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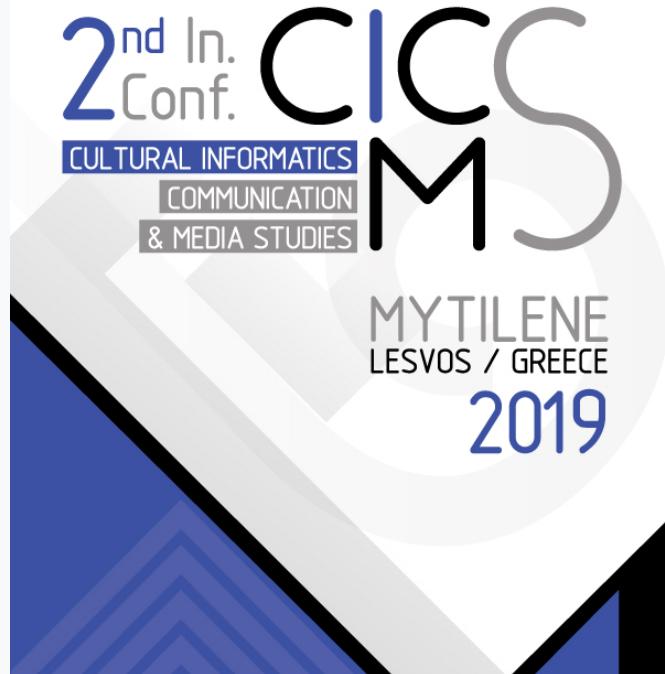
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Interactive multimedia information for digital Anatomy Museum

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Abstract

Online technology advances and the reduction of their cost have facilitated their use by museums. Today, internet users visit museums' websites around the world on regular basis. Website design helps to disseminate information and multimedia content from exhibitions and to attract visitors as well. The integrated communication strategy of the museums has changed due to digital museums development. The exhibits of anatomical museums present the complexity of human anatomy to medical students and to general public. Visiting of such museums could be difficult as the impact of their exhibits on visitors could lead to various reactions. These museums offer medical knowledge employing anatomical maps, bones, cadavers and various items explaining the history of anatomy and medicine. The aim of this research is to create and present a digital multimedia museum of Anatomy, located at the School of Medicine, Faculty of Health Sciences of Aristotle

University of Thessaloniki. The results of this study focus on the development of a digital museum for citizens, that offers an integrated, open access experience for all. The research contributes to the construction of anatomical museums' digital presence using online new technologies and multimedia content.

Keywords:

Multimedia, Digital, Virtual, Museum, Website, Anatomy

1. Introduction

Humanity's cultural heritage has been radically digitalized through years, being more and more available online on museum websites, cultural platforms, and social media. Visitors browse online museum collections for their personal enjoyment, information, inspiration and learning. Regardless the personal goals that motivate actual or online visitors, new technologies are part of the society. The incorporation of new technologies into museums calls on the new generation to come closer to authentic collections and to preserve our cultural heritage. One of the main features of new technologies is interaction (Kiourexidou et al. 2019). The interactive exhibit, with its proper design, has the power to attract more and more visitors. Furthermore, the advancement of the website has given different techniques to exploit the museums. A general purpose of the digital museum is to interact with the user in a new environment.

Digitalization can preserve and protect exhibits over time, while preserving the original which is unique. The digitalization of museums aims to protect and ensure access to digital content (University of Patras, 2005) in order to remain accessible to the public without restriction (Unesco, 2003). In this frame, online collections are opening new avenues as they provide access to larger audiences. Our scientific heritage is being digitalized and increasingly found in digital form. The technologies used to create digital files have many advantages. However, there are serious challenges in maintaining the emerging digital technology used in digitalization. The means used for transportation and storage are unstable, and the technology needed for access is rapidly being replaced by newer one. As technologies lose their technical support, access to the digital heritage such as the CD is lost. Digitalizing collections has become a key priority of many museums since they aim to preserve and enrich their Internet facet. Museums with extensive websites and mobile applications are at the forefront of online presence. Digital media, which are well designed and prudent, can enhance the visitor interaction (Kabassi, 2017).

The museum has undergone through many forms over the years until it reaches its current form. According to the statute of the International Council of Museums (ICOM), the term museum means "*a permanent, non-profit institution, at the service of society and its development, open to the public, whose task is to collect, study and to preserve, disclose and exhibit the evidence of human culture and the environment for the purpose of study, education and entertainment*" (ICOM, 2010). The actual museum will not be replaced by the digital museum. On the contrary, electronic information and devices must be complementary and enhance the actual museum (Wang et al., 2009). Websites play an important role in promoting culture (Kabassi et al., 2018). Museums are interested in digitalizing their collections, not only for the sake of preserving their cultural heritage, but also for making the information content accessible to the public in an attractive way (Sylaiou et al., 2009).

The evolution of technology could not have left the museums of anatomy unaffected. More and more museums construct websites with thousands of digital images, including those of human bodies, animals and tools, besides digital museums created (Alberti and Hallam, 2013). Anatomy museums are full of bodies, organs, tissues and tools. It is often difficult to visit these museums because they exhibit organisms that cause different reactions to each person. These museums offer insights in the history of medicine through the stuffed bodies but also through old objects. Museum websites attract visitors easier because of their free

access, while, through the information provided, they encourage visitors to visit the actual museum as well. The visitor can browse the site independently and at no cost. Creating a website is not just a conversion to HTML, but a more complicated process. The use of technologies offers interesting prospects for museums and the opportunity to add a new digital dimension to the traditional museum, thereby creating a digital museum. The internet is a great opportunity for museums to expand their audiences.

The purpose of this research is to create and present a digital multimedia museum of Anatomy, located at the School of Medicine, Faculty of Health Sciences of Aristotle University of Thessaloniki. The results of this study focus on the development of a digital museum for citizens, that provides an integrated, open access experience for all. The research contributes to the construction of anatomical museums' digital presence using new technologies and multimedia content online.

2. Related Work and Methodology

Creating a website enables it to be browsed by remote users worldwide (Kourexidou et al., 2015). Studies have shown a huge increase in online museum visitors (Fantoni et al., 2012). Nevertheless, in order to attract more visitors to a site, this must be rated as useful and functional (Kabassi, 2017). In this frame, visitors of museum websites expect them to be functional, easy to navigate and visually pleasant (Lopatovska, 2015). As a result, many researchers have pointed to the need to evaluate digital museum websites (Cunnliffe et al., 2001; Van Welie, and Klaasse, 2004). A survey, in 2008, (Marty, 2008) investigated the role of websites in the actual museum visit, gathering information from nine different digital museums. Gomes et al. (2011) present an interactive software tool aiming at creating virtual exhibitions. Another study examined the creation of an original digitalized museum based on an evaluation study in sixteen museums (Kamath et al., 2016). Bertacchini and Morando (2011) attempted to analyze how technological innovation shapes the role and mission of museums.

In the last decade, many museums have taken steps to integrate digital methods in their collections. Some of these are: Smithsonian Institution, American Museum of Natural History, etc. The Smithsonian Institution in Washington provides a good example of digitalization. A new educational, interactive multimedia museum, open to the public, was created in the area of Platonos Academy. The aim of this museum is to highlight the historical and archaeological features of the Academy by using modern technologies (Platonos Academy, 2013). Another museum in digital form is Thebes Archaeological Museum that includes online games, virtual tours and 3D illustrations (Archaeological Museum of Thebes, 2016). At the Digital Museum of Macronissos, visitors can browse numerous documents from archive collections, mentally visit camp sites and buildings, and search for evidence (Makronissos, 2019). The National Museum of History in Athens has created multimedia applications, enabling users to browse through some historical events (National Historical Museum, 2019).

In this paper, researchers create and present a digital multimedia museum of Anatomy. Initially, the objects contained in the museum along with its room were digitalized in order for high-resolution photos to be used for the creation of multimedia content. After having

completed an online database search, the authors decided that the digital museum should contain the following multimedia features: video narration for actual space exploration, 360° model views (Třebický et al., 2018), photorealistic 3D models of historical objects and virtual tours in the museum's area (Skamantzari and Georgopoulos, 2016). With these features, museum tours can be accessed remotely via exhibit communication services, which are displayed through multimedia information on the museum's website, video surveillance on the museum's YouTube channel or distribution of images from museum's profile on social networks.

3. Results

The way that information on a website is presented is an important landmark in its development process in order to effectively communicate its content to the web visitors. Multimedia content is particularly rich today and has many forms. The following four interactive multimedia information elements were created and adapted for the online museum of anatomy in order to enhance museum's communication with users:

- a) Video with a narrative about the actual tour of the place,
- b) 360° models' views,
- c) Photorealistic three-dimensional (3D) models of objects and
- d) Virtual reality tour in the museum with a 360° view of the space around a fixed location.

Originally, a video (a) was created featuring the Museum of Anatomy, in which the camera is leading from the museum entrance through the room. The video length is one minute from real scenes, was captured by a 2160p (4K) camera for excellent resolution purposes and tripods were used to keep the image stable. The resolution of the original video created was 4096 × 2160 pixels. During testing and adapting the original material to the museum's website, it was found that this analysis cause a delay in its reproduction. The video was thus converted to 1920 × 1080 pixels Full HD, so users won't have problem playing the video.

Moreover, the authors captured photographs of objects in the space and then presented them to users in two ways. One is with photographs and the other is with 360° view (b). The 2D images were captured by a high-quality camera on a white background. Initially, they were in a .nef image file format and afterwards were incorporated into a photo editor to convert to .jpg and RGB, so to load at high speed when visiting the museum's website (figure 1). Regarding the presentation of the photos in 360°, these were first captured by the camera as a set of photographs, they were then imported into a proprietary software to create the 360° view and presented online using interactive viewing. Twelve (12) photos were taken for each object and placed at 30° distance with specified directions of 0 °, 30 °, 60 ° etc. In the presentation of the object on the website, the user is given the option to manipulate the model with the arrow keys placed in the lower right corner of the screen (figure 2).



Figure 1. Object presentation in 2D format



Figure 2. Presentation of an object in 360°

Computer-generated 3D models have been widely used in the field of cultural heritage applications, helping to diffuse images across the web. Blender an open source 3D modeling software was selected from a huge variety of 3D modeling programs and each object was built in about three days. Models construction was divided into two levels (c). The first level is the shape and the second level the texture of the objects. The 3D models were first made by inserting two-dimensional photographs into the program to design the photographs, and then by using tools, the volume of objects and textures was rendered to be plausible. Finally, rendering was done to extract the photos (figures 3-5).

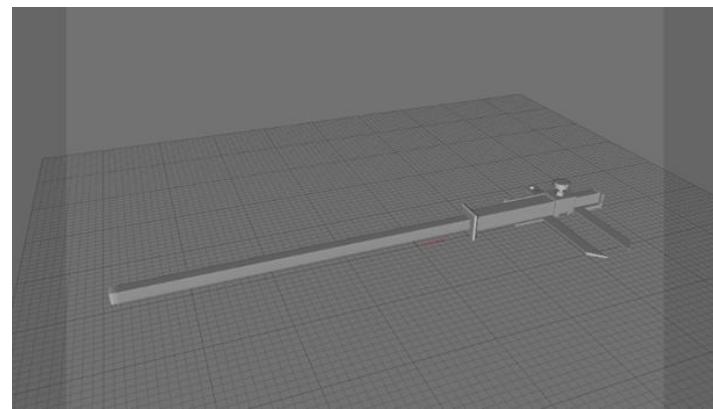


Figure 3. 3D modeling environment



Figure 4. 3D model (front view)



Figure 5. 3D model (rear view)

Finally, the museum's digital space was created from photographs in order to accomplish a 360° view of the space around a fixed location (d), giving a sense of immersion. This space was created using a plug-in on the website to present the museum room. The plug-in was installed, and photos were embedded to begin the construction of the room. Some points were then added to the photographs with information so that the user, when selecting them, could be in contact with exhibit information. In all the above multimedia presentations there were texts with information explaining what each object is, its function and use that were also added. The multimedia content created is a digital communication tool and completes the presentation of museum's interactive media.

4. Discussion

The main purpose of this study was to create and present a digital multimedia museum of Anatomy, located at the School of Medicine, Faculty of Health Sciences of Aristotle University of Thessaloniki. Multimedia is a mean that uses numerous forms of information and information processing (e.g. text, audio, graphics, animation and video) to inform or entertain the user (Pavithra, 2018). Video is a modern tool, a powerful and highly effective way of communicating and promoting the museum. A related survey showed that 72% of customers would prefer to learn about a product or service by viewing a relevant video (HubSpot, 2019). According to Choi and Johnson (2007) the video can help to understand the content more easily compared to an explanatory material. The Museum of Anatomy constantly addressing to the needs of visitors and wishing to strongly support their online visit, created a video from its place. This trend is already visible in many museums, one of which is the Acropolis Museum which has implemented a conservation and restoration program for the Erechtheion Caryatids. Visitors had the opportunity to watch on-site videos of Museum preservationists scouring the sculptures (The Acropolis Museum, 2012), another video that was created by the museum to attract visitors (The Acropolis Museum, 2017). Another video-producing museum is the British Museum. It has a YouTube channel that was launched again in August 2010 (The British Museum, 2011) with a specific plan to upload new high-quality content quality 2-3 times a month. Many of these videos are thematic or report-based (The British Museum, 2006).

The 360° photos allowed the museum's objects to be displayed at no cost, but the process to capture and edit the photos took time. Displaying all sides of a product in a single view saves screen space and makes the site look different (Třebícký et al., 2018). Many museums use the 360° feature, one of which is The Metropolitan Museum of Art in New York that presents its space through a 360° video in which the user can interact and view the surroundings (The Metropolitan Museum of Art, 2017).

In creating interactive multimedia content, researchers modeled objects in 3D models while retaining virtual copies of susceptible objects. The completed interactive 3D recording is a virtual representation of the museum's physical objects that the user can see from every corner of the computer. As 3D recording became more widely available, museums' websites are becoming easier to use. One of the museums in Greece using 3D models is Thebes Archaeological Museum, which presents some of the exhibits in 3D in its website (Archaeological Museum of Thebes (2016). The site of the museum was digitally created

using photographs. According to Gomes et al. (2011), immersive photographs further expand the sense of immersion, offering 180⁰ up-and-down viewing capabilities.

This study created multimedia content that apply to a compact anatomy museum, without users being surveyed. As confirmed by surveys related to small museums (Sylaiou et al., 2009) and medical small museums (Scucces et al., 2012), users prefer multimedia content which is immediately accessible and relevant to their content. In addition, they want to have fast speed access and to communicate their content directly to users with new interactive technologies. Finally, the research by Kortbek and Grønbæk (2008) investigated and evaluated whether multimedia content can satisfy the users themselves not only in their online visit but also when they use it after their actual visit to the museum.

5. Conclusions

The objective of this paper is to highlight the use and exploitation of multimedia content in websites. The contribution of this paper lies on describing the construction of the anatomical museums' digital presence using new technologies and multimedia content online. Researchers have discussed the application of four multimedia techniques for digital art communication in a museum. 3D modeling and objects presentation in a museum is a very difficult and complicated process, which requires detail and precision. Multimedia in the digital presentation of the museum offers the visitor a new experience over a simple text. Typically digital presentation includes interactive multimedia, hypermedia, digital video, computer graphics, virtual reality, and interactive exhibitions.

Users interact not only before their actual visit to the museum but also during that, something that is useful for museums as well. The interaction and communication between users and exhibits may not be a mere visit matter but a reason for constructing new representations and uses of the exhibits themselves in the new digital world that has been created. In the future, it would be advisable to conduct research to check whether the digital information added to the site has contributed to the museum's success. New technologies allow the museum to obtain a whole new reality. The collection should be accessible and enjoyable, not only for those who visit it, but also for those who have access to electronic devices such as computers, mobile phones and other. Developing a museum with multimedia content requires an interdisciplinary approach and is one of the elements that makes it impressive for the public.

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