Heritage virtualization - innovations in museum narrative

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Abstract: *The topic of digitalization of heritage is one of the pressing issues regarding the protection and development of culture. Digitalization is making Europe's cultural resources an important pillar of the digital economy and improving public access to the various forms of heritage and interaction between heritage and public. Heritage stored into the memory institutions with the advancement of digital technologies and communications, require a new "read", in expanded historical, geographical, scientific, but already and technological context. In this sense, the research perspective that defines the present study views the world of digitalised cultural artefacts as a technologically mediated way not only of documenting, but also as a new way of telling stories and disseminating cultural knowledge in the form of virtual heritage (VH).*

Keywords: *CULTURAL HERITAGE, VIRTUAL HERITAGE, NEW TECHNOLOGIES, MUSEUM NARRATIVE, CONSUMER PERCEPTION*

1. Introduction

The topic of digitalization of heritage is one of the pressing issues regarding the protection and development of culture. Digitalization is making Europe's cultural resources an important pillar of the digital economy on one hand, and improving public access to the various forms of heritage and interaction between heritage and public on the other.

Movable and immovable cultural values stored into the memory institutions (libraries, museums, galleries, community centers, etc.), with the advancement of digital technologies and communications, require a new "read", in expanded historical, geographical, scientific, but already and technological context. This necessitates the need for a versatile scientific and applied expertise which works simultaneously in the field of museology, informatics and management in order to develop and integrate innovative technologies for managing, exhibiting and promoting museum collections and cultural heritage. Storytelling, which is the most important aspect of all computer-generated worlds, needs both inspired screenwriters – museum curators and innovative technologies to offer easy and simultaneous use of object semantics, their digital images, their descriptions and user expectations. In recent decades, virtual reality and augmented reality technologies have been widely used in this field, and the rapid pace of development has already made it possible to reproduce mixed reality and augmented (advanced) virtuality.

In this sense, the research perspective that defines the present study views the world of digitalised cultural artifacts as a technologically mediated way not only of documenting, but also as a new way of telling stories and disseminating cultural knowledge in the form of virtual heritage (VH).

2. Innovative technologies for heritage virtualization

In the context of an active policy for the development of the cultural and creative industries, on the one hand, and the emphasis on the protection of cultural heritage and its integration as a resource for sustainable development, on the other, scientific theories and practitioners often seek opportunities to solve problems in the field and implementation of policies through digital technologies.

Cultural researchers and practitioners in the cultural industries have begun to take an interest in technologies and their applicability in the field of heritage since the late 1990s, with many suggesting the potential for protecting and promoting it [1,2]. Practical examples show that over the years, technologies have facilitated the presentation of heritage and facilitated the accumulation of a rich digital archive of cultural content. In this sense, however, it is more appropriate to speak of digitalization as documentation of heritage, on the one hand, and / or of a new type of digital heritage (virtual – VH), which has its own characteristics that differ from the characteristics of heritage in its tangible and intangible varieties,

although representative of the same. Champion [3] describes virtual heritage as a term that reflects the ambiguous and interpretative nature of its processes. It is an "attempt to convey not only the appearance but also the meaning and meaning of cultural artifacts and related social value, designed and used through the use of interactive and immersive digital media." The new digital legacy is easily catching the public's attention and impacting through the abundance of information that can be disseminated through channels to multiple recipients. And if cultural studies in the 1990s concerned the audiovisual presentations of heritage, presented in the form of audio and / or video recording of a particular object, then today we are already talking about reality and virtuality in a spatio-temporal continuum of heritage. In this sense, as Seulah Kim et al. [4], the digital technologies of the Fourth Industrial Revolution enrich the museum experience, enabling visitors to use others' experience, imagination and creativity. Klaus [5] uncovers the foundations of the Revolution in several major technologies: virtual reality (VR), augmented reality (AR), 3D printing systems, metadata, artificial intelligence (AI) and cloud computing. Some of them, as well as some variants (mixed reality - MxR, augmented virtuality - AV), are already widely used in museum activities as well as in the creative industries around the world. As far as Bulgaria is concerned, examples are still limited, with technologies at the stage of learning and integration.

The technologies listed have their points of contact, but they are generally different. Their main characteristics also determine the extent to which they are used and integrated in the context of the cultural and creative industries in connection with the vitalization of heritage.

In order to evaluate the potential for the application of the described innovative technologies as a possibility and basis for the development, it is first necessary to characterize them and then to consider them in the field of research and application of the heritage.

Seoulah Kim et al. [6] describe the effectiveness of VR technology (a fully computer-generated world) as an unattainable reality experience. Technology immerses users in a virtual environment with no or little opportunity for direct interaction with their immediate physical environment [7]. VR has the potential to simulate imaginary and existing physical environments, along with their processes.

Azuma [8] defines AR as a system that combines real and virtual content, provides interactive real-time environments, registers in 3D and aims to improve the understanding or perception of the physical environment. This is achieved by adding digital content to the physical environment or overlaying a virtual image on a real image.

Like AR, Augmented Virtuality (AV) also seeks to improve consumers' understanding of the environment to which it is applied. To this end, AV is expanding virtual environments with live scenes of events and real-world elements. Due to the virtual simulations

that serve as the base environment in AV, this segment, as Bekele and Champion [9] write, can be misunderstood as a kind of VR, which is problematic as the goal of improving the virtual scene environment Live is to improve understanding of the underlying virtual environment. And while VR has no direct impact on the consumer's perceptions of the real world, AV does to some extent this, as live scenes are transmitted from the real world.

MXR technology blends real and virtual environments into different shapes and proportions. Like AV, mixed reality is still rarely used, especially with regard to cultural heritage. Technologies such as the Cave Automatic Virtual Environment (CAVE) system lessen the sense of reality and enhance virtuality.

The digital technologies described are particularly attractive to a wide audience who are not interested or aware of cultural heritage, especially in the part of the intangible or tangible cultural heritage preserved in ruins.

The technology itself is sufficient to elicit public curiosity, lower accessibility barriers, and as mentioned above, there are multiple opportunities to disseminate through multiple channels to multiple recipients. This means that the general public has direct access to the media of the culture in question and the opportunity to experience and gain experience in a comfortable and enjoyable environment that enhances the motivation and awareness of the audience and thus helps to preserve and develop the heritage [10].

3. Heritage virtualization in museum narrative

The topicality of the researched field presupposes increased scientific interest in the topic in recent years. At the same time, the rapid development of technology, on the one hand, and the sluggish institutional system in the field of cultural heritage, on the other, focus researchers on the problems of digitalization from the point of view of heritage documentation in particular. The potential of tools such as 3D, AR, VR and their variations remain relatively little studied in terms of their use in the field of heritage. However, as pointed out by Asenjo, Economou and Meintani [11], museums are leading in the experiments with these new technologies and the ways in which it can be used as educational tools. As far as Bulgaria is concerned, there is not only a lack of theoretical reasoning on the issue, but also a delayed application of these new technologies in comparison with other European countries. However, it should be noted that our country is cited as a good example in the EU Report 2019 in connection with the implementation of the Recommendations on the digitization and online accessibility of cultural materials and digital storage [12]. The project implemented by the Municipality of Plovdiv creates a digital center for construction of 3D models of buildings, urban areas and objects, which distinguishes it as a good practice at European level in terms of digitalization of immovable cultural monuments. This important fact implies increased interest and rapid progress in the coming years of our country in terms of the applicability of digital technologies in the field of heritage.

The digitization of heritage or the use of computer-generated worlds to disseminate cultural knowledge in the form of virtual heritage can be called "new museology". Within the changing environment, movable and immovable cultural values stored in the institutions of memory (libraries, museums, galleries, community centers, etc.) require a new "reading", in an expanded historical, geographical, scientific, and now technological context. This imposes the need for multifaceted scientific and applied expertise, which works simultaneously in the field of museology, informatics and management, in order to develop and integrate innovative technologies for management, exhibition and promotion of museum collections and cultural heritage in general. In this sense, museum narrative and storytelling, which is the most important aspect of all computer-generated worlds, needs both inspired screenwriters - museum curators, and innovative technologies that offer easy and simultaneous handling of the semantics of objects. , with digital

images, with descriptions and with consumer expectations. In addition to the scientific context, the term "heritage", considered within the Network Society, beyond the scientific value, semantically expands its essence in the field of cultural values through consumer content, which complements and enriches the story told by the artifacts and thus expands the scope in who think and perceive heritage, and hence collective and community memory. Thus, the institutionalized memory becomes a contact zone, which seeks and meets its audience through active communication in a technologically mediated way. Thanks to this process, the museum narrative in the 21st century is no longer linear, directed by the institution to the public, but multi-layered, in which experts and users of heritage participate equally.

Modern "new" museology and museum narrative have developed in the context of the museum's crisis since the late twentieth century, when a broad public debate began about the foundations of the institution and its impact on audiences. The "technological" aspect of the new museology supports the process of heritage valuation, offering a new understanding for a wider part of society and thus improving communication. In fact, heritage, although derived from the past, is constructed in the present and in this sense it should be adapted to the present. The last decade has seen an increase in the number of digital projects that take place on different scales and through different technological tools - from the use of 3D visual and audio modeling of archaeological sites for large-scale digitalization to generating entirely computer worlds that immerse the audience in the past. , using the technologies listed in the previous section. The new instruments provide a new experience and involve the active participation of the public in the museum narrative. As Henderson argues [13], the range of leisure activities is expanding, changing social practices, the use of time and places for leisure. In other words, to meet today's challenges and the development of communities, the museum in the new century is transformed from an educational to an entertainment institution. This, of course, does not mean that the dissemination of knowledge remains in the background, just the focus has changed, according to the requirements of modern times. In this line of thought, it is technology that mediates the balance between the various functions of the new museology.

Navarrete [14] summarizing Falk and Dierking's idea of the museum as entertainment, writes that the time to visit the institution increases, including the period before, during and after the actual visit. According to Navarrete, the overall museum experience is shaped by finding information on the Internet, visiting, sharing images on social media and gaining new knowledge and memories. In other words, technology is an important part of the overall museum experience, and the institution's presentation on the Internet is an important part of the museum's narrative. It should be noted that visiting the museum today can be both physical and virtual. And it is here that AR and VR technologies are used, less their AV and MxR variants.

Navarrete [15] writes that digital technologies unleash the repositioning of collections and thus the so-called Niggermann, de Decker, & Lévy creates a new Renaissance, and the legacy finds new applications and new users. It is about the development of new products and services by museums such as online exhibitions, virtual tours of exhibition halls, new processes for research, display and management of collections, presentation of movable and immovable cultural heritage, samples irretrievably lost to humanity. In this way, memory institutions reach new markets and add to existing resources opportunities to generate new capital through a new offer for a complete experience. Through modern innovative technologies, it now includes not only the cultural artifact and verbal (or textual) presentation by the tour guide, but a complete immersion in the atmosphere of the past through an audio-visual presentation that mixes real and virtual environments.

In 2004, Wojciechowski et al. [16] offer the ARCO system - Extended Presentation of Cultural Objects as part of the Fifth Framework Program of the European Union (IST-2000-28336).

This system allows the museum to easily create virtual exhibitions using AR and VR technologies. The application can be used both in the physical environment and on the Internet, allowing visitors to interact with the content in an intuitive way. An example of such an exhibition is "Travels in the Mediterranean" from February 2020 at the Lumiere Gallery in Paris. The interactive exhibition includes over 500 paintings by famous artists, most notably Claude Monet and Auguste Renoir, presented through holographic images projected over more than 3,000 square meters. The paintings literally come to life in front of the visitors against the background of classical jazz. In a similar aspect, the Rijksmuseum presented Rembrandt's voice recreated through biometric data. It is superimposed on the image restored on the basis of portraits of the artist and so the museum successfully teaches drawing lessons in a digital environment.

Riedel et al. [17] presents a system for improving the readability of difficult-to-read details of artifacts due to their poor physical condition. The system projects an expressive 3D visualization on a real object, emphasizing its characteristics in real time.

The 3D Murale project [18] – 3D measurement and virtual reconstruction of Europe's ancient lost worlds - aims to develop a system capable of recording phases of archaeological excavations using virtual reality technologies. In addition to artifacts, stratigraphic layers can also be modeled. This requires the use of a variety of 3D shooting techniques. In addition, the project offers the reconstruction of exposed remains of ceramics, sculptures and even buildings, as well as their visualization. Similar is the ARCHEOGUIDE [19] project, which allows visitors to see virtual reconstructions of ancient buildings. Users are equipped with an HMD device (literally - Head mounted display). Depending on the position of the visitor, the device displays relevant information. The LIFEPLUS [20] project has similar functions, the main difference being that in this case real-time 3D simulations of ancient fauna and flora are covered.

Miyashita et al. [21] offer an AR-based digital guide designed for two main purposes: to provide visitors with information that allows them to fully understand works of art, and to help them navigate the exhibition space in a meaningful way.

Han [22] also presents AR systems for outdoor cultural heritage based on innovative technologies. These systems can recognize a cultural heritage site in real time by virtually reconstructing the 3D object in a real visual environment. An example of such a presentation is given by Banterle et al. [23] with the augmented reality application LecceAR. Of course, in practice there are other similar examples, including from Bulgaria.

Another example of an open-plan solution is the Ename 974 project, aimed at the virtual reconstruction of an extensive archaeological site located in Ename, Belgium [24]. Through stationary AR kiosks, visitors have the opportunity to experience the reconstruction of medieval buildings by visualizing virtual models superimposed on video data captured by a camera. Through special touch screens, users can control the camera and the displayed data.

Virtual Showcase Projects [25] are designed to eliminate the need to use conventional methods for representing cultural objects. The project aims to integrate AR technology into traditional museum showcases so that virtual images are projected on the side of the artifacts, allowing users to explore both the physical artifacts and their virtual reconstructions.

It is particularly important to note that all these applications of new technologies in the field of cultural heritage create an entirely new museum narrative in which the public is fully engaged. All these innovations involve not just contemplation of heritage, but active participation in the process of knowledge creation. This process can be further enhanced by the introduction of game elements in the narration (perception) of the heritage. As Luna, Rivero and Vicent write [26]- some innovative technologies implemented in mobile applications offer routes for visitors to follow in the museum space, others - outdoor routes, quizzes and even more complex approaches to gamification, of course , there are also applications that simply provide information about inheritance assets in the form of texts, videos or other resources.

Regarding the use of AR and VR in the context of heritage, research on the products created has been done in Spain, Italy, Greece, Korea and Malaysia, which research is summarized by Luna, Rivero and Vicent, which summarize that projects such as LIFEPLUS, ARCHEOGUIDE, Itacitus [27], Ancient Pompeii [28, 29] and other have been shown to increase visitors' understanding of cultural heritage. The reason is found in the personalized content that engages the audience through interactive interaction with the heritage.

Technology is evolving rapidly, and if years ago its use was an expensive pleasure for large museums, today even the smallest can afford innovation. An example in this direction can be the Archaeological Museum - Sandanski, which employs only 4 people. A virtual guide - an archbishop from the period of early Christianity, recreated using AR technology, complements the team, helping to serve visitors with a story about the history of the ancient basilica. The holographic image of Spartacus is the other innovation that impresses the audience of the museum. Full-length, the ancient Thracian complements the museum narrative with a first-person narrative. The described innovations are available thanks to the proliferation of smart devices, still an expensive pleasure remain HDM devices that offer complete immersion in the past.

4. Conclusion

The advantage of the virtual heritage, reconstructed through innovative technologies, is found in the possibility for full restoration of the currently destroyed monuments. Through AR and VR, the exterior and interior of buildings preserved in ruins is completely possible, without contradicting the Venice Convention on the Restoration of Immovable Cultural Monuments. Moreover, they can not only be reconstructed, but also brought to life by technology. Based on preserved historical data, it is quite possible for the history of an object to be told in the first person by a historically charged person. All this is without a doubt an intriguing presentation that not only engages, but intrigues audiences and creates a new visitor experience - real or virtual.

As Luna, Rivero and Vicent [30] point out, it is important to conclude that research is difficult and even more difficult to construct in terms of the use, application and impact of technology on museum narrative and visitors. The reason is the rapid pace at which innovation develops, which leads to constant change and innovation. This complicates the research in the long run, because at the moment when a given technology has been studied and applied, there are already new ones that make the previous ones meaningless and in this context the research is no longer relevant. This is a special case in Bulgaria, where only in recent years there has been talk of the existence of virtual and augmented reality, and their application in the field of heritage began only 2-3 years ago. At the same time, globally, for example, Italy, China and other countries with a rich cultural heritage already have comprehensive policies in place regarding the use of technology. The EU has even developed technology visualization standards through the London Charter [31]. While we in Bulgaria continue to understand digitalization as documentation of heritage, focusing on the lack of unified software for digitization of cultural values.

An important factor in terms of heritage virtualization and the change in the museum narrative is funding. Although technology prices are becoming more affordable, economic resources are a prerequisite for the development of quality tools that are based on clear educational and / or entertainment objectives and that can be changed and improved after the analysis of the results.

The presented innovative technologies and good practices allow museums to present their collections and preserved heritage in a new and intriguing way for the public. Thus, the so-called new museology. The "technological" aspect of the new museology supports the process of heritage valuation, offering a new understanding for a wider part of society and thus improving communication. The museum's narrative of linear, directed by the institution to the public, gradually becomes multi-layered, in which experts and users of heritage participate equally. This process opens up new opportunities, but also new challenges in the field of cultural heritage.

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