

Experiencing Cultural Heritage Through Gamification

Mardin orphanage

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This paper presents early-stage research about the role of gamification in experiencing cultural heritage strongly within the sociological context, specifically focusing on the transformation of the old orphanage located in the historical city center of Mardin. The study acknowledges the significance of the old orphanage as an architectural heritage exemplar, built of natural Mardin stone, situated within a unique historical and archaeological urban environment. However, it recognizes the challenges of preserving the building's heritage value, which necessitate surpassing the superficial restoration methods applied to adapt it into a hotel. The primary motivation of this research is to develop a method for creating a navigable and interactive virtual replica of the orphanage, centering on the processes and outcomes of transferring its heritage value. To achieve this, the paper initially outlines the documentation and analysis procedures employed, utilizing photogrammetry to capture the past and current states of the orphanage. Subsequently, participants engage with a gamified and realistic digital replica of the orphanage, involving task-based interactions and scenario-based experiences. The paper concludes by presenting preliminary results concerning participant reactions to the initial virtual model, delivered through a VR device. By raising awareness about the significance of restoring and preserving historical heritage, this study aims to positively impact the domains of tourism, education, and conservation. Furthermore, it intends to shed light on future research opportunities in the field of digital cultural heritage.

Keywords: Gamification, Digital Cultural Heritage, Virtual Reality, VR Device, Photogrammetry, Mardin.

INTRODUCTION

Virtual Reality (VR) is widely used in architecture to facilitate the design process and preserve and represent cultural heritage. Besides its diverse applications across different sectors, it is important to examine and research the use of VR tools and methods to integrate historical representation, as they can enhance the accessibility and understanding of cultural heritage.

Individuals' awareness, education, and curiosity play a crucial role in the protection, dissemination, and sustainability of cultural heritage. Being utilized as tools for participation in cultural heritage, VR technologies have increasingly become affordable and available for personal use.

Among many exciting and innovative advancements in VR, transforming cultural heritage into a gaming environment has also become important in recent years. The transformation of

cultural heritage codes into a sustainable and impactful education transfer within a competitive and targeted setting. Games have always played an important role in human culture. However, digital games, with their various techniques and genres, offer a new form of this ancient method of social interaction, providing references to both the virtual and physical worlds. The field of cultural heritage is currently exploring the integration of game experiences with VR tools, as well as the infusion of game design elements into VR experiences. Meanwhile, the application of game technology and design methods in non-gaming industries is referred to as gamification.

Gamification focusing on heritage sites and practices engages visitors and allows new means of interacting with cultural heritage information. For the sake of dissemination of knowledge, studies aim to deploy the dynamics of games based on human desires, such as rewards, status, success, self-expression, and competition. On top of this, current research shows us (Ozer et al., 2016) augmented Reality (AR) offers location information to help perceive the realism of heritage places. Combined with well-known forms of scavenging and treasure hunting, location-aware storytelling enhances heritage awareness experiences and increases visitor engagement.

Since modern gaming technologies can provide real-time interaction between content participants and participants themselves in a realistic environment, they have the potential to play an active role in increasing the accessibility of cultural heritage (Anderson et al., 2010).

Within the scope of the study, a method is being developed to transfer cultural heritage information to the youth. The experience environment offered by AR and VR technologies, which are used in many fields, are instrumental to conducting this study. Scenarios that enable effective participation and interaction of individuals within a certain age range will be developed.

An old Orphanage in Mardin is chosen as the case study. To convey the transformation and

lifetime story of this building throughout history, we study the integration of VR and AR methods enhanced with gamification into this heritage context while aiming to preserve the memory of the space. The gamified digital replica of the historic building, which is under construction, aims to provide a discussion platform. The efficacy is determined by the amount of information transferred to the users, which is evaluated at the end of the experiments. In this paper, the difficulty level of the engagement, the age range of the users, the socio-cultural characteristics of the building, the urban location of the building, and the effect of the current usage situations of the building are examined and documented.

HISTORICAL CITY OF MARDIN

Mardin, a historic town in the southeastern part of Turkey, boasts significant religious, commercial, and residential sites. Its diverse demographic composition is reflected in the wealth of architectural elements, including monasteries, mosques, churches, mansions, pavilions, terraced houses, and decorative ornaments. Previous research in the field of Computer-Aided Architectural Design (CAAD) has focused on the digitalization of Mardin's historical stone carvings (Hamzaoglu, Özkar, & Aydin, 2022), rule-based layout generation of houses with distinctive courtyards, open spaces, arches, and vaults (Torus and Çolakoğlu, 2009) and many more.

One noteworthy architectural feature in Mardin is the old orphanage (partially constructed by Lole the Architect (Mimar Löle), an Armenian who significantly contributed to the city's heritage by constructing numerous buildings from the late 19th to the early 20th century. In this study, the city center of Mardin and the orphanage structure are planned to serve as settings for a digital game, aiming to explore the utilization of games and gamification methods as tools for cultural heritage preservation and dissemination.

Architectural Features

The historic building's structure; in accordance with the topography of the land, has a "U" plan scheme extending in the north-south direction overlooking the Mesopotamian plain. It shows a complex structure originally built from the Z+1 floor, a masonry brick floor was added in the late period, and today it has a three-story plan scheme. As can be understood from the bedrock built on the interior walls of the building, the orphanage was built as a monolith on the bedrock (Figure 1).

Figure 1:
Exterior pictures of
the orphanage.



The original main door, which provides the entrance to the building, was given from the south side of the ground floor, and another simple-shaped door was opened on the same façade in the late period. There is a door opening on the northern façade of the first floor, which was opened in a later period. On the ground floor, two inner courtyards have a rectangular and square plan. From these courtyards, there are two stone-stepped stairs leading to the east and west directions of the upper floor terrace (Figure 2).

Figure 2
Plan and section
drawings of the old
orphanage
(acquired from Ata
İletmiş 2010)



RELATED WORK

Virtual Space

In the context of cultural heritage, video games can broaden the scope of research through multiple

perspectives and alternative narratives by enhancing the skills of cultural heritage stakeholders. Heritage representation has been used extensively since video games were introduced into the cultural heritage site. Although the use of cultural heritage sites in digital games has started recently, it is now widely used. The relative research projects are studied under two settings, 2D and 3D.

Some familiar examples appear over time; Apotheon, Assassin's Creed is such a game: Apotheon is a 2D action game inspired by Ancient Greek mythology. The game of Teos, which has an important place in this field. Another example among 2D game setups is trying different experience and interaction systems to revive archaeological finds with digital possibilities. This example was created by selecting the ancient city of Teos as a pilot region. It presents, tests, and discusses the mobile platform game application (Dionysos of Teos) produced in the Digital Teos Project (Varinlioğlu, 2017).

Game applications in cultural heritage areas have developed over time and have taken steps in parallel with the developing technological methods. There has been a transition to 3D playgrounds in 2D game spaces. This transition has enabled the cultural heritage area to be perceived more effectively. 3D games have become widespread and have significantly benefited from innovations in 3D visualization, such as augmented reality (AR) and virtual reality (VR). The perception of 3D space is improved within the game discovery experience of digital game users of many ages, enabling the transmission of space data more effectively.

Architectural space or environment is undoubtedly present in the development process, from 2D or text-based games for computer games to three-dimensional photorealistic video games. Architecture has started to reserve its place thanks to the new concepts added to the game design processes. Especially during the level design processes, the architects design the game sections and maps. In addition to these, spatial playability, positioning of objects, and determining the purpose

of maps and spaces can also occur depending on the design skills of architects. Architects are given important roles in these matters (Ryan, 1999). The need for architectural design processes in games and learning the ways of perception are provided by the experiences gained from the role of architecture in real life.

Gamification

Gamification is an approach to game thinking and mechanics to increase motivation and encourage problem-solving in a non-gaming context. In other words, gamification can be expressed as using game design elements outside the normal context of games (Deterding et al., 2011). According to Gartner's (2011) Hype Cycle, many areas have a significant and growing gamification process. Applying gamification to any activity encourages increased participation and engagement (Brigham, 2015). Seaborn and Fels (2014) argue that gamification can more accurately be defined as a subset of a larger effort to improve the user experience of interactive systems through game design, increasing user motivation, engagement, and enjoyment in non-game, computer-mediated environments. In order to make these processes more interesting, game techniques are added to existing educational processes (Kapp, 2012).

The potential of gamified AR technologies has been explored in indoor and outdoor heritage sites (Benckendorff, Tussyadiah, and Scarles, 2018). The study of Hammady, Ma and Temple (2016) exemplifies combining indoor augmented reality and gamification techniques in the Egyptian Museum in Cairo. New technologies provide a seamless illusion of a mediated experience (Riva, Waterworth and Murrayl, 2014). According to Champion (2010), it is possible to create a sense of greater naturalness via location-based games that make the boundary invisible between the virtual and real world.

Visualization

The planning phase becomes even more critical as projects related to visualizing and presenting archaeological and historical settlements require many disciplines to work together. In order to successfully complete these projects, various disciplines such as archaeology, architecture, history, anthropology, maps, photogrammetry, urban planning, and geodesy must work together in coordination.

The use of photogrammetry is crucial in this context as it enables the extraction of visual data and metric accuracy from site photographs (Marín-Buzón et al., 2021). The first and most important step in augmented reality presentations is creating the 3D model, therefore the photogrammetry method was chosen as it has been utilized by various disciplines for a considerable period of time. (Alptekin and Yakar, 2020). Photogrammetry; In the field of 3D modeling, web-based visualization, and augmented reality technologies, provides significant advantages in terms of the potential to improve the experience of people related to cultural heritage. The primary factor in choosing the photogrammetry method is integrating the SfM algorithm with this technology. With this algorithm, camera parameters can be calculated automatically using sequentially captured photo pairs. (Şenol and Kaya, 2019)

This study was conducted in three stages:

- (i) Data collection / Analysis
- (ii) Transferring data to digital media / Data process and modeling (photogrammetry)
- (iii) Creation of Virtual Reality environment / Application development

Documentation

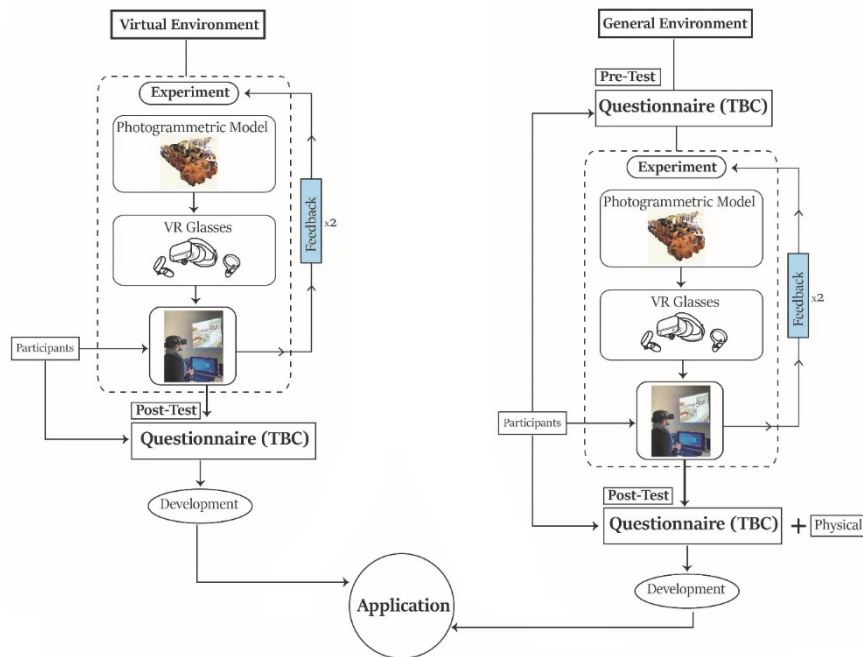
In the documentation phase, we gather all available data, including sections, plans, photographs taken at various times, surface photographs, 3D laser scanning data, surveys, reports from archaeologists and historians, and archive documents. This allows for the utilization of photogrammetric, measurement, and reality capture methods with VR.

A database is a collection of information organized into files and tables, enabling it to store and group data to cater to multiple users concurrently. One of the greatest advantages of having a database system is the ability to access data instantly when necessary. This not only saves time but also prevents the need for data repetitions, ensuring that all information is accurate and up-to-date. By implementing a well-designed database system, you can increase efficiency and improve the overall functionality of your organization. (Gönenç, 2004).

METHODOLOGY

In this study, analysis, modeling and application stages were examined together. The usefulness of oral history data in game production has been observed. Restoration drawings helped complete the model and give an idea about the sections that could not be entered (Figure 3).

Figure 3 Diagram of the method



Preparation of the Experiment Settings

Data Collection. The old Mardin Orphanage, was restored and converted into a hotel in 2010. Historical building data is collected, and old photographs were examined and reviewed in detail.

Restoration and survey drawings were examined; restoration, survey, and restitution reports were analyzed.

Interviews were held with hotel employees, neighborhood residents, market shopkeepers and people who stayed in orphanages. Oral history

information about the building and the people's memories were compiled.

Modelling. The building was surveyed to create a model of the building. The structure was scanned with a tablet which has a lidar scanning feature. Unfortunately, it was not possible to model the complete structure as the lower floors lacked sufficient lighting and there were customers

occupying certain hotel rooms. The scanned data was compared to the restoration and survey drawings. We have thoroughly examined the building's dimensions and cross-checked the scan for any missing components. It has come to our attention that there are certain areas where the scan has not been complete. (Figure 4).

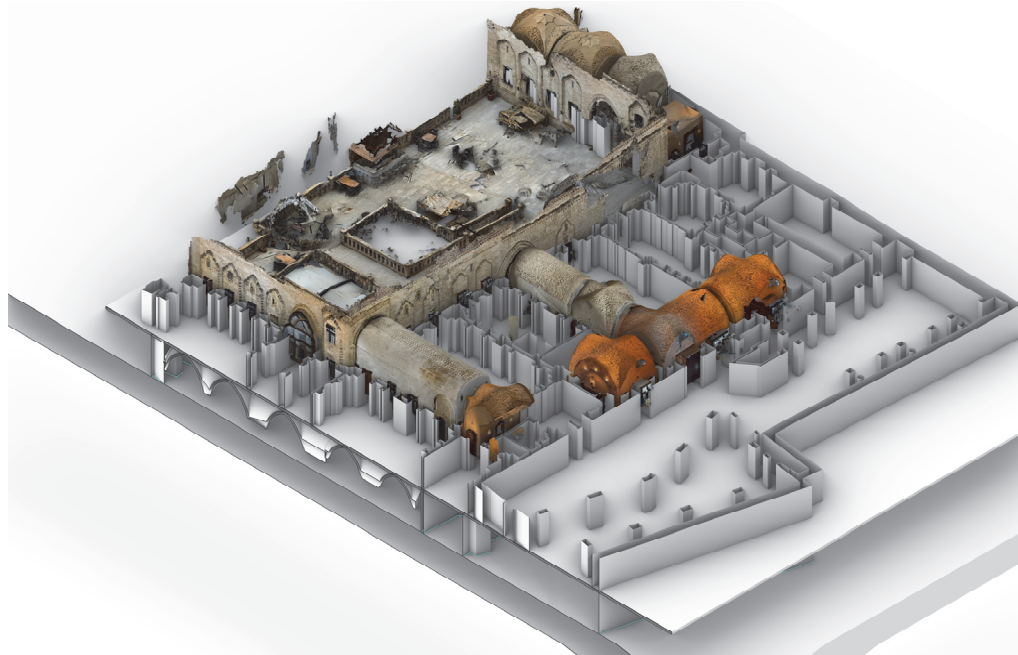


Figure 4
Superposed models
of
photogrammetric
and solid
geometries built in
Rhinoceros

Application. The collected data was stored and grouped and extracted by use case. It is important to weave the experiences of the individuals who use the building into the overall data story. By incorporating their memories and perspectives, we can better understand how the space is being

utilized and identify areas for improvement. The goal was to incorporate gamification into the model created based on the collected stories. The produced model and game formation will be opened to experience with an application. The mobile game will also be offered to users using mixed reality tools.

Experiment

Procedure. This experiment was carried out in a closed area of 25 square meters. The experiment was scheduled for the afternoon of the day. The environment is illuminated by daylight, and natural light is also used.

The experiment was experienced with three participants. Each participant's experience lasted ten minutes. The total experience time of three people is 30 min. The experiment lasted two hours, including setup and breaks.

VR glasses are used in the experiment in which the created digital model was presented for the participant's experience. Before the experience, the participants were informed about the orphanage and the hotel. During the experiences, the processes are recorded.

Method and Material. Oculus Rift virtual reality glasses were used as a tool in the experiment. The Oculus Rift consists of head-worn glasses, two control sticks, and two sensors that detect movements. Head-mounted glasses have a microphone and speaker. It works connected to the computer and can follow the hand and head. The Rift S uses a single snapshot LCD display with a resolution of 2560×1440 with a refresh rate of less than 90 Hz.

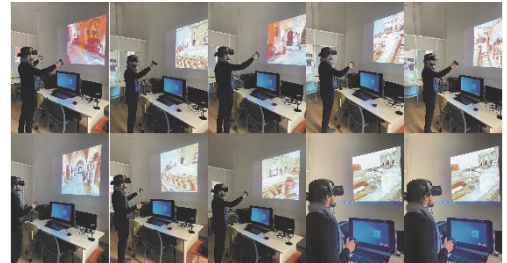
Participants. Three participants are chosen among people who have not been physically in the orphanage and have never used VR glasses. The first participant is an architecture student (male, 23), the second is also an architecture student (female, 23), and the third is a philosophy master's student (male, 30). The participants to be tested in the further stages of the study will be selected from adults between 18-40.

The participants were chosen to see how the spatial knowledge that architecture students gained in design education would affect their experience. On the other hand, a philosophy student was chosen to see how an out-of-field individual, far from the

knowledge of architecture and space, would produce results.

Findings. At the beginning of the experiment, information about the use of VR glasses was given, and a short trial was conducted. Afterward, general information was given about the orphanage and its transformation into a hotel. This information included the historical use of the orphanage, its location in the city and its structural information.

The first user found the spaces rich and felt like they were inside the space. He said that the current use of the building did not give any data about the orphanage and that he needed to obtain historical information from experience (Figure 5).



The second user mentioned the indoor and outdoor transitions. He felt that the stone building felt the material's texture and that he was walking in space. During the experience, he tried to imagine that there was an orphanage there (Figure 6).



The third participant found the virtual tour impressive. He felt that he was in the physical space

Figure 5:
First participant

Figure 6
Second participant

within the space. The stone motifs found in the building caught his attention. He said that the current use of the building is a hotel and that this type of use creates difficulties in perceiving the orphanage. He had difficulty using the control sticks used with VR glasses (Figure 7).



Based on the pilot study findings, it appears that users have varying preferences when it comes to experiencing cultural heritage via virtual environments. The first participant shows interest in historical information about the orphanage, while the second attempts to understand the material texture. On top of that, the user from a different field than architecture pays more attention to the perception of the building as an orphanage. In this regard, the findings provide valuable insight into the diversity of aspects to be considered in the gamification of a virtual cultural heritage experience. Provided that the study considers various aspects of the building and its heritage, further work will also compare physical and virtual environments by testing two sets of results as shown in the abovementioned.

Limitations and Implications. The experiment was tested with a few participants due to the time limit. The number of users is small, but a pattern is expected with repetitive feedback loops. The statements of the users during and after the experiment contribute to the experimental environment and the development of the experiment. The feedback received from the users

will enable the application development that will form the project's backbone.

The first stage of the method only includes the Virtual Environment (VE) and the user's evaluations of it. The cycle provided by the Virtual Environment consists of the user providing the experience in the model with the VR glasses and the experience again after the feedback in this process. Evaluation efficiency increases with the amount of relationship the user establishes with the model, and this relationship is tried to be strengthened.

With the results of this study, one or two more rounds of feedback loops will be created as design research, and the design of VE will be improved on the combination of models. The merging and development of the photogrammetric model and other models created in the computer environment will take place in this process.

The gamified interactive elements will provide a preliminary assessment of the sociological context of the structure, its spatial characteristics and the aspects of AND that should be considered in terms of revealing the structural elements. The contribution of structural and sociological values to the experience will be provided by feedback, it was found important to complete the developments and VE design here.

CONCLUSION

This research aims to develop a method for creating navigable and interactive virtual environments of heritage places, focusing on the processes and results of this transfer. The study recognizes the sensitivity of working with historical buildings and the sociological context in which they exist.

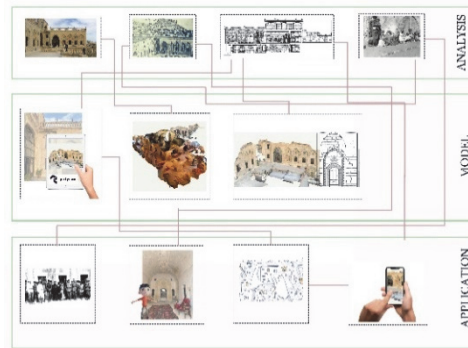
The study examines the transition of an old orphanage building, now used as a hotel, to digital media. Firstly, it discusses how gamification techniques can facilitate the dissemination of cultural heritage knowledge. Secondly, it presents findings from user feedback obtained through an experiment that deploys an interactive virtual replica of the orphanage building. It contains intangible

Figure 7
Third participant

heritage elements such as memories of children, staff, and other users.

The study uses surveys to test the feasibility of the virtual replica in transferring heritage knowledge. The research contributes to understanding novel digitalization stages in cultural heritage by exploring how photogrammetric and realistic 3D models can be transformed into interactive environments that increase the sense of place while empathizing with the sociological context of an old orphanage building (Figure 8).

Figure 8:
Process diagram



As a result, this study focuses on the critical importance of restoring and safeguarding historical heritage by augmenting visitor awareness. The anticipated outcomes include positive influences on increased tourism engagement, enriched educational experiences, and enhanced conservation efforts. Moreover, the study aims to stimulate continued research in this field, inspiring scholars and practitioners to explore new avenues and strategies for effectively preserving and promoting historical heritage. Ultimately, by emphasizing the value of heritage restoration and preservation, the study seeks to create a broader understanding and appreciation of cultural legacy, leading to its long-term protection and sustainable utilization.

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