

Transforming storytelling into a story-living virtual museum: EPANASTASIS-1821

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Abstract. This contribution is a step-by-step description of the development of the virtual museum EPANASTASIS-1821. Its core scope is to indicate the pipeline applied for the creation of a full-immersive virtual museum, from the conception of the original idea to the evaluation process of the final production. The contribution aims to specify the perspectives of virtual museology in contradiction to digital exhibition of cultural material, to indicate the limitations and the potentials of incorporating the technologies of virtual reality and of serious games in the production of full-immersive cultural experiences and to shed light on the aspects of future digital museum practice. The virtual museum EPANASTASIS-1821 is a museum that exhibits historical material, nevertheless its virtual and gamified form made possible the transformation of the passive museum experience into an interactive, participatory one, that strengthens designers' creativity, enhances the interpretation's impact and, in an overall perspective, leads to a more democratized perception of cultural heritage.

Keywords: Virtual Museum, Immersive technologies, Game technologies, Interactive environments, Storytelling, History

1 Introduction

Virtual Museum (VM) EPANASTASIS-1821 is an innovative museum experience with the aim to create new perspectives in experiential museology, using the technologies of virtual reality (VR) and serious games (SGs). The core scope of the VM EPANASTASIS-1821 is to communicate and highlight the potentials of using virtual reality tools in the reconstruction of historical environments and, by embedding gamification to make the museum experience participatory, interactive and edutaining [1]. Virtual museums are a dynamic cultural entity of current museum practice. Their entity adapts and evolves accordingly to the technological developments in information communication [2]. Designing a virtual museum is a procedure of flexibility and freedom for the designer to apply his creativity, through the design of the exhibition plan and the embodiment of hi-tech representation means [3].

In this contribution, we present an overview of the design, the content and the impact of the VM EPANASTASIS-1821. The initial perspectives and concerns about the development of a hybrid form of a digital museum that is presented in a virtual form and incorporates serious games technology are also presented in this paper.

Correspondingly, the contribution describes the overall impression the users have of the museum and the way the development process changed or created new perspectives on virtual museology. Elements of how well designed and full-immersive virtual experiences can enhance peoples' interaction with history and culture and lead to a better understanding of the storytelling are also presented.

2 Virtual Museums and games

2.1 The principles: Accessibility, Participation, Democratization

Digitalization of cultural assets started as a conservation solution. The need of keeping the remains of the human culture protected and stored for the next generations led to the implementation and use of evolving technological methods and tools. As the cultural sector becomes gradually a more accessible source of education, social interaction and entertainment, its communication channels take advantage of the technological advances and incorporate the current trends, such as virtual reality and serious games technologies [4, 5]. COVID-19 outbreak set new perspectives on the development of immersive and remotely accessible cultural experiences, as the cultural institutions worldwide adopted various digital solutions in order to keep their audiences engaged [6]. Gamification plays a key role towards this direction, as it empowers the possibilities of more participatory experiences of the cultural assets and the meaning making [7].

As there is no widely accepted definition of virtual museums, the term refers to a digital entity that presents cultural content, open to the wide audience. Although its form varies, from online presentation of cultural assets to full immersive virtual reality exhibition experiences, the fundamental mission of digital museum entities is to make cultural assets accessible and comprehensive [3, 8]. The virtual character breaks the barriers of distance and paves the path to the democratization of culture and knowledge.

2.2 Virtual Museum EPANASTASIS-1821

EPANASTASIS-1821 is a museum that narrates the story of the Greek Revolution war against the Ottoman rule that broke out in 1821, lasted for 9 years and led to the establishment of the Greek sovereign state in 1830. The Greek Revolution is one of the most important military and political events of modern Greek history and as a consequence it was widely memorized on the occasion of the celebration of the 200 years since the beginning of the liberation war. VM EPANASTASIS-1821 was developed within this historical framework and with the aim to highlight aspects and personalities of the Revolution through the use of the innovative technological tools of virtual reality and serious games.

The exhibition material of the museum EPANASTASIS-1821 consists of a collection of digitized artifacts, such as archives, paintings, maps, sketches and flags that are related to the historical period of the Revolution. The exhibition design is developed in the interior of a 3D building that resembles the museum space. The artifacts are organized in specific exhibition units and are accompanied by interpretation material, the exhibition texts.

The user is able to experience the virtual museum EPANASTASIS-1821 only by using the appropriate devices that is the *Oculus Rift S Head Mounted Display with touch controllers 2nd generation* that offer the highest level of immersion. The museum is accessible by the public, with the exception of the age restrictions imposed by the devices production company (not suitable for children under the age of 13)¹. The *touch controllers* offer the user the ability to move in the virtual space with a great extent of flexibility and to interact with the exhibits. Based on these potentials, the VM EPANASTASIS-1821 incorporates gamification to create a more effective understanding of the narration by engaging the users in a participatory, active storytelling. The abovementioned elements of the VM EPANASTASIS-1821 were the result of a preliminary design phase that included the conception of the main idea, the principles and the technical guidelines that formatted the character of the virtual museum.

3. Methodology

3.1 The concept idea

The first issue to be addressed in an exhibition development is to designate the concept idea of the exhibition. The concept idea of the VM EPANASTASIS-1821 is an exhibition developed in a virtual museum space that narrates the story of Greek Revolution war in a combined chronological and thematic exhibition route [9], through a collection of related digitized material, and by using the technology of serious games transforms the storytelling into a full-immersive, interactive story-living experience.

3.2 The thematic framework

The story of the Greek Revolution is not easy to be narrated in a single exhibition. Apart from the military events, the victories and the defeats, this historical period relates to a multidimensional grid of political, social, financial issues that could not be excluded from the exhibition core. Thus, the thematic framework of the exhibition design covered a chronological period from the pre-revolution years to the years right after the war and it was divided into seven thematic units.

Each thematic unit consists of an array of sub-units that support the storytelling by helping the user acquire a broad and comprehensive understanding of the historical period of the war. On the whole, the structure of the thematic framework, with its main themes and sub-themes, is designed on the basis of two principles: thematic autonomy, so each thematic unity has its own meaning that can be acquired separately, which gives the user the flexibility to skip thematic units that is not interested in, and continuous

¹ <https://www.oculus.com/safety-center/>

narration flow, which helps visitor understand the sequence of the historical events. Each unit is supported by a collection of artifacts and exhibition texts.

3.3 The exhibits

The next step in the development of the virtual museum EPANASTASIS-1821 was to create a collection of artifacts to function as the exhibits of the virtual exhibition space. Four factors defined the selection of the artifacts:

1. Artifacts' chronological and thematic correlation with the museum's storytelling.
2. The collection should represent a wide geographical area of Greece, correspondingly to the exhibition units
3. Artifacts' availability in digital form
4. Given that there were no artifacts available in three-dimension digital form, the exhibits of the virtual collection were mainly two-dimension artifacts, such as paintings, archives, maps and flags.

Consequently, a collection of artifacts in digital form of high quality was concentrated from twelve different cultural institutions all over Greece (museums, libraries, archives, galleries)². In a few cases, selected artifacts, such as a monocular, were designed from scratch in a 3D digital form in order to be used in interactive experiences.

3.4 The museum space

The virtual museum space that hosted the exhibition plan wasn't designed with a modern architectural form. A historical building of the 18th century, located in Zagora of Pelion, in Thessaly, known as *Ellinomouseion* [10], which used to function as a school during the 18th and 19th century, was digitized and 3d modeled. The building is characteristic of the traditional architecture of the area in the Ottoman period. The virtual museum space was developed having as an architectural basis the digitized historical building, nevertheless it was adjusted to the guidelines of the exhibition plan. Thus, when transforming the building into a virtual museum space, there were some interventions made in the inner space of the building, according to the exhibition plan. But the overall impression the user gets when he virtually enters the museum space is that of the original historical building.

3.5 The exhibition plan

The exhibition of the seven thematic units was designed for the two-floor virtual museum space. The user enters the building from the ground floor and stands in front of the first –introductory-unit, which use is to welcome and orientate the user to the following exhibition units. The second and third exhibition unit are being developed at the ground floor, while the rest – fourth to seventh- at the first floor. Profoundly, the

² General State Archives, National Historical Museum Athens, Hellenic Maritime Museum, War Museum Athens, Museum of Macedonian Struggle Thessaloniki, Capodistrias Museum Corfu, Bouboulina Museum Spetses, Faltaits Museum Skyros, Averoff Museum Metsovo, National Gallery-Nafplion Annex, Historical Archive-Museum of Hydra

user must climb upstairs in order to reach the first floor. That makes the user's museum experience more realistic. The design of the exhibition units is developed according to the content of the storytelling. For example, the second unit is designed to be a circular route around the visitor that symbolizes the historical unit of the common life of the Greeks and the Ottomans in the Greek territory. Each unit has its own contextual display plan, which is designated accordingly to its thematic meaning [2].

3.6 The strategy

VM EPANASTASIS-1821 was designed with the perspective to be an interactive virtual museum experience and not just to transfer into the virtual world what it would be a physical museum space. The core innovation of VM EPANASTASIS-1821 is that it narrates the story but also it gives the users the chance to live the story. In order to achieve its perspectives, the VM EPANASTASIS-1821 adopts a three-goal strategy that can be summarized to the following points [2] (see **Fig.1**):

1. **Learn.** The visitor should learn about the Greek Revolution through the exhibits and the interpretation material (exhibition texts), through the narration.
2. **Experience.** The visitor should experience the historical period of the Revolution through the narration and his interaction with the exhibits and the virtual reconstruction of the historical environment.
3. **Act.** The visitor should become a historical figure himself and act as a protagonist of the story.

The three-goal strategy is achieved by implementing a combination of narrative means in the exhibition design, including the exhibition material (exhibits, texts) and technological means that transform the verbal and visual information into animation and gamified environments.

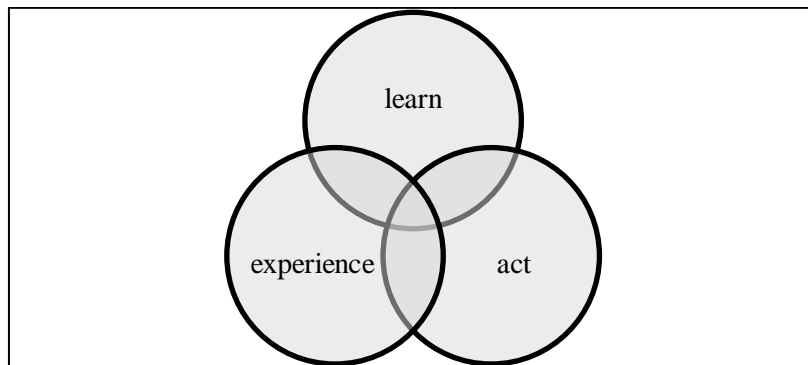


Fig. 1. The three-goal strategy of Virtual Museums EPANASTASIS-1821 exhibition program.

3.7 The technologies

For the development of the VM EPANASTASIS-1821, a combination of cutting-edge technologies from the sector of creative industry and applied informatics was used [2]. The *Cinema4D* software package by *Maxon* [11], was used for the accurate design of the 3D models. The photorealism was succeeded through the open-source image editor *GIMP* [12] and *UV-mapping* and *baking* techniques for texturing and materials. Regarding the 3D animation that was embedded on *FBX* file format, the *rigging and bones* tools of *Cinema4D* were used. *Unity* [13] game engine was adopted for the development of the virtual environments, not only for the virtual museum, but for the virtual reconstructions of the historical environments as well. All interactions between the user and the virtual elements were scripted in *C#* and *JavaScript* languages. Lastly, *Oculus Rift S* Head Mounted Display with *touch controllers 2nd generation* offered the higher level of immersion [14]. The virtual reality equipment provides a resolution of 1280x1440 pixels per eye with a refresh rate of 80 Hz, and simulates the movements of human's hand up to the level of the fingers. In addition, *Oculus Rift S* is fully compatible with *Unity* game engine and can be obtained at an affordable price.

3.8 3D visualization of storytelling

What makes a museum experience more engaging is the ability of communicating the information in a comprehensive way through creative communication channels. In the case of information material that is wide or complicated and needs a long exhibition text, a visualization of the information may be more effective and easier to understand. In the case of the thematic unit that refers to the conversion of the merchant ships into war ships for the needs of the war, 3D video animation, titled as “**Need more warships**”, was created and was incorporated into the exhibition material to show the way this conversion was made. The development of the 3D video animation was based on the description of historical archives and technical sketches.

3.9 The immersive technologies

Virtual reality technology in cultural heritage has changed the way people experience tangible and intangible culture. By exploiting the potentials of virtual reality tools, designers can recreate virtually a historical environment and make it interactive, thus enabling the user to interact into a historical space with historical objects. VM EPANASTASIS-1821 recreates four historical environments where the user is transferred in time and space and experiences the historical era of the Revolution.

In the “**Captain's cabin**” experience, the user is virtually transferred inside the office cabin of a 19th century boat, where an amount of archives related to the Greek naval battle of the Revolution are scattered on the desks around the office. The user acts as the captain of the ship and owner of the office. When entering the office, the user can wander around, find the archives and interact with them by using the two touch controllers. It is possible to bring the archives closer to the lights next to the window in order to read them that creates a very realistic and immersive experience. The “**Captain's cabin**” is attached at the second exhibition unit, in the sub-unit that refers to the Greek merchants and captains of the Revolution years.

The “**Oath of Philike Etaireia**” experience recreates a painting of Dionysios Tsokos (1849, National Historical Museum) that depicts a fighter, probably Theodoros Kolokotronis, swearing to the liberation war. The user is transferred into the painting’s environment and interacts with archives and artifacts related to Philike Etaireia, which was a secret organization devoted to the preparation of the Revolution. According to the related historical records, the fighters had to follow certain rules and procedures in order to become members of this secret society. The user becomes one of the thousand members of Philike Etaireia, enters the secret room where the oath took place and interacts with documents which bear written coded messages for the initiated.

3.10 The Games

Two full-immersive experiences, the “**Fireship**” and the “**Exodus of Ares**” are developed based on two related paintings. In these two experiences, the user is immersed in the virtual reconstruction of the paintings’ scenography and becomes an active participant of the story. The historical information is communicated to the user through interactive experiences that elevates the museum experience from passive to an active, joyful and memorable one.

The painting “**Kanaris burning the Turkish flagship**” painted by Nikiforos Lytras (1832-1927, Averoff Gallery Metsovo) is transformed into a virtual experience in which the user is engaged in a game, with the mission to prepare the ship in order to venture an arson. The user is transferred on the deck of the fireship and has the time-challenge mission of filling it with explosives. The ship approaches the enemy ship and attaches to it. The user has to set it on fire and safely escape from the burning ship.

The “**Exodus of Ares**” is inspired by Konstantinos Volanakis painting “The Exodus of Ares” (1894, National Gallery, Nafplion annex) and is a gamified virtual reconstruction of a heroic naval battle of the war. The user has the mission to manage the ship in order to escape from the enemy’s fires. The historic event took place during the fifth year of the Revolution and it was the final act of an Egyptian’s victorious battle. Nevertheless, the Greeks, trying to escape from the enemy fleets, attempted a desperate sailing among the enemy’s ships that led to their heroic escape. The user is transferred on ship ARES and taking over the command of the ship, has the time-challenge mission to sail it to a safe place.

3.11 The evaluation

The workflow of the VM EPANASTASIS-1821 development was significantly affected on various levels due to the pandemic and the governmental health restrictions implemented for the cultural institutions, and as consequence, it was not possible for the research team to run evaluation pilots in the amount of selected museums in Greece, as it was initially designed. However, the VM EPANASTASIS-1821 was presented and tested publicly, on various events hosted in both Athens and Thessaloniki, such as the Athens War Museum, the Thessaloniki International Exhibition and the PHILOXENIA International Tourism Exhibition. The users were provided with questionnaires in digital form, consisting of three categories of multiple-choice questions: 1. personal data and relationship with culture, 2. previous experience with digital culture, and 3. evaluation of the VM EPANASTASIS-1821. In the third part, the users were asked to evaluate their experience in terms of efficiency, engagement, orientation, utility of the

devices, learnability, feeling of immersion [15, 16, 17]. The users were also asked to express their overall level of impression and level of satisfaction. The research team, who was in charge of conducting and supervising the evaluation pilots, had also recorded users' reactions and comments through the observation method.

Of the amount of the 187 people who experienced VM EPANASTASIS-1821, 34 users completed the evaluation form, half of them men. The prevailing user's profile is that of a high-educated person, who has a stable relationship with culture (visits museums often), and has a positive opinion of technology in culture and games as means which can enhance the museum experience. The evaluation's results proved that VM EPANASTASIS-1821 manages to accomplish its three-goal strategy. The users' answers showed that the majority of them managed to understand the issues discussed in exhibition thematic development, was feeling comfortable to navigate around the exhibition plan, did not lose the sense of orientation and was aware of their options, got acquainted with the manipulation of the devices quickly and got the feeling of the time travel and immersion to the historical environment.

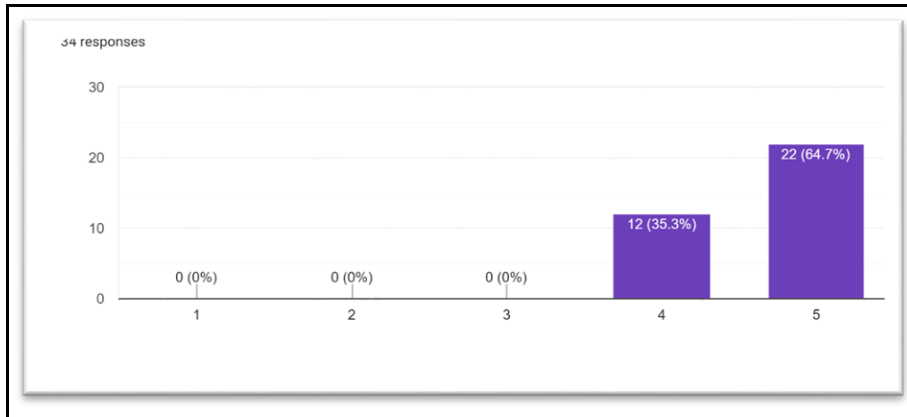


Fig.2 Users evaluate the level of immersion into the historical environment, using a 5-point rating scale (1=totally disagree to 5=totally agree).

4 Discussion

The development of VM EPANASTASIS-1821 was a challenge considering both the technological and the museological aspects. From the museological point of view, virtual museums are a current, quickly evolving entity of the museum field, with no widely acquainted characteristics and standards, both by the international bibliography and the museum practice. This factor offers the designers the freedom to exceed their creativity limits, apart from the practical and theoretical issues that this absence arises. Considering the case of a virtual museum, that is not the digital replica of a physical form and it's totally digital-born, there are no restrictions to the amount of artifacts a virtual museum space can exhibit nor are limitations to the type or size of the virtual museum space, nonetheless the designer must take into account that the exhibition material in a virtual space should not cause to the user tiredness, boredom or loss of orientation.

Interaction with the artifacts, the space and the storytelling is what makes the museum experience more vivid, participatory and experiential, and offers new insights in the communication of history, arts and culture in general. The embodiment of serious games in virtual museum environments redefine the way history is narrated, exhibition is designed and storytelling is communicated. The key words in virtual museums are experience and inclusiveness, thus the way people experience the past, with no age, educational or physical accessibility restrictions.

5 Conclusion

The purpose of this contribution is to present the workflow implemented for the development of the VM *EPANASTASIS-1821*. With the description of the pipeline that was adopted during the creation of a full-immersive, interactive virtual museum, this paper highlights the potentials of digital museology and the elements that may define the marginal differences between digital and virtual museum entities. It also exposes the potentials and the restrictions that determine the content, the characteristics, the options offered and the overall identity of the VM *EPANASTASIS-1821*.

Above all, this contribution indicates the potentials of the embodiment of serious games in a virtual museum environment, which could, concisely, redefine the way people experience virtual museums of the future. The evaluation results proved the positive attitude of the public towards a cultural practice that is not object-orientated, but experience-oriented and requires its engagement to the storytelling procedure. This fundamental shift of storytelling to a more story-living experience could bring a revolution to cultural heritage communication.

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