

Modern approaches utilized in virtual museums to assist cultural heritage The British museum as a study case

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Abstract:

Virtual museums leverage technology to overcome limitations of physical museums by offering detailed artifact examination, VR experiences, and interactive features. The article explores the debate on virtual vs physical museums, concluding that both offer value and should work together. It details the technologies behind virtual museums and explores modern exhibition techniques like VR and AR. Highlighting the role of virtual museums in heritage preservation and acknowledging challenges, the article concludes that virtual museums are crucial for cultural heritage accessibility, engagement, and understanding. The British Museum exemplifies how technology can revolutionize cultural heritage presentation and preservation.

Keywords: virtual Museums - Cultural Heritage - Modern technology - Virtual Reality (VR)- the British Museum - Augmented Reality

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1. Introduction:

The museum, a cornerstone of cultural heritage preservation and dissemination, has historically faced limitations in accessibility and engagement. Physical location restricts visitation, while the immense volume of artifacts often necessitates selective display. However, the digital revolution has marked in a new era for museums, with virtual spaces leveraging modern technology to bridge these gaps. This article explores the transformative role of modern approaches in virtual museums, demonstrating how these platforms are not only Facilitating access to cultural heritage but also encouraging deeper engagement and enriching the understanding of history.

By employing virtual reality (VR), and interactive features, virtual museums transcend the confines of physical walls. High-fidelity representations of artifacts allow for detailed examination, while VR experiences transport visitors to recreated historical settings. Interactive elements like audio guides, quizzes, and user-generated content further enhance engagement, making learning about cultural heritage an active and dynamic experience. This article delves into these innovative approaches, analyzing their impact on accessibility, preservation, education, and the overall experience of cultural heritage. Through a critical examination of these advancements, we will demonstrate how virtual museums are not merely replicating the traditional museum experience but are actively redefining it for the 21st century.

This research aligns with the growing interest within the management field in the intersection of technology and cultural institutions. By exploring the innovative practices of virtual museums, this

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article offers valuable insights for museum management professionals seeking to leverage technology to enhance their institutions' reach and impact.

2. The relationship between museum and virtual museums:

This part will emphasize on the difference between real and virtual museums and explain connection between them.

2.1. Definition of virtual museum:

A virtual museum is defined as a museum that utilizes modern information and communication technologies to present museum collections. It can be an integrated cognitive system, offering interactive 3D representations or copies of monuments created using computer methods. Additionally, it can be a digital unit that complements, improves, or extends the museum experience through personalization, interactivity, and rich content.

There are two types of virtual museums, a Virtual Museum available only online and Virtual museums operating online but expanding the offer of a traditional museum.

One of the unique features of virtual museums include the ability to collect exhibits from various locations and different museums, creating exhibitions that may not have been possible in the traditional form. They can also provide access to collections that are not presented in traditional museums, promote cultural heritage, and serve educational and entertainment purposes(Skalskacimer, B, & A, p. 04).

2.2. The interaction between real and the virtual museums:

Museums have long grappled with the tension between physical and digital experiences. This debate, often framed as the "real-virtual divide," centers on whether virtual exhibits can ever truly replicate the essence of a museum visit.

Ann Mintz, a museum scholar, argues strongly against the idea of a full-fledged virtual museum. She highlights the limitations of digital technology: the loss of texture and scale in paintings viewed on screens, the imperfect color reproduction, and the fundamental difference in how our brains process information from objects versus monitors.

Mintz goes further, emphasizing the unique emotional connection visitors forge with physical objects in museums. These experiences, she believes, cannot be replicated virtually. As a result, some critics, echoing debates surrounding photography's introduction in museums, view digital media with suspicion.

However, the digital age is here to stay. The key lies in finding synergies between physical and virtual museums, offering the "best of both worlds" as Clough (2013) suggests. This requires rethinking the very terms "real" and "virtual."

The International Council of Museums (ICOM) offers a helpful perspective. They argue that "virtual" doesn't oppose "real" but rather "actual." A virtual museum, in this sense, represents the totality of possibilities – all the museums and solutions imaginable in the museum world.

Similarly, Pierre Lévy proposes that "virtual" shouldn't be seen as the opposite of "real" but of "actual." The virtual represents potential, waiting to be actualized. Just like a seed holds the potential for a tree, a virtual museum can hold a multitude of possibilities for future exploration and engagement.

However, actualization doesn't always happen. The seed may not grow, and a virtual museum's potential may not be fully realized. Furthermore, the meaning of "real" and "virtual" varies across disciplines. This adds another layer of complexity to defining the virtual museum.

By acknowledging these differing perspectives, we can move forward with a more nuanced understanding of the virtual museum. This exploration will delve into ICOM's definition of museums and virtual museums, examine the foundations and early years of virtual experiences in museums, and consider the impact of the internet and World Wide Web. Ultimately, this journey

will lead us to a more comprehensive definition of the virtual museum in the ever-evolving museum landscape (Werner, 2019).

3. Technological requirements for virtual interaction:

This section explores virtual museums (VMs) that leverage the internet for immersive online experiences. It then examines how modern exhibition techniques like VR and AR are transforming physical museum visits by creating interactive and engaging encounters with cultural heritage.

3.1. Technologies that support virtual museums:

The internet has revolutionized the museum experience by enabling the creation of virtual museums (VMs). VMs leverage the internet's capabilities to provide immersive and accessible online experiences that complement, and even replace in some cases, traditional physical museums. The internet empowers virtual Museums in several ways:

Multimedia: VMs can utilize a vast pool of multimedia resources including text, images, audio, video, animations, and even VR to cater to diverse learning styles and foster deeper engagement.

Simulation and Modeling: Simulation technologies allow visitors to virtually explore recreated historical scenes, manipulate objects in 3D space, and participate in simulated experiences, fostering a sense of active discovery and exploration compared to static displays.

Beyond the Screen: Mini-worlds and games provide a playful and engaging way for visitors to interact with museum collections through avatars. Augmented reality (AR) can further bridge the gap between the physical and virtual worlds by overlaying virtual objects onto real-world environments.

Visualization Tools and Live Streaming: Visualization tools allow for the presentation of complex datasets in a compelling way, while live streaming technology can be used to capture and transmit real-time museum events, offering a window into the workings of the physical museum for virtual visitors.

In conclusion, VMs leverage the power of the internet and various technologies to create vibrant and dynamic online environments that complement and enrich the traditional museum experience for a global audience(2022، عاطف عطية).

3.2. Modern Techniques in Museum Exhibitions:

The museum experience has undergone a significant transformation in recent years due to the integration of advanced technologies into exhibition design and presentation. These modern techniques have revolutionized the way museums engage with visitors, providing immersive, interactive, and informative experiences that transcend the limitations of traditional displays.

3.2.1. Virtual reality exhibition:

A virtual reality exhibition is an immersive and interactive experience that allows users to explore artificial environments and interact with 3D models of museum artifacts. It can be experienced through VR devices like head-mounted displays or 3D glasses, or through interactive installations in physical spaces. These exhibitions can also be accessed through web browsers, offering 3D galleries for virtual exploration. Additionally, augmented reality exhibitions overlay virtual objects onto real-world environments, providing a unique way to interact with museum artifacts. Overall, virtual reality exhibitions provide a blend of entertainment and education, engaging visitors in constructing their own exhibitions and experiencing artifacts from different viewpoints.

The combination of augmented reality (AR) technology and virtual museums has been a subject of interest for researchers and professionals. AR has been applied in museum exhibitions to enhance the visitor experience by providing interactive and immersive elements. The use of AR in virtual museums allows for the presentation of holograms, virtual environments, and interactive displays, enriching the educational and entertainment aspects of the exhibitions. Additionally, AR technology has been employed to make historical and cultural content more accessible and engaging for visitors.

The application of AR in virtual museums has the potential to increase interest, disseminate information effectively, and provide a more interactive and dynamic experience for museum visitors (Sylaiou, Liarokapis, Patias, & Georgoula, 2005).

3.2.2. Augmented and mixed reality exhibitions:

3.2.2.1. Augmented Reality (AR) Technology

AR technology seamlessly integrates the virtual and real worlds to facilitate effective interaction between the two realms. Milgram and Kishino proposed a theoretical framework for AR, termed the "Reality-Virtual Continuum." They posited that AR encompasses a spectrum between reality and virtuality. Azuma's study further elucidates that AR comprises three key elements: real-time virtual world merging, real-time interaction, and registration tracking.

3.2.2.1.1. Real-time Virtual World Merging: By real-time tracking of the surrounding environment, the AR system superimposes virtual reality scenes onto the real world through display devices.

3.2.2.1.2. Real-time Interaction Technology: AR real-time interaction primarily involves interacting with a two-dimensional screen to control a three-dimensional virtual object.

3.2.2.1.3. Virtual-Real Fusion Technology: This technology refers to the display technique that seamlessly merges virtual scenes with real scenes. An AR system must ensure the consistency of virtual and real scenes, including geometric consistency, lighting consistency, and temporal consistency. (Chong & YE, 2022)

Augmented and mixed reality exhibitions are immersive and interactive experiences that combine virtual and physical elements to enhance the visitor's engagement with cultural heritage. These exhibitions utilize advanced technologies to provide a more realistic and interactive environment for museum visitors. Augmented reality (AR) involves overlaying virtual objects onto the real-world environment, allowing visitors to interact with virtual artifacts in the physical space. On the other hand, mixed reality (MR) exhibitions integrate virtual and real objects in the same space, creating a seamless blend of physical and digital elements (Chen & Liu, 2024).

3.2.2.2. Key features and applications of augmented and mixed reality exhibitions include:

3.2.2.2.1. Enhanced visitor experiences: These exhibitions offer a more engaging and interactive way for visitors to explore cultural artifacts and historical contexts.

3.2.2.2.2. Interaction with virtual artifacts: Visitors can manipulate, rotate, and examine virtual artifacts in detail, creating a more immersive learning experience.

3.2.2.2.3. Integration of virtual and physical spaces: AR and MR exhibitions enable the coexistence of virtual and real objects, blurring the boundaries between the physical museum environment and digital content.

3.2.2.2.4. Social and learning enhancements: These technologies can enhance social experiences and learning in museum settings, providing new opportunities for education and interaction (Sylaiou, Liarokapis, Patias, & Georgoula, 2005).

Overall, augmented and mixed reality exhibitions represent innovative approaches to museum experiences, leveraging technology to create more immersive and interactive encounters with cultural heritage (Xiaoyan, Rao Unnava, & Hyojin, 2019).

3.2.3. Hologram technology

Hologram technology offers a revolutionary approach to visualization and interaction, employing lasers to create three-dimensional images that appear to float in mid-air. This technology captures intricate details of objects through a complex interplay of light waves, allowing for reconstruction and display of virtual representations. Beyond its captivating nature, holography offers distinct

advantages: unparalleled realism, interactive experiences, and the ability to create augmented reality environments. These features have led to diverse applications, including enhancing museum exhibits, facilitating medical training, and revolutionizing product design and entertainment. In the realm of museums and archaeological sites, holography plays a crucial role in preserving endangered heritage. By

3.2.4. Printing and Scanning Technologies in Museums:

3D-scanning and printing technologies are revolutionizing the museum experience by offering visitors new creating high-resolution, 3D visualizations of artifacts, interactive exhibits, and even virtual reconstructions of historical sites, holography fosters a deeper understanding and appreciation of our shared past (Zhu & Wang, 2022). ways to engage with and understand museum objects. According to a study, these technologies allow visitors to "feel and look at objects previously only viewable under glass" (p. 33), providing a more sensory and direct experience than traditional displays.

Museums are employing 3D-printing in several key ways:

- **Hands-on learning:** Museums can scan and replicate original pieces for visitors to handle and study directly.
- **Educational exhibits:** Exhibits dedicated to 3D-printing technology itself can spark visitor interest and engagement.
- **Restoration:** Damaged artifacts can be restored using 3D-printed replicas.

3D-scanning and printing technologies are changing museums. These technologies allow visitors to have a more hands-on experience with museum objects, such as feeling replicas of artworks or designing their own 3D models. This can be especially beneficial for visitors with visual impairments or for educational purposes. Additionally, 3D scanning allows museums to share their collections digitally, making them more accessible to a wider audience. Overall, 3D technologies are creating a more interactive and engaging museum experience. (Roberto Ivo & Paula) (Roberto & Fernandez, 2022, p. 38)

4. The Role of Virtual Museums in Heritage Digitization:

Cultural heritage is the memory of a nation and a testament to its existence throughout the ages. Digitization serves as a conduit for transferring heritage from the past through archives to the present via modern technological means, encompassing preservation and storage methods, and into the future through the internet and other cutting-edge technologies in the realm of digitization and innovation.

Traditionally, heritage documentation has been carried out in museums. With the advent of the digital transformation, museums have begun digitizing their collections through virtual museums, which provide a wealth of additional information about artifacts, such as ownership history and other pertinent information related to museum holdings. Digital artifacts can also be viewed and enlarged, enabling the discernment of minute features like tiny cracks or smooth brushstrokes.

Furthermore, archaeological remains can be recreated using a diverse display approach, where the virtual display can transform guests from passive viewers and readers into active participants and representatives. Visitors can engage in a more enriching and enjoyable experience.

Virtual museums can also provide a range of information about intangible heritage, such as handicrafts, customs, and traditions, which can be presented in multiple languages.

As a result, the digitization of heritage underscores its immense significance for museums and the protection of their resources and collections. In addition to its role in preserving the role of museums for future generations by enabling public participation, it paves the way for a sustainable future and ensures that cultural heritage information is digitally accessible for general ease of access.

On the ground, the digitization of heritage or digital documentation of heritage faces numerous challenges, extending beyond technical issues. Virtual museums grapple with a disconnect between

development and concern for their wide-ranging applications. Unfortunately, the virtual museum strategy is not yet considered a priority for real-world museums.

Despite the remarkable technological advancements and internet speed, which increasingly link the digital and physical worlds through a range of devices, including mobile phones, and offer new possibilities for preserving, archiving, and promoting our cultural heritage. Therefore, virtual museums should be given due attention as part of a larger strategy for preserving and promoting cultural heritage(Qian, 2024, pp. 1-12).

5. Digital approaches in British museums (Study case):

This section explores the application of modern exhibition techniques in the British Museum, a world-renowned institution. This case study will illustrate how these advancements influence the presentation and understanding of cultural heritage.

5.1. presentation of the British Museum:

The British Museum stands as a global hub of culture and history, attracting a staggering 27 million visitors to its website and 4.5 million to its London location. Engaging audiences worldwide, it boasts 6 million followers across English and Chinese social media. The museum fosters a love of learning, welcoming 153,000 UK schoolchildren annually and showcasing its innovative spirit through the Samsung Digital Discovery Centre, which has seen 68,000 participants. Further demonstrating its commitment to national heritage, the BM has facilitated the recording of 59,000 finds through the Portable Antiquities Scheme. The reach of the collection extends beyond its walls, with an estimated 4 million visitors encountering loaned objects across the UK and an impressive 1,700 traveling internationally. Even a single YouTube video explaining the Rosetta Stone has garnered 1.1 million views, highlighting the power of the BM's digital outreach. Through physical visits, digital platforms, educational programs, and international partnerships, the British Museum actively connects people with the vast tapestry of human history(the british museum review, 2022-2023).

5.2. Digital working:

Digital media continue to open exciting new channels for the BM. Anyone anywhere in the world can now access over 4 million objects from the BM collection online. Information about the artefacts and the world cultures they represent has found popular new platforms: images transmitted via Twitter and Instagram, and videos on Facebook and YouTube reach vast audiences never before so easily accessed. It is new conversation in which the public and museum staff engage one another, generate debate and share ideas. The BM's national programs support diverse digital outcomes. National training videos are posted online. Websites such as the Portable Antiquities Scheme share the latest Discoveries and research. Internationally the BM supports wider digital access to culture. With partners in India an exhibition website on India's global connections in the past was designed. In China, the BM is now present on several social media platforms. International research has benefited enormously, with major digital collaborations on collections such as African rock art. The BM's Research Space initiative, for which the Andrew Mellon Foundation renewed its support, is working to provide a semantic web platform that links multiple online sources for researchers around the world(the british museum review, 2022-2023).

5.3. Communicating online:

On social media, the BM has acquired 4.8m followers, a growth of 34% over the previous year. The BM scores highest among its global peer group for interactions on Twitter and Facebook: followers engaging with online

content by responding to, liking or sharing posts. Most popular on the BM's social media in 2017/18 were images of Japanese prints. A BM video on Hokusai's *The Great Wave*, posted in June 2017, received over 3.7m views. Three broadcasts on Facebook Live drew in viewers from 89

countries. Curators responded in real time to questions on Stone Age, Bronze Age and Iron Age objects. Other popular videos published on YouTube, Facebook and Instagram included two videos on contemporary Japanese porcelain, supported by JTI, and YouTuber Tom Scott playing the 4,500-year-old Royal Game of Ur with a BM curator. The BM is also collaborating with the Alan Turing Institute on a groundbreaking study of TripAdvisor review data to better understand the visitor experience. On the 'Curator's Corner' of the BM blog, experts introduced a 17th-century night clock, Islamic astrolabes and the Rosetta Stone.

Comedian Isai Lawrence interviewed historians and conservators for the monthly Membership podcast. Articles about the exhibitions proved extremely popular, with posts introducing the Scythians and the Lion-Man sculpture attracting tens of thousands of readers. For a growing Chinese audience, the BM is reworking its Mandarin website, sponsored by UnionPay. Accessible from the BM homepage, the site will feature a new design, collection highlights and visitor information. The BM also launched accounts on Chinese microblogging platform Weibo and social media app We Chat.

5.4. Influence of Modern Approaches on British Museum's Cultural Heritage Document

The British Museum, with its rich history and prestigious status as a venerable institution, holds a significant place in the hearts of Londoners, the British people, and individuals from all around the world. Through its modern approaches to preservation, curation, and research, the British Museum has been able to expand its influence on cultural heritage. One of the key modern approaches implemented by the British Museum is the production of a range of publications that showcase its research. They use different technologies to digitally document and present their collection to a wider audience. One of the most important approaches utilized in the museum is the augmented reality and virtual reality technologies, which enhance visitor experiences by providing interactive and immersive encounters with artifacts and exhibitions.

By incorporating augmented reality and virtual reality technologies, the British Museum is able to engage visitors in a more dynamic and interactive way, allowing them to explore the artifacts and exhibitions in a virtual environment. This not only makes the visit more engaging and memorable but also helps visitors to better understand and remember the information presented.

Additionally, the British Museum has embraced digital platforms and online resources to extend its reach beyond the physical confines of the museum. Through their website and various social media platforms, the museum provides access to virtual tours, online exhibitions, and educational resources. This allows individuals from all around the world to engage with the museum's collection, learn about different cultures, and appreciate the importance of cultural heritage. These modern approaches have had a significant influence on the cultural heritage preserved and showcased by the British Museum. The integration of interactive display methods and technology in the British Museum's exhibitions has revolutionized the way cultural heritage is presented and experienced.

6. conclusion:

Virtual museums serve as powerful tools in the digital age, enhancing the preservation, accessibility, and understanding of cultural heritage. They offer accessible platforms for global audiences to explore and learn about diverse cultures, regardless of location or limitations. Furthermore, virtual museums contribute to the preservation of endangered artifacts by creating digital replicas and fostering research and education through remote access to collections. Beyond these core functionalities, virtual museums promote cultural exchange and collaboration, bridging gaps in cultural understanding and fostering appreciation for the world's rich heritage.

Institutions like the British Museum exemplify the effectiveness of this approach. By embracing modern technologies like augmented reality (AR) and virtual reality (VR), the British Museum curates interactive and immersive experiences that deepen visitor engagement with historical artifacts and exhibitions. Additionally, the museum's robust digital presence through websites and

social media platforms extends its reach beyond physical limitations, allowing global audiences to access virtual tours, online exhibitions, and educational resources. The British Museum's integration of technology and digital platforms serves as a prime example of how virtual museums can revolutionize the way cultural heritage is presented, experienced, and preserved for future generations.

In conclusion, virtual museums play a crucial role in safeguarding and promoting cultural heritage in the digital era, ensuring its accessibility and continued appreciation for generations to come. Institutions like the British Museum demonstrate the transformative potential of virtual platforms in enriching cultural experiences and fostering a deeper understanding of our shared past.

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