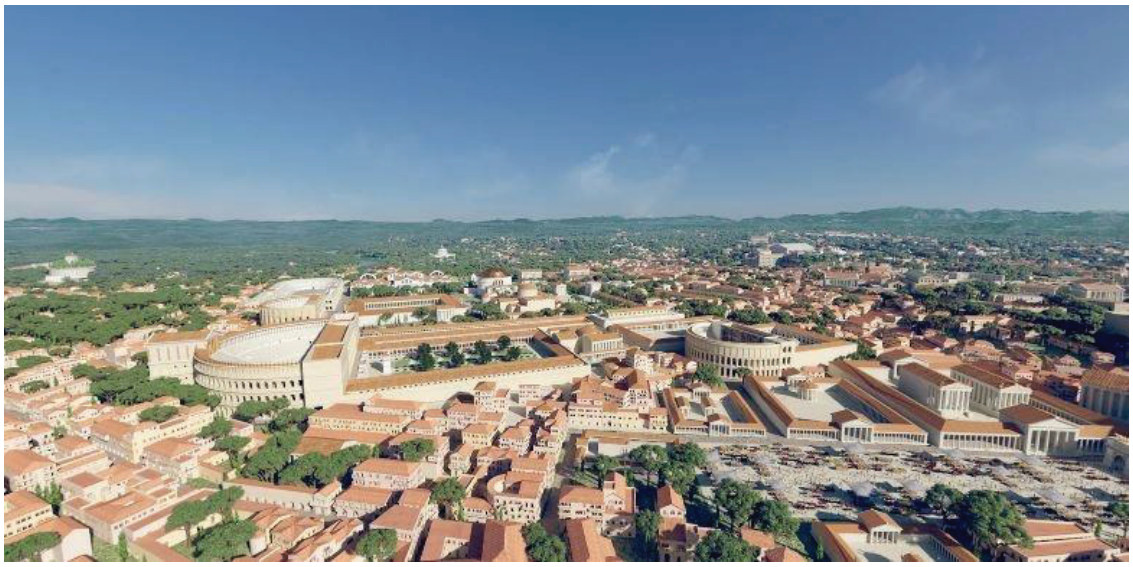


Figure 2. 23. The panoramic photograph of the Rome Reborn Project used in Time Warps 2 (Source: Flyover Zone Inc. 2023)

2.7. Comparative Evaluation of Different Digital Reconstruction Methods

People in the cultural heritage and architecture disciplines are increasingly utilising virtual reality (VR) techniques in their projects, taking advantage of the availability of digital data collection and reconstruction technologies. 3D digital technologies are mostly utilised in the measuring and documentation phases, as well as the reconstruction and presentation phases. Digital reconstruction technologies are increasingly popular because of their speed, cost-effectiveness, ease of revision, and reduced reliance on human resources compared to physical reconstruction procedures. Nevertheless, when examining research in this discipline from a scientific perspective, it is important to not prioritise its visual attractiveness and neglect the essential phases of

restitution and analysis in a conservation project. Conservation projects that prioritise visitor impact may rely on studies that lack a strong historical basis. These studies may have limited data, but they prioritize the final result and strive to create visually impressive outcomes. Especially in the absence of a physical trace of lost heritage assets and sites, the reliability of the restitution phase becomes a much more important issue.

Significant percentages of structures have either been completely lost or have undergone major interventions within the scope of the period studied in Gülbahçe. This lost heritage should be presented. However, there is a lack of comprehensive visual records documenting the original condition of the lost and intervened structures in Gülbahçe. Also, interviews with people who lived in Gülbahçe in the past and archival surveys of Gülbahçe in the 19th century show that the accuracy of a 3D digital model built only from current photographic site survey data will be a topic of debate. The reason for this is that the IBM method necessitates a substantial quantity of various shooting angles and high-resolution photos in order to produce a 3D digital model. Unfortunately, there are no available historical photographs achieving these criteria. There is only one photograph from the 19th century and a few historical movie sequences from the streets shot in the 1980s. The photo is low-resolution and was taken from the south of the settlement. Furthermore, due to the location where the photo was taken, far from the village, the information we have is not sufficient to digitally model the reconstruction in detail. These properties of the photography make it unsuitable for use in the IBM method. Therefore, although the IBM method achieves more photorealistic results compared to the geometric image-based method, they are not applicable in Gülbahçe. Moreover, the RGB method, which constructs a model by scanning current conditions, is not suitable for application in this case study area due to the major alterations and transformations that current buildings have experienced throughout time. When considering lost heritage areas, as in the detailed comparison of image-based modelling and IBM and RGB approaches above, it is important that the rates of loss and intervention for heritage areas to be digitally modelled are not high. Given the models produced by IBM and RGB, they fail to provide accurate information regarding the original state of these structures in the context of this study. Consequently, utilising these methods in Gülbahçe is unsuitable. Furthermore, a dependable settlement plan can be produced based on the sketches and historical maps of the period studied in Gülbahçe. The CGA method has no priority over the geometry-based modelling method when it comes to the digital reconstruction of 19th century Gülbahçe, when the settlement pattern could mostly be developed on the site plan.

Nowadays, image-based modelling, range-based modelling and computer-generated architectural modelling are among the preferred methods because the final products have realistic renderings and the results can be achieved in less time. Given the high rate of loss in the case study area, the fact that the structures that have been subject to major interventions, and the lack of resolution and number of photographs to model the past of the structures that have been lost and subjected to major interventions, it is not possible to provide a complete model of the site with the other modelling methods. As a result of the circumstances mentioned above, the decision was made to utilise the Geometry-Based Modelling method is the most suitable for the digital reconstruction of 19th century Gülbahçe in this thesis, instead of the IBM, RBM, and CGA methods. The 3D digital reconstructed model is created by using layers in the Archicad-Graphisoft modelling software.

Table 2. 1. The Criteria for Decision Making (Source: Author 2024)

PRIORITY	CRITERIA FOR DECISION MAKING	GBM	IBM	RBM	CGA
	Capable of constructing without relying on the visual site survey information.	x			x
	Capable of efficiently utilizing the absence of any visual data	x			x
	Capable of manually revising the components of the scene	x			
	Capable of efficiently utilizing the restricted shooting angles of photographs	x			x
	Able to effectively utilize the low-resolution visual data of the lost heritage	x			x
	Capable of achieving in less time the final products realistic renderings		x	x	x
	The cost-effectiveness is lower compared to physical reconstruction procedures	x	x	x	x

CHAPTER 3

GENERAL CHARACTERISTICS OF GÜLBAHÇE

The case study is the Gülbahçe village of Urla province of the metropolitan city of İzmir in Turkey. The village, which extends along the western shore of Gülbahçe Gulf, is 50 km west of Izmir city centre and 13 km west of Urla district centre. The region where it is located is called the Urla Peninsula. IZTECH Campus is located in the southwest, and Balıklıova village is located in the north of the Gülbahçe.

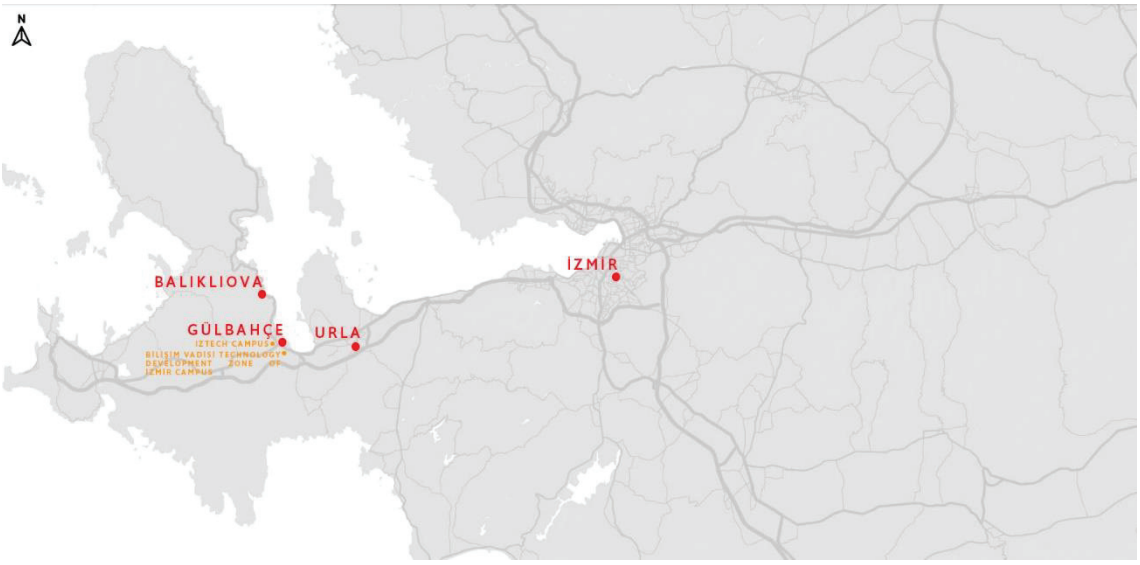


Figure 3. 1. The Location of Gülbahçe (Source: Author 2023)

There are ruins of a basilica with a baptistery dating back to the Byzantine period, the Gülbahçe Historical Geothermal Spring Bath, a windmill ruin and many examples of civil architecture in Gülbahçe. There are also IZTECH Gülbahçe Campus and Bilişim Vadisi Technology Development Zone of İzmir Campus within the administrative borders of the Gülbahçe Village.

Some areas within the borders of the village were declared a 38. Group[11] Sustainable Protection and Controlled Use Area with the decision of T.C. Ministry of Environment, Urbanization and Climate Change of Ministerial Order, numbered 76074, dated 27/04/2018 (38. BÖLGE DOĞAL SİT TESCİLİ 2018)[12]. Also, some areas within the borders of the village were declared as first and third-degree archaeological sites with the decision of İzmir Number 1 Regional Conservation Council of Cultural Assets, numbered 6016, dated 11/05/2017.[13] Nowadays, rapid urbanization of this case study area is observed due to the natural beauty of this region, its proximity to the sea and IZTECH.

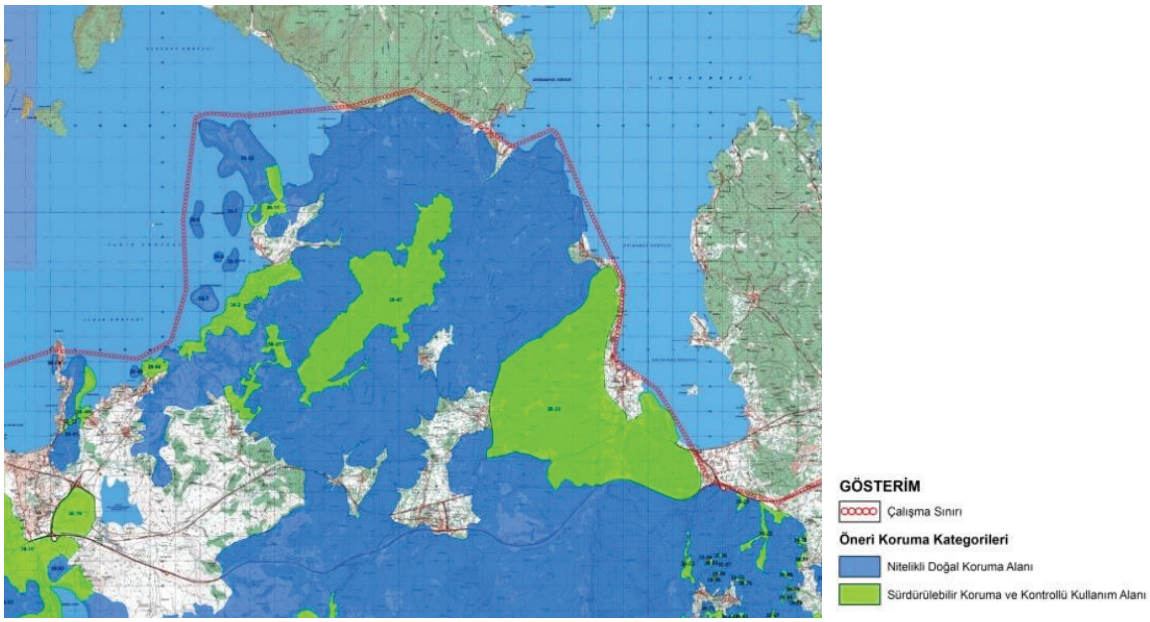


Figure 3. 2. 38. Group (Çeşme, Urla, Güzelbahçe, Seferihisar ilçeleri) Sustainable Protection and Controlled Use Area (Source: 38. BÖLGE DOĞAL SİT TESCİLİ 2018)

[11] It refers to the land, water, and marine areas that hold significant ecological value at both national and global scale. These areas are highly susceptible to environmental pollution and degradation, and it is imperative to safeguard and maintain the sustainability of their biological diversity, natural resources, and cultural values. The declaration of such areas is done through the Decree of the Council of Ministers (Korunan Alanların Tespit, Tescil ve Onayı 2012). The special environmental protection zones in which the case study area is located is classified as 38. Group.

[12] The letter of approval for Decree Number 76074, which was dated on April 27, 2018 is in the appendices.

[13] İzmir Büyükşehir Belediyesi İmar ve Şehircilik Dairesi Başkanlığı Koruma Alanları Şube Müdürlüğü. 2022. URLA İLÇESİ, GÜLBAHÇE MAHALLESİ VE KARAPINAR MEVKİİ 1/5000 ÖLÇEKLİ NAZIM İMAR PLANI DEĞİŞİKLİĞİ AÇIKLAMA RAPORU. (March, 17, 2022). Decision No: 05.343, İzmir. Accessed November 26, 2023, https://www.izmir.bel.tr/tr/NazimImarPlaniDetay/30195/131.

3.1. Climate, Flora and Fauna

The Gülbahçe village has a Mediterranean climate: winters are temperate and rainy, summers are hot and dry, and springs are transitional (T.C. Orman ve Su İşleri Bakanlığı Meteoroloji Genel Müdürlüğü, Meteoroloji 2. Bölge Müdürlüğü 2023). The annual average temperature in the years between 1938 and 2022 by province was a minimum of 13.6 °C, a maximum of 22.7 °C, and a yearly of 17.9 °C (T.C. Çevre, Şehircilik ve İklim Değişikliği Bakanliği Meteoroloji Genel Müdürlüğü 2023). The extreme temperature measured in the same period was a minimum of -8.2 °C and a maximum of 43.0 °C (T.C. Çevre, Şehircilik ve İklim Değişikliği Bakanliği Meteoroloji Genel Müdürlüğü 2023). It has a high sunshine duration potential. Thanks to the duration of the sunshine and sufficient amount of precipitation, the soil structure has a suitable climate for agricultural purposes (T.C. Orman ve Su İşleri Bakanlığı Meteoroloji Genel Müdürlüğü, Meteoroloji 2. Bölge Müdürlüğü 2023).

Three different vegetation formations are distributed in the Urla Peninsula: forest, maquis and phrygana formation. The dominant community plant of forest vegetation is the Calabrian pine. The main maquis formations in the peninsula are oleaster, kermes oak, bushy juniper, sandalwood and may blossom. The main phrygana formations in the peninsula are poterium spinosum, labdanum, lavender, thyme, and mullein (Velibeyoğlu 2014).

The Urla Peninsula hosts various species by fauna characteristics. The wetlands in the southern part of Karaburun are where the endangered Eurasian otters (Lutra lutra) are found. Caracal (Caracal caracal) is one of the important mammal species found in small numbers in the area. Besides, all of the islands in the area are important for the presence of raptorial birds and seabirds (Velibeyoğlu 2014).

3.2. Landscape and Topography

The Gülbahçe village takes its name from the Gülbahçe Gulf. Gülbahçe is on a gulf together with five other neighbourhoods which are Menteş, Özbek, Torasan, İçmeler and Balıklıova. The village is located on Gülbahçe Hill at the edge of a small coastal plain. Also, the Değirmenaltı area is located on the east of the Gülbahçe Hill. The Tatar River flows into the Gülbahçe Gulf where the Gülbahçe Historical Geothermal Spring

Bath is found juxtaposing the east side of the Çarpan Hill on the west coast of the Gulf of Gülbahçe.

Figure 3. 3. Landscape and Topography Mapping of Gülbahçe (Source: Author 2023)

3.3. Historical Background

Gülbahçe has a multi-layered character where we can follow the traces and remains of different civilisations. The history of the settlement is clarified below in chronological order.

3.3.1. Prehistoric Period

Urla Peninsula has revealed a culturally affluent history that dates back to the Palaeolithic period. The Anatolian peninsula, with its marine connections, has emerged as a focal point for trade and settlement among the Aegean population. The Urla region, located in the midst of the peninsula, held a central position in prehistoric times, just as it does now. The small village settlements on the Urla Peninsula are believed to have centred around Liman Tepe, which served as the central hub of a regional economic and

administrative system. Additionally, there is one of the small village settlements situated in the Değirmenaltı area, namely on the cape within the coastal plain adjacent to Gülbahçe village. According to Caymaz, while comparing the vessel forms found in the settlement with an abundance of economic resources, it can be observed that the Değirmenaltı pottery is mostly associated with the middle and late stages of the Early Bronze I period (Caymaz 2008). The underwater remains indicate that a portion of the village is situated below the sea level (Caymaz et al. 2022). The presence of military particular unit has been discovered in Gülbahçe-Hamamtepe in the Early Bronze Age II period. The Urla Peninsula was a primary destination for the significant migrations that occurred along the Western Anatolian coast towards the end of the Bronze Age (Caymaz 2008).

The peninsula experienced a revival in culture as it became the home to three of the Twelve Ionian cities, that is Klazomenai, Erythrai, and Teos (Caymaz 2008).

3.3.2. Historic Period

Ionian communities migrated to Anatolia and established city-states in Western Anatolia in the late B.C.2000s. The Union of Ionian Cities called Panionian started to operate strong commercial and political relations with the East in the B.C.9-8. Erythrai (Ildırı, Çeşme), Klazomenai (İskele, Urla), Teos (Sığacık, Seferihisar) and Lebedos (Ürkmez, Seferihisar) were some of these city-states founded on the peninsula (Velibeyoğlu 2014). Gülbahçe was located on the border of Klazomenai and Erythrai.

Figure 3. 4. The Location of Gülbahçe (Source: Author 2023)

Değirmenaltı was located on the Gülbahçe coast and had a dense settlement during the Roman-Early Byzantine period. Remains from this period can be seen throughout the coastal plain. In addition, there are also basilica ruins dating back to the 7th century in Değirmenaltı (Caymaz et al. 2022). In 1897, a farmer released the wall traces when digging a little into the ground. The first investigation of the structure was made by G. Weber in the early 1900s (Amygdalou 2022).

The Turks reached the Aegean Sea and İzmir in the 1080s by Çaka Bey. The Beyliks founded by Çaka Bey dissolved after his death. After this date, there was a Turkish-Byzantine struggle in Western Anatolia for about two centuries. The Beyliks Period began in Anatolia with the collapse of the Anatolian Seljuk State in 1308. İzmir and Urla joined the lands of Aydınoğlu Beyliks. Aydın and its surroundings were captured by the Ottoman Empire in 1390. However, this area was again captured by the Beyliks after Yıldırım Bayezid lost the Battle of Ankara. II. Murat abolished the Beyliks in 1425-1426, and Urla completely came under the rule of the Ottoman Empire (Caymaz 1974).

3.3.2.1. Ottoman Period

Urla had developed economically over time by thriving on land and maritime commerce thanks to its geographical location. Urla was located on the road that connected the commercial relationship between Chios Island and Çeşme with Anatolia and had the feature of a distributive point during the Ottoman period (Baykara 1991).

In the 15th century, Urla, transferred a majority of its commercial activities to İzmir when İzmir Port became operational in the 16th century. Consequently, Urla emerged as the primary hub for agricultural production in the region (Atay 2003). The non-Muslim population resided only in the centres of Izmir and Urla at the beginning of the 16th century (Kütükoğlu, 2000b). However, the population statistics of the second half of the 16th century show a population increase in Urla (Atay 2003). The reason for this increase was the start of migration from the Aegean Islands to Urla with the conquest of Chios in 1566 and Cyprus in 1571 (Kütükoğlu 2000a).

Urla became a rural settlement centre in the 17th and 18th centuries. The economy declined due to the Izmir port was active in maritime commerce during the 18th century. The social structure of Urla was changed by the increase in the non-Muslim population due to increasing migration at the end of the century (Atay 2003).

The main source of income in Urla was viticulture and raisin trade in the 19th century. However, yield from the land decreased because of the phylloxera (vine aphid) that occurred between 1890 and 1900. The disease's lands were rehabilitated into cultivated land as vineyards by the Ottoman Greeks. They started to own half of the vineyards in return for rehabilitation during this period (Milioris 1957).

Various sources focus on two different narratives about the settlement of the Greek Orthodox population in Gülbahçe. According to first narrative; first immigrants came from the region of Karistos (Karystos), a village of Eğriboz (Evya) in the second half of the 18th century (Çokona 2016). They started to work in the farms of the region of a pasha named Bostancıoğlu in Gülbahçe. The houses were built in circular rows adjacent to each other with their doors opening onto the square. Additionally, this group of houses had only one large door opening to the outside (Milioris 1957). According to the other narrative, there was a farm here belonging to an Armenian agrarian elite who had very good relations with the Turks in the beginning. Many fugitives wanted from Greece for various reasons were hiding and working on this farm. These farmer fugitives staked out a claim for this farm within time. When they couldn't get through an agreement with the Armenian agrarian elite, they were confiscated from it by threatening. Following that, the farmers shared this farm which is famous for its rose garden, among themselves (Milioris 1957). According to the CAMS interview, the farm which was famous for its rose garden was within walking distance to the village square. Its location can be found as a result of the information coming from oral history, TKGM and the site survey. It is possible to see the remains of the house and courtyard walls from this area, which is now Gümüşkoy or Old Gülbahçe area.

Figure 3. 5. The Settlement of Gülbahçe in the 19th Century (Source: Author 2023)

Gülbahçe was a rich town centre at turn of the 20th century. The people who lived in Gülbahçe lived on viticulture, wheat and bean farming, livestock and fishing. The people grew Sultani and Razaki grapes (HOMEACROSS 2023). It had a lot of stores, bakeries, grocery stores, and coffeshop. In addition to these, Gülbahçe had a port opposite Yılan Island, and the first cooperative for transporting goods of Gülbahçe was with the Alevrou boat. Their boats went to Lesvos, Foça, Çanakkale, İzmir, Chios and Samos. Their maritime commerce goods were wood, coal, animals, and raisins (CAMS).

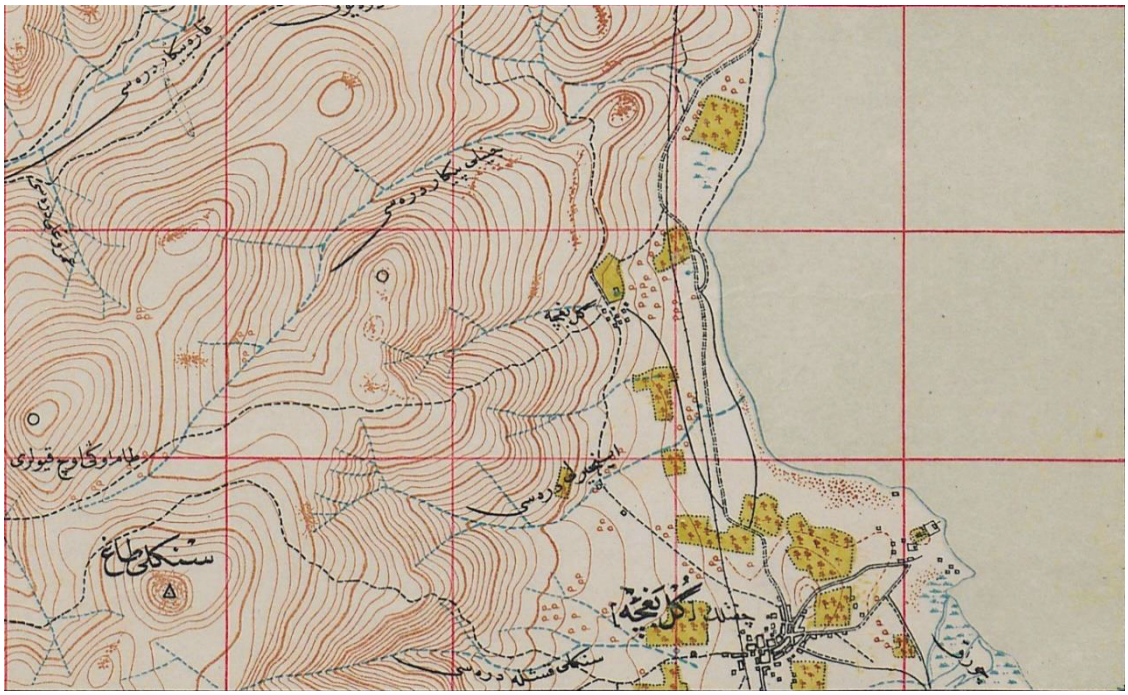


Figure 3. 6. Cropped from the Ottoman Map of Gülbahçe in 1927 (Source: SALT Research and Müdaafa-i Milliye Vekaleti Harita Müdüriyet-i Umumiyesi Matbaası 2023b)

There were three windmills in Gülbahçe. According to the CAMS interview, the windmills were grinding the yield of the town. They were located on the top of a hill, from where you were able to view Chios and Karaburun (CAMS). The owner of two mills was Hadjidiamantis, while one mill belonged to a person called Pousoula at the Gülbahçe Hill (ΑΝΤΩΝΗΣ 2010). Two of these three have no physical remains today, but we know their place thanks to Pavlidis' book and narratives of the current locals.

Pavlidis states that there were two public squares in Gülbahçe at the beginning of the 20th century. One was in the middle of the settlement dotted by the Hagios Georgios Church too and was called the Hagios Georgios Square. This was the centre of the village where Hagios Georgios coffeehouses and commercial buildings stood (ΑΝΤΩΝΗΣ 2010). In addition to these, Hadjidiamanti's house was on one side of the square. It was a well-built two-storey house with a lot of windows and a balcony. Until 1908 the only merchant in Gülbahçe was Hatzidiamantis. He bought from İzmir and he had a big grocery store in the village where he sold his stuff (CAMS). This building does not exist today but the current locals still remembers the buildings with its owners name. The building was used as the primary school of the village for a long time. The locals still use Hagios Georgios Square extensively as the village's main square (HOMEACROSS 2023).

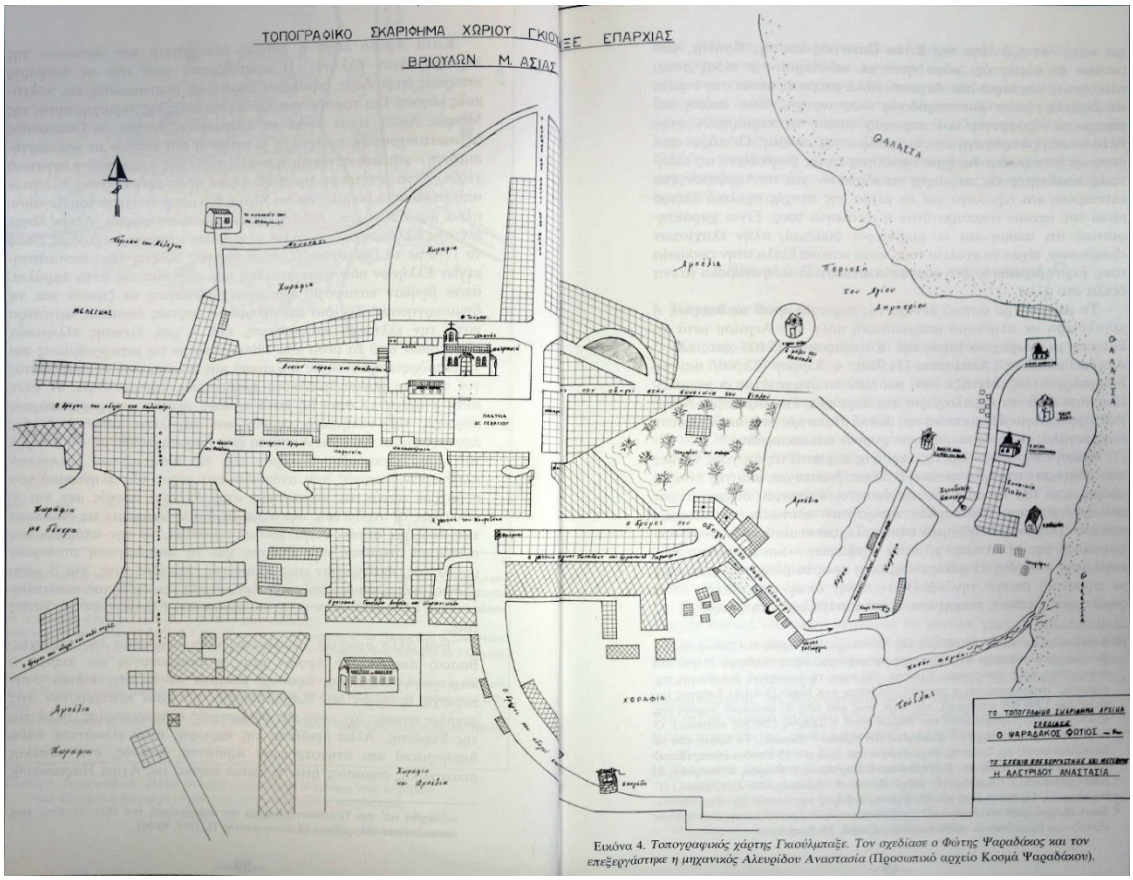


Figure 3. 7. The Site Plan of Gülbahçe in the 19th Century (Source: ΑΝΤΩΝΗΣ 2010)

Before 1922, there was a church, two chapels, ruins of a basilica, a boys' school and a girls' school in Gülbahçe (CAMS). The feast day of the Hagios Georgios Church, known as the central church, was celebrated with a keskek festival attended by Turkish villagers as well. It is thought that this festival continued uninterrupted until the 1881 Chios earthquake when the church was collapsed (Tunçağ 2022). However, the church was reconstructed after the Chios earthquake, and the festivals were held even during the First World War between 1914 and 1918 (Milioris 1957). Amygdalou's describe the legendary discovery of the basilica ruins that the village woman named Sofia had a sacred request from Hagios Demetrious, who visited in 1896 in a dream and asked her father, who owned the land, to dig it up and release him. The association of the discovery of the basilica with a dream was also confirmed by George Weber, a teacher at the Izmir Protestant School, who visited the village of Gülbahçe in 1900 to study the ruins. After excavating and unearthed the basilica, it became a part of village life in various ways. She adds that: " *With the Saint's implicit permission, the villagers took ayasma from the little well, and used it as a therapeutic potion. The Saint was blessing the village not just with a church, but with sacred infrastructure, an ayasma, a holy source of water."* (Amygdalou 2022).

a b

Figure 3. 8.a. Ruins of the Hagios Demetrius Basilica and Baptistery, b. Basilica and Baptistery Plan drawn by K. Michel (Source (a): HOMEACROSS 2023, Source (b): Kalkınoğlu 1990)

It is said that 120 palikarians (Greek Orthodox young men) from Gülbahçe villagers participated as volunteer soldiers for the Greek army in the Ottoman-Greek War of 1897 (ΑΝΤΩΝΗΣ 2010). However, some crises began especially in the Greek settlements on the western coast of the Ottoman Empire such as Gülbahçe by the year 1914. Gülbahçe became an important centre of British espionage activities after declaring World War I (Milioris 1957). Some of the Gülbahçe villagers participated as volunteer soldiers for the Greek army in World War I in 1915 (ΑΝΤΩΝΗΣ 2010). The war survivors returned to Gülbahçe at the end of World War I after the defeat of the Ottoman Empire. However, Gülbahçe villagers left for Uzunada, Lesvos and Chios by their boats with the liberation of İzmir from the Greek occupation on September 9, 1922. Upon the arrival of the Turkish army ground forces at Gülbahçe, they proceeded to move the surviving villagers of Gülbahçe to Urla. The survivors of the Gülbahçe villagers were settled in exchange settlements in Attica as a result of the Lausanne Peace Treaty (Milioris 1957).

3.3.2.2. Republic Period

The war between Greece and Turkey officially ended with the Lausanne Peace Treaty of 1923. One of the most important annexes of the Lausanne Peace Treaty is the Lausanne Peace Treaty VI. Convention Concerning the Exchange of Greek and Turkish Populations which was signed at Lausanne, on January 30, 1923. The process that turned minorities into immigrants was officialised in both countries with the signing of the Population Exchange Treaty between Turkey and Greece (MFA 1930). Approximately 500 thousand Turkish and Muslim population migrated from Greece to Turkey, and 1.5 million Greek-Christian Orthodox population migrated from Anatolia to Greece (Sunata 2022). According to articles 9 and 10 of the Lausanne Peace Treaty VI. Convention Concerning the Exchange of Greek and Turkish Populations, Muslims in Greece, who were subject to exchange, had to leave their movable and immovable properties in cities and villages. However, they had the right to compensation equal to the value of these properties from the state of the country in which they would settle (MFA 1930). Even though the treaty conditions were like these, the implementation could not be realised completely as in the treaty (Sunata 2022). Because the lands of the newly established Republic of Turkey were war-ravaged. At that time, it could not achieve political and

economic union. Therefore, The Ankara Agreement on June 10, 1930, brought solutions to the problems arising from the population exchange between Turkey and Greece and, closed the issue of compensation absolutely for all (Erdem 2021).

As a consequence of this Turkish immigrants from Greece were settled in the vacant Gülbahçe village. In the first phase, Turkish immigrants from Crete's Chania and Heraklion regions were settled in 1924. After that immigrant families came from Thessaloniki, Florina, Drama and Pristina. Albanian who came from Thessaloniki and Piriştina were settled in Konya at first and then they were settled in Bağarası. However, they moved from Bağarası to Gülbahçe due to malaria in 1926. After the population exchange, the establishment of the village was completed in 1927.

The immigrants made their living from agriculture and sheep and goat breeding. When they were settled in Gülbahçe, they did not know the viticulture and raisin. Therefore, they uprooted the vineyards and planted the agricultural products that they are familiar. Also, a small group of immigrants made their living from fishing. Therefore, the port was not as successfully utilised for economic purposes as it had been during the 19th century. It continues to function as a small port with a limited number of fishing boats. Hagios Georgios Square served as a village square for immigrants, and its surrounding cafes and commercial buildings remained in use for the same purpose. The church of Hagios Georgios was refunctioned as a mosque by immigrants, and subsequently a minaret was constructed. The big two-storey residence situated on the square, owned by Hadjidiamanti, was refunctioned as a primary school due to its durability and its central location within the settlement. However, there are currently no tangible remains of this building. Furthermore, currently, only one of the three mills in the village has existing physical remains. Over time, the chapels were gradually destroyed and currently, just the courtyard walls of Hagios Panteleimon Chapel survive.

Following the 1950s, there was a notable surge in the quantity of second homes, particularly along the Aegean and Mediterranean coasts of Turkey. Since they directly contribute to the tourism economy, second houses are considered a part of the tourism industry. The coastal areas of Urla had an increase in popularity as an ideal location for a second house during the period of 1965 to the 1970s in Izmir (Emekli 2002). Gülbahçe is a coastal village in Urla that is conducive to swimming. In addition, agricultural land are being sold for the purpose of constructing second homes, taking use of their sandy-plain characteristics. These areas have also seen an increase in development projects aimed at catering to the tourism industry. The expansion of second home developments across

extensive regions has had a negative impact on coastal locations. Subsequently, the capacity of the coasts to support a population has been stretched to its limit. The protection-use balance of coastal areas and the quality of rural texture were destroyed (Alp 2012).

However, the construction of lands away from the coast with sea and forest views began, while the coasts were previously under the pressure of holiday resorts. Because the Balçova-Urla section of the Çeşme highway was put into service in 1992 and the foundation of the first building in IZTECH's Gülbahçe Campus was laid in 1994. Buildings that were examples of qualified traditional architecture were subjected to uncontrolled major interventions and demolition for accommodation services and the catering industry because of the opening of the Institute. All these factors destroyed a large part of Gülbahçe's rural heritage until the coronavirus disease (COVID-19) pandemic period. The COVID-19 pandemic has also significantly affected the lives of individuals and societies. People had to spend time at home throughout quarantine practices have caused radical changes in living accommodations during the COVID-19 pandemic. In addition, as a result of the October 30, 2020, Aegean Sea Earthquake and the 2023 Kahramanmaraş Earthquake, most of the people who lived in apartments changed their preferences as low density detached house. For these reasons, the traditional houses from the turn of the 20th century experienced another demolishment wave starting from the pandemic.

3.4. Socio-cultural Characteristics

There is no cultural and demographic continuity in the Urla Peninsula as in other geographies communicated with the sea. The Urla Peninsula has been a migration region until today. Albanian and Turkish Muslim citizens who came with the population exchange after the Turkish War of Independence were settled in Gülbahçe. Afterwards, it has still maintained its feature of being a constantly receiving and sending migration region due to the student circulation in the IZTECH Gülbahçe Campus.

There are also educational institutions at primary and secondary school levels in Gülbahçe apart from IZTECH. As a health institution, there is a health centre in Gülbahçe and Oral and Dental Health, Nursing and Emergency Response Services used by IZTECH students and staff on the IZTECH Campus.

When the occupations of the people living in the villages are evaluated, it is determined as academic staff, lecturers, farmers, fishermen, drivers, catering businesses, housewives, retired, labourers and shepherds (Kar 2023).

3.5. Economy

The main economic source of Gülbahçe is agriculture and animal husbandry. However, with the pressure of tourism and the establishment of IZTECH, the locals are selling their lands to build dormitories on agricultural lands and second homes.

As in all of the coastal villages of Urla, some people in the Gülbahçe village have based on in small-scale fishing. Also, there is a cage fish farming in the sea at the Gülbahçe Karapınar location (Velibeyoğlu et al. 2014). In addition to this, various surf schools have increased their activities in the last decade since Gülbahçe coasts are suitable for surfing and kitesurfing.

Activities such as festivals are organized to increase agricultural production and maintain cultural and traditional values in village settlements. Gülbahçe Albanian Pastry Festivals are organised by the leadership of S.S. Gülbahçe Women's Enterprise Production and Management Cooperative at the second weekend of May. In addition, the West Urla Villages Environmental Protection, Beautification and Development Association (BUKÖYDER), the Fisheries Cooperative and the Transportation Cooperative have continued their activities in Gülbahçe.

CHAPTER 4

DIGITAL RECONSTRUCTION OF 19th CENTURY GÜLBAHÇE

The digital reconstruction modelling process is essentially a problem of design, including the creation of an information system capable of comprehensively representing the intricate nature of a lost structure or site (di Mascio et al. 2016). This thesis suggests using 3D digital reconstruction as a method for presenting lost heritage. Additionally, the reliability related to the original architectural characteristics of the lost heritage is also taken into consideration.

4.1. Digital Reconstruction Phase

Data collection, understanding the original characteristics of the lost heritage to be modelled, and visualization are the three primary phases of the 3D digital reconstruction. The method and content of each phase are clarified in the following.

4.1.1. Data Collection

The data required for the 3D model has been collected via various sources. These sources are explained in the following.

4.1.1.1. Site Survey

A comprehensive site survey was carried out on January 24th, March 8th, March 31st, May 3rd, and August 22nd in 2023.

The site survey aimed to decipher the existing buildings and the locations of lost buildings. A detailed survey has been conducted in this phase to document the existing

heritage buildings and to distinguish the pre-1922 buildings from post-1922 buildings that are also constructed with traditional materials and techniques. The mass and façade characteristics, the architectural elements, materials, and techniques is thoroughly analysed. 50 buildings were deciphered as constructed before 1922. These buildings have different levels of condition.

Figure 4. 1. A diagram showing data collected via a site survey (Source: Author 2024)

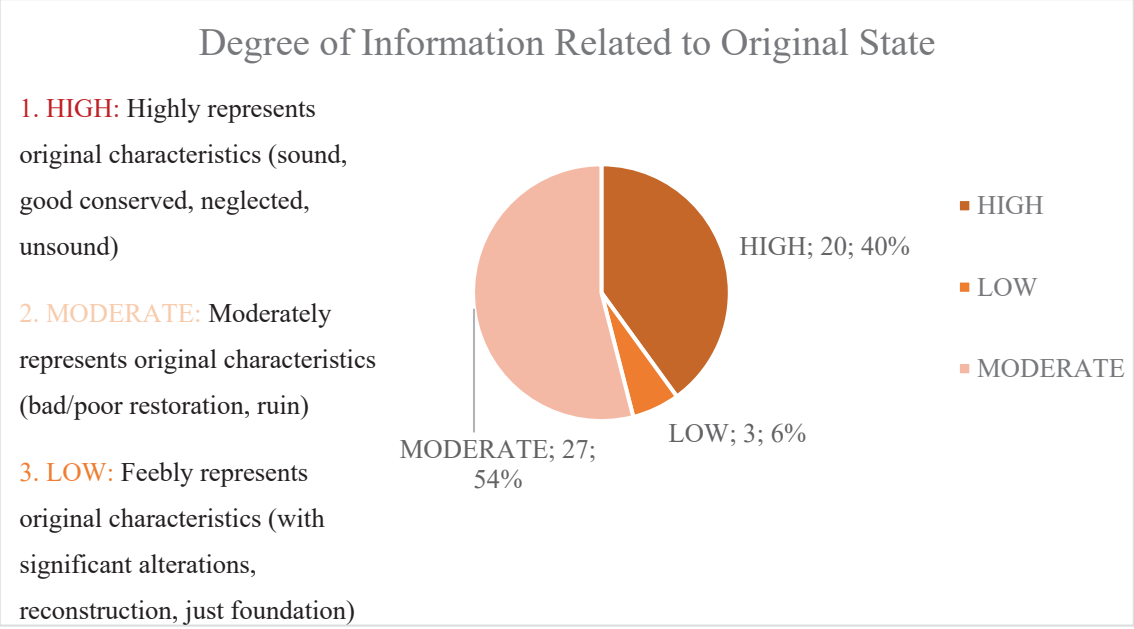


Figure 4. 2. Degree of information related to original state of the existing structures deciphered through the site survey (HOMEACROSS 2023)

4.1.1.2. Oral Study

Oral study is an additional significant source of information regarding the lost heritage in Gülbahçe of the 19th century. Interviews were conducted with 12 individuals who currently reside in Gülbahçe, with a particular focus on elderly individuals who are members of the population exchange families. These interviews were conducted March 31st, May 3rd, and August 22nd in 2023. Before the interviews, participants were informed about the purpose of the thesis. In these interviews, participants requested that their names not be disclosed. However, they consented to the use of the information they provided. For this reason, nick-names are provided for those who didn't want their names to be disclosed. The nick-names of the interviewes and the content of the information provided are given in Table 4.1.

Table 4. 1. Data collected from an oral study (Source: Author 2024)

PARTICIPANT	OBTAINED INFORMATION	DATE (dd.mm.yyyy)
Y** K****	The migration and resettlement process of the Muslim exchanges, the built and cultural landscape of Gülbahçe at the mid-20th century and how this landscape has been transformed afterwards, the location of his family's destroyed house, the Hagios Georgious Church, the Pousoula windmill, ruins of the Hagios Demetrius Basilica and Baptistery, courtyard walls of the Hagios Panteleimon Chapel, and the ruins of the village windmill	31.03.2023
F** M*****	The migration and resettlement process of the Muslim exchanges, location of the the church of Panagia Mourtidiotissa, Hagios Panteleimon Chapel and how it was destroyed, and her family's destroyed house, M. Kemal Atatürk visit to Gülbahçe at the beginning of the 20th century	31.03.2023
A** Ç****	The migration and resettlement process of the Muslim exchanges, the built and cultural landscape of Gülbahçe at the beginning of the 20th century and how this landscape has been transformed afterwards, the buildings on 12092, 12098 and 12104 Streets at the mid-20th century and how these buildings transformed afterwards, the location of his family's destroyed house, and the Hagios Georgious Church, M. Kemal Atatürk visit to Gülbahçe at the beginning of the 20th century	03.05.2023

(cont. on next page)

Table 4.1. (cont.)

A* Ç**** **	The location of her family's destroyed house	03.05.2023
A** Ş**** **	The location of his family's destroyed house	03.05.2023
M*** K*** **	The built and cultural landscape of Gülbahçe at the end of the 20th century and how this landscape has been transformed afterwards	03.05.2023
A Y******* **	The built and cultural landscape of Gülbahçe at the mid-20th century and how this landscape has been transformed afterwards, transformation of primary school in the main square, and location of the Pousoula windmill and its destruction, his family's destroyed house, and the Hagios Georgious Church	03.05.2023
E* G** **	The condition of her house before the restoration and the interventions taken to improve it	03.05.2023
D** Y***** **	The migration and resettlement process of the Muslim exchanges, the built and cultural landscape of Gülbahçe at the mid-20th century and how this landscape has been transformed afterwards, location of the Hagios Georgious Church, the Pousoula windmill, ruins of the Hagios Demetrius Basilica and Baptistery, courtyard walls of the Hagios Panteleimon Chapel, old graveyard, the ruins of the village windmill, port	22.08.2023
M* Y***** **	The migration and resettlement process of the Muslim exchanges, the built and cultural landscape of Tatari Area at the mid-20th century and how this landscape has been transformed afterwards, the location of his family's house	22.08.2023

(cont. on next page)

Table 4.1. (cont.)

H** Y*****	The migration and resettlement process of the Muslim exchanges, the built and cultural landscape of Gülbahçe at the mid-20th century and how this landscape has been transformed afterwards	22.08.2023
K** Y****	The built and cultural landscape of 12092. Street at the mid-20th century and how this landscape has been transformed afterwards	22.08.2023

The narratives of the current locals were very useful in understanding the migration and resettlement process of the Muslim exchanges of Gülbahçe, who are originally from Crete's Chania, Heraklion, Thessaloniki, Florina, Drama, and Pristina. The narratives are also very helpful to understand the built and cultural landscape of Gülbahçe at the beginning of the 20th century and how this landscape has been transformed afterwards. The existence and location of various lost buildings, such as the Hadjidiamanti house, Stavros Hadjidiamantis windmill, Pousoula windmill, Hagios Panteleimon Chapel, and the church of Panagia Mourtidiotissa, could be deciphered with the help of these narratives.

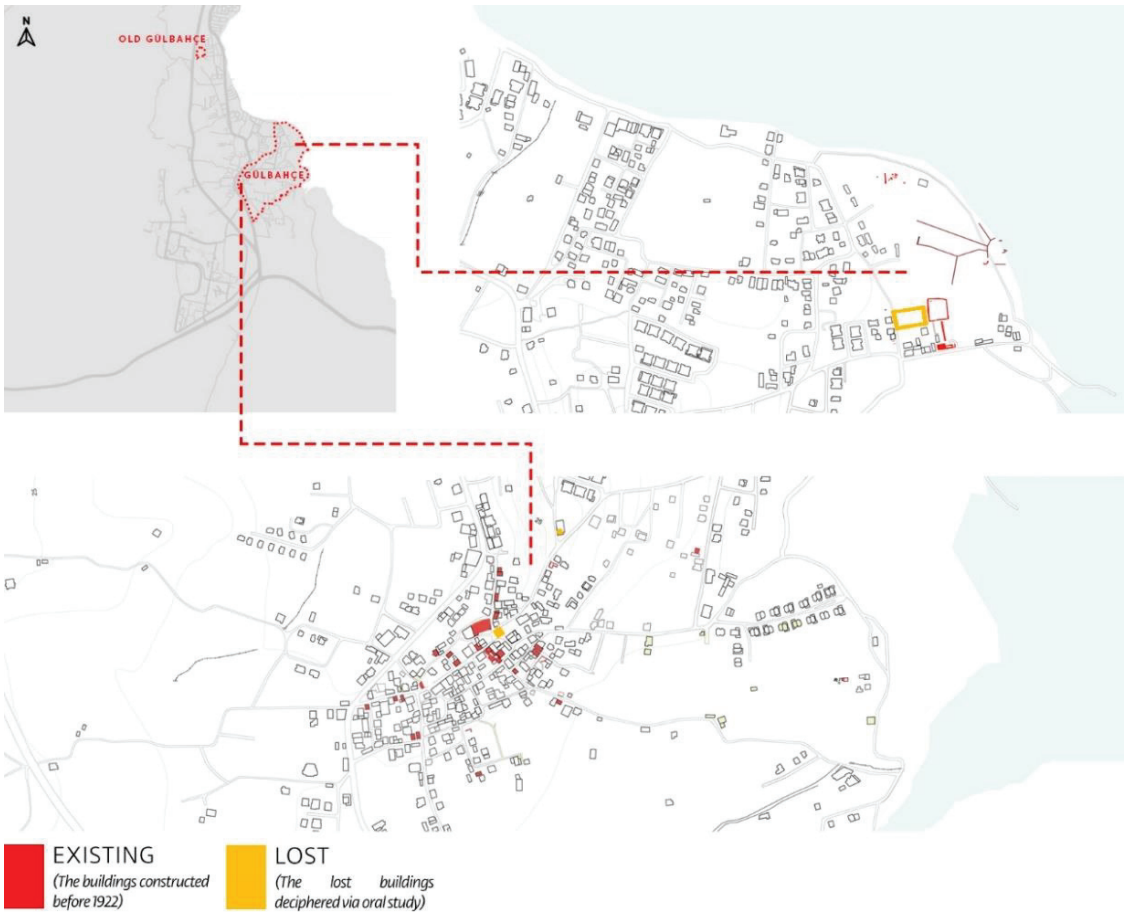


Figure 4. 3. A diagram showing data collected via a site survey and an oral study (Source: Author 2024)

4.1.1.3. Oral History Archive

The oral history archives consist of documents obtained from CAMS[14] and fieldwork conducted by HOMEACROSS team in August 21st, October 10th, 2021 and August 25th, 2022.

Through oral history archives, the detailed information of the settlement characteristics and structures in the 19th century could be deciphered. Given the material gathered from the oral history archive, the fieldwork was expanded to include an investigation of the structures or remains that could potentially be associated with the stated structures. In this context, the location of Old Gülbahçe had been enhanced in terms

[14] Oral sources are oral history archives from CAMS, under the framework of the HOMEACROSS project for archival research.

of reliability by juxtaposing different sources. It is possible to see the remains of the courtyard walls and remains of structure from the 19th century in this area. Based on data from the CAMS oral history archive, research was conducted in the area surrounding the Tatar River, also known as the Tatar area in TKGM. The Tatari area, as mentioned in CAMS, has been identified as an area containing the remains of an inn that served as resting places for both humans and animals.

Figure 4. 4. The Tatari Area in 2023 (Source: HOMEACROSS 2023)

Furthermore, this study has provided a more comprehensive understanding of the specific characteristics of the remaining architectural structures and lost heritage that have endured to the present time. It is understood that there are three windmills located in Gülbahçe. Based on the CAMS interview, the windmills were processing the agricultural produce of the village. Their location was above a hill, affording a panoramic view of Chios and Karaburun. Hadjidiamantis was the owner of two mills, whereas Pousoula owned the other mill. The structure referred to as the church on the coast by the residents of Gülbahçe has been identified as Hagios Panteleimon Chapel in according to CAMS interviews. The dimensions of the chapel were up to 10–12 meters long and up to 8 meters wide. It had a dome and arches. Based on the CAMS interview, Dimitros Hadjidiamanti's residence and grocery store were situated on one side of the main square. The structure was a well constructed two-story building ornamented with several windows and a

balcony. As stated in the CAMS interview, the Boys' School was located next to the Church of Hagios Georgios. There were two teachers. Currently, the people have reused the Church of Hagios Georgios and transformed it into the Gülbahçe Mosque.

Table 4. 2. Data collected from an oral history archive of CAMS (Source: HOMEACROSS 2023)

INFORMANT NAME	YEAR OF FIRST INTERVIEW (dd.mm.yyyy)
E******** H*****	1955
G******* M**********	1959
N******* P******	1963
R**** D******	1965
K******* V*******	1955
I****** V*******	1968
N******* G******	1955
E****** K********	1955
N****** K*********	1955
V******* M**********	1963
N******* M********	1938
I****** M********	1955
A********* M*****	1955
K***** N*******	1955
F**** P*****	1955
M**** H*********	1955
K****** F********	1955

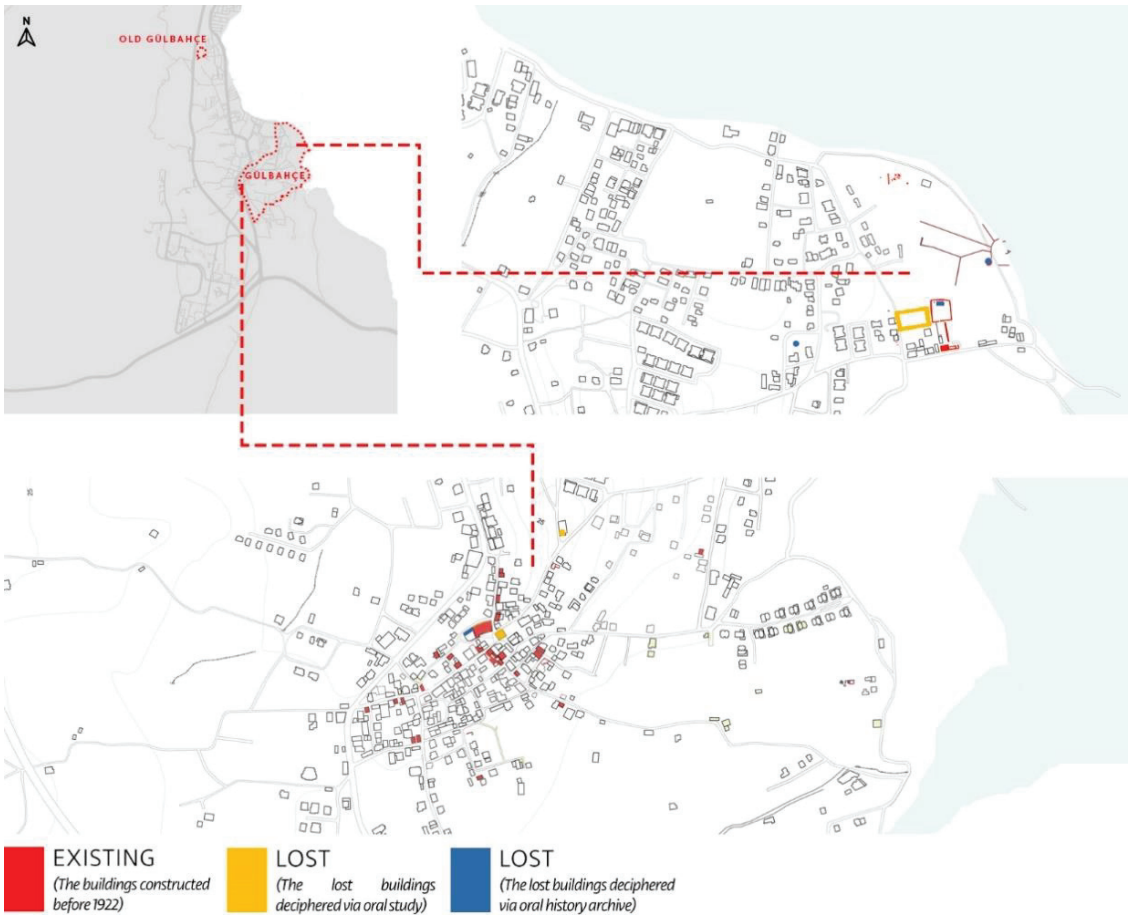


Figure 4. 5. A diagram showing data collected via a site survey, an oral study and an oral history archive (Source: Author 2024)

A comprehensive digital model of Pousula windmill, Hadjidiamantis windmill, village windmill, wells, and the materials used in the roads and buildings has been achieved utilising data obtained from a site survey, an oral study, and an oral history archive detailed above.

4.1.1.4. Literature

The literature study is utilized to provide clarification on the available detailed information about the settlement characteristics and structures in the 19th century and to identify 19th century structures that were lost. This thesis did a comprehensive analysis to understand the built environment of Gülbahçe in the 19th century, using many sources.

The information obtained from the book "Ο Γχιουλμπαξες Ερυθραίας" by ΑΝΤΩΝΗΣ in 2010 has served as a valuable resource for the historical investigation of

Gülbahçe. This book contains a comprehensive description of the housing of families, workplaces, and public spaces in the village, focussing on a particular route. Furthermore, the settlement's landscape character is thoroughly defined, along with the precise position and physical architectural characteristics of schools, religious buildings, and public areas located beyond the route. In addition, the book provides comprehensive descriptions of the rituals and daily living practices associated with each space.

The unpublished MSc thesis is "Ege Bölgesi Rum Ortodoks Kiliseleri" by Erol in 2003 explain in detail about external depiction of Hagios Georgious Church. Thanks to this explaination, the apse, which does not exist today, was modelled and the construction date of the structure was determined.

The Hagios Demetrious Basilica plan of Karl Michel obtained from the article "Gülbahçe Bazilikası ve Vaftizhanesi" by Kalkınoğlu (1990).

Table 4. 3. Data collected from a literature survey (Source: Author 2024)

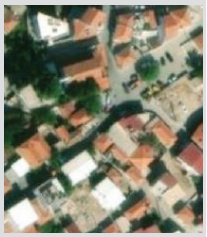
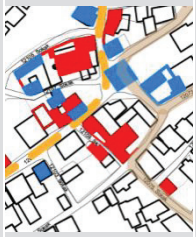
NO	CURRENT LOCATION	MIND MAPPING	STORY	PAGE	SOURCE
1	 (Source: ArcGIS Pro 2024)	 Blue: Lost, Red: Existing, Orange: Urla Main Road, Brown: Secondary Road (Source: Author 2024)	The teacher's accommodation, which included 3-4 rooms, was located to the north-west of the Church of Hagios Georgious courtyard. The official offices were located in the south-west corner, and the boys' school was placed to the south-west. Located at one side of Hagios Georgious Square was the house and grocery of Dimitros Hadjidiamantis, while on the opposite corner was the cheese factory and various coffeehouses.	57	ΑΝΤΩΝΗΣ, Π.Υ. (2010). Ο Γχιουλμπαξες Ερυθραίας. Athena: ΠΡΟΜΗΘΕΥΣ.

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Table 4.3. (cont.)

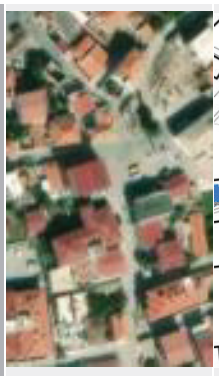
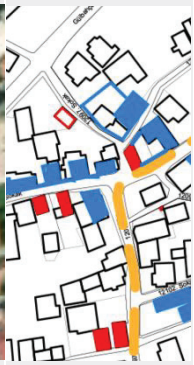
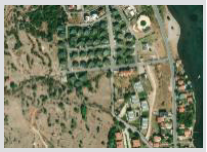
2	 (Source: ArcGIS Pro 2024)	 Blue: Lost, Red: Existing, Orange: Urla Main Road (Source: Author 2024)	The road from Kavakia to Gülbahçe via the main road to Urla, which includes a passage through a region known as Fountain Houses. The road in question goes directly to Bilious Square, which is surrounded by establishments such as coffeehouses, a grocery, and cobbler shops.	53 & 55 & 60	ΑΝΤΩΝΗΣ, Π.Υ. (2010). Ο Γχιουλμπαξες Ερυθραίας. Athena: ΠΡΟΜΗΘΕΥΣ.
3	 (Source: ArcGIS Pro 2024)	 Red: Existing Orange: Urla Main Road (Source: Author 2024)	This neighbourhood, including around 50 houses, is a small settlement referred to as Baxes or Bahtce in various references.	17 & 58-59	ΑΝΤΩΝΗΣ, Π.Υ. (2010). Ο Γχιουλμπαξες Ερυθραίας. Athena: ΠΡΟΜΗΘΕΥΣ.

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Table 4.3. (cont.)

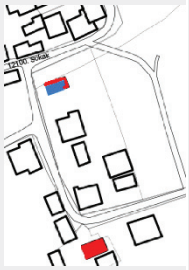
4	 (Source: ArcGIS Pro 2024)	 Blue: Lost Red: Existing (Source: Author 2024)	The Girls' School was one of the two schools in Gülbahçe. The Girls' School was established in the early 1900s in Lower Neighbourhood by Stamatis Vlysidis. The name given to it was Lower School. A French engineer created architectural drawings for schools. All the classes had been grouped into one room, where a teacher was lecturing. The structure included a stockyard enclosed by a tall exterior wall. Pavlidis provides the following definition for the Girls' School: "Residents of Gülbahçe considered brass knob handles to be similar to solid gold. Therefore, this school was influenced to villagers." The school was first built with two levels. It is possible to see the remains of the school, today.	90	ΑΝΤΩΝΗΣ, Π.Υ. (2010). Ο Γχιουλμπαξες Ερυθραίας. Athena: ΠΡΟΜΗΘΕΥΣ.

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Table 4.3. (cont.)

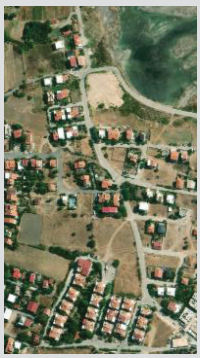
5	 (Source: ArcGIS Pro 2024)	 Blue: Lost Red: Existing (Source: Author 2024)	In 1914, the windmill owned by Stavros Hadjidiamantis and the windmill owned by Pousoula were situated on the highest hill of the the village. These windmills were located in close proximity to the road constructed by the residents, which facilitated convenient transportation to the sea and other mills. The road leads to the chapel of Hagios Panteleimon, which is located on the sea side. The cemetery is located to the south-west of the chapel.	56	ΑΝΤΩΝΗΣ, Π.Υ. (2010). Ο Γχιουλμπαξες Ερυθραίας. Athena: ΠΡΟΜΗΘΕΥΣ.

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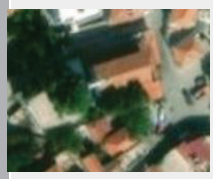
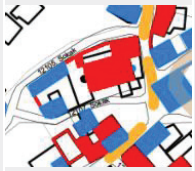
Table 4.3. (cont.)

6	 (Source: ArcGIS Pro 2024)	 Blue: Lost, Red: Existing, Orange: Urla Main Road, Brown: Secondary Road (Source: Author 2024)	A significant alteration made to the church architecture involved the elimination of the apse located to the east, as well as the construction of a neighbouring house. Furthermore, a comprehensive description of the church's interior and exterior was included. The inscription on the triangular pediment, surrounded by mouldings, was still readable on the rectangular entry positioned on the road level in the northeast corner at the time the thesis was written. Consequently, IA and 1844 were inscribed on the left side, whereas XPI and ΜΣΧΡ were inscribed on the right side. In Greek, the initials IA represent the beginning letters of January, while XPI represents the initial letters of Christmas.	35-36	Erol, A.E. (2003). EGE BÖLGESİ RUM ORTODOKS KİLİSELERİ. Unpublished MSc Thesis, Ege University, İzmir.

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These sources were specifically used to authenticate the accuracy of information obtained from oral studies and oral history archives. The identification of lost heritage with a high degree of reliability was achieved due to the convergence of multiple sources. Furthermore, the variety of lost heritage assets increased.

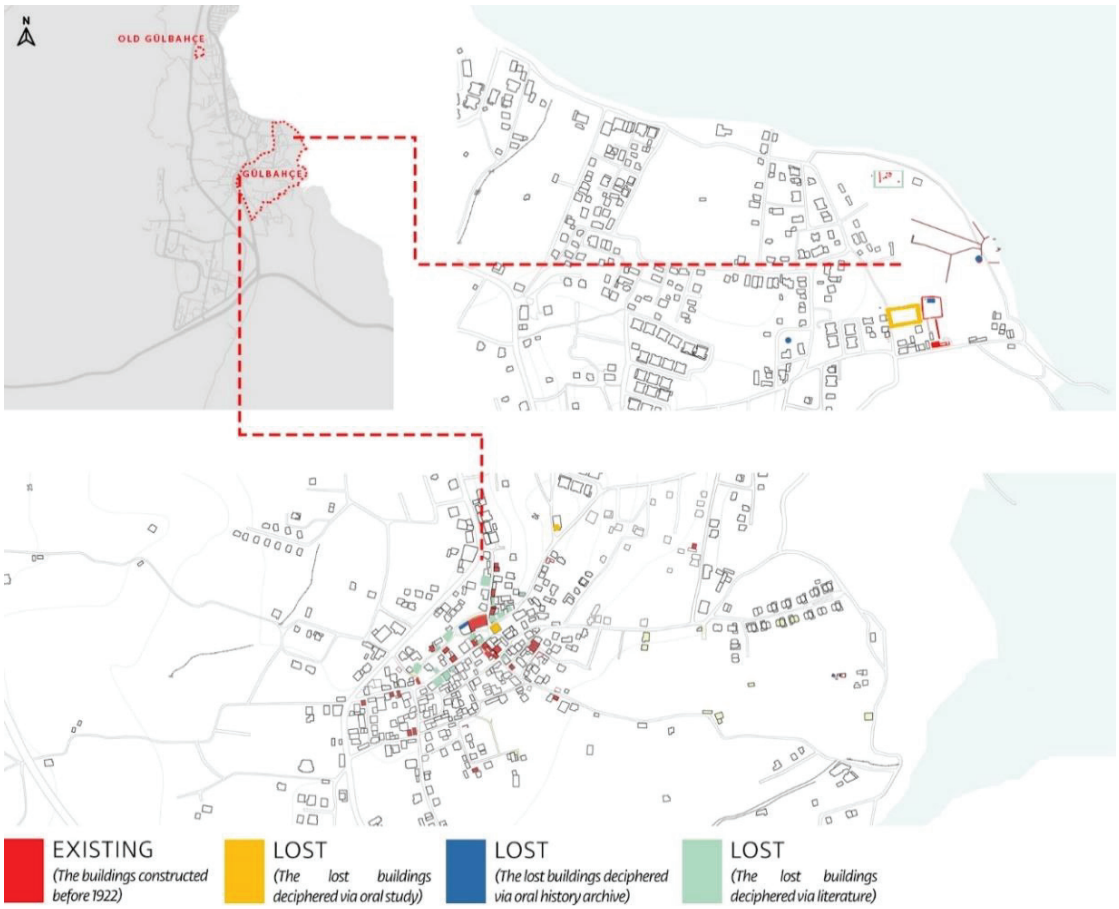


Figure 4. 6. A diagram showing data collected via a site survey, an oral study, an oral history archive and a literature (Source: Author 2024)

A comprehensive digital model of the Hagios Georgious Church, the Chapel of Hagios Panteleimon, The Hagios Demetrious Basilica, was created using data from field research, oral work, the oral history archive, and the literature detailed above.

4.1.1.5. Historical Cartographic Resources

The 1927 Ottoman Map[15] from SALT provides detailed information about the building islands, roads, toponyms, and countour lines. The Ottoman scripts on the map have been transcribed by F. Nurşen Kul.

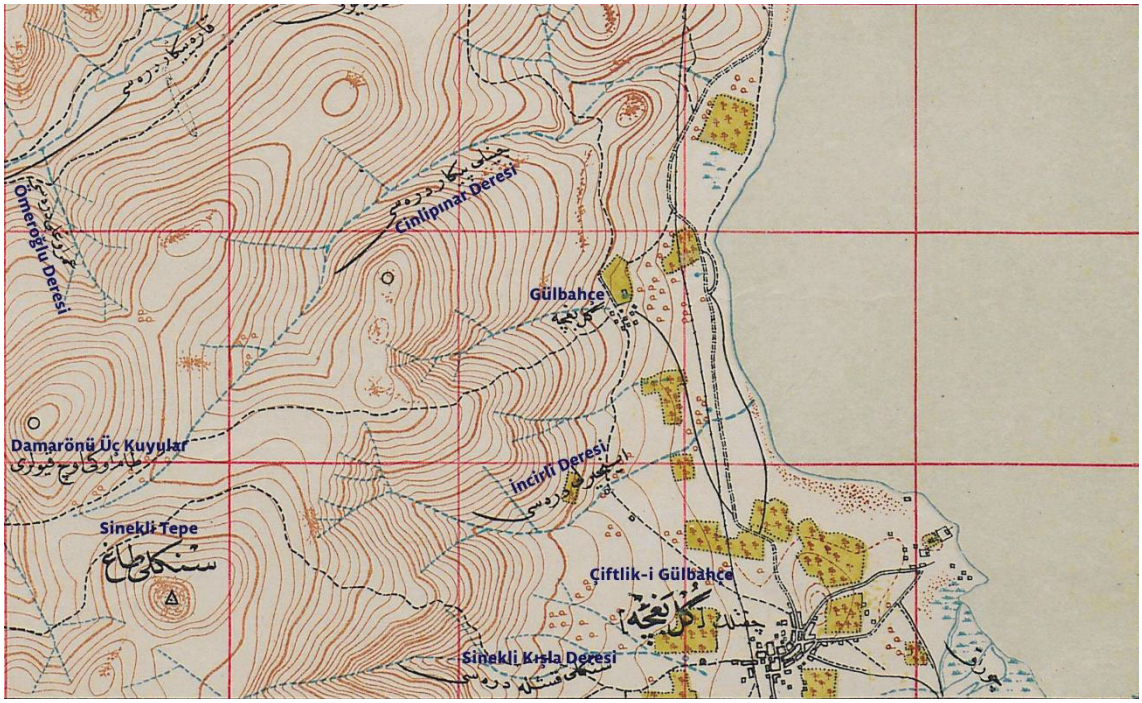


Figure 4. 7. The 1927 Ottoman Map of Gülbahçe has been selectively edited to show a specific area and has been translated into Turkish (Source: SALT Research and Müdaafa-i Milliye Vekaleti Harita Müdüriyet-i Umumiyesi Matbaası 2023b)

1925 Ottoman map is another historical cartographic source utilized in this study. This map was helpful for understanding the the closeby environment of Gülbahçe. In addition to this, the 1892 and 1893 Ottoman Maps[16] were analysed. However, these maps lacked precise information regarding the architectural and settlement characteristics of Gülbahçe. The Ottoman scripts on the maps have been transcribed by Leonidas Moiras

[15] "Gülbahçe, İzmir (1:25000)", SALT Research Archive, the printing press of Müdaafa-i Milliye Vekaleti Harita Müdüriyet-i Umumiyesi.

[16] The Presidency of the Republic of Türkiye directorate of State Archives Ottoman Archives

who is the Ottoman Historian of the HOMEACROSS project. Also, the 1890 Westliches Klein Asien Map by Heinrich Kiepert were analysed. However, these map lacked precise information regarding the architectural and settlement characteristics of Gülbahçe.

Figure 4. 8. The 1890 Westliches Klein Asien Map by Heinrich Kiepert has been selectively edited to show a specific area (Source: SALT Research and Chez Dietrich Reimer Berlin and 2023a)

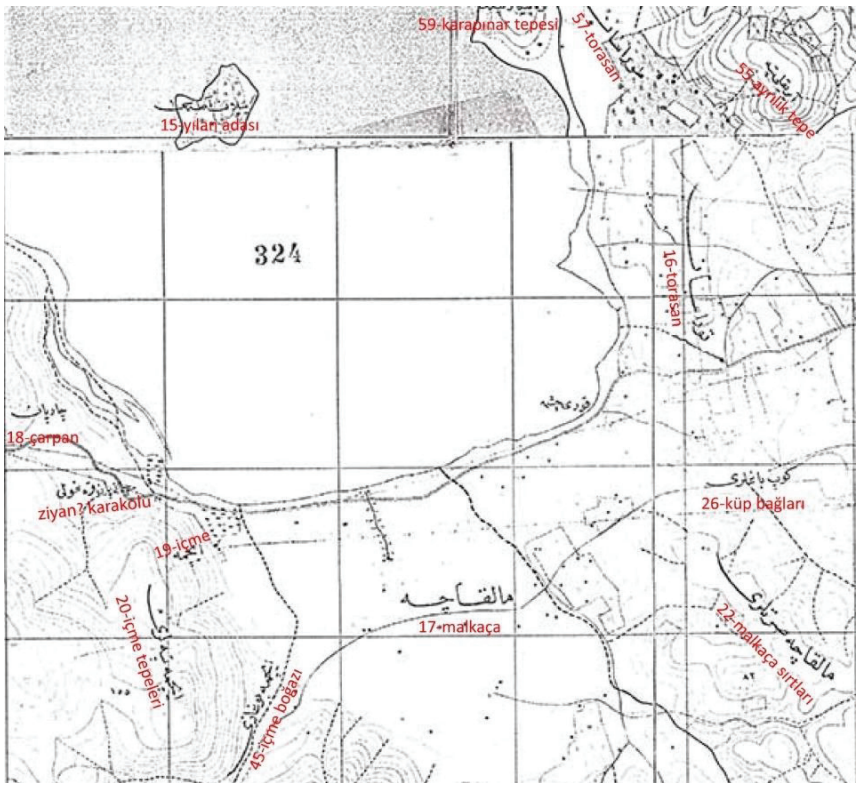
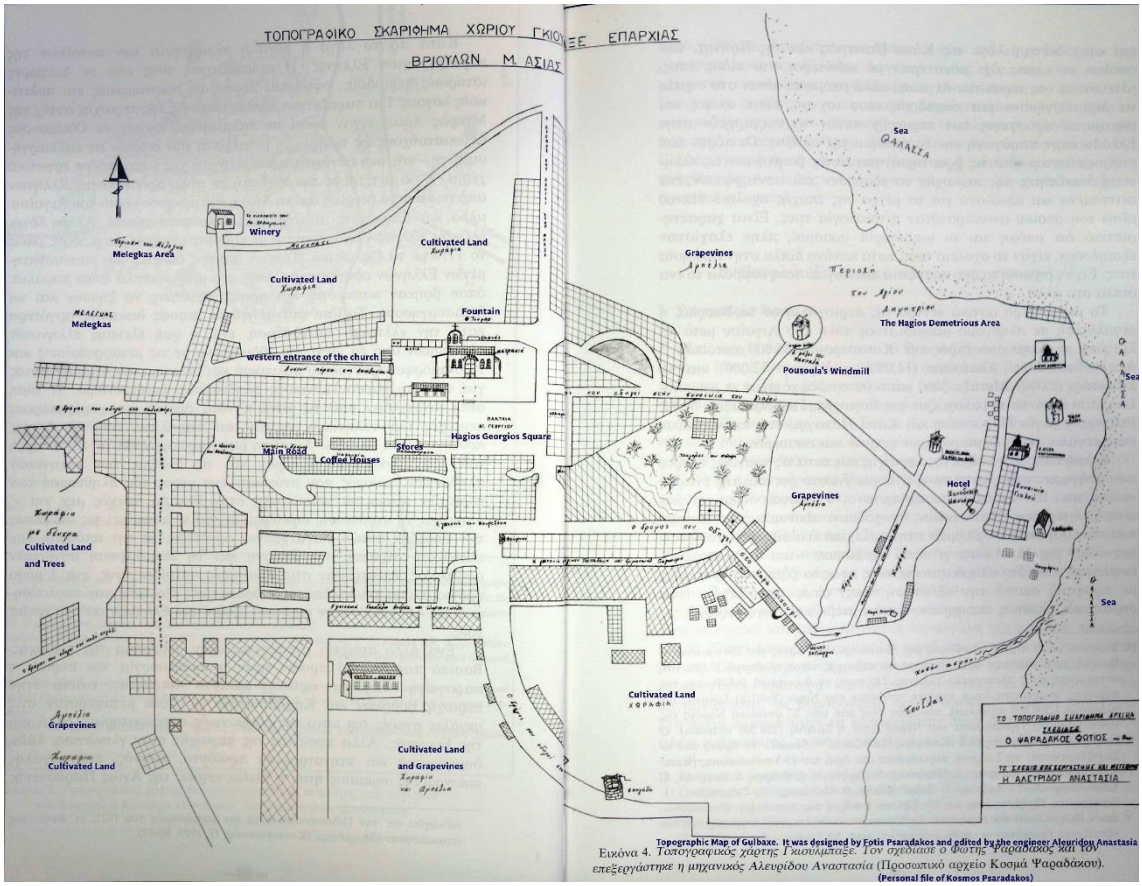


Figure 4. 9. The 1925 Ottoman Map of Gülbahçe has been selectively edited to show a specific area and has been translated into Turkish (Source: Presidency of the Republic of Türkiye directorate of State Archives Ottoman Archives 2023)

The mind map in the book "Ο Γχιουλμπαξες Ερυθραίας" was a unique source to understand the settlement characteristics, the roads, the monumental buildings, the landmarks, and the characteristics of the surrounding cultivated lands of Gülbahçe. The important parts of the book as well as the Greek scripts of this particular map has been translated into English by Kalliopi Amygdalou the principal investigator of the HOMEACROSS project.



Εικόνα 4. *Τοπογραφικός χάρτης Γκιουλμπαξέ. Τον σχεδίασε ο Φώτης Ψαραδάκος και τον επεξεργάστηκε η μηχανικός Αλευρίδου Αναστασία* (Προσωπικό αρχείο Κοσμά Ψαραδάκου).

Figure 4. 10. The Site Plan of Gülbahçe in the 19th Century has been translated into English (Source: ΑΝΤΩΝΗΣ 2010)

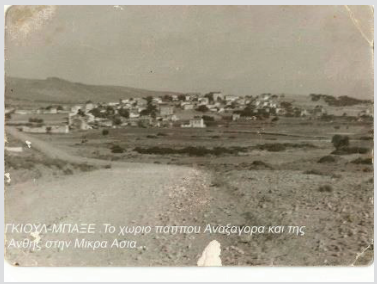
A comprehensive digital model of topography and landscape with roads, cultivated lands, grapevines, and trees has been constructed utilising data obtained from a site survey, an oral study, an oral history archive, the literature, and the historical cartographic resources detailed above.

4.1.1.6. Historical Photographic Resources

The photographic resources include aerial photographs, historical photographs, and a movie that was filmed in Gülbahçe. The aerial photographs of the case study area were taken in 1957, 1965, and 1975. The photographs were obtained from the archives of the General Directorate of Mapping of the Ministry of National Defence. The historical photographs on the aother hand are obtained unpublished theses and publications, a villager's personal archive from 1970, and Google Street View pictures taken in 2019. The photographs captured during the fieldwork conducted for HOMEACROSS in 2021 were also utilized.

The photographic materials obtained from the book "Ο Γχιουλμπαξες Ερυθραίας" and the movie "Adı Vasfiye" directed by Atıf Yılmaz in 1985 have been an invaluable source for understanding the lost heritage of Gülbahçe.

Table 4. 4. Data collected from historical photographs (Source: Author 2024)

NO	LOCATION	PHOTOGRAPH	PHOTOGRAPH DATE	SOURCE
1	 (Source: ArcGIS Pro 2024)		Unknown (between 1922 and 1970)	Çamlıbel, E. [@ercamlibel]. (2019, April 28). "GÜLBAHÇE KÖYÜ 1922 yılı" [Photograph]. Pinterest. https://www.pinterest.com.mx/pin/615867317773284740/

(cont. on next page)

Table 4.4. (cont.)

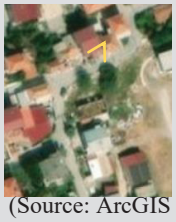
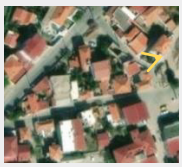
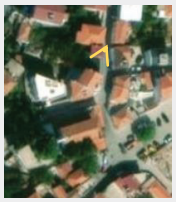
2	 (Source: ArcGIS Pro 2024)		1970	[Photographs of Deniz Yıldız]. (1970). Personal Archives of Deniz Yıldız.
3	 (Source: ArcGIS Pro 2024)		1983	ΑΝΤΩΝΗΣ, Π.Υ. (2010). Ο Γχιουλμπαξες Ερυθραίας. Athena: ΠΡΟΜΗΘΕΥΣ.
4	 (Source: ArcGIS Pro 2024)  (Source: ArcGIS Pro 2024)	 	1992	Λίζα, Μ. (1992). ΑΣΤΥΓΡΑΦΙΑ ΤΗΣ ΕΛΑΣΣΟΝΟΣ ΑΣΙΑΣ. Athena: ΔΡΩΜΕΝΑ.

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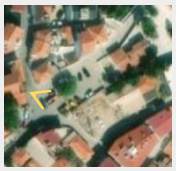
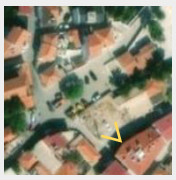
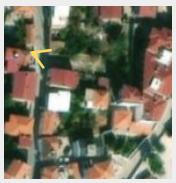
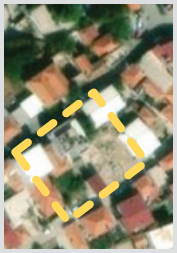
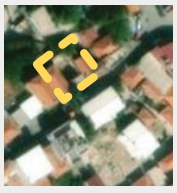
Table 4.4. (cont.)

5	 (Source: ArcGIS Pro 2024)		2021	Amygdalou. K. (2021). HOMEACROSS – Space, memory and the legacy of the 1923 Population Exchange between Greece and Turkey. Athens: European Research Council (Horizon 2020).
	 (Source: ArcGIS Pro 2024)			
	 (Source: ArcGIS Pro 2024)			

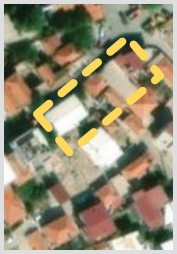
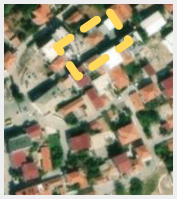
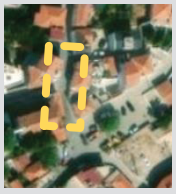
The movie "Adı Vasfiye," directed by Atıf Yılmaz in 1985, features sequences filmed in Gülbahçe that can be watched from 46:06 to 1:02:00 movie time interval. These sequences showcased largely preserved street the layout of 12092nd and 12098th streets, as well as the authenticity of the architectural elements on the buildings' facades. To ascertain this lost cultural heritage, screenshots were captured from the movie.

Table 4. 5. Data collected from historical photographs from the movie "Adı Vasfiye" (Source: Author 2024)

NO	LOCATION	SCREENSHOT	TIME INTERVAL	DATE	SOURCE
1	 (Source: ArcGIS Pro 2024)	  	48:10 - 48:18	1985	Yılmaz, Atıf, dir. *Adı Vasfiye.* 1985; Estet Video Cengiz Ergun.
2	 (Source: ArcGIS Pro 2024)		48:32 - 48:37	1985	Yılmaz, Atıf, dir. *Adı Vasfiye.* 1985; Estet Video Cengiz Ergun.

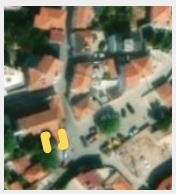
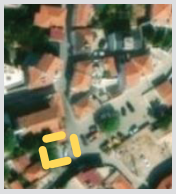
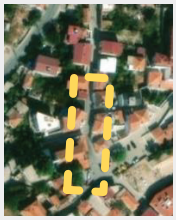
(cont. on next page)

Table 4.5. (cont.)

3	 (Source: ArcGIS Pro, 2024)	 	48:38 - 48:43	1985	Yılmaz, Atıf, dir. *Adı Vasfiye.* 1985; Estet Video Cengiz Ergun.
4	 (Source: ArcGIS Pro, 2024)		50:49 - 51:05	1985	Yılmaz, Atıf, dir. *Adı Vasfiye.* 1985; Estet Video Cengiz Ergun.
5	 (Source: ArcGIS Pro, 2024)		52:56	1985	Yılmaz, Atıf, dir. *Adı Vasfiye.* 1985; Estet Video Cengiz Ergun.

(cont. on next page)

Table 4.5. (cont.)

6	 (Source: ArcGIS Pro 2024)		52:57 - 53:01	1985	Yılmaz, Atıf, dir. *Adı Vasfiye.* 1985; Estet Video Cengiz Ergun.
7	 (Source: ArcGIS Pro 2024)		53:14	1985	Yılmaz, Atıf, dir. *Adı Vasfiye.* 1985; Estet Video Cengiz Ergun.
8	 (Source: ArcGIS Pro 2024)		53:15 - 53:23	1985	Yılmaz, Atıf, dir. *Adı Vasfiye.* 1985; Estet Video Cengiz Ergun.

A comprehensive digital model of the Girls' School, rooms under the Hagios Georgious Church, and houses, particularly those located at the 12092nd and 12098th, was reconstructed using data from field research, oral work, the oral history archive, the

literature, the historical cartographic resources, and the historical photographic resources detailed above.

Figure 4. 11. A comparative study is used to create a sketch displaying the settlement pattern and lost heritage assets in 19th century Gülbahçe (Source: Author 2023)

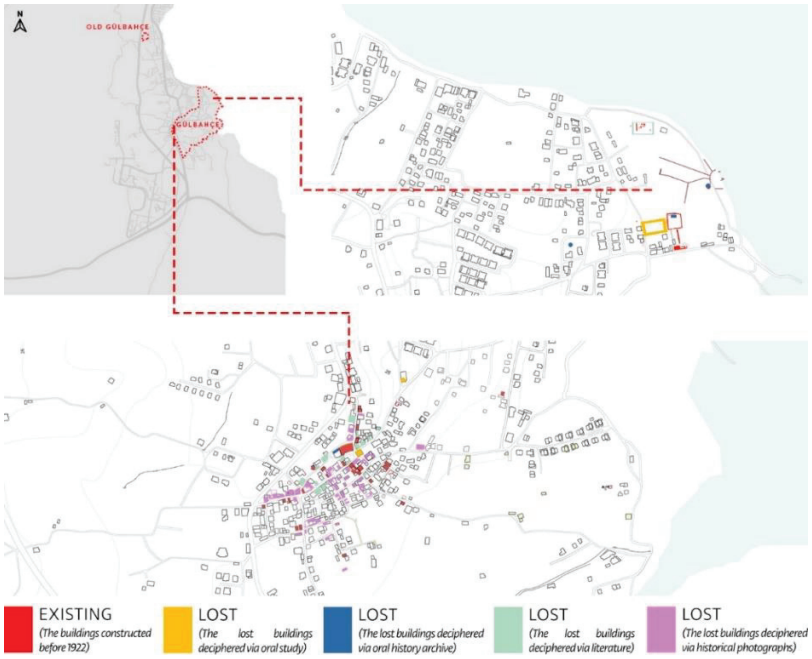


Figure 4. 12. A diagram showing data collected via a site survey, an oral study, an oral history archive, a literature and historical photographic resources (Source: Author 2024)

4.1.2. 3D Digital Modelling

Once the data from the 19th century Gülbahçe settlement was collected and arranged, professionals specialising in 3D digital modelling were consulted to determine the most suitable modelling software. Based on interviews conducted with the members of the modelling team of The Construction of a New City: Ankara 1923–1933[17]; Serkan Örnek who works on the 3D modelling team of Teos Excavations; and Serkan Günay who has recently finished his ph.D[18] in Oxford Brookes on image based modelling of lost architectural heritage, the author concluded that Archicad-Graphisoft was the best appropriate software for this thesis. Following the 3D modelling software decision stage, data was gathered regarding different software options for determining the appropriate tool for this method. The base 2D drawings necessary for constructing the 3D model were generated using the AutoCAD 2024 software. The visuals' perspective views were edited using Adobe Photoshop CS6. Archicad 27 served as the 3D modelling programme, while LumionPro 2023 was used for rendering.

The modelling process comprises two phases. The first is the modelling of the landscape. Prior to commencing the modelling process, a significant amount of information was collected in order to improve the reliability of the model. This process entailed superimposing data from the 2D contour lines from both the current time and the cartographic resource such as SALT Research Archive (1927), which were combined and generated using AutoCAD 2024. The drawn contour lines represent an elevation of 1 meter.

[17] The Yenişehir region was urbanistically and architecturally modelled in 1933 for the exhibition "The Construction of a New City: Ankara 1923–1933," organised by VEKAM as part of the 50th anniversary celebration of the creation of the Vehbi Koç Foundation. Ali Cengizkan and Müge Cengizkan curated the exhibition. This study concentrates on the first ten years of Ankara's establishment as the capital, specifically in the Yenişehir district, and the growth of a new urban center from the declaration of the Republic until 1933 (For comprehensive information, see to https://mugecengizkan.blogspot.com/2018/05/arastrma-ankara-1923-1933.html?m=1&s=35) (Koç University 2024).

[18] The aim of the PhD thesis, titled "HERITAGE OF THE 'OTHER' THE FUTURE OF LOST ARCHITECTURAL HERITAGE", is to examine and assess how the visual representation of lost heritage influences the notion of identity associated with one's current place of residence and place of origin (Günay 2022).

Figure 4. 13. A cropped map from the SALT Research Archive (1927) is utilised to identify contour lines (Source: SALT Research and Müdaafa-i Milliye Vekaleti Harita Müdüriyet-i Umumiyesi Matbaası 2023b)

In order to create a digital 3D model of the landscape, the contour lines previously drawn in AutoCAD were exported to Archicad 27. Subsequently, the landscape was created in three dimensions using Archicad 27.

The same processes were used to model roads and blocks, and this process was repeated for each of them.

The second phases of the modelling involves the construction of the buildings. To improve the reliability of the model, the sources detailed in Chapter 4.1.1. are used. Afterwards, the site plan was drawn using AutoCAD 2024, and then it was exported to Archicad 27 to create a digital 3D model of the buildings.

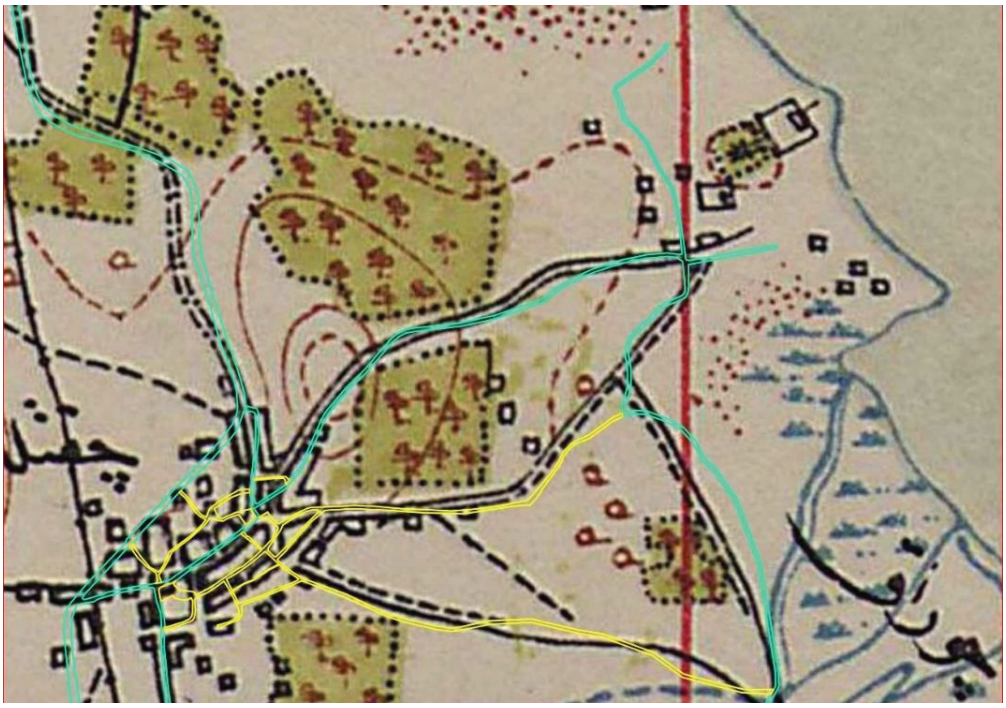


Figure 4. 14. A cropped map from the SALT Research Archive (1927) is utilised to identify roads and city blocks (SALT Research and Müdaafa-i Milliye Vekaleti Harita Müdüriyet-i Umumiyesi Matbaası 2023b)

Figure 4. 15. An aerial photograph taken in 1975 is utilised to identify lost heritage assets (Source: Author 2023)

However, this exported data serves solely as a foundation for generating detailed three-dimensional mass model parameters using wall and roof features in Archicad 27. The height of the buildings was determined by referencing images acquired during the site survey. The height of the building was obtained by computing the ratio between the known dimensions of an architectural element in the photograph and the overall height of the structure. This method has only been used to digitally reconstruct existing buildings that have undergone minimal intervention.

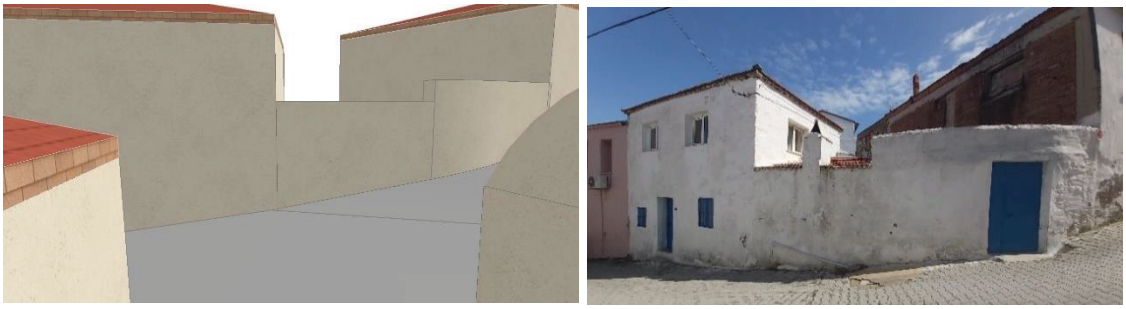


Figure 4. 16. An example of the vertical dimensions of digitally reconstructed structures obtained using photographs acquired during the site survey (Source: Author 2023)

Figure 4. 17. An example of the measurement and scaling of digitally reconstructed buildings and their architectural elements using photographs obtained during the site survey (Source: Author 2024)

The data regarding the lost heritage assets in the site plan was acquired from historical maps and aerial photographs. The architectural characteristics of the lost structures are determined through correlation of primarily historical visual sources as well as oral sources.

Figure 4. 18. An example of digitally reconstructed buildings and their architectural elements on 12098 Street, utilising screenshot from the movie "Adı Vasfiye" (Source: Yılmaz 1985; Author 2024)

4.2. Determination of the Reliability Degrees

The loss of and ruined condition of some of the remaining buildings and limited photographic and cartographic data on the original condition of the buildings and ruins required assumptions on the 3D model. According to Knowles, it is crucial to assess the reliability and accuracy of the data source in this situation (Knowles 2018; cited in Günay 2022). Because it has the potential to raise questions about the reliability of the digital model produced. Given that no existing evidence exists that the accuracy of the created digital model can be verified, it is crucial to identify and prominently present the reference sources used to generate the model during the presentation. During the final phase of data visualization, it is necessary to systematise the criteria that establish reliability before adjusting the method according to the degree of reliability.

Information on mass and façade layout are two different evaluation criteria that determine the degree of reliability in the context of lost heritage. The information assessed in the mass reliability degree table pertains to the mass's location and dimensions. Based on these criteria, two different tables were generated to assess the degree of reliability. The tables have been graded to ensure that the visual representation of the final product, resulting from the visualization of the information included in the tables, is comprehensible to all observers. As a result of utilising both tables[19], a consistent representation was achieved, resulting in a clear and concise presentation.

In the data collection phase, the sources that were described in detail were grouped together for the reliability table of the mass characteristics of lost heritage objects. When forming this grouping, to considered the inclusion of dependable sources, such as archival visuals and prior study, as they enhance the reliability of the final product (Pietroni and Ferdani 2021; cited in Günay 2022). As the majority of visuals are objective sources. The impartiality of the sources utilised in the digitization of lost architectural heritage is a crucial condition (Günay 2022). The absence of lost architectural history is inherent, which might lead to discussions that are susceptible to manipulation. In considering this

[19] Tables of the reliability degree of mass, tables of the reliability degree of façade, and site plan along with their respective IDs number in the appendices.

situation, a hierarchy of source objectivity is presented below, in descending order of importance:

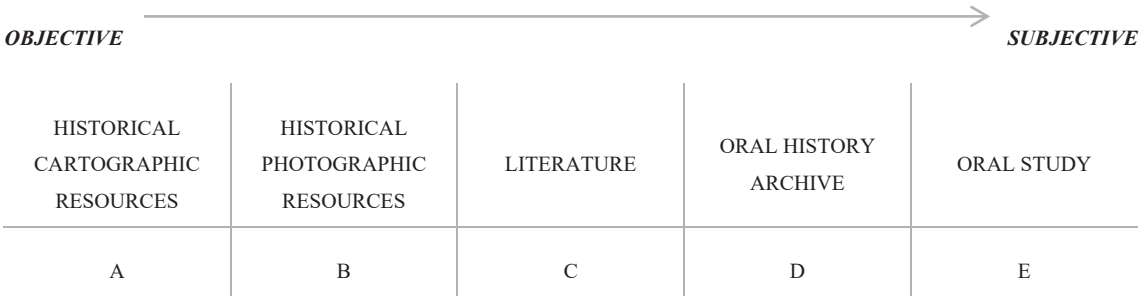


Figure 4. 19. A diagram illustrating the hierarchical arrangement of objectivity of sources (Source: Author 2024)

Another crucial factor determining the reliability of the lost architectural heritage is the ability to support the information collected from several sources. Historical photographs and maps may not provide comprehensive information about a lost structure. When faced with such a situation, it is crucial to have cross-references. Therefore, despite its high objectivity, it is necessary for it to have additional sources (Günay 2022).

Based on the above criteria, three distinct degrees of reliability were established depending on the sources. To ensure a mass has a high degree of reliability, it must obtain information from sources in group A. For a moderate degree of reliability, information from at least one source in group B or C is required. If there is no information available from sources in groups A, B, or C, the degree of reliability is low.

RELIABILITY DEGREE OF MASS	SOURCES
HIGH (M_H)	***A,*** B,C,D,E
MODERATE (M_M)	***B or C,*** D,E
LOW (M_L)	D,E

Figure 4. 20. Reliability Degree of Mass related to source (Author 2024)

Table 4. 6. The Reliability Degree of Mass (Source: Author 2024) [20]

ID	Historical Cartographic Resources		Historical Photographic Resources							Literature		Oral History Archive		Oral Study	Reliability Degree of Mass
	1927 Ottoman Map	ΑΝΤΩΝΗΣ, Π.Υ.	n.d. Çamlıbel, E.	1970 Yıldız, D.	1975 Aerial Photograph	1985 Adı Vasfiye	ΑΝΤΩΝΗΣ, Π.Υ.	Λίζα, M.	Home across	ΑΝΤΩΝΗΣ, Π.Υ.	Unpublished Theses	CAMS	Home across		
1						X				X				X	**M_M**
8					X					X				X	**M_M**
9											X				**M_M**
17					X					X					**M_M**
22												X			**M_L**
23									X						**M_M**
26		X								X		X			**M_H**
27		X								X		X			**M_H**
28					X					X		X		X	**M_M**
29												X		X	**M_L**

[20] A table of the Reliability Degree of Mass is in the appendices.

Once the location and dimensions of each lost heritage mass were established, decisions were made regarding the degree of reliability of the façade layout of the lost heritage. Prior to requiring the reliability of the façade, it was necessary to evaluate the degree of reliability of the mass. In the absence of precise information on the exact location and dimensions of a structure, it is not feasible to arrive at a precise and accurate conclusion regarding the façade layout of the structure. Consequently, based on this requirement, the degree of reliability of a façade layout is either equal to or less than the reliability level of its structure.

Based on the above criteria, three distinct degrees of reliability were established depending on the reliability degree of mass. To ensure a façade has a high degree of reliability, its mass should has a high degree of reliability. For a moderate degree of reliability, value from high or moderate reliability degree of mass is required. If its mass has a low degree of reliability, reliability degree of the façade could not be high or moderate.

Assessing the reliability of the façade does not require supporting the information obtained from historical cartographic sources. Historical cartographic resources lack information or drawings of the façades of the structures. Due to this, historical cartographic resources have been excluded from the sources at the reliability degree of façade table, unlike the reliability degree of the mass table.

RELIABILITY DEGREE OF FAÇADE	RELIABILITY DEGREE OF MASS	SOURCES
HIGH (H)	M_H	***B,*** C,D,E
MODERATE (M)	M_H or M_M	***B or C,*** D,E
LOW (L)	M_H or M_M or M_L	D,E

Figure 4. 21. Reliability Degree of Façade related to source and relability degree of mass (Author 2024)

Table 4. 7. The Reliability Degree of Façade (Source: Author 2024) [21]

ID	Reliability Degree of Mass	Historical Photographic Resources						Literature		Oral History Archive		Oral Study	Reliability Degree of Façade
		n.d. Çamlıbel, E.	1970 Yıldız, D.	1985 Adı Vasfiye	ΑΝΤΩΝΗΣ, Π.Υ.	Λίζα, M.	Home across	ΑΝΤΩΝΗΣ, Π.Υ.	Unpublished Theses	CAMS	Home across		
1	M_M							X					**M**
8	M_M		X					X				X	**M**
9	M_M								X				**M**
17	M_M												**M**
22	M_L							X				X	**L**
23	M_M						X						**M**
26	M_H						X						**M**
27	M_H							X		X			**M**
28	M_M	X						X		X		X	**M**
29	M_L												**L**

[21] A table of the Reliability Degree of Façade and Key Map For Tables Of Reliability Degree are in the appendices.

By analysing the condition of the existing buildings, the visual documents, and the narratives regarding their original state, it is possible to reliably determine the original condition of these buildings. Therefore, the thorough examination of the reliability of the existing buildings is not conducted.

4.3. Data Visualization

The LumionPro12.5 software was preferred for the visualisation and animation of digital reconstruction of 19th century Gülbahçe. It simplifies up the process of architectural visualization and provides a free student licence for the author to utilise. Furthermore, it possesses the capability to operate in real-time with Archicad-Graphisoft.

Lumion software operates by identifying the colour or texture of each surface of the 3D digital model and adapting the visualization settings accordingly. The visualization parameters assigned to one surface with a desired feature will be automatically applied to additional surfaces with the same feature, eliminating the need for manual adjustment. Prior to exporting the 3D digital model to Lumion software, the surfaces of the model that are desired to have the same feature should be set in the 3D modelling software so that each of them has the same colour or texture and is different from the other surfaces.

At this phase, two different visualization methods were utilised. The first method is to represent both the lost and existing buildings using the same visualization parameters. The objective of this method is to comprehensively examine the overall settlement pattern in Gülbahçe during the 19th century.

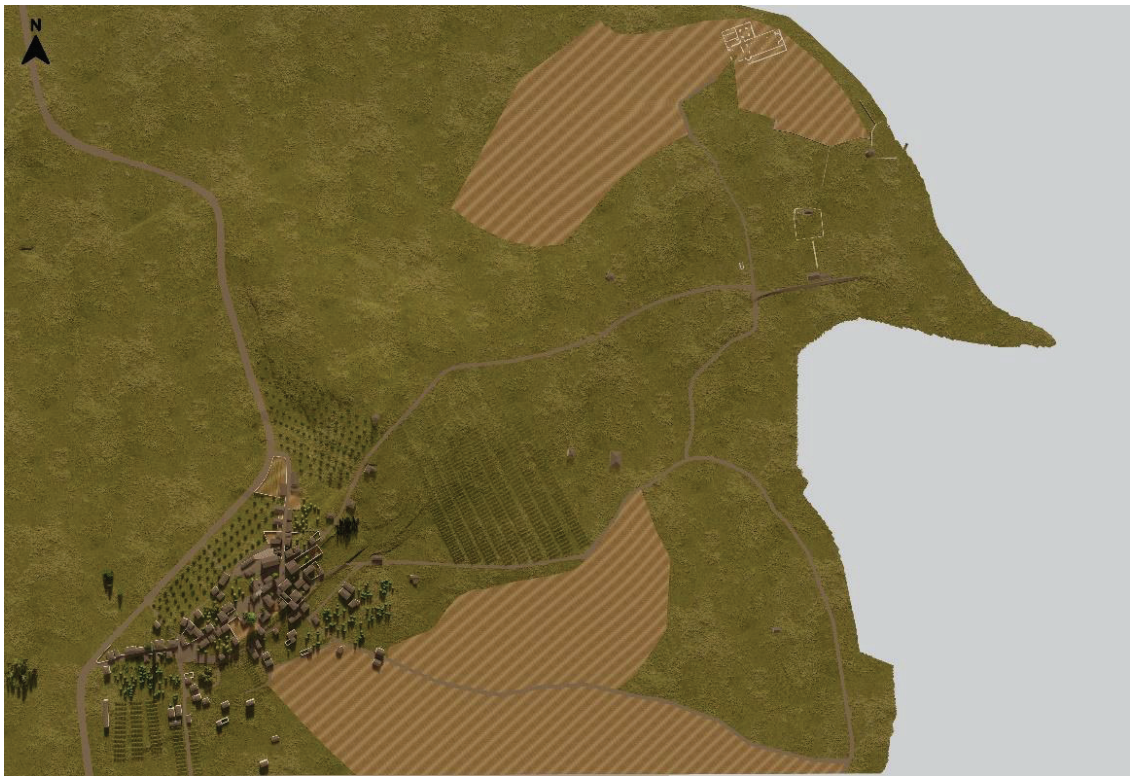


Figure 4. 22. Top View of the Digital Reconstruction of 19th Century Gülbahçe (Source: Author 2024)

Figure 4. 23. Viewpoint of the Ruins of the Hagios Demetrius Basilica and Baptistery, styled by the first visualisation method (Source: Author 2024)

Figure 4. 24. Viewpoint from Hagios Panteleimon Chapel to Gülbahçe, styled by the first visualization method (Source: Author 2024)

Figure 4. 25. Top View of the Digital Reconstruction of 19th Century Gülbahçe (Source: Author 2024)

Figure 4. 26. The first visualisation method styles the view of the Girls' School in 19th century Gülbahçe (Source: Author 2024)

Figure 4. 27. A viewpoint from the east of windmill owned by Pousoula to Hagios Georgios Square, styled by the first visualization method (Source: Author 2024)

Figure 4. 28. Viewpoints from Urla main road to Hagios Georgios Square, styled by the first visualization method (Source: Author 2024)

Figure 4. 29. Partial view of the Hagios Georgios Church and Dimitros Hadjidiamanti's residence and grocery store in the Hagios Georgios Square (Source: Author 2024)

a

b

Figure 4. 30.a. View of Hagios Georgios Square from the entrance of the Hagios Georgios Church of courtyard, b. View of Hagios Georgios Square from coffehouses at the Urla main road (Source (a): Author 2024, Source (b): Author, 2024)

The second method differs in its visualization parameters according to the degree of reliability of the lost heritage. The objective of this method is to demonstrate that not all reconstructed lost heritage exhibits the same degree of reliability and that the information contained within each reconstruction varies in terms of accuracy. Both the

lost heritage and the existing heritage were modelled using the same modelling method. To differentiate between the two, the lost heritage objects were coloured. When selecting the colour, it was crucial to choose a hue that would prevent the texture of the buildings and architectural elements from fading into the background. Then, the structures that had their colors changed were tested for their transparency to see how much heritage was lost and how reliable the structures were. The transparency rating is 0 when the degree of reliability is high, 0.2 when it is moderate, and 0.6 when it is low. The transparency hierarchy in these images results in a gradual decline in the reliability of the reconstructed lost structures, resulting in a more transparent image.

It is necessary to make certain modifications in the Archicad 27 programme prior to using Lumion12.5 software for rendering the 19th century Gülbahçe 3D digital model created in Archicad 27. To adjust the transparency of the lost heritage based on its degree of reliability, the surfaces with equivalent visual properties in the 3D modelling software are organised together using the same colour. The LumionLiveSyncForArchiCAD_3.60.919 plugin was installed in Archicad in order to import the Gülbahçe 19th century Archicad model into Lumion12.5. This Archicad plugin enables real-time execution of the Archicad model and facilitates its export as a Collada (.DAE) file, which can then be imported into Lumion. The .pln file, which had its colours modified for the renderings of the 19th century Gülbahçe 3D digital model created in Archicad 27, was converted to a .dae file using this plugin. The visualization phase was afterwards carried out in Lumion, adhering to the above visualisation parameters.

Figure 4. 31. The reliability degree approach offers a view of Hagios Georgios Square from the entrance of the Hagios Georgios Church courtyard (Source: Author 2024)

Figure 4. 32. The reliability degree approach offers a view of Hagios Georgios Square from coffehouses at the Urla main road (Source: Author 2024)

Figure 4. 33. The reliability degree approach offers a view of coffeehouses on Urla main road (Source: Author 2024)

Figure 4. 34. The reliability degree approach offers a viewpoint from the east of windmill owned by Pousoula to Hagios Georgios Square, styled by the first visualization method (Source: Author 2024)

Figure 4. 35. The reliability degree approach offers a partial view of the Hagios Georgios Church and Dimitros Hadjidiamanti's residence and grocery store in the Hagios Georgios Square (Source: Author 2024)

Figure 4. 36. The reliability degree approach offers a view of Urla Main Road (Source: Author 2024)

Figure 4. 37. The comparative approach provides a view of 12098 Street in terms of reliability degree (Source: Author 2024; HOMEACROSS 2021)

Figure 4. 38. The comparative approach provides a view of 12098 Street in terms of reliability degree (Source: Author 2024; Yılmaz 1985)

Figure 4. 39. The comparative approach provides a view of 12092 Street in terms of reliability degree (Source: Author 2024; HOMEACROSS 2021)

Figure 4. 40. The comparative approach provides a view of 12092 Street in terms of reliability degree (Source: Author 2024; Λίζα 1992)

Figure 4. 41. The comparative approach provides a viewpoint of Gülbahçe in terms of reliability degree (Source: Author 2024; Çamlıbel 2019)

Figure 4. 42. The reliability degree approach offers a view of Biliou Square (Source: Author 2024)

Figure 4. 43. The reliability degree approach offers a view of coffeehouses square on Urla main road (Source: Author 2024)

CHAPTER 5

CONCLUSION

This thesis achieved to digitally reconstruct the 19th century Gülbahçe, which has largely lost its characteristics, allowing an immersive experience that is no longer accessible in physical form. This digital reconstruction model showcases an effective method for presenting lost heritage by integrating many types of data, such as historical cartographic and visual sources, oral studies and oral history archives, literature and site survey.

A thorough literature review of digital modelling methods and their outcomes was conducted, and advice was sought from experts to choose the appropriate method for the Gülbahçe case. The 19th century Gülbahçe was reconstructed using digital tools and the geometry-based modelling method. The geometry-based modelling requires the collection of highly reliable and detailed information about the buildings' architectural characteristics. Geometry-based modelling is selected since it enables the reconstruction of lost structures by utilising data from various sources. In Gülbahçe, significant percentages of structures have either completely disappeared or undergone major interventions. Given the high rate of loss in the case study area, as well as the lack of resolution and number of photographs to model the original condition of the buildings, it is not possible to provide a complete model of the site using only IBM and RBM methods. However, the initial goal involved employing image-based and range-based techniques, then integrating this data into a virtual environment to reconstruct the lost heritage and its surrounding landscape through geometry-based methods. Different modelling techniques in such a hybrid model enable easy differentiation between existing and lost buildings. However, the buildings that remain from the 19th century have experienced significant alterations. Although alternative methods like IBM and RBM are capable of modelling current structures, they are not appropriate for 19th century structures that are undergoing major alterations. As a result, the visuals acquired using the IBM or RBM methods will not provide precise insights into the architectural characteristics of the 19th century settlement characteristics. Important visual data for image-based and range-based

modelling was unavailable during the digital modelling phase, leading to the use of the same method to model both existing cultural assets and lost heritage elements. The difference between lost and existing heritage was established during the rendering phase rather than the modelling phase. Additionally, while the CGA method appears appropriate for the thesis's case study, it fails to fulfil the requirement of manually editing scene components. Furthermore, research on the CGA method's ability to automatically generate complex and repetitive geometric shapes while integrating information from literature reviews is lacking. Additionally, geometry-based modelling provides a flexible method that easily processes any contemporary information about the case study and its scale. Given all of these reasons, the geometry-based modelling method is the most appropriate for this thesis.

The geometry-based modelling requires the collection of highly reliable and detailed information about the buildings' architectural characteristics. To collect the required data, all the literature sources and archives in Turkey and Greece were searched. One of the most significant contributions of this research is the collection of all Ottoman, Turkish, and Greek bibliographic and archival materials related to Gülbahçe. The model was prepared with the help of this valuable big data. However, if any new information is obtained, it is easy to transfer this data to the model.

Without sufficient documentation through digital reconstructions, heritages that have been lost may risk being completely forgotten, as they are not given priority in conservation efforts (Günay 2022). It is not possible to present the 19th century Gübahçe in its physical form because reconstruction of lost buildings is scientifically and practically incorrect and impossible since the reliability regarding the original conditions of the lost buildings is controversial and new buildings are already constructed in the place of lost heritage buildings. Therefore, the 19th century Gülbahçe was reconstructed using digital tools and the geometry-based modelling method. The 3D model offers an extensive understanding of the built and cultivated environment, enabling an immersive encounter with lost cultural heritage that is physically unreachable. The final model presents the 19th century characteristics of Gülbahçe. Collecting information about this lost heritage helped foster intercultural understanding. It is significant for documenting the lost heritage that relates to the families of populations that no longer live in that area. Simultaneously, this study is also of significant importance in terms of creating a common public knowledge of the final product reached in the presence of information from two different cultural and social memories.

In addition, by presenting the images and videos created within the scope of this thesis, it is possible to determine the similarities and differences between the images in their memories and the experiences of Gülbahçe residents, especially those interviewed within the scope of the oral study. For example, survey groups would classify the visuals according to their degree of reliability and evaluate the ease of understanding of the proposed method. According to the results of this survey, the success rate of this method would be tested, and a scientific contribution would be made. Moreover, this settlement, which has been ingrained in the collective memory of many societies, can be gamified in a virtual environment through an interdisciplinary approach that incorporates modelling. This gamification allows for the evaluation of the reliability of the information presented in the visuals and videos based on comments gathered from various study groups, including those of diverse ages, cultures, and educational attainment. Also thanks to, this approach will facilitate global digital accessibility, allowing for the observation of diverse societies' perceptions of space and settlement. Additionally, participants can experience the created videos on-site at an information stand near relevant structures and areas by using a QR code. Moreover, participants can enhance their virtual experience by utilising more advanced mobile digital technologies like VR and AR.

The thesis proposes a method that, like other digital 3D models, is highly compatible with newly developed digital technologies like virtual reality (VR) and augmented reality (AR). Thanks to this compatibility, the final product has a positive impact on the perception of lost heritage, as determined by the reliability degree of the proposed method. This is because presenting reliability ratings based on objective data together with the final product largely removes question marks about the digital reconstruction of controversial lost heritage during the presentation. Consequently, this method will provide a scientific contribution to the ongoing discussions on the ethical aspects of heritage visualisation. Utilizing advanced techniques to present lost cultural assets will allow future scholars to improve their depictions' reliability and authenticity.

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APPENDIX A

LETTERS OF APPROVAL

EK

İzmir İli, 38. Grup (Çeşme, Urla, Güzelbahçe ve Seferihisar İlçeleri) Doğal Sit Alanı, Bakanlık Makamının 27.04.2018 tarihli ve 76074 sayılı OLUR'u ile "Doğal Sit-Nitelikli Doğal Koruma Alanı" ve "Doğal Sit-Sürdürülebilir Koruma ve Kontrollü Kullanım Alanı" olarak tescil edilmiştir.

27 Ekim 2017 tarihli ve 30223 sayılı Resmi Gazete'de yayımlanan "Korunan Alanların Tespit, Tescil ve Onayına İlişkin Usul ve Esaslara Dair Yönetmelikte Değişiklik Yapılmasına Dair Yönetmelik"in 3. Maddesinin (j) bendinde yer alan "Anıt ağaçlar hariç, tabiat varlıklarının ve doğal sit alanlarının tescil kararları Resmi Gazete'de yayımlanır ve Bakanlığın internet sayfasında bir ay süre ile duyurulur." hükmü gereği ekteki haritada belirtilen doğal sit alanının tescili tebliğ olunur.

Alana ait koordinat ve parsel bilgileri www.says.gov.tr adresinde mevcuttur.

İli : İzmir

İlçesi-mahallesi: Çeşme, Urla, Güzelbahçe ve Seferihisar İlçeleri

Mevkii : 38. Grup Doğal Sit Alanı

NİTELİKLİ DOĞAL KORUMA ALANI
SÜRDÜRÜLEBİLİR KORUMA VE KONTROLLÜ KULLANIM ALANI

Figure A. 1. The letter of approval for Decree Number 76074, which was dated on April 27, 2018 (Source: 38. BÖLGE DOĞAL SİT TESCİLİ 2018)

Figure A. 2. Areas within the scope of the decision of the Izmir Metropolitan Municipality Council dated 17.03.2022 and numbered 05.343 (İzmir Büyükşehir Belediyesi İmar ve Şehircilik Dairesi Başkanlığı Koruma Alanları Şube Müdürlüğü 2022)

APPENDIX B

TABLES OF THE RELIABILITY DEGREE OF MASS

Table B. 1. The Reliability Degree of Mass (Source: Author 2024)

ID	Historical Cartographic Resources		Historical Photographic Resources							Literature		Oral History Archive		Oral Study	Reliability Degree of Mass
	1927 Ottoman Map	ΑΝΤΩΝΗΣ, Π.Υ.	n.d. Çamlıbel, E.	1970 Yıldız, D.	1975 Aerial Photograph	1985 Adı Vasfiye	ΑΝΤΩΝΗΣ, Π.Υ.	Λίζα, M.	Home across	ΑΝΤΩΝΗΣ, Π.Υ.	Unpublished Theses	CAMS	Home across		
1						X				X				X	**M_M**
2					X	X				X				X	**M_M**
3						X				X				X	**M_M**
4					X	X				X				X	**M_M**
5					X	X				X				X	**M_M**
6					X	X				X				X	**M_M**
7						X				X				X	**M_M**
8					X					X				X	**M_M**
9		X									X			X	**M_M**
10		X			X					X				X	**M_H**

(cont. on next page)

Table B.1. (cont.)

ID	Historical Cartographic Resources		Historical Photographic Resources							Literature		Oral History Archive		Oral Study	Reliability Degree of Mass
	1927 Ottoman Map	ΑΝΤΩΝΗΣ, Π.Υ.	n.d. Çamlıbel, E.	1970 Yıldız, D.	1975 Aerial Photograph	1985 Adı Vasfiye	ΑΝΤΩΝΗΣ, Π.Υ.	Λίζα, Μ.	Home across	ΑΝΤΩΝΗΣ, Π.Υ.	Unpublished Theses	CAMS	Home across		
11					X					X				X	**M_M**
12					X					X				X	**M_M**
13					X					X				X	**M_M**
14					X					X				X	**M_M**
15					X					X				X	**M_M**
16					X					X				X	**M_M**
17					X					X					**M_M**
18					X										**M_M**
19					X					X		X	X	X	**M_M**
20					X					X		X		X	**M_M**

(cont. on next page)

Table B.1. (cont.)

ID	Historical Cartographic Resources		Historical Photographic Resources							Literature		Oral History Archive		Oral Study	Reliability Degree of Mass
	1927 Ottoman Map	ΑΝΤΩΝΗΣ, Π.Υ.	n.d. Çamlıbel, E.	1970 Yıldız, D.	1975 Aerial Photograph	1985 Adı Vasfiye	ΑΝΤΩΝΗΣ, Π.Υ.	Λίζα, M.	Home across	ΑΝΤΩΝΗΣ, Π.Υ.	Unpublished Theses	CAMS	Home across		
21					X					X		X	X	X	**M_M**
22									X						**M_L**
23					X					X		X			**M_M**
24									X						**M_M**
25		X								X		X			**M_H**
26		X								X		X			**M_H**
27		X								X		X			**M_H**
28					X					X		X		X	**M_M**
29												X		X	**M_L**
30									X						**M_M**

(cont. on next page)

Table B.1. (cont.)

ID	Historical Cartographic Resources		Historical Photographic Resources							Literature		Oral History Archive		Oral Study	Reliability Degree of Mass
	1927 Ottoman Map	ΑΝΤΩΝΗΣ, Π.Υ.	n.d. Çamlıbel, E.	1970 Yıldız, D.	1975 Aerial Photograph	1985 Adı Vasfiye	ΑΝΤΩΝΗΣ, Π.Υ.	Λίζα, M.	Home across	ΑΝΤΩΝΗΣ, Π.Υ.	Unpublished Theses	CAMS	Home across		
31									X						**M_M**
32									X						**M_M**
33			X	X	X										**M_M**
34			X	X	X										**M_M**
35						X						X		X	**M_M**
36						X				X					**M_M**
37						X				X					**M_M**
38						X				X					**M_M**
39						X				X					**M_M**
40						X				X					**M_M**

(cont. on next page)

Table B.1. (cont.)

ID	Historical Cartographic Resources		Historical Photographic Resources							Literature		Oral History Archive		Oral Study	Reliability Degree of Mass
	1927 Ottoman Map	ΑΝΤΩΝΗΣ, Π.Υ.	n.d. Çamlıbel, E.	1970 Yıldız, D.	1975 Aerial Photograph	1985 Adı Vasfiye	ΑΝΤΩΝΗΣ, Π.Υ.	Λίζα, M.	Home across	ΑΝΤΩΝΗΣ, Π.Υ.	Unpublished Theses	CAMS	Home across		
41						X				X					**M_M**
42						X				X					**M_M**
43						X				X					**M_M**
44						X				X					**M_M**
45						X				X					**M_M**
46						X				X					**M_M**
47						X				X					**M_M**
48						X				X					**M_M**
49						X				X					**M_M**
50						X				X					**M_M**

(cont. on next page)

Table B.1. (cont.)

ID	Historical Cartographic Resources		Historical Photographic Resources							Literature		Oral History Archive		Oral Study	Reliability Degree of Mass
	1927 Ottoman Map	ΑΝΤΩΝΗΣ, Π.Υ.	n.d. Çamlıbel, E.	1970 Yıldız, D.	1975 Aerial Photograph	1985 Adı Vasfiye	ΑΝΤΩΝΗΣ, Π.Υ.	Λίζα, M.	Home across	ΑΝΤΩΝΗΣ, Π.Υ.	Unpublished Theses	CAMS	Home across		
51						X				X					**M_M**
52						X				X					**M_M**
53									X						**M_M**
54									X						**M_M**
55					X			X							**M_M**
56					X			X							**M_M**
57					X			X							**M_M**
58					X			X							**M_M**
59					X			X							**M_M**
60					X			X							**M_M**

(cont. on next page)

Table B.1. (cont.)

ID	Historical Cartographic Resources		Historical Photographic Resources							Literature		Oral History Archive		Oral Study	Reliability Degree of Mass
	1927 Ottoman Map	ΑΝΤΩΝΗΣ, Π.Υ.	n.d. Çamlıbel, E.	1970 Yıldız, D.	1975 Aerial Photograph	1985 Adı Vasfiye	ΑΝΤΩΝΗΣ, Π.Υ.	Λίζα, M.	Home across	ΑΝΤΩΝΗΣ, Π.Υ.	Unpublished Theses	CAMS	Home across		
61					X			X							**M_M**
62					X			X							**M_M**
63					X			X							**M_M**
64					X			X							**M_M**
65					X			X							**M_M**
66					X			X							**M_M**
67												X			**M_L**
68												X			**M_L**
69			X	X											**M_M**
70			X	X											**M_M**

(cont. on next page)

Table B.1. (cont.)

ID	Historical Cartographic Resources		Historical Photographic Resources							Literature		Oral History Archive		Oral Study	Reliability Degree of Mass
	1927 Ottoman Map	ΑΝΤΩΝΗΣ, Π.Υ.	n.d. Çamlıbel, E.	1970 Yıldız, D.	1975 Aerial Photograph	1985 Adı Vasfiye	ΑΝΤΩΝΗΣ, Π.Υ.	Λίζα, M.	Home across	ΑΝΤΩΝΗΣ, Π.Υ.	Unpublished Theses	CAMS	Home across		
71			X	X											**M_M**
72			X	X											**M_M**
73			X	X											**M_M**
74			X	X											**M_M**
75		X	X		X					X		X			**M_H**
76			X	X											**M_M**
77			X	X											**M_M**
78			X	X											**M_M**
79			X	X											**M_M**
80			X	X		X				X					**M_M**

(cont. on next page)

Table B.1. (cont.)

ID	Historical Cartographic Resources		Historical Photographic Resources							Literature		Oral History Archive		Oral Study	Reliability Degree of Mass
	1927 Ottoman Map	ΑΝΤΩΝΗΣ, Π.Υ.	n.d. Çamlıbel, E.	1970 Yıldız, D.	1975 Aerial Photograph	1985 Adı Vasfiye	ΑΝΤΩΝΗΣ, Π.Υ.	Λίζα, M.	Home across	ΑΝΤΩΝΗΣ, Π.Υ.	Unpublished Theses	CAMS	Home across		
81			X	X		X				X					**M_M**
82					X					X					**M_M**
83			X	X		X				X					**M_M**
84			X	X	X					X					**M_M**
85			X	X	X					X					**M_M**
86			X	X	X					X					**M_M**
87			X	X	X					X					**M_M**
88					X										**M_M**
89					X										**M_M**
90			X	X	X					X					**M_M**

(cont. on next page)

Table B.1. (cont.)

ID	Historical Cartographic Resources		Historical Photographic Resources							Literature		Oral History Archive		Oral Study	Reliability Degree of Mass
	1927 Ottoman Map	ΑΝΤΩΝΗΣ, Π.Υ.	n.d. Çamlıbel, E.	1970 Yıldız, D.	1975 Aerial Photograph	1985 Adı Vasfiye	ΑΝΤΩΝΗΣ, Π.Υ.	Λίζα, Μ.	Home across	ΑΝΤΩΝΗΣ, Π.Υ.	Unpublished Theses	CAMS	Home across		
91			X	X	X					X					**M_M**
92			X	X	X					X					**M_M**
93			X	X	X					X					**M_M**
94					X					X					**M_M**
95					X					X					**M_M**
96					X					X					**M_M**
97					X					X					**M_M**

APPENDIX C

TABLES OF THE RELIABILITY DEGREE OF FAÇADE

Table C. 1. The Reliability Degree of Façade (Source: Author 2024)

ID	Reliability Degree of Mass	Historical Photographic Resources						Literature		Oral History Archive		Oral Study	Reliability Degree of Façade
		n.d. Çamlıbel, E.	1970 Yıldız, D.	1985 Adı Vasfiye	ΑΝΤΩΝΗΣ, Π.Υ.	Λίζα, Μ.	Home across	ΑΝΤΩΝΗΣ, Π.Υ.	Unpublished Theses	CAMS	Home across		
1	M_M							X					**M**
2	M_M			X				X					**M**
3	M_M			X				X	X				**M**
4	M_M			X				X					**M**
5	M_M			X				X					**M**
6	M_M												**L**
7	M_M			X				X					**M**
8	M_M			X								X	**M**
9	M_M								X				**M**
10	M_M											X	**L**
11	M_M							X					**L**
12	M_M												**M**

(cont. on next page)

Table C.1. (cont.)

ID	Reliability Degree of Mass	Historical Photographic Resources						Literature		Oral History Archive		Oral Study	Reliability Degree of Façade
		n.d. Çamlıbel, E.	1970 Yıldız, D.	1985 Adı Vasfiye	ΑΝΤΩΝΗΣ, Π.Υ.	Λίζα, Μ.	Home across	ΑΝΤΩΝΗΣ, Π.Υ.	Unpublished Theses	CAMS	Home across		
13	M_M							X				X	M
14	M_M							X				X	M
15	M_M							X					M
16	M_M							X					M
17	M_M							X					M
18	M_M							X					M
19	M_M							X	X	X		X	M
20	M_M							X	X	X			M
21	M_M							X	X	X	X	X	M
22	M_L							X				X	L
23	M_M						X						M

(cont. on next page)

Table C.1. (cont.)

ID	Reliability Degree of Mass	Historical Photographic Resources						Literature		Oral History Archive		Oral Study	Reliability Degree of Façade
		n.d. Çamlıbel, E.	1970 Yıldız, D.	1985 Adı Vasfiye	ΑΝΤΩΝΗΣ, Π.Υ.	Λίζα, Μ.	Home across	ΑΝΤΩΝΗΣ, Π.Υ.	Unpublished Theses	CAMS	Home across		
24	M_M						X						**M**
25	M_H							X		X			**M**
26	M_H							X					**M**
27	M_H							X					**M**
28	M_M	X						X		X		X	**M**
29	M_L												**L**
30	M_M	X					X						**M**
31	M_M	X					X						**M**
32	M_M	X					X						**M**
33	M_L	X											**M**
34	M_M	X											**M**

(cont. on next page)

Table C.1. (cont.)

ID	Reliability Degree of Mass	Historical Photographic Resources						Literature		Oral History Archive		Oral Study	Reliability Degree of Façade
		n.d. Çamlıbel, E.	1970 Yıldız, D.	1985 Adı Vasfiye	ΑΝΤΩΝΗΣ, Π.Υ.	Λίζα, Μ.	Home across	ΑΝΤΩΝΗΣ, Π.Υ.	Unpublished Theses	CAMS	Home across		
35	M_L			X								X	**M**
36	M_M							X				X	**M**
37	M_H			X				X					**M**
38	M_H			X				X					**M**
39	M_H			X				X					**M**
40	M_M		X					X					**M**
41	M_M		X					X					**M**
42	M_M		X					X					**M**
43	M_M		X										**M**
44	M_M		X					X					**M**
45	M_M		X										**M**

(cont. on next page)

Table C.1. (cont.)

ID	Reliability Degree of Mass	Historical Photographic Resources						Literature		Oral History Archive		Oral Study	Reliability Degree of Façade
		n.d. Çamlıbel, E.	1970 Yıldız, D.	1985 Adı Vasfiye	ΑΝΤΩΝΗΣ, Π.Υ.	Λίζα, Μ.	Home across	ΑΝΤΩΝΗΣ, Π.Υ.	Unpublished Theses	CAMS	Home across		
46	M_M		X					X					**M**
47	M_M		X										**M**
48	M_M		X					X					**M**
49	M_M							X					**M**
50	M_M		X					X					**M**
51	M_M							X					**M**
52	M_M							X					**M**
53	M_M						X	X					**M**
54	M_M						X					X	**M**
55	M_M					X		X					**M**
56	M_M					X		X					**M**

(cont. on next page)

Table C.1. (cont.)

ID	Reliability Degree of Mass	Historical Photographic Resources						Literature		Oral History Archive		Oral Study	Reliability Degree of Façade
		n.d. Çamlıbel, E.	1970 Yıldız, D.	1985 Adı Vasfiye	ΑΝΤΩΝΗΣ, Π.Υ.	Λίζα, Μ.	Home across	ΑΝΤΩΝΗΣ, Π.Υ.	Unpublished Theses	CAMS	Home across		
57	M_M					X		X					**M**
58	M_M					X							**M**
59	M_M					X		X					**M**
60	M_M					X							**M**
61	M_M					X							**M**
62	M_M					X							**M**
63	M_M					X							**M**
64	M_M					X							**M**
65	M_M					X							**M**
66	M_M					X							**M**
67	M_L									X		X	**L**

(cont. on next page)

Table C.1. (cont.)

ID	Reliability Degree of Mass	Historical Photographic Resources						Literature		Oral History Archive		Oral Study	Reliability Degree of Façade
		n.d. Çamlıbel, E.	1970 Yıldız, D.	1985 Adı Vasfiye	ΑΝΤΩΝΗΣ, Π.Υ.	Λίζα, Μ.	Home across	ΑΝΤΩΝΗΣ, Π.Υ.	Unpublished Theses	CAMS	Home across		
68	M_L								X				**L**
69	M_M	X											**M**
70	M_M	X					X						**M**
71	M_M	X											**M**
72	M_M	X											**M**
73	M_M	X											**M**
74	M_M	X											**M**
75	M_H	X			X			X		X			**H**
76	M_M	X											**M**
77	M_M	X					X						**M**
78	M_M	X					X						**M**

(cont. on next page)

Table C.1. (cont.)

ID	Reliability Degree of Mass	Historical Photographic Resources						Literature		Oral History Archive		Oral Study	Reliability Degree of Façade
		n.d. Çamlıbel, E.	1970 Yıldız, D.	1985 Adı Vasfiye	ΑΝΤΩΝΗΣ, Π.Υ.	Λίζα, Μ.	Home across	ΑΝΤΩΝΗΣ, Π.Υ.	Unpublished Theses	CAMS	Home across		
79	M_M	X					X						**M**
80	M_M	X		X				X					**M**
81	M_M	X		X				X					**M**
82	M_M												**L**
83	M_M	X						X					**M**
84	M_M	X						X					**M**
85	M_M	X						X					**M**
86	M_M	X						X					**M**
87	M_M	X											**M**
88	M_M												**L**
89	M_M												**L**

(cont. on next page)

Table C.1. (cont.)

ID	Reliability Degree of Mass	Historical Photographic Resources						Literature		Oral History Archive		Oral Study	Reliability Degree of Façade
		n.d. Çamlıbel, E.	1970 Yıldız, D.	1985 Adı Vasfiye	ΑΝΤΩΝΗΣ, Π.Υ.	Λίζα, Μ.	Home across	ΑΝΤΩΝΗΣ, Π.Υ.	Unpublished Theses	CAMS	Home across		
90	M_M	X						X					**M**
91	M_M	X						X					**M**
92	M_M	X						X					**M**
93	M_M	X						X					**M**
94	M_M							X					**M**
95	M_M							X					**M**
96	M_M							X					**M**
97	M_M							X					**M**

APPENDIX D

KEY MAPS FOR TABLES OF RELIABILITY DEGREE

Figure D. 1. Key Map for Tables of Reliability Degree (Source: Author 2024)

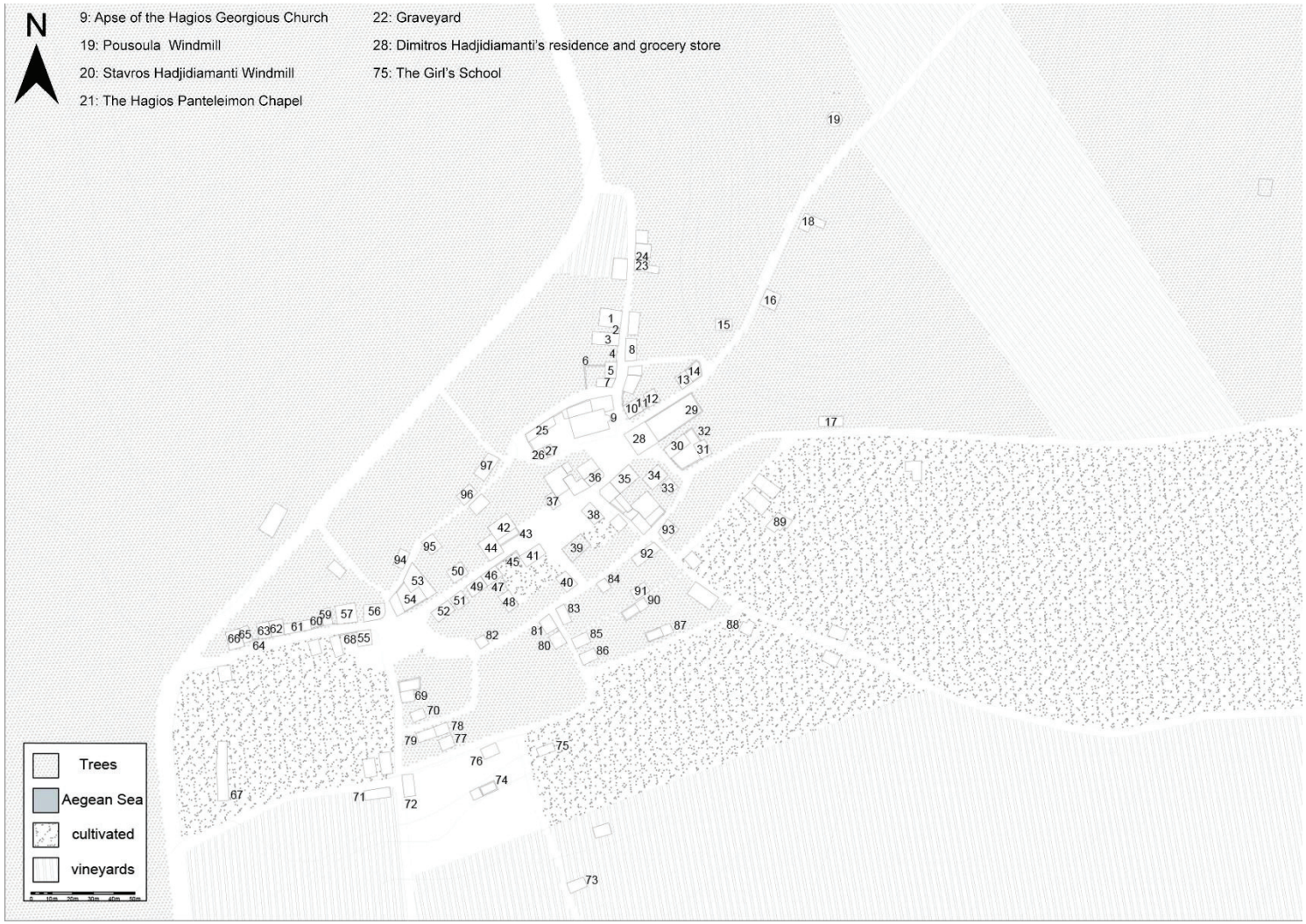

Figure D. 2. Key Map for Tables of Reliability Degree (Source: Author 2024)

APPENDIX E

THE DIGITAL RECONSTRUCTION OF 19TH CENTURY GÜLBAHÇE: QR CODE AND ITS CORRESPONDING LINK

https://www.keypano.com/v/6_n91586_w57c6-1720022868.html

Figure E. 1. QR Code for the Digital Reconstruction of 19th Century Gülbahçe
(Source: Author 2024; keypano © 2024)